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MEDICAL JURISPRUDENCE

FOR

INDIA,

WITH ILLUSTRATIVE CASES.

BY

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BRIGADE SURGEON, I.M.S., RETIRED;
LATE CHEMICAL ANALYSER TO GOVERNMENT OF BOMBAY; PROFESSOR OF CHEMISTRY AND MEDICAL JURISPRUDENCE, GRANT MEDICAL COLLEGE, BOMBAY.

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PREFACE.

THE second edition of this standard work having been out of print for some years, and the large demand for it still continuing, opportunity has been taken in preparing this third edition to recast the work in a form which, it is hoped, will render it still more helpful. Notwithstanding that a very large amount of new matter and most of the remaining cases from Chevers' pioneer work, and from Coul Mackenzie's monograph have been added along with several new illustrations, it has yet been possible by the use of smaller type to keep the book with its illustrative cases, about five hundred in number, within the compass of one volume of somewhat similar size to the last. The Index also has been considerably extended.

The work is offered as a complete exposition of the Indian Medical Jurisprudence of to-day, as far as is possible ; and it is intended not only as a text-book for civil surgeons and medical students in India, but also as a work of reference for magistrates, police-officers, lawyers and judges throughout India.

For much valuable assistance in its preparation I have great pleasure in expressing my indebtedness to several friends, and in particular to Dr. Arthur Powell, Surgeon to the Coroner of Bombay.

L. A. WADDELL.

Calcutta, October, 1903.

PREFACE TO FIRST EDITION.

In compiling this book my object has been to supply a want which I have often felt while lecturing on Medical Jurisprudence in an Indian College, *viz.*, that of a concise manual of the subject specially adapted for use in India. In doing so I have made the freest use of the numerous standard treatises on Medical Jurisprudence and subjects allied to it, and of the admirable Bengal Medico-Legal Reports of my friends Surgeons-Major K. McLeod and R. Harvey. So freely have I drawn from such works, that it is possible I may have in places omitted to acknowledge my indebtedness to them; if so, I trust that my omission will be considered repaired by this general acknowledgment.

I have also to thankfully acknowledge the personal assistance freely accorded to me by many of my friends, and especially the very great and valuable aid given me by Mr. J. D. Inverarity, Barrister-at-law, Brigade-Surgeon W. Dymock, and Surgeon-Major K. R. Kirtikar. I have further to express my thanks to Colonel Boyd, Bo. S. C., from whose sketches, and Dr. Heneage Gibbes, from whose micro-photographs, the illustrations of this book are derived. Any success this work may have I am certain will be largely due to the help my friends have so freely accorded to me.

I. B. LYON.

Grant Medical College, Bombay,
September, 1888.

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CORRIGENDA AND ADDENDA.

Page 2, line 2 from bottom of footnotes, *prefix* reference number 3.

„ 3, line 16 from bottom, *before* 'two' *insert* 'about.'

„ 6, footnote, *insert* reference number 1, and in number 2, line 1, *delete* duplicate 'rate.'

„ 8, line 22 from bottom, *for* 'envelop' *read* 'envelope.'
line 2 from bottom, *before* 'Tahsildar' *insert* 'Sub-Deputy Collector or.'

„ 16, footnote line 4, *for* 'that' *read* 'for.'

„ 18, line 6 from top, *for* 'charecter' *read* 'character.'

„ 20, line 1, para. 2, *for* 'organised' *read* 'organized.'

„ 29, line 16 from bottom, *for* 'canernosa' *read* 'cavernosa.'

„ 34, line 20, *after* 'year' *add* 'except when under a guardian appointed by a court or under a Court of Wards when the individual does not attain majority until completion of twenty-one years of age' (Act IX of 1875, s. 3).

„ 35, line 3 of table, *for* 'laetral' *read* 'lateral.'

„ 36, line 5 from bottom, *after* 'teeth' *insert* 'at ten or eleven, 24, and line 4 from bottom, *after* permanent *add* 'second.'

„ 42, in table *Females* No. 1, *for* 'eyes' *read* 'eyebrows,' and as No. 8 *insert* 'Muhammadans no vermilion on hair-parting: Hindu married women smear vermilion on hair-parting.'
Foot note, line 1, *add* 'Bengali married women wear a thin iron wristlet on left wrist, and in E. Bengal wear a double *Sari*.'

„ 47, last line, *add* 'see also case of Pratab Chand of Burdwan or *The Bengal Tichborne Case*, p. 639.'

„ 48, line 2, *for* 'Matin' *read* 'Martin.'

„ 62, line 14, *for* 'instertorous' *read* 'stertorous'

„ 92, line 6 from bottom, *for* 'IIIb' *read* 'Appendix III, page 648.'

„ 121, line 71, *delete* words after 'wound.'

„ 243, line 8, *for* 'of' *read* 'the.'

„ 245, line 8 from bottom *delete* the second 'the.'

„ 248, line 12, *for* 'the' *read* 'is the.'

„ 251, line 7, *add* 'though rupture of the uterus may leave no external marks.'

„ 252, line 9, *add* 'an inference unjustifiable on the evidence.'

Page 252, line 30, *for* 'after' *read* 'afterwards.'
„ 258, line 25, *for* 'duly' *read* 'unduly.'
„ 258, line 8 from bottom, *for* 'dirty, *read* 'dirt.'
„ 261, line 17, *for* 'alleged' *read* 'physical.'
„ 262, line 24, *after* 'membrane' *add* 'or skin.'
„ 311, line 8 from bottom, *after* 'milk' *add* 'bacterium coli.'
„ 353, line 20, *add* 'suspected lunatics cannot be detained under observation for more than 14 days.'
„ 385, line 1, *after* 'epilepsy' *add* 'syphilis, which renders the life uninsurable without heavy loading until five years have passed without symptoms.'
„ 446, line 10 from bottom, *for* 1 *read* 2.
„ 453, line 11, *for* 'affector' *read* 'affection.'
„ 472, lines 18 and 24 from bottom, *for* 'B28' *read CCXXXIX.*
„ 518, line 4, *for* 'monatum' *read* 'montanum.'
„ 518, line 33, *for* 187 *read* 492.

"*As a hunter tracks a wounded beast to its lair by its drops of blood so let a King track [crime] to justice by close searched proofs.*"—MANU.

INTRODUCTORY.

MEDICAL RELATIONS WITH THE LAW COURTS.

MEDICAL Jurisprudence or *Forensic*[1] *Medicine* or *Legal Medicine*, as it is variously called, may be defined as 'the application of Medical Science to the purposes of the Law.'

In the interests of good government, the Law requires and can compel medical men to assist it in laying bare the evidence of many kinds of crime and offences against the person and civil rights of individuals and the community at large, such as assault, murder, poisoning, rape, legitimacy, inheritance, divorce, insanity, fraudulent impersonation, questions of damages for injuries, life assurance, &c. Being thus liable to be called upon at any time to give evidence as a medical jurist in the witness-box, in cases of more or less public interest or notoriety, it is necessary even for his own reputation that the medical man should learn to look from the medico-legal standpoint upon all his cases which are likely to become the subject of judicial inquiry; and that he should carefully note down at the time everything likely to be of medico-legal importance. It is also desirable that he should know something of the legal nature of evidence and the procedure in courts of law—and in the case of the medical jurist in India, the procedure in Indian law courts in particular, some of the peculiarities of crime in India, the circumstances under which the more common crimes come to be perpetrated, and the devices ordinarily taken to conceal crime in this country.

Medical testimony so important in every country is especially so in the East, where it is often the only trustworthy evidence upon which hangs the liberty or the life of a human being.

[1] 'Forensic' is derived from the Latin *forum*, the market-place, because the Romans, whose law code still remains to-day the basis of our own, held their court of justice there.

KINDS OF INDIAN CRIMINAL COURTS.

The preliminary inquiry into offences against the person and into sudden and unnatural deaths in India is made by a police-officer[1] who is authorised in fatal cases to forward the dead body for examination to the nearest civil surgeon or other qualified medical man appointed by the Local Government to conduct such examinations, except in Calcutta and in Bombay city where the coroner makes an inquest and arranges for the *post-mortem* examination. District and other first class magistrates also may hold inquests and order the exhumation of a body for examination.[2]

The medical officer's report is sent to the magistrate of the district (or his subdivisional magistrate), who, in cases where a reasonable suspicion is established against an accused person in the case, may require the presence of the reporting medical officer to give a **deposition** at his court in presence of the accused and be cross-examined if necessary. For the medical report cannot be admitted as evidence, until it has been deposed to and recorded *de novo* by the magistrate in presence of accused. At this court you should give your evidence with as much care as you would do in the High Court, for your evidence is recorded, and the case may go to the higher court however trivial it may seem, in which case the opposing counsel with your evidence in the lower court laid before him and with weeks to pick holes in any loose expressions you may have used and prompted by a clever medical man at his elbow, may bring your evidence into discredit. On the other hand, if the medical report does not substantiate the charge, the case is not usually proceeded with further ; for the medical officer exercises practically the judicial function of a " Court of First Instance " in assault cases.

Should it prove to be one of the more grave offences such as murder, causing miscarriage, rape, &c., such as are triable only by courts of session or high courts, the district magistrate (or his subdivisional magistrate) after recording the evidence **commits** the accused for trial to the higher court. In this way the medical man who conducted the original examination may be required to appear before more than one court in connection with the same case should the magistrate deem it necessary.[3]

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[1] *Cr. P. C.*, *s.* 174, 1. In Bombay and Madras Presidencies the inquiry into unnatural deaths may be made by the village headman (*s.* 174, 4).

[2] *Cr. P. C.*, *ss.* 174 (5), 176.

[3] *Id.* *s.* 509 (1), shows that if the civil surgeon's evidence is taken before the committing magistrate and *attested* by him, that is to say, the committing

The various **criminal courts** in order from the higher to the lower are :—

(*a*) High Courts.
(*b*) Courts of Session.
(*c*) Magistrates of the 1st class and Presidency Magistrates.
(*d*) Magistrates of the 2nd and 3rd class.

The **powers** of these courts are :—

The High Courts and Courts of Session are empowered to try any offence and to pass any sentence authorised by law ; but a sentence of death passed by a Court of Session shall be subject to confirmation by the High Court. (*s.* 31.)

Courts of Presidency Magistrates, and Courts of Magistrates of the first class, may not try certain grave offences, *e.g.*, murder, causing miscarriage, rape, and unnatural offences, and may not, for any single offence, sentence to more than two years' imprisonment and 1,000 rupees fine.

Courts of Magistrates of the second class may not try any offence punishable with three years' imprisonment (*s.* 29), and may not, for any single offence, sentence to more than six months' imprisonment and 200 rupees fine.

Courts of Magistrates of the third class may not try an offence punishable with one year's imprisonment, and may not, for any single offence, sentence to imprisonment for more than one month and 50 rupees fine.

Third-class Magistrates may not sentence to solitary confinement or to whipping, and Second-class Magistrates may only sentence to whipping, if specially empowered by the Local Government. (*s.* 32.)

A jury is required in every criminal trial before a High Court. Juries are of two kinds, **Special** and **Common.** A special jury is composed of persons taken from a special list of two hundred. In every case where the offence to be tried is punishable with death, and also in such other cases as a Judge of the High Court may direct, the trial is to be before a special jury. (*s.* 276.) In all other cases the trial takes place before a common jury, *i.e.*, composed of persons whose names appear in the general list of persons liable to serve as jurors.

Trials before a Court of Session are ordinarily conducted with the aid of assessors, two or more in number, but the Local Government can, by order in the official *Gazette*, direct trials before any Court of Session of all offences or any particular class of offences to be by jury. Section 320 of the Code enumerates the *persons exempt* from liability to serve as jurors or assessors, and clause (*h*) of this section includes among those exempted "surgeons and others who openly and constantly practise the medical profession."

When an accused person appears to be "*of* **unsound mind,** *and consequently incapable of making his defence,*" the Magistrate holding

---

magistrate must state below the civil surgeon's deposition that it was taken in presence of accused and explained to him and that he had an opportunity of cross-examination, the higher court may accept it as evidence without calling the civil surgeon. Clause 2, however, empowers the higher court to call him, but this is not usually done with provincial cases unless the committing magistrate has omitted some important point.

the inquiry or trial, or the Court of Session or High Court, in the case of persons committed for trial before these courts, shall first inquire into or try the fact of such unsoundness of mind, and if this be proved the inquiry or trial shall be postponed and the Magistrate shall cause the accused to be examined by the Civil Surgeon or such other medical officer as the Local Government directs and thereupon shall examine such surgeon or other officer as a witness and shall reduce the examination to writing.

Coroner's Court. This is a preliminary court of inquiry in the presidency-towns into the cause of all accidental and sudden deaths occurring in those towns, where there is any suspicion of foul play. The coroner views the body at his **inquest** with a jury. At this court no accused need be present as no one is being tried, unlike a magistrate's court which is a court of inquiry, not into the mere cause of death, but into the culpability of a person accused of some specific criminal act or negligence[1] of a criminal kind, and where the accused must be present and where witnesses may be cross-examined, and the simpler cases be dealt with summarily.

At the coroner's court, however, any "suspected person" must be present if possible and has the right of producing witnesses, cross-examining himself or by counsel, and of making any defence or statement he desires. When a suspected person is ill the inquest is adjourned till he is able to attend. The coroner's court also enquires into the culpability of a person suspected and returns a verdict specifying the offence of the suspected person, *viz.*, 'culpable homicide amounting to murder,' 'rash and negligent act,' &c. The coroner in India has the power to commit to the sessions direct.

In cases of fatal accident and sudden death under suspicious circumstances occurring in practice, the attending surgeon should never grant a death certificate when he cannot certify to the true cause of death, even should the family of the deceased press for a certificate to save the publicity of an inquest. It is his duty to report the matter to the police or the coroner direct, for afterwards if the magistrate or coroner be not satisfied that the death was from natural causes or simple accident they may have the body exhumed after burial.

The **duties of a Coroner** in India are :—

"Where a Coroner has reason to believe that the death of any person has been caused by accident, homicide or suicide or suddenly by

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[1] Offence by illegal omission (*Cr. P. Code, s.* 32) *e.g.*, a woman may be committed for murder by intentionally omitting to tie the cord or to supply her infant with food.—See 'Infanticide.'

means unknown or that any person being a prisoner has died in prison and that the body is lying within the place for which the Coroner has been appointed, the coroner shall inquire into the cause of death."[1] Other provisions are :—

(*a*) That an inquest need not be held in a case where a prisoner has died in prison from cholera or epidemic disease. (*s.* 9)

(*b*) That the Coroner may order a body to be exhumed. (*s.* 11)

(*c*) That the inquiry is to be conducted with the aid of a jury (of 5, 7, 9, 11, 13 or 15 in number) who, with the Coroner, are to view, the body. (*ss.* 12, 15.)

(*d*) The Coroner is empowered to order a *post-mortem* examination. with or without analysis of the viscera, to be made by any medical witness summoned to attend the inquest, and such medical witness, other than the chemical examiner to Government, shall be entitled to such reasonable remuneration as the Coroner thinks fit. (*s.* 18.)

(*e*) Evidence is to be given on oath (*s.* 19) reduced to writing by the Coroner (*s.* 20), and the jury are to return a verdict. (*s.* 23.)

(*f*) A Coroner may appoint a Deputy Coroner to act for him when sick, or absent for any lawful or reasonable cause. (*s.* 28.)

PROCEDURE IN COURT.

To these courts you are summoned to attend by a **subpœna**, a writ commanding attendance under a penalty. In civil cases it is necessary that a **fee** termed 'conduct money' should be offered on delivering the summons ; if this be not done you may in civil cases, *previous to being sworn*, refuse to give evidence till any reasonable fee you demand has been paid. But it is chiefly with regard to criminal cases you have to give evidence, and you have no option but to be sworn and examined irrespective of the question of fees.[2]

Fees in cross-examination in Criminal cases: In support of a rule obtained on behalf of Iswar Chunder Ranth, calling upon the district magistrate of Dacca to show cause why the conviction and sentence passed on the petitioner should not be set aside and the trial resumed on the ground that the petitioner was not allowed to cross-examine the medical witness in the case, except on payment of the usual costs and compensation. The petitioner was convicted by an honorary magistrate of Narayanganj of causing hurt and was sentenced to six months' rigorous imprisonment and to a fine of Rs. 100 or, in default, six weeks' additional imprisonment. Their lordships made the rule absolute, holding that the petitioner was entitled, under section 350 of the Criminal Procedure Code, to cross-examine the witness without payment of costs or compensation, Calcutta High Court.—*Englishman*, 23rd January 1900.

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[1] *The Coroner's Act* (Act IV of 1871), *s.* 8.

[2] The usual rates for fees to common and medical witnesses are here given:—Criminal courts are authorised to pay, at the rates specified below, the expenses of complainants and witnesses—first, in all cases, whether non-bailable or bailable, in which the prosecution is instituted or carried on by or under the orders, or with the sanction of Government, or of any judge, magistrate, or other public officer ; secondly, in all cases entered in column 5

On being called into the witness-box to be **sworn** it is well for obvious sanitary reasons not to 'kiss the book'; but to claim to be sworn by the Scotch form. For this hold up the right hand above your head and say in a loud firm tone: "I swear by Almighty God, as I shall answer to God at the

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of the schedule appended to the Criminal Procedure Code as not bailable, when it shall appear to the presiding officer to be directly, in furtherance of the interests of public justice; thirdly, in bailable cases in which the presiding officer of the court, if a magistrate of the 1st class, or in which the magistrate of the district, on the recommendation of the magistrate of the 2nd or 3rd class, considers that in the interests of public justice such payment is required: fourthly, in all cases in which the witnesses are compelled to attend by the magistrate under the provisions of section 351 of the Code. No payment shall be made by the Government to witnesses summoned at the instance of the complainant under section 244, unless the prosecution appears to the court or magistrate to be in furtherance of the interests of public justice.

2. The rates referred to in the foregoing rule are as follows:—

(*a*) For the ordinary labouring class of natives, two annas per diem.

(*b*) For natives of higher rank in life, four annas per diem.

(*c*) For Europeans and Eurasians and natives of superior rank, a diet allowance according to circumstances up to a limit of Rs. 3 per diem.

3. Travelling expenses will be given only when the journey could not, with reasonable ease and expedition, have been performed on foot or in the case of persons whose age, position and habits of life render it impossible for them to walk. In such cases, in addition to diet allowance, travelling allowance shall be given at the following rates:—

(*a*) When the journey is by rapid dâk by road; the actual expenses incurred up to a maximum limit of four annas a mile.

(*b*) Where the journey is wholly or partly by rail.

(1) For natives generally, railway fare by the lowest class.

(2) For Europeans, Eurasians and natives of superior rank, second class railway fare; but the court may in its discretion award first class railway fare when the persons concerned, from their social position, would ordinarily travel by that class.

4. From the above rules are excepted

(*a*) Government servants, who shall receive no diet allowance, but shall be entitled to actual travelling expenses only to an amount not exceeding what they would be entitled to for the journey under the rules ordinarily applicable to officers in the departments to which they belong.

(*b*) Witnesses following any profession, such as medicine or law, to whom a special allowance shall be given according to circumstances.

The number of days which should be allowed for the journey to and fro will be determined by the officer ordering the payment in each case. For this purpose a table should be prepared and kept in each court showing the distance of each thana from the Sadar station and subordinate stations, the number of intermediate ferries to be crossed, and the existence or absence of roads or waterways. (U. P. Manual of orders of Government, Part VI)

When a medical officer, other than a civil surgeon or medical officer of any grade in the civil employment of Government, is called upon to make a *post-mortem* examination, he should be paid a fee of Rs. 16 for the same. Should he be summoned to give evidence in the case in court, he is not entitled to any further remuneration beyond the ordinary travelling allowance of a witness.

For a medico-legal examination, other than a *post-mortem* examination the fee is Rs. 10 on the same conditions. Government of India No. 1370, dated 23rd June, 1869, and No. 3050, dated 11th August, 1882.

last day of Judgment, I will tell the truth, the whole truth and nothing but the truth." Then your evidence will be taken.

EVIDENCE.

Every fact which is referred to in law must pass through the process of proof by testimony. How this testimony is elicited in India is detailed in the *Indian Evidence Act* (Act I of 1872).

Evidence is given in two forms—(1) *oral* or (2) *documentary*.

Oral evidence must in all cases be *direct*, i.e., if it refers to a fact which could be seen, heard or perceived in any other manner, it must be the evidence of a witness who says he saw, heard or so perceived it; if it refers to an opinion or the grounds on which that opinion is held, it must be the evidence of the person who holds that opinion on those grounds and not mere hearsay. Oral evidence[1] is the more important of the two, as it admits of cross-questioning so that the giver of documentary evidence is subject to be summoned for oral examination. If oral evidence refers to the existence or condition of *any material thing*, the court may require the production of such a thing for its inspection, *viz.*, a blood-stained weapon, or article of clothing, a portion of eliminated poison, &c., &c. Hence such article should, always after examination, be preserved, if possible, for production before the court.[2]

Documentary evidence comprises all documents produced for the inspection of the court. For the medical jurist this comprises :—

1. *Certificates* of death,[3] ill-health, insanity, &c.
2. *Medico-legal reports* or the formal reports of an examination made by a medical man under a warrant from a magistrate, coroner or authorized police-officer in cases of assault, murder, &c. (see form of a report in appendix). In these reports all the dates and numbers should be expressed in writing, and all articles submitted for examination should be labelled with a distinguishing number for reference. The **Opinion** based on the facts noted should be stated briefly

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[1] *I. E. A., s.* 60.

[2] '*Circumstantial*' evidence attests one of the subsidiary circumstances of the case, *e.g.*, in case of an alleged stabbing of *A* by *B* on a river bank at 4 o'clock on a particular day, circumstantial evidence would be that I saw *B* with a knife in his hand at ten minutes to four on that day near that place.

[3] Death-certificates must be given free of charge if you know the cause of death, even though your attendance-fees have not been paid.

and clearly and given with the utmost caution. For the apparent or alleged cause of injury or death is not always the real one ; thus in India it is a common practice to hang up the dead body of a person who has been murdered so as to create a suspicion of suicide, see ' Hanging ' in Chap. VII.

Both of the above classes of documents require to be sworn to orally as true by the person who drew them up, in the more serious cases ; but *the following documentary evidence is accepted without oral evidence in court :—*

(1) **Printed Opinions of Experts** expressed in any treatise commonly offered for sale, and the grounds upon which such opinions are held may be proved by the production of such treatises, if the author is dead, or cannot be found, or has become incapable of giving evidence, or cannot be called as a witness without an amount of delay or expense which the court regards as unreasonable. (*I. E. A., s.* 60.)

(2) **Dying Declarations.** Statements, written or verbal, made by a person who is dead as to the cause of his death or as to any of the circumstances of the transaction which resulted in his death, are admissible in cases where the cause of that person's death comes into question, no matter whether the person making such statement was or was not under expectation of death at the time of making it. (*I. E. A. s.* 32. and *Cr. P. C., s.* 164.)

It may here be noted that according to the law of England, a dying declaration is only admissible when the person making it is in actual danger of death, and is aware of his danger, on the presumption that a dying man will tell the truth. The declaration should, if possible, be written by the person making it, otherwise it must be taken down in the identical words uttered by the dying man in his own vernacular, and read over to him and then, if possible, signed by him and attested by the writer, and by any other respectable witnesses who may be present. It should then be forwarded in a sealed envelope direct to the magistrate who would ordinarily enquire into the case. At the Sadar station the civil surgeon, or the assistant surgeon in charge of the hospital, should at once call on the District Magistrate, or, in his absence, the senior Magistrate present at the station, to arrange for the record of the dying declaration of such persons as are likely to die and are in a fit state to make a statement. If in the opinion of the civil surgeon or assistant surgeon, there is no time to call on the District Magistrate or the senior Magistrate present at the station, the nearest Magistrate may be sent for to take the dying declaration, a stipendiary Magistrate being called if possible. If, in the opinion of the Civil Surgeon or assistant surgeon, there is no time to call any Magistrate, he may himself record the declaration. In cases where there is no time to call on the district magistrate or senior magistrate present at the sadar, he should be informed of the action taken.

At outlying dispensaries.—The Hospital Assistant in charge should at once call on the Tahsíldár, or, in his absence or when he has no magisterial powers, the nearest Honorary Magistrate, to record the dying declarations of such persons as are likely to die and are in a fit state to make a statement. If there is, in his opinion, no time to call on the Tahsíldár or an Honorary Magistrate, he may record the dying declaration himself.

The **state of mind** of the declarant at the time when he made his declaration is of great importance.

Case I.—An European in a drinking bout at Calcutta was found in his room, bleeding from a wound on the back of the head. A police-officer enquired "How did this happen?" He replied, "She (his wife) threw a glass at me." The wife said "Don't say that; you know I did not do it; he had fallen out of bed on a cup." The man was drunk and never spoke rationally up to the time of his death three hours after. Portions of the enamel of a tea cup (bloody fragments of which were found scattered about the rooms) were removed from the wound before death and some minute flakes of the enamel had been driven under the pericranium. At the *post-mortem* examination traumatic extravasation of blood on the brain was found, attributed to *contre-coup;* and the universal medical opinion was that the wife's statement was the true one, and that when the man accused her he was not mentally in a condition to know how the injury had been inflicted. A fall upon a tea cup could produce the appearances described whereas the power of a woman's arm would be insufficient to throw a tea cup with such strength as to force the enamel under the pericranium. The wife was acquitted. Chevers, *M.*, 93.

In the case of a **will** by a dying man, if no magistrate can be obtained, the medical attendant may record it, in which case the attestation clause should not be forgotten and care should be taken that its conditions are strictly complied with:—"Signed by the testator *A B* in the presence of us (there must always be two witnesses) present at the same time who at his request, in his sight and presence and in the presence of each other have attested and subscribed the same." All alterations must be initialled by both testator and witness, as well as each page and the foot or end should be signed by the testator or by some other person in his presence and by his direction. The testator must be conscious at the time when the witnesses attach their signature.

(3) **Evidence given in a previous judicial proceeding** by a witness who is dead, or cannot be found or is incapable of giving evidence, or is kept out of the way by the adverse party, or whose attendance cannot be obtained without an amount of delay or expense which the court under the circumstances of the case considers unreasonable, is admissible under certain conditions (*s.* 33). Under this rule the deposition on oath of a dying person, taken by a magistrate in presence of the accused, becomes admissible in place of a dying declaration, and when the circumstances of the case permit, it is always advisable to take steps to obtain such a deposition.

(4) **Deposition of a Civil Surgeon or other medical witness,** taken and attested by a magistrate in the presence of the accused, may be given in evidence in any inquiry or trial or other proceeding under the Code of Criminal Procedure, although the deponent is not called as a witness, but the Court may, if it thinks fit, summon and examine the deponent. (*Cr. P. C.*, *s.* 509.)

(5) **Any document purporting to be a report under the hand of any Chemical Examiner** or Assistant Chemical Examiner to Government, upon any matter or thing duly submitted to him for examination, or analysis and report, in the course of any proceeding under the Code of Criminal Procedure, may be used as evidence in any inquiry, trial or other proceeding under the said Code. (*Cr. P. C.*, *s.* 510.)

WITNESSES.

Evidence is of two kinds, namely, (1) **Common**, or testimony to facts which the ordinary witness has actually observed himself, and (2) **Expert**, or interpretation of facts by skilled persons or specialists. The medical witness usually gives evidence of both kinds ; but more especially the latter.

(1) **A Common Witness.**—The medical man is a common witness when he testifies to the exact size and number of wounds, blood-stains, &c., of a wounded person he has examined, the exact weight of solids and volume of fluids he refers to, the circumstances under which he found the body, any statement or confession made by the dying person, the actual cause of death, &c.

All persons are competent to testify, unless the court considers that they are prevented from understanding the questions put to them, or from giving rational answers to those questions, by tender years, extreme old age, disease, whether of body or mind, or any other cause of the same kind. (*Cr. P. C.*, *s.* 118.)

In certain special cases (*ss.* 121 to 129) a witness may on certain grounds **claim exemption** from being compelled to answer certain questions, *e.g.*, "no public officer shall be compelled to disclose communications made to him in official confidence when he considers that the public interests would suffer by the disclosure." (*Cr. P. C.*, *s.* 124.) A witness is not exempted from answering questions on the ground that his answers would tend to criminate himself, but, if compelled to answer, his answers cannot be used as evidence against him. (*Cr. P. C.*, *s.* 132.)

In addition to the **checks on untruthfulness** of a witness afforded by the provisions of the Penal Code relating to the giving of false evidence (*ss.* 191 to 195), and the publicity of judicial proceedings, there is the most effective one of requiring evidence to be given *viva voce*, in presence of the party against whom the evidence is produced, who has the opportunity of cross-examining the witness.

(2) **An Expert Witness.**—This is defined[1] to be a person "specially skilled in foreign law, science or art, or in questions as to the identity of handwriting or finger-impressions." Medical experts are skilled in such special branches as toxicology, obstetrics, insanity, &c.; and also in the interpretation of wounds, &c. The ordinary expert witness acts as an interpreter of facts without having personal knowlege of them. Previous personal knowledge of the facts of a case precludes a witness from taking any possible advantage of the *status* of an expert[2] as regards compulsory attendance at court, &c.

Case II.—A medical man who has not seen a corpse which has been subjected to a *post-mortem* examination, and who is called to corroborate

[1] *I. E. A.*, *s.* 45.
[2] Mann, p. 9.

the opinion of the medical man who made the examination and gave his opinion as to the cause of death is in the position of an expert. *Queen-Empress* v. *Meher Ali Mullick* (Wilson, J., May 11th, 1888, Calcutta).

The medical witness, in nearly nine cases out of ten, is an expert. It is a decision rather than evidence which the law demands of him when replying to such questions even in regard to facts observed by himself as :—Is this wound dangerous to life? Was the wound accidental, suicidal or homicidal? Was it inflicted before or after death? With what kind of weapon was it inflicted?

In answering such questions he should be careful to draw no stronger inference than the facts warrant, and when the facts do not warrant a decided opinion either way, he should state his reasons for being unable to give a definite opinion on the point. Experts may refresh their memory by referring to professional treatises.[1]

EXAMINATION.

Your oral evidence is taken in the following order :[2]—

(1) **Examination-in-chief.**—This is a series of questions put to you by the counsel for the side on which you appear, with the object of placing before the court in a clear manner all the principal facts you know that bear upon the case in point. He knows from his '*brief*' the nature of your answers and usually arranges his questions so that you can answer them by '*Yes* or *No*,' thus :—You are Dr. Brown? Yes. You are a Bachelor of Medicine? Yes. You live at such a place? Yes. You saw the deceased? Yes. He had a bullet wound of the chest? Yes ; and so on.

(2) **Cross-examination.**—You are now subject to be questioned by the opposing counsel, with the object of weakening your evidence as far as possible, by trying to show how your details are inaccurate, conflicting or contradictory. You must be prepared even for questions calculated to disparage your skill. Thus in a case of criminal abortion you might be asked : You are not an obstetric surgeon? How many cases of midwifery have you attended during the past year? In cross-examination '*leading* questions,' *i.e.*, questions which suggest the answer wished for or expected (*s.* 141) may be asked (*s.* 143).

(3) **Re-examination.**—This is made by the counsel of your own side for the purpose of explaining apparent inaccuracies or discrepancies in your statements which may have been brought out by your cross-examination. No new matter may

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[1] *I E A.*, *s.* 159.

[2] *Id.*, *ss.* 137, 138 *et seq.*

be introduced at this stage without the consent of the judge or the opposing counsel, and the opposing side may cross-examine on the fresh point.

The judge and jury may question you at any stage to clear up ambiguous points. It often happens that the medical evidence is so little in dispute that no cross-examination is held. A medical witness is generally allowed to be present throughout the case to hear the other witnesses so as to enable him to form his expert opinion.

HINTS FOR GIVING EVIDENCE.

The medical witness should remember that he is not, and should not be, a partisan on either side. He has come to tell the truth, what he *knows* about the case, and not to clench the case against the prisoner. As he is not omniscient, he must not be ashamed to say 'I do not know.' Your evidence ought to impress the judge and jury and, if you can, try to make your evidence a self-evident truth.

Notes in Court.—All facts of medico-legal importance observed by you in a case should always be committed to writing in your own hand, on the spot or as soon after as possible, and such notes may be taken to the court to refresh your memory.[1] But as the evidence of a witness must be oral, as far as possible, you are not allowed to read out such notes, as evidence to the court. Any writing used to refresh memory must be shown to the adverse party if required (*I.E.A.*, *s.* 161.)

Speak slowly, loudly and distinctly to allow both judge and recorder to hear easily and to make notes of what you say.

Use plain and simple language, avoiding technical terms which are not intelligible to non-medical persons, such as 'cicatrix,' 'contusion,' 'gastric mucous membrane,' 'pericardium,' 'ecchymosis,' 'traumatic,' &c.; employ instead 'scar,' 'bruise,' 'lining membrane of the stomach,' &c.

Avoid superlatives and exaggerations. Avoid such expressions as "there was an enormous bruise on plaintiff's shoulder, the blow *must have been* a *savage* one delivered with great *violence*."

Be precise and concise. For example, be prepared to give the date and time of each event about which you have to give evidence, the exact measurement of wounds, the exact weight of solids and volume of fluids, &c. Photographs should be utilized if available.

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[1] *Nix. Ad. Rept.*, 4th April, 1854.

State facts only, not mere opinions, unless expressly asked for these latter. Thus in a case of suicidal hanging, you should only certify to the fact of hanging, for whether it is suicidal or homocidal or accidental, is a matter of expert opinion or other evidence. Give your answers irrespective of the possible result on the trial.

Keep your temper during cross-examination. To lose it would convey the unfavourable impression to judge and jury that you are hasty in forming conclusions and therefore untrustworthy. If compelled to answer *Yes* or *No* to a question in cross-examination when it would convey a false impression, qualify it by an explanation ; and appeal to the judge if you think any question unfair.

Professional Secrets.—In a court of law a medical adviser is bound, if asked, to disclose otherwise inviolable secrets which he may have had confided to him professionally by a patient, as in questions of legitimacy, venereal disease with reference to divorce, &c. If the medical attendant through conscientious scruples refuses to answer he is liable to be committed for contempt of court. In such cases you should appeal to the judge so that if he still rules that it is necessary, it will be evident that you divulge these secrets only under the strongest compulsion of the law of the land.

Lord Mansfield puts it very clearly—"If a surgeon was voluntarily to reveal secrets, to be sure he would be guilty of a breach of honour ; but to give that information in a court of justice which by the law of the land he is bound to do, will never be imputed to him as any indiscretion whatever." (Duchess of Kingston's Case, 20 S. T., p. 573.)

In the interests of humanity and purity it seems undesirable that a woman to whom a loathsome disease has been communicated by a dissolute husband should find herself chained to him for life, and be unable to gain the ordinary means of redress, because the only witness who can prove this material medical fact has scruples of conscience, or is technically excluded from testifying.

Quotation from Books.—You are not allowed to quote in your replies any books by an author who is alive, on the principle that evidence should be oral and the giver of it should be present for cross-examination. Books are sometimes quoted in court by counsel and the witness is asked whether he agrees with the quotation. In such cases the witness should, before replying, ask to be allowed to read it over himself, and see whether the context does not give it a different meaning from that assumed for it by the opposing counsel.

In giving an Opinion consider with yourself what are the various points on which you are likely to be called upon to give an opinion, *i.e.*, what inferences drawn from the facts

would tend to support either side of the case. Consult the works of the leading authorities on these points ; ascertain what opinions are therein expressed, and the grounds on which such opinions are held, and frame your own opinions with due regard thereto. Be careful to draw no stronger inference and give no stronger opinion than the facts warrant you in doing. It frequently happens that the facts available do not justify a conclusive opinion being given one way or other. In such a case do not hesitate to state so, but be prepared to state precisely your reasons for being unable to give a definite opinion on the point.

DIFFICULTIES IN DETECTING CRIME IN INDIA MEDICO-LEGALLY.

Some of the special difficulties in the way of the medical jurist in India getting at the truth in criminal cases are due to :—

1. Rapidity with which decomposition destroys dead bodies in the hot climate.
2. Facilities for concealing and destroying dead bodies, together with the general practice of rapid cremation or burial a few hours after death.
3. Insufficient particulars of crime in the police-reports accompanying the alleged assaulted person or a decomposed dead body.
4. Untrustworthiness of so much native evidence, owing to the wide prevalence of false-swearing and fabricating false charges.

1. Rapid Decomposition.—This tends to obliterate rapidly the traces of the cause of death. Not unfrequently the despatch of the body or its preliminary examination is delayed for several hours with consequent loss of evidence, owing to the responsible native subordinate, for his own personal convenience, shrinking from contact with the dead body until evening or the next day, as contact with a corpse prevents a native of India mixing with his family or friends until purified by more or less elaborate ceremonial bathing. For this reason, indeed, a fudged report may be sent in without the body having been inspected at all. When, as so generally happens, the body does not reach the medical officer for examination until several days after death and after having been carried scores of miles in the heat on men's shoulders, it is in such a horribly putrid condition[1] as to

[1] Although the statute [*Cr. P. C., s.* 174 (3)] expressly states that bodies have to be sent for medical examination in doubtful cases, only "if the state

render it very trying to the surgeon to make even an external inspection, putting detailed dissection quite out of the question. It thus becomes all the more necessary that the police-report accompanying the body should furnish the medical officer with sufficient particulars to indicate the direction in which he should pursue his search into the cause of death. Otherwise when decomposition has fully set in he cannot be expected to throw much light on the cause of death. Nevertheless it is well never to refuse to make an examination even in such cases. For wounds inflicted during life can, for a considerable time, be distinguished in the dead body from those inflicted after death and from mere decomposition-changes. **Certain tissues**, such as those of the uterus,[1] resist decomposition for a long time ; certain **poisons** (such as arsenic) may persist for many months, **fractures** will be evident, though, if the decomposition is far advanced, it will be difficult to say whether the fracture occurred during life or not, and some important **identification marks** may be elicited.

2. **Concealment and destruction of bodies.**—In addition to the common practice of rapid cremation and early burial in destroying traces of murder, unusual facilities exist for concealing the dead bodies of murdered persons in rivers, wells, ponds, swamps, dry water-courses, thickets of waste land and jungle, rubbish heaps, standing crops, stacks of wheat or straw or heaps of chaff. Most of these places are infested by carrion feeders (dogs, jackals, vultures, crows, crocodiles, fish, rats, &c.), which soon mangle the corpse beyond recognition or reduce it to a skeleton. Moreover as the common mode of disposing of the ordinary dead from natural causes is to throw the bodies into rivers or ponds or strew them about the outskirts of the villages in shallow graves, whence the bodies are dragged out by dogs and jackals, it is not easy to identify among these any murdered body when once it is somewhat decomposed or defaced. The commonest way of disposing of a murdered body in the plains is to throw it into a river, or into a disused well—for this purpose it may be trussed up and carried many miles from the scene of murder, or tied to a pole and dragged along if the murderer be single-handed. The next most common way is probably to hide it in the jungle. Occasionally such bodies are buried under the mud floors of

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of the weather and the distance admit of its being so forwarded without risk of such putrefaction on the road as would render such examination useless"—this provision is not usually observed, and the thin sprinkling of wood-charcoal does little to check the advancing decomposition.

[1] *Niz. Ad. Rept.*, N.-W. P., 1854, 204 ; *id.*, 1852, p. 1121.

houses, and usually in the house of an innocent party. Certain Hindus who murdered a fellow Hindu and his mistress plotted to bury the woman's body in a Muhammadan grave, which no one would think of opening, and to leave the man's body in the house to make it appear that he had been murdered by his mistress who had absconded. A case came under my[1] notice where the body of the murdered man was buried in the bed of a hill stream, which for this purpose had been diverted from its channel and then turned on again.

3. **Insufficient particulars of crime.**—In India the medical officer rarely sees the dead body when and where it is found. He has usually to depend for such important information on the report of untrained persons. As the local investigation is generally made by the village authorities and police in remote villages without medical aid, many important points are consequently omitted. Although it is a principle both in England and in India that the medical officer should be furnished with as full particulars as possible to assist him in finding out the true cause of death, this principle has been objected to by an Indian judge.[2] If, however, the medical officer be purposely kept in the dark as to the facts and ascertained circumstances attending a death on which he has to report, with only the decomposed body available for examination, there must necessarily be a great likelihood of justice miscarrying.

4. **Falseness of native evidence.**—The untrustworthiness of native evidence in India is notorious. In nearly every case in law, more or less false evidence is given through inherent oriental deceit, fear of incriminating themselves or of offending interested parties, through stupidity, apathy or malice intent. It is referred to by the Privy Council as[3] "the lamentable disregard of truth prevailing amongst the natives of India." As regards Bengal, the Inspector-General of Police[4] states that

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[1] *L. A. W.* It occurred in the Ranchi District of Chota Nagpur in 1886.

[2] The Civil Surgeon of Cawnpore in 1852 with reference to a body which had been sent to him without particulars as to the alleged cause of death asked for in future an outline of the circumstances under which bodies were sent to him for report; so that he might have some guide to the organs most requiring scientific examination. But the Sessions Judge thought "*This would interfere with a principle of criminal justice and would be analogous to putting leading questions, the answers to which would not be evidence*, nor would it be fair to the prisoner, for though a severe sword-cut might be reported on, the presence of a disease, lung or spleen, might pass unnoticed though the actual cause of death." The superior Court in their remarks on this case decided that "the communication which had passed between the Sessions Judge and the Civil Surgeon was altogether irregular and objectionable." (*Niz. Ad. Rept.*, N.-W. P., December 21st, 1852.)

[3] Cowell, quoted by Chevers, *M.*, p. 86.

[4] *Rept. Beng. Police* for 1866, pp. 10, 53.

this "is a country where perjury is the rule and not the exception, where no man will tell the whole truth or the simple truth ..... where false witnesses can be bought for a few annas." The constant difficulty therefore is to sift the truth from the falsehood.

These false charges are usually supported with carefully concocted details, sometimes of such an incredibly minute character as to be obviously of a "too perfect" kind. Though as a rule much less ingenuity is displayed in perpetrating and concealing the crimes than would be expected from the subtle cunning and deceit practised in the smaller affairs of every-day life. This may be explained by the fact that the intelligence of the violent criminal in India, as elsewhere, is generally below the average.

A very common form of **conspiracy** is to cause a person to disappear, and then to charge with murder some person against whom a spite is cherished. A plausible explanation is given of the disappearance of the body of the alleged murdered person, or a putrid corpse is obtained from the adjoining river and gashing it in several places, it is brought forward as the remains of the missing individual. In such conspiracies circumstantial details are not infrequently sworn to by several persons, testifying as eye-witnesses to alleged facts of the murder, to the burial of the corpse, &c., so that conviction for the murder may be duly passed, and the falsity of the whole proceedings not be discovered until the **reappearance alive of the alleged murdered person.**

Case III.—Ibrahim Beg, a wealthy *mahajan* (merchant), was convicted of the murder of his young wife Chumbelee. On the day previous to the one appointed for the execution of the convict, an individual informed a young English civilian that Chumbelee was alive, and led him to the place where she was kept concealed by a gang of *fakirs* in a subterranean chamber of a tomb. It then turned out that the whole affair was a conspiracy got up by a man named Khan Beg, the *mahajan's* next heir. This man, with the assistance of one of the *mahajan's* servants, first excited Ibrahim Beg's jealousy, and led him to beat his wife. Her loud screams were heard by the neighbours. They then abducted the wife and handed her over to the *fakirs*, in whose custody she was subsequently found. Just before the quarrel between Ibrahim Beg and his wife, the conspirators had got hold of a female body. They cut off the head of this, put on the arm of the corpse one of Chumbelee's bangles, and buried the body in the courtyard of Ibrahim Beg's house. Here it was discovered on the day after the quarrel, and was supposed to be the body of Chumbelee. The man who gave information that Chumbelee was still alive was a subordinate in the affair, who was dissatisfied with the remuneration given him for his services.[1]

[1] Chevers, p. 54.

Case IV.— Regarding another case, the Sessions Judge wrote :—

"It would be impossible to imagine a case more completely satisfactory as regards at least the guilt of Abdool Kurem [the falsely accused] than this, because when the [police] darogah's report was completed, and as in fact it remained until the appearance of Pertab Narain [the alleged *murdered* man] brought to light its real character. The prosecutrix was the mother of the missing man, the principal witnesses were his wife and his cousin, while the prisoner's own servants detailed at length circumstances attending the burial of the body. There were no inconsistencies and no contradictions in the evidence, which from first to last gave the hearers the impression that a heinous crime had indeed at last been brought to light, in spite of a powerful combination to conceal it."[1]

False Confessions of fictitious murder.—The falsely accused persons, even when not the subject of delusional insanity, may confess to have done the alleged murder and yet the alleged murdered person appears alive in Court :—

Case V.—In the Mirzapur district, a Rajput widow known to be unchaste eloped with a paramour. The headless body of a woman was found in a well, and was supposed to be the body of the widow who had eloped. The widow's brothers were charged with her murder, confessed their guilt (?), and were convicted. Just before they were sentenced the missing widow appeared ; she had heard by chance that her brothers were charged with killing her, and came forward to clear them. The brothers said they had confessed to the murder because they thought it was hopeless to plead innocence.[2]

False Evidence fabricated by Police.—The native police also whose duty it is to make the preliminary report on criminal cases are drawn from the ranks of the masses and are still credited with suppressing incriminating evidence for a monetary consideration, as well as with **extorting false confessions** by torture or threats through mistaken zeal or other motive, all tending to obscure the truth. Thus a head constable at Rangpur in Bengal induced a woman to say that a certain corpse found floating on a river was that of her adopted father. He further instigated her to charge five men with the murder. At this juncture a sub-inspector took up the case, and the five men were arrested and kept for the night in the custody of these constables who maltreated their prisoners and thereby induced them to confess that they had committed the murder. When the trial was going on the missing man came into court.[3]

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[1] *Niz. Ad. Rept*, 1853, I. 259. Other cases of this kind. *Niz. Ad. Rept.*, N.-W. P., 1854, 381 ; *Police Rept.*, L. P., 1844, p. 37.

[2] Chevers, p. 69.

[3] *I.-G. Bengal Police Rept.*, 1866, p. 47.

A murder may be committed to support a false charge, see page 22 and *cases VII and VIII.*

Again a sessions judge records:—"I do not credit the evidence of the eye-witnesses as to the place where and the mode in which the wound was inflicted.....the eye-testimony of the knife and the blow on the road was an after-thought of the police to make the case more complete according to their infamous custom in these parts."[1]

So much suspicion clings to the evidence offered by the police, that it is specially enacted that[2] "no statement made by any person to a police-officer in the course of an investigation under this chapter shall, if taken down in writing, be signed by the person making it, nor shall such writing be used as evidence."

SOME CAUSES OF CRIME IN INDIA.

Custom.—A good deal of the crime against the person in India is due to the primitive social state of the mass of the people with its proportionate degree of moral insensibility and the cast iron cult of custom which binds the people to the ways of the past. Practices which are considered to serve some more or less useful purpose for the community in its particular stage of development are not regarded for the time being as criminal. Thus many practices which now a days under British rule are considered crimes were not deemed to be crimes at all under Hindu and Muhammadan rule, such as burning widows alive at the funeral pyre, female infanticide, burial of lepers alive, 'justifiable suicide,'[3] revenging certain wrongs by taking the law into one's own hands; and cases of such murders and human sacrifice, still occur nearly every year. Mutilation of nearly every part of the body is authorized as a punishment in Hindu law, for example, the hand or foot, both

[1] *Niz. Ad. Repts.*, V, part 2, 1885, p. 812.

[2] *Cr. P. C., s.* 162.

[3] Five kinds of suicide are considered justifiable by Hindus: It is written in the *Brahma Purana:* "Let the man who is afflicted with a grievous and incurable disease enter a burning fire, or procure his death by starvation, or by plunging into unfathomable waters, or by precipitating himself from an eminence, or by ascending to paradise by a respectful pilgrimage to the Himalaya Mountains. Whoever relinquishes life under these circumstances, by precipitating himself from the sacred *vista* tree at Prayága, or, his time being come, destroys himself, that high-minded person shall receive a great reward in a future state, and shall not be considered a suicide; even although he may have been a great sinner, he shall meet with supreme bliss in paradise. The privilege of practising the abovenamed austerities is extended to the human species in general, without restriction either in regard to sex or tribe." (Macnaughten *Nizamut Adawlut*, vol. i, pp. 220-1: Vakeel of Government *versus* Sohawun.)

hands, one hand and one foot, both hands and both feet, buttock, lip, penis, testicles, pudenda, rectum, ears, nose, breaking the teeth, finger or fingers, piercing or gouging out the eyes, &c. Burial alive was a recognized Muhammadan torture, and torture is still practised by the police to extract evidence. Trial by ordeal is still not infrequent :

Case VI.—In 1900 in a village in Madras a shoe was lost, and the village magician was commissioned to discover the thief. He distributed some powders to the assembled villagers, and immediately after eating the powders two boys were seized with violent vomiting, and one of them died. From his viscera three grains of corrosive sublimate were extracted.[1]

In Burma, a short spell of organised robbery with assault or murder (*dacoity*) is still fashionable amongst the youth of that country to prove their daring and manhood.

Nevertheless, and indeed as a consequence partly of this and of the stagnant state of society in rural India, the Indian criminals are broadly speaking of a less inveterate criminal type than in Europe. There are relatively fewer of that gross anti-social type of moral monster, the '*habitual criminal*,' who infests society under the stress of the higher civilization. The very great majority of violent criminals in India are '*criminal by passion*,' fairly well meaning and generally law-abiding men who, stung into sudden madness by some insult or wrong, real or fancied, to themselves or families, take justice or retaliation into their own hands, and so find themselves in the clutches of the law.

Intoxicants.—The relatively milder type of the average criminal is perhaps in some measure due to the relative infrequency of *alcoholic drunkenness* amongst Indians, as alcoholism is found to contribute so largely to hereditary crime in Europe. In Burma, murderous assaults even on near relatives are not uncommon under the influence of alcohol ; in Rangoon alone over 300 sword-cuts of the head occur annually, many of them fatal. The intoxicant most indulged in by a few of the more disreputable Indians, namely *Indian Hemp*, accounts for some of the most violent tragedies, such as running '*amok*,' and other maniacal crimes.

Race.—In so large a continent as India, comprising so many diverse physical features, climates and races with different social and religious customs, it is to be expected that some of the crimes against the person and the mode of committing them should differ somewhat in character in different parts

[1] Madras Chemical Examiner's *Report* for 1900, p. 8.

of the country and be determined to some extent by the different environments of the people.

The softer and more degenerate people of the plains wreak their spite or vengeance more by false charges and subtle poison, or afraid of bodily risk themselves they hire ruffians to beat or murder their enemy and scheme deeply to hide their crime. Whilst the hardier up-country people and hillmen, taking the law into their own hands, attack openly and slay with their own hands regardless of personal risk or blame; and are less cunning in concealing their crime. The wilder tribesman lies in wait for the person he believes to have wronged or bewitched him, and on killing his victim he makes little attempt to hide the body and usually admits his guilt at once. Certain crimes are confined to certain tribes or castes, such as the poisoning of cattle, especially by *abrus*-seed needles ('*sui*'), which is done by the *chamár* or leather-worker caste with the object of getting cheap hides for their stock in trade.

Religion is responsible for several kinds of crime in India. Those murders perpetrated in the name of religion, in which Hindu widows are induced to sacrifice themselves on the funeral pyre or grave of their husbands, still occasionally occur nearly every year. In 1901 one occurred at Gaya, although it is over seventy years since *sati* was declared illegal by the British Government. Special police precautions have yet to be taken every year to prevent Hindus committing suicide by throwing themselves under the wheels of the idol-car of the god Jagarnath. Female infanticide on account of the religious and social difficulties of marrying daughters still occurs to some extent, especially in Upper India. Abortion and child murder are most common amongst the unfortunate class of young Hindu widows for whom re-marriage and social rights are denied by their religion. Amongst Muhammadans sexual crimes are much more frequent than amongst Hindus. Prostitution is much more extensively practised amongst the former, and sexual jealousy resulting in the murder of paramours and favoured rivals is probably the most frequent cause of homicide amongst Muhammadans. In Bengal, for example, the greatest number of rape cases are reported from the Muhammadan districts of Mymensingh and Dacca. That fanatical form of homicidal insanity 'running *amok*' is more common amongst Muhammadan fanatics than Hindus.

Domestic characteristics are that women mostly employ poison rather than bodily violence, and their crime is directed for the most part against their husband or some rival in his affections.

Famine.—Under the stress of hunger in famine years there is a marked increase in such crimes as robbery by violence, poisoning, &c.

MORAL INSENSIBILITY IN MOTIVES.

The *motives* for murder in India are often atrociously unnatural and exhibit much moral insensibility—a truly criminal trait.

Murder of own family to fasten a charge on an enemy.—The victim is usually an old infirm person or a child. Numerous such cases occur every year. A woman in Patna district poisoned *her own* little daughter, and concealing the body on the premises of a neighbour with whom she was at enmity accused him of having murdered her.[1] "A man in Jhansi (1885) killed his daughter because his neighbour had slandered her in order that the girl's blood might be upon the neighbour's head. A master murdered his servant (1881) and threw the body before the door of his enemy solely in order to bring a false charge against the latter. A similar case occurred in Azamgarh five years later; a boy was murdered by his grandfather and uncle; they threw the body into a sugar-cane field, and then charged the owner with the crime. A still stranger story comes from the Muthra district. Randhir, a Jat, who had once been a thriving man in Randhirpur, fell into the hands of the money-lenders, lost his property and his house and became for some crooked reason embittered against his old fellow-villagers. He made up his mind to bring them into trouble. Taking his chopper with him he met a little *chamár* girl whom he took into a temple in Bahadurpur. There he cut her throat and slightly wounded himself and then brought a charge of dacoity and murder against the people of his old village."[2] A man sentenced at Cawnpore as accessory to the murder of his own sister confessed that the deceased's own son and another relative had beaten her to death and had absconded with her property, and that he afterwards witnessed the partial burial of her body in one of the apartments of the house in which they all resided as a joint-family. He had deceived the neighbours as to the cause of the unpleasant effluvium which proceeded from his house, by attributing it to the death of a snake in one of the drains. The body was found several

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[1] *Bengal Police Rept.* 1868, p. 139.
[2] Kitts' *Serious Crime in an Indian Province*, 1889, pp. 14, 15.

days after the murder in a locked room, the key of which was in the prisoner's possession.[1]

Case VII.—**Murder of father by son amid crowd of witnesses in broad day to lay false charge at another man's door.** In 1902, a certain dhobi of the village of Kalanjari, thana Jani, in the district of Meerut, found that some clothes which had been given to him to wash, had been stolen. He suspected two Dhanuks of the village, who had been in his service as watchmen, and a relative of theirs, and brought them before the zemindars. The Dhanuks protested that they knew nothing about the clothes, so the dhobi, Ramzani by name, reported the matter at the thana. The head-constable of Jhani and two other constables returned with Ramzani to investigate the matter, and the head-constable took up temporary quarters at the house of a Jat zemindar named Jhunku, this apparently being the customary thing in the village. After making several inquiries, and inspecting the hut from which the clothes had been stolen, the head-constable, whose name was Niaz Ahmad, called several zemindars to the house of Jhunku, presumably to assist in the inquiry, and afterwards sent a chaukidar to fetch the three suspected Dhanuks. In answer to the summons, about a dozen Dhanuks turned up with their women-folk, making a great noise as they approached Jhunku's house. They were armed with *lathis*, and evidently meant mischief. Niaz Ahmad asked them the reason of this conduct, and one Siria, who seems to have been the ringleader of the party, replied, "Jhunku wants to get us all summoned. We have come to see how he will do it." Jhunku replied, "Why should I have you summoned? Those who are the thieves will be chalaned." The head-constable added, "Don't make a noise, justice will be done." "How will justice be done?" replied Siria, "we will get Jhunku summoned first." Saying this, Siria gave an old Dhanuk, who was standing beside him, a push, with the result that the old man fell, striking his head against the *chabutra*. The old man, by the way, was Siria's father, Chimman by name, and was about sixty-five years of age. Several of the Dhanuks then cried out, "Kill the old man and accuse Jhunku," and several of them began to strike the prostrate body. They seized the man by the legs and dragged him fifteen paces away, and then Siria jumped on his chest. The police and zemindars appear to have made some ineffectual attempt at rescue. The Dhanuk tumbled the old fellow on to a charpoy and marched away in the direction of Meerut. There are two witnesses who state that they encountered the party on its way to Meerut, and that the Dhanuks told them that Chimman had been assaulted by Jhunku, and that they were taking him to the police-station. Chimman, however, feebly protested from the charpoy, saying that he had been assaulted by the Dhanuks themselves, and that they wanted him to bring a false case against Jhunku. By the time they reached Meerut old Chimman was dead, and the Dhanuks charged Jhunku and several others with the murder, saying that the reason for the crime was that Jhunku and the police had demanded money from them in connection with the theft case, that they had refused, saying that they had none, that Chimman had expostulated, and that for this he had been done to death with *lathis*. The Magistrate and the Judge both disbelieved the story of the defence and believed the story told by the police and the zemindars. The Magistrate charac-

[1] *Viz. Ad. Repts.*, N.-W. P., 1853, p. 765.

terised the crime as most strange, unnatural and revolting, and the Judge agreed with him. He sentenced Siria to be hanged, three others to be transported for life for the murder, besides finding them guilty of fabricating evidence against Jhunku, with the intention of causing him to be convicted of murder. He found six more Dhanuks guilty of abetment of the second crime and sentenced them to various terms of imprisonment.—Allahabad High Court, JJ. Knox and Blair, 1902.

Case VIII.—**Murdering adult brother.** On the morning of the 17th December 1901 the decapitated body of one Tahal Singh was found in the field of Pertap Singh in the Gurdaspur district of the Punjab. Suspicion was at first directed against Pertap Singh, but the police were able to discover that on the night of the murder the deceased had been last seen in the company of certain persons including his own brother and the lumbardar of the village going towards the field where the body was found next morning. "It also transpired," we quote the words of the police report, "that on the 16th of December the murdered man and his brother Mahal Singh were drinking at a liquor shop in Nowshera, and there the murdered man, who was rather intoxicated, invited certain friends to drink with him saying it was the last opportunity they would have, as he would soon be in two or four pieces. The brothers then went to Kotla, where the other accused were assembled and had more drink." By the advice of the public prosecutor a pardon was offered to the brother of the murdered man, and his story was as follows:—"He, his brother, Tahal Singh, and the lumbardar, were great friends, and they had a common enemy in one Pertap Singh of Bulewal, between whom and themselves there had been a considerable amount of litigation. At the time of the murder Pertap Singh had brought a charge of assault against him and his murdered brother (Tahal Singh), and Pertap Singh's son had a similar charge pending against the lumbardar. They arranged that Tahal Singh should be murdered, his body put in Pertap Singh's field, and a charge of murder brought against him. Tahal Singh consented to be killed for this purpose of revenge. On the night in question the party proceeded after a drinking bout to Pertap Singh's field, the lumbardar carrying a *gandasa*. On arriving at the field accused No. 1 threw Tahal Singh down, and he and the lumbardar gave their superfluous clothes to accused No. 5 to hold. The lumbardar then seized the murdered man by the hair, while he himself and Bela Singh, accused No. 4, each seized a leg. Budha Singh, accused No. 1, decapitated the deceased with the *gandasa*. All then went to Kotla where they washed their hands and feet at a well and burned some of the murdered man's clothes in the lumbardar's courtyard. The *gandasa* belonged to accused No. 1 and was found in his house by the Police."—*C. & M. Gazette*, 11th February 1902.

Case IX.—**Butcher murders his child to please paramour.** In June 1901, before the Allahabad High Court, Mula, a butcher of the sweeper caste, resident of mohalla Naimandi, Rekabganj, Agra, was convicted for the murder of his daughter, a child of four years of age. According to the evidence and the confession of the accused, Mula had had an intimacy with Musamat Koka, a sweeper, and used to live at her house. Shortly before the murder took place Koka left Mula and went back to live with her own husband. This seems to have put Mula into a state of fury, and he threatened to cut off the woman's nose. On the night before the murder he visited her and during his visit struck the woman's year-old child. According to Koka, the man threatened

to kill the child. The woman got into a rage and cried out, "Why should you kill her, you give her neither food nor drink, why don't you kill your own child?" According to the accused, the woman asked for the body of his own child. Mula went away and slept in his own house that night. In the morning he took his daughter to the slaughter-house, where he was employed as a butcher, and cut the child's throat in the manner animals are slaughtered. The man then took the body of the little girl to the house of Koka and entered the room in which she and her husband were sleeping. Before awaking Musamat Koka he laid the body of the girl on a bed on which Koka's husband and Koka's son were sleeping. He then roused the woman and asked her to give him a smoke saying, "God knows whether I shall live or die." She pointed out the tobacco at the fireplace. He brought fire from the fireplace and prepared his *chilum*. He then asked the husband to smoke, addressing him in the same words, and the husband waking up, asked what was the matter. He showed him the body lying on the charpoy and said he had killed the child at the bidding of Koka.

Parents sometimes conceal the murder of their son or daughter and report the death as being due to attack by wild beasts or suicide.[1] So common is this moral insensibility to natural ties that the high court refers to it as "instances of persons consenting to forego the prosecution of those who have committed the most serious injuries to their persons or properties are within the common experience of every magistrate in this country."[2]

One wretched woman having murdered a child for the sake of its ornaments, which were worth less than six rupees,[3] was found burning the child's body at her own fireplace.[4]

The moral insensibility in natives of India is also apparent in their well-known apathy during accidents and assaults. They calmly look on at the struggles of a drowning man, without attempting to lend him assistance, and often do not attempt to save the victims of attempted murder. Thus a young woman was seen by a man at noon to throw a boy ten years of age down a dry well twenty feet deep. The man never attempted either to catch the murderess or to help the child in the well, alleging that he had a boil on his foot and a load of fuel on his back; without throwing down his load he went to the village and informed the child's father. The father went to the spot, but did not attempt to take out the body until the *evening!*

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[1] *Bengal Police Rept.*, 1849, p. 8.
[2] *Niz. Ad. Repts.*, Vol. VI (1856), p. 801.
[3] Eight shillings.
[4] *Bengal Police Rept.*, 1866, p. 172.

MEDICAL JURISPRUDENCE.

PART I.—GENERAL EXAMINATION.

CHAPTER I.

IDENTIFICATION OF THE LIVING AND DEAD.

THE medical jurist may be called upon to establish the identity of a person in cases of suspected foul play resulting in death, or in cases of alleged assault, rape, disputed sex, fraudulent personation for the purpose of securing property or the prolongation of a lapsed pension, a fraud which is facilitated in this country by the seclusive rights claimed by married women (*pardah nashin*). In India, it is especially difficult at times to determine the identity of bodies owing to their rapid decomposition by the heat, and their liability to defacement when exposed to the ravages of beasts and birds of prey. On the other hand, the necessity for thorough identification is here all the greater owing to the custom of rapid burial and cremation and the occasional practice of supporting a false accusation of murder by causing a person to disappear for a time and bringing forward meanwhile as the body of the missing individual a putrid corpse (see p. 17) readily procurable from any river.

Even in the ordinary routine examination of medico-legal cases, it is always well to get the identity of the person or body in question attested by at least two acquaintances, whose name or names should be noted by you, as the personal identity of the individual examined is of such legal importance.

Identification may thus be required of (*a*) a living person, (*b*) a dead body, (*c*) fragmentary human remains, or (*d*) bones only. For this purpose you consider (1) the sex, (2) age, (3) race and caste, (4) any characteristic marks or peculiarities.

SEX.

The determination of sex is not usually difficult, mere inspection of the external genital organs being sufficient to settle most cases otherwise doubtful, without resorting to medical evidence. In cases, however, of suspected murder, where the body is mutilated or only part of it or of the skeleton are available for examination, and in the rare instances of doubtful sex due to malformation where succession to property is concerned, it becomes a much more difficult question, requiring expert evidence. The question of sexual capacity and development also arises sometimes in alleged rape, impotence, &c.

Illustrative cases of doubtful sex :—

Case X.—**Levi Suydam.** Suydam presented himself as a freeman, and thus entitled to vote in a contested election. Dr. Barry having found an imperforate penis with a depression in the site of the male meatus, a short urethra opening underneath the penis (hypospadias), and a cleft scrotum with a small but perfect testis in its right half, pronounced him to be a male and entitled to vote. Dr. Ticknor, who objected at first, came to the same conclusion. A few days after it was discovered, by his sister's and his own confession, that Suydam regularly menstruated, and had done so for years. His figure was feminine, the breasts were well developed; and on passing a sound into the urethra, instead of reaching the bladder it passed into a cavity like the vagina, three or four inches deep. It was also said that this urethra had been made for him by the accouchear who attended at his birth."—*Amer. Jour. Med. Sc.*, July 1847.

Case XI.—Æt. fifty-five at death. General configuration, that of a woman (during life celebrated anatomists had formed different opinions as to the sex). At the post-mortem there were found, on the right side, a withered testicle, a penis, and a prostate gland; and on the left an ovary, uterus, vagina, and fallopian tube. Tidy's *Leg. Med. I.*, 353, case 128.

Case XII.—**Hubert I. Pierre.**—Died at the age of seventeen. No down on chin or lip. Breasts of middle size, with large areolæ. The bust was feminine, but the hips were imperfectly developed. Penis four inches long with prepuce, but imperforate, a little indentation occurring at the ordinary spot of passage. Under the penis was a fissure resembling that between the labia. The left labium contained a testicle with spermatic vessels, whilst in the right a body descended when the abdomen was pressed, which proved to be an imperfect uterus, with fallopian tube and ovary. A rudimentary vagina one inch long was also present."—*Beck.*

Case XIII.—"A person affected with hypospadias was married for twenty years, and during all that time was treated as a female. Sexual intercourse was regularly effected by the canal of the urethra, nor was it until the period just mentioned had elapsed, that it was discovered that the individual was a man."—Ogston, *Med. Jur. Lect.*, p. 52.

A remarkable instance of concealed sex was the case of Dr. James Barry, an army surgeon, who rose to the rank of

Inspector-General of Hospitals, and after death was discovered to be a female.

SEX OF THE LIVING.

This question may arise in connection with malformed infants as well as adults where property is left to an heir of a definite sex.

Thus in entailed property with succession in the male line, if a widower with no son but a daughter marries again and has only a daughter, his property would be divided equally between the two daughters, unless a male child had been born to either wife, when even if it lived only half a minute the whole of the property would go to the sister of this male infant as heir of her brother (*possessio fratris*).

At a later age this question may occur with reference to malformed individuals as to their (1) education whether as a boy or girl, (2) marriage as a man or woman or (3) right to vote as a man. In such cases it is sometimes very difficult to determine the sex, especially in infants. Here a consideration of the morphology and development of the sexual organs is of assistance as these abnormalities are due to faulty development in the fœtal stage during the differentiation of the sexes. In the normal female there is, so to say, an arrest of development in the middle line below the genital tubercle or clitoris, the homologue of the glans penis, thus forming the entrance to the vagina, and the lateral cutaneous folds do not coalesce to form the labia majora. In the normal male the genital folds meet and coalesce in the middle line below to form the scrotum and corpora spongiosa and canernosa and above to close over the urethra as far as the glans to form the penis. If the genital folds do not unite, the urethra of the male remains open constituting *hypospadias* which simulates to some extent the female organs, especially if the testicles have not descended. If in the female there be excessive lateral union and growth of the clitoris the condition may simulate the male.

The chief homologous parts in the male and female are[1]:—

Male.	*Female.*
Glans penis	... Clitoris.
Prepuce	... Nymphæ.
Scrotum	... Labia majora.
Sinus pocularis	... Uterus.
Vas deferens	... Ducts of Gaertner
Gubernaculum testis ...	... Round ligament.
Testicle	... Ovary.

[1] Watson, *Journ. Anat. and Phys.*, 1879.

The possible abnormal variations from faulty development in these organs which mask the sex may be divided into :—

True Hermaphrodites.—Where the organs of both sexes are present.

False Hermaphrodites.
- *Androgyni*, or womanly men, whose male organs resemble those of the female.
- *Androgynæ*, or manly women, whose female organs resemble the male.

In the 'false' hermaphrodites the abnormalities are confined to the external organs, whilst in the 'true' the essential internal organs also are affected. *Androgyni* have, as the most common condition, *hypospadias*, so-called from the urethra opening *below* the small imperforate penis. In *epispadias* there is deficiency of the anterior wall of the bladder, so that the ureters open externally above the short imperforate penis. In both of these conditions the testicles may not have descended. In *Androgynæ* it is usually a case of enlarged clitoris with a prolapsed uterus, the fissure of which is transverse, whilst that of the penis is vertical. In such cases, if menstruation is found, it is a female ; if a testicle or seminal emissions, it is a male.

'True' Hermaphrodites.—The old myth attributed to these beings the possession of organs of both sexes with the power of self-reproduction. No individual with such powers has ever been known to exist. This name, however, is still applied to those individuals who possess certain of the genital organs of both sexes. In the remarkable case of Catherine Hohmann, she had the sexual instincts both of a male and a female, she menstruated periodically and had seminal emissions containing spermatozoa.[1] See also *Case XI*, page 28.

This so-called 'true' hermaphrodism has been divided by Sir J. Y. Simpson[2] into :—

Lateral.—Testicle on one side and ovary on the other.

Transverse.—External organs male and internal female or the reversal.

Vertical or double.
- (*a*) Ovaries with combined male and female passages.
- (*b*) Testicles with combined male and female passages.
- (*c*) Ovaries and testicles co-existing on one or both sides.

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[1] *Med. Times & Gaz.*, June 28, 1873, *and Am. Jour. Obstetrics*, 1876, p. 615.
[2] Todd's *Cyclop. of Anatomy.*

The 'lateral' is considered by Watson to be the only true kind of hermaphrodism, while (*c*) ought probably to be classed amongst double monsters.

In such cases the sex may be very difficult to determine. No definite rules can be laid down ; each case must be decided on its own merits, following the legal rule that the individual is to be of that sex which most predominates.

Examination locally should include, as far as possible, the internal genitals by bimanual and rectal palpation if necessary. In addition to the local examination the following general characteristics should be considered :—

General Sexual Characters.—

1. *General configuration* of the body. The shoulders are generally less wide than the hips in females, the reverse in males. The breasts much more developed in females.
2. *Hairiness* of face and pubes after puberty is greatest in males.
3. *Voice* is deeper in tone in male, and the pomum adami more prominent.
4. *Sexual instinct* is assumed to be towards the opposite sex, although there are recorded instances of sexual indulgence of an inverted character (*see* Sodomy).

Essential Tests of Sex.—These are, to recapitulate :—

1. Possession of a *testicle* accompanied by emissions of fluid containing spermatozoa—this is the strongest possible evidence of a male (but see case of Catherine Hohmann, p. 30).
2. Possession of an *ovary* accompanied by periodic hæmorrhages from an opening about the genitals is the strongest evidence of a female. The uterus, vagina and breasts are merely incidental appendages.
3. In the absence of the above two characters, the presence of a *uterus* or a second opening behind that leading into the bladder indicates a female.
4. The general configuration of the body when it agrees with these local indications may be considered confirmatory evidence, but if it disagrees it should be disregarded.

SEX OF THE DEAD.

When the entire body is available for examination there will be no difficutly in the great majority of cases in determin-

ing the sex, and in doubtful cases of malformed organs dissection will at once reveal the true sex. Any question with regard to the sex of a dead body, usually arises when only mutilated fragments of a body or only bones are available for examination.

For the identification of such bones the text-books on general anatomy should be consulted. The more important **Sexual Characteristics of the Skeleton are**:—In the female :—

1. The *bones* are smaller, thinner and lighter, and muscular attachments less prominent than in the male.
2. The *pelvis* is shallower, wider, ilia more expanded, sacrum more concave than the male (where it is straighter), the symphysis shorter, pubic arch wider, with edges more diverted, foramina more triangular and outlets larger than in the male.
3. The *ribs* have a greater curvature than in the male.

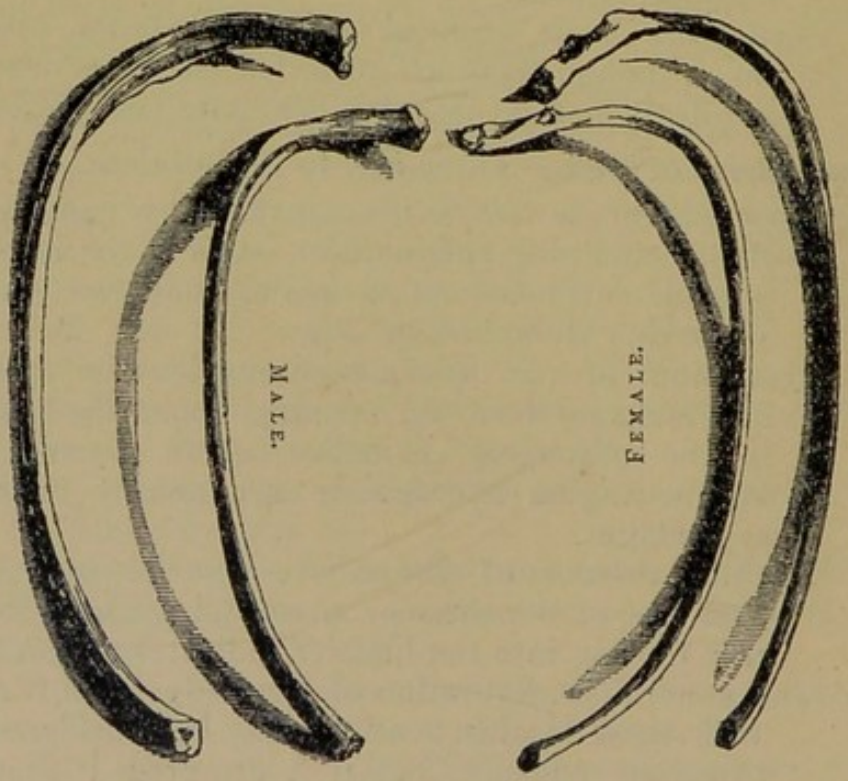

Fig. 1.—Curvature of female rib *v.* male.

The average measurements of bones in each sex, for Europeans, are here detailed :—

Measurements of bones at different ages (in inches).[1]

Age.	Height.	Spine.	Circumference of skull.	Humerus.	Radius.	Hand.	Femur.	Tibia.	Foot.	Pelvis. Transverse diameter of.	Pelvis. Antero-posterior.
At birth	19	7·0	15·0	3·5	2·5	3·1	4·3	3·5	3·5	1·3	1·3
2 years (average) ...	27	8·5	17·7	4·7	3·6	3·1	6·2	5·1	3·6	2·2	2·2
4 to 6 years (average)...	35	11·8	18·0	6·6	4·8	4·1	9·1	7·1	5·1	2·5	2·5
8 to 12 years (average)	43	12·8	18·8	8·3	6·0	5·1	11·4	9·4	6·4	3·1	3·1
15 years — Female ...	55	17·0	19·0	10·3	7·0	5·8	14·8	11·0	7·8	4·0	3·6
15 years — Male... ...	54	16·5	19·0	10·5	7·5	5·6	15·0	11·5	...	...	...
15 years — Average ...	54	16·6	19·3	10·4	7·4	5·7	14·8	11·6	8·0	3·8	3·6
18to19 years — Female ...	59	19·0	19·5	11·0	8·2	6·5	16·0	12·8	8·0	5·0	4.8
18to19 years — Male... ...	59	17·5	20·4	11·0	8·5	6·3	15·0	13·0	8·0	3·9	3.8
18to19 years — Average ...	60	18·5	19·8	11·4	8·6	6·6	15·5	13·3	8·3	4·7	4·5
Adult European (average) ...	65	22·2	20·5	12·7	9·2	7·3	17·88	14·4	10·6	5·2	4·3

AGE.

The determination of age may be required for the identification of an individual, living or dead, as well as for the question of criminal or civil responsibility in regard to marriage, fecundity, rape, and viability, &c., relation to infanticide, making wills, capability as a witness, &c.

Criminal responsibility.—Children under the age of seven are deemed incapable of committing an offence. Children between the ages of seven and twelve in India (seven and fourteen in England) are only deemed capable of committing offences if they have attained a certain degree of maturity of understanding.[2] Sexual intercourse with a girl under the age of twelve is in India **rape**, even if the girl consents or is the individual's own wife.[3] In England, sexual intercourse with consent is a felony up to the age of thirteen, and between the ages of thirteen and sixteen, is a misdemeanour and punishable as such.[4] In India, however, the law is in practice assimilated to that of England, by the prosecution, when failing to prove a child to be under 12, often indicting the accused under *s.* 361, *I. P. C.*, for 'enticing' or 'kidnapping' or under *s.* 373 for "buying, hiring or otherwise obtaining for prostitution or

[1] From Dr. Humphry. *The Human Skeleton.*

[2] *I. Penal Code, ss.* 82 and 83

[3] *I. Penal Code, s.* 375. see also 'Rape.'

[4] *Criminal Law Amendment Act*, 1885 (48 and 49 Vict., c. 69). Section 7 of this Act also makes it an offence to abduct an unmarried girl under eighteen with intent that she should be unlawfully and carnally known by any man.

any unlawful or immoral purpose" or under *s.* 373 for "selling, letting to hire or otherwise disposing of any minor under sixteen," which make connection with a girl under 16 a misdemeanour; and then the surgeon has to enquire whether the girl be under or over sixteen. Only a person over the age of twelve can give a **valid consent** to suffer any harm which may result from an act done in good faith, and for the sufferer's benefit (*I. P. C.*, *s.* 90); and in cases where the act does not come within this description, the consenting individual must be of the age of eighteen or more, for his consent to be valid (*I. P. C.*, *s.* 87).

(2) **Capacity to contract marriage.**—According to the law of England, females under the age of twelve, and males under the age of fourteen, cannot contract marriage.

(3) **Attainment of majority.**—In England majority is attained at twenty-one. Persons under this age are minors. A minor cannot make a valid will, cannot alienate his goods by deed, cannot be called upon to serve on a jury, &c. Certain cases excepted, persons domiciled in British India attain majority on completion of their eighteenth year.

Legally an individual attains a given age on the first minute of the day before his birthday, *e.g.*, an individual in England who, popularly speaking, will be twenty-one on the 3rd of May, will legally cease to be a minor at the end of the last minute of the 1st of May.

(4) **Eligibility for certain kinds of employment.**—By law in England, in factories children under eight may not be employed, and children between eight and thirteen may only be employed for six and a half hours per day. Further, males and females, between thirteen and eighteen, may only be employed for sixty hours per week. The Indian Factories Act (XV. of 1881) provides that, in factories coming under its operation, no child under the age of seven shall be employed, and that children between the ages of seven and twelve shall not be employed for more than nine hours per day, and shall have one hour daily for rest, and four unemployed days per month.

The chief **data for estimating the age** of an individual are—(1) the teeth, (2) height and weight, (3) some minor signs, and (4) extent of ossification.

AGE OF THE LIVING.

This can only be estimated with any degree of certainty in the young. After adult life is reached, the age can only be

guessed at approximately, in the absence of a regular certificate of birth or a horoscope. The points to be noted are :

(1) **Teeth**.—These yield indications of age up till the thirteenth or fourteenth year, and with the 'wisdom' teeth up to the eighteenth year.

The *temporary* or 'milk teeth' and the *permanent* teeth usually appear in the following order :—

Eruption of Temporary or Milk teeth.[1]

Eruptive order.	Name.	Age.
1	Lower central incisors	7th month.
2	Upper ,, ,, ...	8th ,,
3	Upper lateral ,, ...	7th to 9th month.
4	Lower ,, ,, ...	10th to 12th ,,
5	1st temporary molars	14th month.
6	Canines	17th ,,
7	2nd temporary molars	22nd to 24th month.

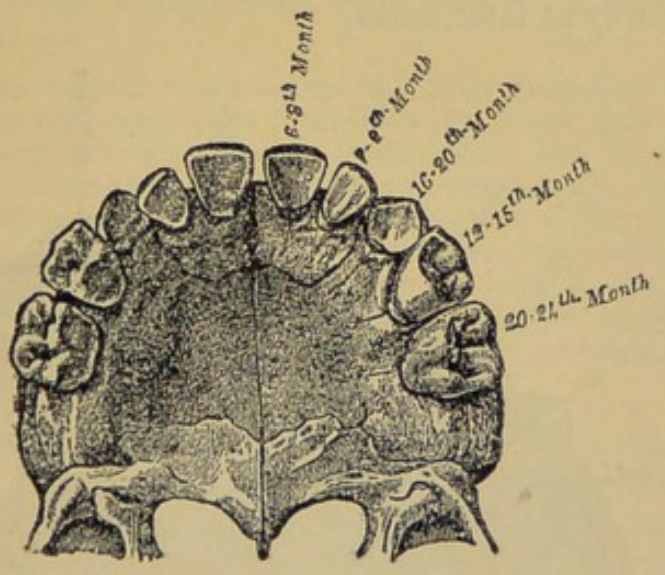

Fig. 2.—Temporary teeth (upper jaw).[2]

In certain weakly children, especially those suffering from rickets the dentition may be delayed, while in syphilis the teeth may be premature, and even present when the child is born.

The Permanent Teeth are thirty-two in number, 16 in each jaw. The following table by Dr. A. Powell gives the order of their appearance for India according to a very large series of observations by him.[3]

[1] From Macalister's *Human Anatomy*. [2] From Macalister's *Human Anatomy*.
[3] *I. M. G.*, 1902, p. 230.

Eruption of Permanent Teeth.

	Powell for Natives of India.	Saunders.	Pedley.	Gray.	Mann.
First Molar ...	6th to 7th year.	8th ...	6th ...	7th ...	7th.
Central Incisor ...	7th	9th ...	7th ...	7th ...	8th.
Lateral ,, ...	8th to 9th	10th ...	8th ...	8th ...	9th.
Canine ...	10th to 13th	13th ...	11th to 12th.	11th to 12th.	11th to 13th.
Anterior Premolars or Bicuspid.	9th to 10th	11th ...	9th ...	9th ...	10th.
Posterior Premolars	10th to 12th	12th ...	10th ...	10th ...	11th to 15th.
Second Molar ...	11th to 12th	13th to 15th.	12th ...	12th to 13th.	13th to 16th.
"Wisdom" ...	14th to 27th	18th to 25th.	17th to 25th.	17th to 21st.	18th to 30th.

In Natives of India a few exceptions may be found to these figures, but these exceptions will be found on the precocious side, rarely at later dates.

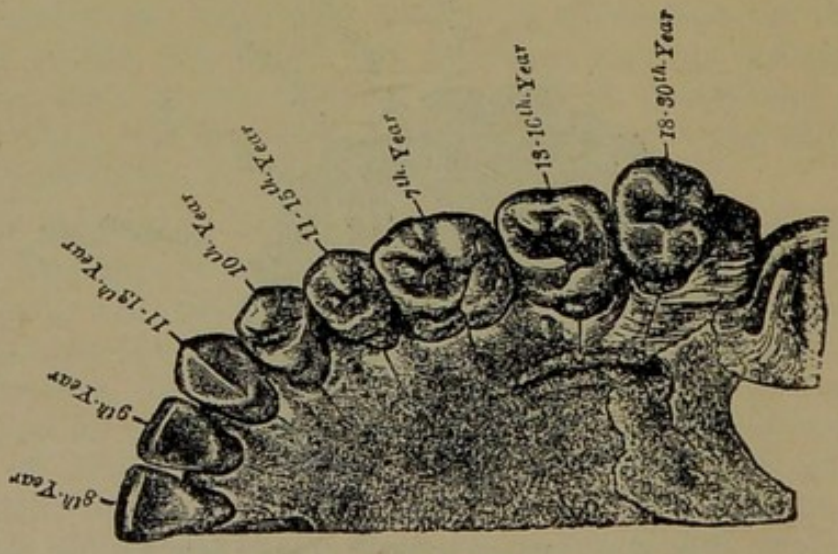

Fig. 3.—Permanent teeth.[1]

Generally, a child of nine should have twelve permanent teeth; at 13 or 14 it will have 28. In a case at Chingleput, Madras,[2] the age was decided to be between 12 and 13 because the permanent molar teeth were ready to come through the gum. In advanced life the teeth become worn down and discoloured, and more or less are lost.

[1] From Macalister's *Human Anatomy*.
[2] J. Short, *Madras J. Med. Sc.*, 1862, p 227.

Dr. Powell notes that :—The first molars appear with great regularity in the sixth or seventh year Of 41 children, aged seven, all had their first permanent molars.

The central incisors appear during the seventh, the lateral at the eighth or ninth year. All nine-year old children, natives, Jews and Parsis, had all the incisors permanent. Of ten Europeans aged nine, one girl had not shed her lateral milk incisors.

The canines shewed greater variation in the time of eruption. They usually appear during the eleventh or twelfth year. I have seen permanent canines in a child of nine.

The anterior bicuspids appear in the ninth or tenth, the posterior from the tenth to the twelfth year. The second molars come with great regularity in the eleven or twelfth year. They may appear earlier, but I have never seen a Hindu or Mussalman child of twelve without second molars. I have seen two Parsis, aged 12¼, without permanent second molars. I have seen wisdom teeth in Hindu children aged $13\frac{2}{12}$, $13\frac{4}{12}$ and $13\frac{9}{12}$. A few extraordinary irregularities may be found, but such freaks do not invalidate the general rules. I have known a European cut a wisdom tooth at thirty-six. Ackery quotes a case of temporary molars retained at 63, and Salter quotes a case of the same teeth being retained at 65.

To distinguish the *permanent* from the *deciduous* or temporary teeth is not always easy. Dr. Powell gives the following directions :—

Taylor says the milk teeth are smaller than those that replace them. How is the surgeon to compare ? Besides this is not true of the deciduous molars. These are usually larger than the bicuspids which replace them. The anterior milk teeth are vertical, the permanent are usually inclined somewhat forward. The crowns of the milk teeth are of a white china-like colour as compared with the ivory white of the permanent. The junction of the crown with the fang of the milk tooth is often marked by a ridge which is not seen in the permanent. "Mercurial" teeth and Hutchinson's teeth must be of the permanent set.

Height and Weight.—The ratio between these is too variable for any formula to be of much value. The average weight of Indian children at birth has been estimated at 5¼lbs. ;[1] that of English children at 6½lbs., and during the first year after birth about one pound is gained each month.[2] Of adults the average height and weight in the majority of Indian races is lower than that of Europeans.

For **Europeans.**—Average height, without shoes, and average weight, with clothes, of all classes (town and country) of the general population of Great Britain (from the report of the Anthropometric Committee, 1883). This table shows : (1) Growth is most rapid during the first five years of life, the *rate* of growth being about the same in both sexes, girls being a little shorter and lighter than boys. (2) From 5 to 10, boys grow more rapidly than girls. (3) From 10 to 15, girls grow more rapidly than boys. At 11½ to 14½ they are actually taller,

[1] Harvey *loc. cit.*

[2] According to Tidy.

and from 12½ to 15½ actually heavier than boys. (4) From 15 to 20, boys begin again to increase more rapidly than girls, and complete their growth at about 23. (5) After 15, girls grow more slowly, and practically reach their full height and weight at 20. During childhood and adolescence increase in weight is more marked in the winter, and increase in height in the summer.

Age last birthday.	Males. Height. ft. in.	Weight. st. lb.	Age last birthday.	Females. Height. ft. in.	Weight. st. lb.
1	2 9½	— 18½	1	2 3½	—
2	2 9¾	2 4½	2	2 8¼	1 11¼
3	3 0¾	2 6	3	3 0¼	2 3½
4	3 2½	2 9	4	3 2¼	2 8
5	3 5	2 12	5	3 4½	2 11
6	3 8	3 2½	6	3 6¾	2 13¾
7	3 10	3 7¾	7	3 8½	3 5½
8	3 11	3 13	8	3 10½	3 10
9	4 1¾	4 4½	9	4 0¾	3 13½
10	4 3¾	4 11½	10	4 3	4 6
11	4 5½	5 2	11	4 5	4 12
12	4 7	5 6¾	12	4 7½	5 6½
13	4 9	5 12½	13	4 9¾	6 3
14	4 11¼	6 8	14	4 11¾	6 12¾
15	5 2¼	7 4¾	15	5 1	7 8¼
16	5 4¼	8 7	16	5 1¾	8 1
17	5 6¼	9 5	17	5 2½	8 3½
18	5 7	9 11½	18	5 2½	8 9
19	5 7¼	9 13½	19	5 2¾	8 12
20	5 7½	10 3¾	20	5 3	8 11½
21	5 7½	10 5	21	5 3	8 10
22	5 7¼	10 7	22	5 2¾	8 11½
23	5 7½	10 7½	23	5 3	8 12
24	5 7¾	10 8	24	5 2¾	8 9
25-30	5 7¾	10 12¾	25-30	5 2	8 8
30-35	5 8	11 6	30-35	5 1	8 9

For **Indians**:—The following table by Major W. J. Buchanan[1] gives the results of 28,000 observations by him on healthy adult prisoners in Bengal jails:—

Height.	Weight.	No. of Observations.
5′	100	1,863
5′ 1″	102	2,059
5′ 2″	106	5,226
5′ 3″	109	5,787
5′ 4″	112	6,107
5′ 5″	115	3,040
5′ 6″	118	2,498
5′ 7″	121	1,389
5′ 8″	125	623
5′ 9″ and upwards.	129	220

[1] *I. M. G.*, Oct. 1897, p. 363.

This gives the average weight of a Bengali at 109lbs.[1] Lewis gives under 110lbs. as the average weight of N.-W. Provinces men. Buchanan's formula for calculating the weight for the height is :—*Taking 5 feet as equal to 100lb. add 3lb. in weight for every full inch above that*, e.g., *5 feet 6 inches = 100+3×6=118lb.* This certainly is remarkably simple.

In Bombay the average height to weight of 450 native male operatives, chiefly natives of the Konkan and Western Deccan, was :—

Height in feet and inches.					Weight in lbs.
Feet.	Ins.		Feet.	Ins.	
5	0	to	5	1	95½
5	1	,,	5	2	99
5	2	,,	5	3	100½
5	3	,,	5	4	105
5	4	,,	5	5	107
5	5	,,	5	6	110½

The weight slightly diminishes in old age. English *children* attain half their adult weight at about 12 in case of boys, and under 11 in case of girls ; as in this table.[2]

Age.	Males.		Females.	
	Height.	Weight.	Height.	Weight.
	inches.	lbs.	inches.	lbs.
8	46·66	55·08	46·73	52·82
9	49·21	60·02	48·63	56·53
10	51·00	65·29	50·07	61·19
11	52·87	71·01	53·66	68·00
12	54·05	75·00	54·41	75·95

3. Hair on pubes and armpits.—This growth begins about ten or eleven years of age, and in boys is attended about fifteen to eighteen by **deepening of voice.**

4. Breast development in girls.—This varies greatly in time. In native girls the average age of puberty is twelve to thirteen.[3] But even women of twenty sometimes have not menstruated ; and Dr. Powell cites a case of a child, aged four, who had a discharge of blood from the vagina every six or eight weeks and the labia were large and the breasts as large as

[1] Memo. on prison diets.
[2] Dr. Bridges, calculated from children in non-factory districts.
[3] See Chap. XI.

the halves of a moderate sized orange.[1] It is accepted as a good defence in England in cases of alleged rape when consent is admitted or proved that the judge or jury is satisfied that the girl looks sixteen and might have been supposed by the accused to be sixteen years of age, irrespective of her actual age.

5. **Degenerative changes.**—Wrinkles, grey hair, *arcus senilis* which is rare before forty, change in angle of the lower jaw. The angle of lower jaw, which is obtuse in infants, become nearly a right angle in young adults, and in advanced old age becomes again obtuse and shallow, through absorption of the alveolar portion.

6. **Ossification.**—Although this is less easily and certainly observable in the living than in the dead, the *Roentgen rays* enable it to be observed in the former, and it is of especial importance in charges complementary of rape where the surgeon has to enquire whether the girl be under or over sixteen. For points of Ossification see table p. 41.

The epiphysis at the knee-joint unite at the sixteenth year and not the seventeenth to the twenty-fourth as stated in the anatomy books.[2]

The external condyle of the humerus about 13th or 14th year.[3] Internal condyle 17th or 18th year; olecranon, 16th year.[4] Head of the radius which usually appears from the 13th to the 15th year.

The centres of the acromion, the border and lower angle of the scapula, two in the coracoid process appear between the ages of fourteen and sixteen. These latter are difficult to observe by the X-rays. The pisiform bone in children over twelve usually shows ossification. Its absence is strong evidence that the child is under twelve.

AGE IN THE DEAD.

Here, in addition to the foregoing points regarding dentition and height-weight, it is possible to make more extensive use also of that other precise criterion of age, namely, **the progress of ossification**. This is displayed in the following table by Ogston :—

Age after birth.	Points of ossification appear in	Bony union occurs between
4 months	Cornua of hyoid.	
5 ,,	Cornicula of hyoid.	
6 ,,	Anterior arch of atlas.	Alæ majores and body of sphenoid.

[1] *I. M. G.*, 1902.
[2] Dr. Carl Beck, *Jour., Amer. Med Ass.*, 5th January 1901.
[3] Quain : Dr. A. Powell gives 16th to 17th year.
[4] Dr. A. Powell *loc. cit.*

Age after birth.	Point of ossification appear in	Bony union occurs between
1 year.	Lower end of humerus; heads of humerus, femur, and tibia; 1st cuneiform bones.	Posterior arches and body of vertebræ; portions of the temporal bone, except styloid process.
2 years.	Lower ends of radius, tibia, and fibula; ends of metacarpal and metatarsal bones.	
2½ ,,	Patella, lesser tuberosity of humerus and four smaller metacarpal bones.	
3 ,,	Cuboid and large trochanter.	Odontoid and axis.
4 ,,	Trapezoid; 2nd and 3rd cuneiform.	Styloid process and temporal bone.
5 ,,	Semilunar; carpal scaphoid; head of fibula; ends of finger bones.	Rami and body of vertebra dentata.
6 ,,	Proximal epiphyses four smaller toes.	Rami of pubis and ischium.
7 ,,	Trochlea of humerus.	
7 to 9 ,,	Olecranon and scaphoid.	The two bony points at head of humerus.
9 ,,	....	Three portions of os innominatum.
12 ,,	Pisiform.	
14 ,,	Neck and lesser trochanter of femur.	
15 ,,	Inferior angle of scapula.	Last 4 sacral vertebræ; coracoid and body of scapula.
15 to 20 ,,	Sternal end of clavicle, coccyx.	Shaft of femur and its epiphyses; humerus and its epiphyses.
18 to 23 ,,	....	Sphenoid and occipital; tibia and its epiphyses; 1st and middle portions of sternum; epiphyses and body of ribs.
25 to 30 ,,	....	First sacral vertebra and rest of sacrum.

It should be especially noted that :—

(1) Ossification appears in the following epiphyses at the ages stated *in years*. Before the end of the 2nd, in the heads and lower epiphyses of the humerus, femur, and tibia, and in the lower epiphyses of the ulna, radius, and fibula. At 5 in the upper epiphysis of the fibula, at 7 to 9 in the olecranon, and 8 to 10 in the upper epiphysis of the radius.

(2) Ossification appears in the bodies of the following bones at the ages stated (in years). At 2½, patella; at 3, cuboid; at 4, trapezoid and second and third tarsal cuneiform; at 5, semilunar and carpal scaphoid; and at 12, in the pisiform bones.

(3) Bony union takes place at one year, of the posterior arches with the bodies of the vertebræ, and of the three portions of the temporal bone. At 3 years, of the odontoid process with the axis; at 4 years, of the styloid process with the temporal bone; at 6 years, of the ascending and descending rami of the pubis; at 9 years, of the three portions of the os innominatum in the acetabulum; at 15 years, of the last four sacral vertebræ, and of the coracoid with the scapula; at about 25, all

the epiphyses have united ; and at 25 to 30, the first sacral vertebra unites with the others.

(4) *As age advances*, the rib and laryngeal cartilages become ossified and the skull becomes thinned by absorption of diploe.

The above applies also to fragmentary portions of body or skeleton. See also Dr. Humphrey's table on p. 33, from which the age may be approximately estimated from isolated bones.

RACE AND CASTE.

It is not often that this requires to be proved, but the question might arise with reference to the dead bodies of unknown persons. Certain externals of dress and conventional markings serve to distinguish Hindus generally from Muhammadans. The chief of these are here tabulated :—

		Muhammadans.	Hindus.
Males.	1.	Circumcision marks, over 11 years of age.	1. Not circumcised.
	2.	Ears not pierced, or only one.	2. Both ear lobes pierced.
	3.	Crown entirely shaved.	3. Hairtuft retained when crown shaved.
	4.	Callosities from prayer attitudes on forehead, tip of l. ext. malleolus, patella, tuberosity of l. tibia.	4. None.
	5.	Palm of l. hand and tip of little finger occasionally stained with *henna*.	5. Not so.
	6.	Chapkan coat fastened on left side of chest, and may show sunburnt mark.	6. Chapkan opens on right side.
	7.	No sacred thread.	7. Sacred thread in higher castes over left shoulder.
Females.	1.	Not tattooed, especially between eyes.[1]	1. Tattooed between eyes and inside wrist, especially lower castes.
	2.	Ears pierced numerously along helix with silver rings.	2. Ears pierced in few places.
	3.	Nose-ring through septum.	3. Nose-ring through left ala.
	4.	Shoe marks probable.	4. Shoes not worn, toes widespread.
	5.	Palm, soles and nails tinted with brown *henna* or *mehindi*.	5. Stained with carmine *aultha*.
	6.	Sari worn double.	6. Sari worn single.
	7.	Trousers usually.[2]	7. No trousers.

The best test of race is found in the **measurements of the head**, and of these the easiest to take and one of the most important is the *cephalic index*. This is the ratio between the maximum length and maximum breadth of the skull, thus :

[1] Except proselytised Bengali Muhammadans.

[2] A Parsi woman wears trousers and sacred thread around waist like male Parsis.

$\frac{\text{length antero-posterior} \times 100}{\text{breadth transversely}}$ = cephalic index. A skull is '*dolicho-cephalic*' or long-headed when this index is between 70 and 74·5 '*mesati-cephalic*' from 75—79·9, and *brachy-cephalic* (the Mongolian type) or short-headed from 80 to 84·9. A sufficient number of measurements by competent observers has not yet been taken for all India to yield thoroughly trustworthy averages; but the following average cephalic indices [1] may be taken as a working basis for differentiating most of the chief tribes and castes:— As the more aboriginal darker tribes as well as the lighter complexioned (and therefore more purely Aryan castes) are more or less *dolicho-cephalic*, the latter are distinguished by an asterisk from the more aboriginal tribes and castes; Muhammadans are distinguished by a †. It will be noticed that the Brahman type becomes less dolicho-cephalic, therefore less pure, as it descends to Lower Bengal, being intermediate in Behar.

BENGAL.		BEHAR.		CHUTIA NAGPUR.	
Caste or tribe.	Average index.	Caste or tribe.	Average index.	Tribe.	Average index.
Malé	74·8	*Brahman ...	74·9	Chero ...	72·4
Bauri	75·0	Musahar ...	75·2	Chik	73·8
Rājbansi ..	75·2	Kurmi ...	75 7	Asur	74·0
Mālpahari ...	75·8	Chamār ...	76·0	Korwa ...	74·4
Bāgdi... ...	76·3	Kahār ...	76·1	Kharia ...	74·5
Māl	77·2	*Maghaiya Dom	76·2	Munda ...	74·5
Goāla... ...	77·3	*Goāla ...	76·2	Bhumij ...	75·0
Koibarta ...	77·3	*Bābhan ...	76·7	Lohar ...	75·3
Muchi (Chamar)	77·6	Dusadh ...	76·7	Orāon ...	75·4
Sadgop ..	77·6			Kharwār ...	75·6
Pod	77·7			Kurmi ...	75·7
†Muhamadan ...	78·			Bhuiya ...	76·0
Chandāl ...	78·1			Dom	76·0
*Kāyasth ...	78·2			Santāl ...	76·1
*Brahman ...	78·7				

[1] This data for the first four provinces are taken from Risley's *Tribes and Castes, Bengal*, Vol. I, 1889. For the N.-W. Provinces the alternative columns contain, Captain Drake-Brockman's results in *Tribes and Castes of N.-W. Provinces*, I, p. xxvii, and the second Mr. Kitt's, in same pp. xliii; *et seq.* For Madras from E. Thurston's *Bulletin* ii, No. 1.

PANJAB.		N.-W. PROVINCES & OUDH.				MADRAS.	
Tribe or caste.	Average index.	Caste.	Average index.	Average index D.	Average index K.	Caste.	Average index.
Muchhi ...	72·3	*Banya ...	71·3	72·2	...	Badagas ..	71·7
Gujar ...	72·4	Barhi ...	71·8	71·8	...	Muppa ...	72·3
Arora ...	72·6	*Khatri ...	71·9	74·6	...	Tiyyan ...	72·7
*Sikh ...	72·7	Kacchi ...	72·1	72·2	...	Palli ...	73
Chuhra ...	73·4	Koeri ...	72·1	73·4	...	Toda ...	73·3
*Khatri ...	74·0	Kol ...	72·4	72·2	...	Tamil ...	73·6
Awan ...	74·4	Lodha ...	72·6	72·6	...	Paniyan ...	74
†Pathān ...	76·5	*Kayasth ...	72·6	..	...	Kota ...	74·1
Biluch ...	80·0	Pāsi ...	72·6	73·9	...	Vellala ...	74·1
		Kewat ...	72·7	76·8	...	Malaiali ..	74·4
		Lohar ...	72·8	...	...	*Brahman (Battar) ...	74·5
		Chamār ...	72 8	73·9	...	Kummalan	75
		*Kshatriya ...	73·0	73·8	...	Ircala ...	75·8
		*Brahman ...	73·0	73·3	73·3	Kuruba ...	75·8
		Dusadh ...	...	73·1	...	†Shaikh ...	76·2
		Goāla ...	73·1	...	...	*Brahman (Tamil) ...	76·5
		Teli ...	...	73·2	..	Kanarese ...	76·8
		Bhuinhār ...	73·3	...	...	Konga ...	77
		*Kayasth ...		73·3	73·4	Korama ...	77·5
		Kurmi ...	73·3	73·3	...		
		Kahār ...	...	73·4	..		
		†Sayyid ...	...	73·3	73·2		
		†Shaikh ...	...	73·5	...		
		†Moghal ...	...	73·8	74·9		
		Gujar ...	...	73·7	73·5		
		Tharu ...	73·9	...	...		
		Musahar ...	74·1	72·3	...		
		Dhobi ...	...	74·8	...		
		Dom ...	74·8	..	..		
		†Pathan ...	...	75·0	74·4		
		*Jāt ...	...	75·4	74·3		

RACIAL DIFFERENCES IN SKELETON.

Major R. H. Charles, I.M.S., has shown[1] that it is possible to differentiate Oriental from European skeletons by means of peculiarities in the vertebral column, pelvis and lower extremities, the result of changes in the bones brought about by the different modes of sitting. The Oriental in India sits habitually in a squatting posture on the ground or on a cushion and not on a chair. His body, when thus seated, leans much more forward than in the chair position of the West, and the effect of this habit during many centuries has been to cause an alteration in the bones. The importance of being able to distinguish the skeleton of a European from an Indian may be useful

[1] The identification of European and Oriental Skeletons by Major R. H. Charles, I.M.S., *Indian Medical Congress Trans.*, Calcutta, 1894.

at times, such as when a British soldier has disappeared from cantonments and a skeleton is brought forward as that of the missing man.

"As a rule the *body* of a Punjabi *lumbar vertebra* is *thicker behind than in front* ..... and as the type matures with age, the excess of the posterior over the anterior becomes more pronounced. In the female only is the anterior measurement greater than the posterior. The total posterior diameter of the five lumbar vertebræ, I have found exceeded the anterior by 19 mm. in one case. Generally the difference is 8 mm. in favour of the *posterior*. Amongst European skeletons Sir William Turner states there is a variance of 5·6 mm. in favour of the *anterior surface*. The 5th lumbar vertebra is only exceptionally wedge-shaped as in the European. Up to the age of 12 years none of the typical changes have taken place, and it is probable they occur in the epiphysial area, and that it progresses from puberty to 25 years of age eventuating in the fact that the *deepest part of the centrum of a lumbar vertebra is behind and not as in the European in front*.

The *lumbar curve* is straight or very slightly convex. The mean general lumbar index of some recent vertebral column I found to be 106·8. Sir Wm. Turner quotes 96 as the index for the European lumbar curve.

The accessory processes of the 5*th lumbar* are frequently very largely developed and often articulate with the alæ of the sacrum.

The *auricular surface of the sacrum* I found in 78·7 per cent. to be formed of only two vertebræ, the first and second. European sacra have this surface formed from three vertebræ according to Professor Macalister.

The peculiarities above mentioned are more difficult for the ordinary practitioner to determine than the following :—

The ACETABULUM. The most distinctive differences in the morphology of the acetabulum of a native of India are to be found—

1*st*, and principally, in the great size of the *ischial portion* of the *facies lunata*. The rim of the acetabulum here is very prominent, the groove for the obturator externus below it is consequently deep.

2*nd* in the extension forwards and widening out of the *lower horn of the facies lunata* whereby the cotyloid notch is, as it were, partly bridged over instead of being an irregular open space. It looks as if the transverse ligament were ossified on its ischial side.

3*rd*, the *cotyloid notch*, which in the European os innominatum is as a rule, open, presents in all well marked Indian bones the characteristic of being arched over by the forward and upward prolongation of the inferior cornu of the facies lunata. The superficial boundary of the cotyloid notch in the European consists of the transverse ligament alone ; the same boundary in the Indian consists of bone (part of the ischium) plus the transverse ligament.

The head of the FEMUR.—The articular area is of greater extent relatively and absolutely than that of an European bone. The surface is specially prolonged to adapt itself to the modified facies lunata of the acetabulum during extreme flexion and partial abduction, and during semi-flexion and extreme abduction occurring in the hip-joint in the squatting and sartorial postures.

The *neck of the* FEMUR is longer relatively than in the European.

The *upper* surface of the *internal condyle* of the FEMUR is partly articular. This is not so in the European, where it is merely rough for the internal head of the gastrocnemius. It is due to the power of extreme flexion possessed by the Oriental knee-joint.

The *head* of the TIBIA is set on the shaft very obliquely. An Oriental tibia can be easily held by the finger and thumb when the internal tuberosity is grasped behind by them.

The *upper surface* of the *internal tuberosity* slopes considerably downwards and inwards; it is never flat as in the European bone.

The *external tuberosity* of the tibia has its condylar surface convex from before backwards, and the articular area is well prolonged downwards posteriorly.

The upper part of the tibial diaphysis is commonly directed obliquely backwards.

On the *anterior margin of lower extremity of the tibia*, a facet will in the great majority of cases be found on what is the ligamentous area of the European bone.

In upwards of 17 per cent. of tibiæ a second facet on the same border, but occupying a more internal position, will be seen. Both these articulate with corresponding articular areas on the upper surface of the neck of the astragalus.

The ASTRAGALUS contrasted with the European differs considerably. There is a facet on the *upper surface* of the neck to the outside; there is a facet on the same surface more internally, which is continuous posteriorly with the trochlea and internally with the pyriform malleolar articular area. The pyriform articular area on the *inner surface* is greatly prolonged forwards, at times encroaching even upon the neck; when so, it is concave from before backwards. The outer facet alone may be present. The inner facet alone may be present. There may be merely the greatly elongated pyriform facet as a distinctive character.

The *outer margin* of the neck is much thinner than in the European bone—markedly so On the head there is a greater prolongation of the articular surface, both internally and externally relatively to the size of the bone than in the European specimen.

The under surface.—In the European bone the deep concavity or articulation with the large convex facet on the upper surface of the os calcis is bounded generally by two sharp non-articular margins. In Oriental bones the outer margin is frequently articular on its inferior aspect as this part, when the facet exists, articulates with the upper surface of the greater process of the os calcis.

The OS CALCIS.—The *upper surface of the great process* amongst Europeans is generally rough for ligaments and for the attachment of the Ext. Brev. Dig., whereas often amongst Orientals there is a facet continuous with the large posterior articular surface on the body of the bone. This facet is for the lower extremity of the outer margin of the astragalus to which I have just now referred.

Anterior surface of the great process.—There is, as a rule, but a very narrow rough margin between the saddle-shaped surface and the articular facet on the upper part of the sustentaculum tali as the concavo-convex surface is largely prolonged up and in. In European bones there is a less prolongation and a larger rough margin.

For practical purposes it may be assumed that most male Indian **skulls**, certainly those of the lower castes, have a cubic capacity of 1,360 c. cs. or under, whereas European male skulls run from 1,500 c. cs. and upwards. The measurement of the cranial cubic capacity is easily taken with mustard seed, which is procurable in any bazar [though the use of small shot, as in Europe, is better, especially if the skull is wet or dirty].

Some points commonly assigned by authorities as differentiating European and Asiatic skeletons are to be used with caution :—

1*st*.—The bones of the Oriental are smaller. It is generally so, but not by any means always, as witness the skeleton I now show you, which is that of a Punjabi. It measures 6′ 1¼″. You also notice that the bones are large and well marked. 2*nd*.—The skeleton of the Oriental is lighter. An adult male European skeleton weighs about 10lbs. 6oz., the female weighing 8lbs. 13oz. The skeleton of the Punjabi just mentioned weighs 12lbs. 3oz. This is, however, exceptional. The rule holds truer for female skeletons. Here is one of a Punjabi female which weighs 6lbs. 2oz. There is a greater difference in weight and stature between the Indian female and the European female than there is between the males of these races."

CHARACTERISTIC MARKS OR PECULIARITIES.

These may be *congenital* or *acquired*. Those which admit of being photographed should be so registered.

CONGENITAL.

1. **Features.**—Resemblance to parents or family likenesses or to photographic portraits of a missing individual may be important in the case of those claiming to be individuals who have not been heard of for years. In the case of dead bodies, putrefaction rapidly renders the features unrecognizable; in some instances, however, the features have been clearly recognized after long interment, *e.g.*, in the case of Charles I, whose body was exhumed 165 years after death.

Case XIV. **The Tichborne case.**—At the trial of this case in London, in 1874, the main question was whether an individual who claimed large estates was or was not Roger Tichborne. Roger Tichborne was believed to have perished at sea twenty years previously. Some of the witnesses expressed their belief that the claimant was really Roger Tichborne; the majority, however, denied this. The following were some of the main points in the case:—(1) It was proved that Roger Tichborne had been bled repeatedly from the arms, and once also from the ankles and temple; also that he had tattoo marks on the left arm. None of these marks were present on the body of the claimant. (2) Comparison of the features of the claimant with a *photographic* portrait of the true Roger Tichborne showed the following differences; (*a*) The eyes of Roger Tichborne tended upwards from the nose, those of the claimant tended downwards; (*b*) the ears of the claimant were about one-third longer than those of Roger Tichborne; (*c*) the central groove joining the nose to the upper lip was much wider in Roger Tichborne than in the claimant. (3) The claimant was acquainted with many of the events in the life of the true Roger Tichborne, apparently picked up from various sources; he, however, (*a*) did not know the Christian names of Roger Tichborne's mother; and (*b*) could neither read nor speak French, although the true Roger Tichborne spoke French fluently.[1]

[1] Guy's *For. Med.*, p. 37.

Case XV. **Martin Guerre.**—In the second half of the sixteenth century Martin Guerre, then a young man of twenty, absconded from his village in Languedoc, under fear of being charged with theft, leaving behind him his young wife and infant son. Martin Guerre, it was afterwards proved, enlisted as a soldier, and became extremely intimate with a comrade of bad character named Arnauld de Tilh (or Dutille). Eight years after Martin Guerre's disappearance from his home, Arnauld de Tilh appeared there, represented himself as Martin Guerre, and was at once accepted as the latter by all Martin Guerre's relatives, including his wife. The impostor, mainly through his having become acquainted with all the true Martin Guerre's secrets, was able to carry on his imposture with success for several years. At the end of that period a quarrel arose between the impostor and Martin Guerre's uncle, when the latter denounced the former, who was put on his trial. At the trial, of 150 witnesses, forty swore that the accused was Martin Guerre, and fifty that he was not; the remaining sixty were in doubt. Martin Guerre's wife was quite satisfied that the accused was not an impostor. The trial resulted in the condemnation of the accused. He appealed. The Appeal Court found the evidence so extremely conflicting, that they were inclined to reverse the judgment of the lower Court, when the true Martin Guerre appeared. Arnauld de Tilh was thereupon condemned, and subsequently confessed his imposture. Some of the points in this case were: (1) The accused "had double eye-teeth in the upper jaw, a scar on the forehead, the nail of the left forefinger sunk in the flesh, and four warts on the right hand—all peculiarities possessed by the true Martin Guerre." In other personal peculiarities, however, the accused differed greatly from the true Martin Guerre. (2) "Martin was a skilled fencer, which Arnauld was not; and Arnauld could not speak even a few words of Martin's native Basque language."[1]

2. Colour of eyes, skin and hair.—In some individuals one iris differs in colour from the other. The hair resists putrefaction, hence its colour, &c., may be of special importance in the case of exhumed or greatly putrefied bodies. The colour of the hair may, however, have been altered for disguise or otherwise, *e.g.*, *darkened*, generally by the use of metallic dyes, chiefly lead or silver compounds;[2] or rendered *lighter* by chlorine or hydrogen-dioxide solution, in which case the roots will be found less altered and therefore darker than the rest of the hair. The hair is frequently dyed reddish in elderly Muhammadans.

Case XVI.—A portion of a scalp with a tuft of red hair was held to prove the identity of a murdered indigo planter Dick in Nuddea District in 1830.[3]

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[1] Guy's *For. Med.*, p. 15.

[2] For the detection of these the hair may be digested in dilute nitric acid, the acid liquid evaporated to dryness, and the usual chemical tests applied to a solution of the residue; or the hair may be incinerated and the metal sought for in the ash (see detection of lead in organic mixtures).

[3] Chevers, p. 60.

3. **Deformities.**—Such as moles, 'mother's marks' (*nævus*), hare-lip, web-fingers or toes, and additional fingers.

4. **Thumb-prints and Bertillon measurements.**—The registration of thumb-prints as introduced by Mr. Francis Galton is now in general use in India for the identification of criminals, as well as for a check against false personation in the case of all subordinate pensioners, civil and military, *Pardah* ladies, and in many branches of public business, and it is legalised under the Indian Evidence Act for all emigrants signing contracts under the Emigration Act. Impressions in criminals are taken of all ten fingers, for other purposes only of the left thumb. The impression presents numerous fine dotted lines running in directions, which are constant and invariable for the same individual and no two separate individuals' marks exactly correspond.[1] See Fig. 4, B. & D., p. 52.

A small quantity of ordinary printer's ink mixed with a very small quantity of sweet-oil, should be well rubbed with an India-rubber roller on a tin slab until a very thin even layer is formed. The ball of the thumb of the left hand of the person, after being wiped, should be laid on the inked slab and rolled from side to side (not rubbed) until sufficiently inked (this can be learnt from experience) and then lightly and carefully rolled on the paper on which the print is to be taken in such a way that the pattern of the whole of the ball of the thumb from side to side is clearly impressed on it. It must be specially borne in mind that any *side* movement, either at the time of applying or removing the thumb, will cause a smudge and spoil the impression.

Bertillon's measurements of the ear and certain bony points which do not vary between adolesence and old age are specially used for the detection of criminals, but being more difficult to make and varying so much with the personal equation of different operators, the use of this system has been given up by the police in India in favour of the finger print system.[1] The ear measurements are obviously useless in so many tribes which distort their ears by plugs and heavy rings, and in the thickening of leprosy.

Case XVII.—**Murderer detected by his bloody thumb-prints.**—The accused, Man Singh, Kayesth, of Muttra, a *daftari* of the Collector's Office at Muttra was convicted of the murder of Durga Pershad, an *amin* in the same office. The case turned mainly on the identification of the accused by his thumb-mark. Durga Pershad was apparently a man of some means, but lived entirely alone. He lived a penurious life without even a permanent servant in the house. His food was prepared by a Brahman woman who attended for that purpose twice in the day. On the evening of the 4th of March 1901 this Brahman woman prepared his food and when going away left

[1] For details of process see *Finger-prints* by E. R. Henry, I.C.S., London, 1900, supplied to most civil surgeons' offices. Bengalis are said to have no thumb lunulæ, Jews have large ones and Greeks only one.

sitting at his house two men, one of whom she identifies as the appellant Man Singh. She knew Man Singh because he was a constant visitor of Durga Pershad. Nothing suspicious was heard that night. In the morning as no answer could be obtained from Durga Pershad's apartments the police were sent for, and when they effected an entrance they found the old man lying dead in his courtyard, which was covered with blood. The body was marked with no less than 24 incised wounds. The old man had apparently been first attacked in his bed and sitting-room, for the matting on the floor near the bed was drenched with blood. His personal ornaments, &c., were gone, and no money was found in the house. All the boxes had been opened, but no ordinary clothes had been taken. But the murderer, in the words of the Judge, had *left a most damning piece of evidence behind him. On the ground near the body was a brass* lotah *containing a little water, and on that* lotah, *broad and plain, was a bloody finger-print with the whorls and ridges plainly marked.* The mark is in the exact place it would be if the *lotah* were held for pouring native fashion with all the fingers below it and the thumb on the side. The lotah *was photographed at once.* A pugri, out of which a piece had been torn was also found, covered with blood. The police formed the idea that possibly the murderer or one of the murderers had got hurt in the struggle and had used this bit of the pugri to bind up the wound. Some suspicion fell on the appellant, and on the 8th the sub-inspector examined his hand, on the back of which he found a long cut, the marks of which were visible at the hearing in the Sessions Court. In addition to the evidence of the Brahman woman, Kalki Chobe identified the appellant as one of the men who constantly used to visit Durga Pershad. Man Singh was accordingly arrested. One of the Muttra police was sent off to Allahabad with a photograph of the impression found on the *lotah*, and with the impressions of the thumb marks of several persons including those of the accused. The impressions were examined by an expert in the Allahabad Central Office and the impression of Man Singh's right thumb was found to correspond with the impression on the *lotah*.

In reference to the system of identification by thumb marks the Sessions Judge said : "The system of identification by finger prints has now been so carefully elaborated and is so well-known that no judicial officer can feel any doubt that such an identification can be effected by an expert with absolute certainty. But in order to make the matter clear to the assessors, I had the impressions of the thumbs of eight persons, including the accused and the assessors themselves taken in Court just before the expert was examined, and so that no one could have any communication with him. After examining all the impressions he unhesitatingly picked out the accused's impression as being the one on the *lotah*. And I have no doubt that he is absolutely correct." For the defence, evidence was led to show that Man Singh had been at a drama on the day in question. It was pointed out, however, that even if this was so it would not be inconsistent with his having committed the murder. Commenting on this part of the case the judge said :—"In this land of lies an ounce of good circumstance is worth many pounds of oral evidence, and even if, instead of two, two hundred Kayesths swore they had sat in a circle round accused from 6 P.M. to 6 A.M. it would be as nothing in my mind compared with the unexplained bloody thumb print."

The evidence of Kanhaiya Lal, head clerk in the Criminal Identification Department, is as follows : "Criminals are identified by finger prints only now. The measurement system is only in use for the old

cases, in which no finger prints have been taken. I have been employed in this work for three years. All cases from N.-W. P., Punjab, Bengal, Madras and Bombay come to me. I have probably examined more than a lakh of impressions, as in every case there are those of the 10 fingers. I never saw the impression of one man's fingers the same as those of another. They may be alike, but there is always some difference." Asked in what the photograph of the thumb print on the *lotah* tallied with the thumb print of the accused, the witness said: "There are no points of difference and there are the following similarities. To the left downwards from the central ridge there is an island which is also called a bifurcation. Below this there is another bifurcation. Between these two there is only one ridge intervening. The intervening ridge and the ridge of the second bifurcation going upward meet at a place opposite the centre, and the ridge of the first bifurcation meets the ridge issued from the two joint ridges opposite the centre a little above it. From the first bifurcation to right upwards, a ridge abruptly begins and meets the ridge at a distance of four ridges from the right hand delta. These are the main points of similarity."

Justices Blair and Burkitt in their judgment, after an exhaustive examination of the evidence, made the following remarks on the evidence of the expert in thumb impressions:—"The witness, Kanhaiya Lal, who is the head clerk of the Criminal Identification Department, through whose hands, as he swears, every year thousands of finger impressions pass, swears that the thumb impression of the appellant's right hand which was sent to him from Muttra corresponds exactly with the thumb impression photographed from the *lotah*. That photograph has been enlarged at Allahabad by a photographic method without being in any way touched up. The witness in the closest detail gives his reasons for believing that the two impressions are the impressions of the appellant's right thumb. That is evidence upon which we can safely rely." After referring to the test of this witness in the Sessions Court already recounted in the words of the Sessions Judge, their Lordships continue: "In our opinion this evidence is conclusive of the presence of the appellant at the house of Durga Pershad on the night of the 4th March and on the morning of the 5th when Durga Pershad was murdered. The motive for the crime is not far to seek. The appellant was in very poor circumstances. His pay as *daftari* was only Rs. 6 per month. Previous to the 4th of March, he was indebted to several persons in small sums of money, which he was unable to discharge. There was also a decree under execution against him. After the 5th he was in possession of money and paid off several creditors. It is not shown to us how he came into possession of those sums after the 5th of March. The only way of explaining it is by his statement to the Deputy Magistrate that he had received Rs. 15 and a shawl as his part of the plunder. Taking all the above facts into consideration they lead us unhesitatingly to the conclusion that the appellant took part in the murder of Durga Pershad and may possibly have been the sole murderer. The evidence for the defence is worthless. We dismiss the appeal, confirm the sentence and order that it be carried out according to law."—*Pioneer*, June 7th, 1901.

Case XVIII.—**Bloody thumb-print in murder case.**—In 1889 the manager of a tea garden in the Jalpaiguri district was found lying on his bed with his throat cut, his despatch box and safe having been rifled and several hundred rupees carried away. Amongst the papers found remaining in the despatch box was a calendar, on the outside cover of which were two faint brown smudges, one of which under

a magnifying glass was seen to be the impression of some person's thumb (see Fig. 4 *A*). This was sent to the central office of the Bengal Police. It was found to correspond exactly with the right thumb impression of Kangali Charan (see Fig. 4 *B*), a former servant of the deceased, whom the latter had caused to be imprisoned for theft and who had been released from jail some weeks before. He, in consequence, was arrested in Birbhum, a district some hundreds of miles away, and brought to Calcutta, where his right thumb impression was again taken (see Fig. 4 *C*). Fig. *D*

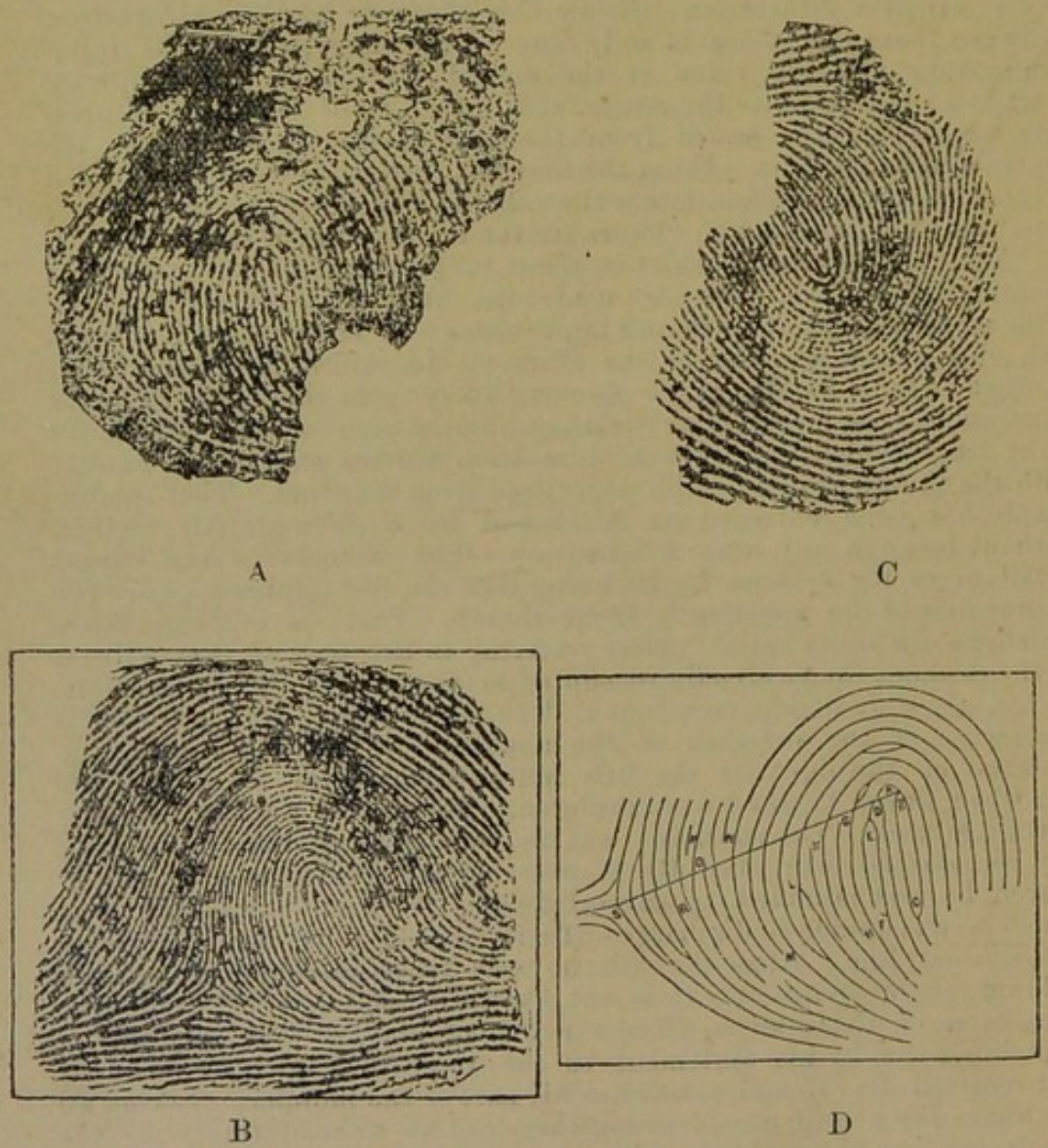

Fig. 4.—*Identification by Bloody Thumb-print in Murder Case.*[1]

A.—Photo-mechanical enlargement of actual blood-print.
B.— Do. do. of thumb print record in Police Office.
C.— Do. do. of fresh print.
D.— Diagram of characteristic ridges.

[1] After E. R. Henry, *Finger-prints*, p. 52.

shows the ridge characteristics relied on in the identification. The Chemical Examiner certified that the brown marks on the calendar were mammalian blood, the inference being that the murderer or his associate griped the calendar with his blood-stained thumb when rummaging amongst the papers in the despatch box for the key of the safe. The accused was committed for trial before a judge and assessors charged with murder and theft, and was finally convicted only of having stolen the missing property, the assessors holding that as no one had seen the deed committed, it would be unsafe to convict him of the murder, and the Supreme Court upheld this decision.

Forgery of thumb-print signatures.—It is not difficult to forge thumb-prints, as Major H. Smith, I.M.S., has shown (*I. M. G.*, 1902, p. 255) in this way :—The original thumb-impression is covered with a damped paper and pressed, by which method the reverse of the original is transferred to the damped paper. Another piece of damped paper is then put over the reverse and pressed and a true copy of the original adheres to the paper.

The following statement shows for seven years the recognitions proved in court in the province of Bengal by means of finger-prints and anthropometry :—

Year.	Recognitions by Anthropometry.	Recognitions by Finger-prints.	Total recognitions by both.	Remarks.
1893	23*	.....	23*	* Started in March.
1894	143	.....	143	
1895	207	.....	207	
1896	334	.....	334	
1897	318	174†	492	† Started in June.
1898	148	345	493	
1899	59	569	628	

ACQUIRED peculiarities.

1. **General condition of body.**—Fat and muscular or the reverse, baldness, &c.

2. **Scars and traces left by old injuries.**—Scars by wounds, burns, and ulcers (syphilitic and other) tend to contract and become more linear in time, but being less vascular than the rest of skin. They are rendered more visible by friction. If necessary, a lens should be used. Their number, situation, size, whether adherent depressed, &c., should be noted—the size should be measured with compasses. A scar is inevitable after a wound, but where there is little loss of tissue and no suppuration, the scar may be slight. Small linear scars may disappear in time. Caspar notes that the linear scars of cupping disappeared in three years. Large scars never disappear, and those of burns, scalds and crushed

wounds are more permanent than those of incised wounds. No scar can be artificially removed. It is very difficult to swear to the age of a scar, some remain red and vascular after many years.

Old fractures and ununited fractures may enable the identity to be established. The body of Livingstone, the great African explorer, was identified by an ununited fracture of the humerus due to the bite of a lion. In case of *Hanbil* v. *Nazeer Khan*[1] identity was established by a peculiarity in the jaw-bone.

Case XIX.—A Bengali impostor pretended he was a native gentleman whose death and consignment to the Ganges some years before was plainly proved. He denied the former fact and alleged that after being thrown into the river he revived. Medical evidence exposed the imposition by proving that part of the body of the deceased had been eaten away by an incurable disease.[2]

3. **Tattoo-marks.**—Unlike scars which are the result of accident or disease and located variously, tattoo marks are the result of deliberate choice and often by the same operator, so that the same design may be reproduced exactly in the same situation on more than one individual. The pigment generally used in India is black or blue, but in Burma red is also extensively used. Pigments consisting of vermilion and ultramarine **disappear** more readily than Indian ink, soot, gunpowder or carbon in other forms, which latter, according to Tidy, never disappear if inserted properly below the epidermis. The shortest time in which non-carbonaceous marks disappear is agreed to be ten years. Tattoo marks **can be removed artificially** during life by friction with a paste of lard and strong acetic acid or dilute hydrochloric acid applied alternately with a solution of caustic[3] potash followed by poulticing. Papaya juice is also alleged to be effectual,[4] but such measures usually leave a scar. The claimant in the Tichborne case (p. 47) had a scar where it was sworn Arthur Orton had been tattooed. Faded tattoo marks are made more distinct by strong friction.

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[1] 3 *Niz. Ad. Rept.*, 122 Chevers 48 [2] Chevers, 100.

[3] Tardieu in *Ann. d' Hygèine publique*, 1855, p. 171, *et seq.* Also Caspar.

[4] This method is thus described:—A solution of papain in glycerine is smeared over the mark and rendering the skin anæsthetic by cocaine. The papain is brought into contact with the intra-cutaneous cells by scarification, this being carried deeply enough to determine the oozing of blood. The outline of the tattoo mark must be followed in all its details, no point thereof being allowed to escape. Then apply a dressing of lint steeped in the papain solution, and fix in position by strips of plaster. In the course of a few days the scabs which have formed come away, and, as a rule, no trace remains of the marks. When these are very deeply seated, however, it is sometimes necessary to repeat the operation.

4. **Loss of Teeth and Artificial Teeth.**—Loss or deformity of teeth and presence of false teeth or correspondence of the jaw with a mould taken by a dentist for the purpose of fitting artificial teeth may be important in establishing identity, see *case* XXI, p. 56. The body of the Raja of Benares, who was slain in battle by Kuttub in 589 of the Hijra, was recognised among heaps of the slain by its artificial teeth, which were fixed in by golden wires and wedges.[1] A bite may be produced by a mouth with certain teeth missing; and so lead to the identification of the biter.

5. **Occupation marks.**—Hands horny or otherwise; stains in hands of dyers, photographers and painters, needle-pricked fingers in tailors, &c. This is chiefly useful in unknown dead bodies.

6. **Memory of past events.**—This is often of great importance in cases of imposture, see Tichborne case, p. 47.

7. **Handwriting, speech and voice, gait, tricks of manner, &c.**

8. **Clothes and Jewelry.**—These are only of very secondary importance, as they are easily changed. For some characteristic varieties of native dress see the paragraph on races, p. 42.

LIGHT SUFFICIENT FOR IDENTIFICATION.

(1) **A flash of lightning** undoubtedly affords sufficient light to enable an individual to so distinctly discern the features, &c., of another, as to be able to subsequently recognise him.

(2) **The flash caused by the discharge of a pistol or gun,** provided the circumstances are favourable, also similarly affords sufficient light for recognition and identification. Favouring circumstances are: close proximity to the discharge on one side of the line of fire; absence of other light; and not much smoke from the powder. **Flashes of light from blows on the head** being merely subjective sensations, cause no illumination of external objects, hence recognition and identification thereby is not possible.

IDENTIFICATION OF FRAGMENTARY REMAINS OR BONES ONLY.

The first thing to determine is whether the fragmentary remains are human or not. Then you note which side of the body or limb they belong to and try to fit the fragments together; noting the means by which the fragments have

[1] Dow's *Hindustan*, I. 145.

been separated, whether cut, or broken or torn asunder or merely grazed by dogs, jackals or other beasts or birds of prey. The state of decomposition of the soft parts may give a clue to the length of time elapsed since death. If vital organs are present, note whether they bear marks of injury likely to have caused death.

Where *bones* only are available it is desirable to record the details of the several bones individually for reference and proof of age, stature, &c. Any **malformations** should be especially noted. The **odour** of recent bones should be noted for the time of death. The odour of bones cleaned by ants, &c., is very different from that of old bones cleaned by decomposition in the earth.

Case XX.—**Callus on fractured bones—detachment of Sacrum.** At Bankura in 1833 two witnesses deposed that the deceased Meah Khan was beaten *a few hours* before his death, one of the blows breaking his rib. The only bone produced in Court was a rib, this had been broken but had osseous callus around both fractured ends, from which the civil surgeon was of opinion that the fracture must have occurred at least seven or eight days before death. The body in question was disinterred three months after the death of Meah Khan and the bones were found clean and free from periosteum, ligament and cartilage, which the civil surgeon considered rendered it extremely improbable that the bones were those of a person who had died three months previously. Dr. Chevers, however, considered that mere *cleanness* of the bones could be accomplished by natural decomposition if exposed to the ravages of multitudes of ants and insects, the odour, however, of a recent bone thus rapidly cleaned by insects would in no way resemble that of one which had gradually undergone denudation underground.[1]

Case XXI.—**Dr. Parkman's case.**—Dr. Parkman, of Boston, U.S., was last seen alive entering the medical institution in which Dr. Webster was lecturer on chemistry. A week afterwards, suspicion having been excited, search was made in Dr. Webster's laboratory, and the remains of a human body discovered. In one place a pelvis, right thigh, and left leg, were found ; and in another the entire trunk and the left thigh. Among the ashes in the furnace of the laboratory, fragments of bone, blocks of mineral teeth, and a quantity of gold, were also found. *Some of the chief points in the case were:* (1) *No duplicate parts were found.* (2) *The pelvis was clearly that of a male.* (3) *The parts of the body were free from all traces of the preservative fluids always* employed in the dissecting room of the college. (4) *Piecing the parts together it was estimated* that the height of the body of which they formed portions was 70½ inches, or exactly the missing Dr. Parkman's height. (5) Three of the fragments of bone found in the ashes of the furnace when put together, made up the greater portion of the right half of a lower jaw. This was of peculiar shape, certain teeth were wanting from it, and it was found to fit exactly a cast of Dr. Parkman's jaw, which had a short time before been taken by a dentist who had supplied Dr. Parkman with artificial teeth, similar to those found in the furnace ashes.

[1] Chevers, *M.*, 66.

Dr. Webster was convicted, and subsequently confessed that he had murdered Dr. Parkman.—(Guy., *F. M.*, 32.)

Case XXII.—**Careless identification of bones.**—A married woman and her child, a girl aged four or five, disappeared at Meerut, under circumstances pointing to their having been murdered by a man named Kulloo, the woman's paramour. Kulloo absconded, but was subsequently apprehended while trying to sell ornaments proved to have belonged to the missing woman. Kulloo, when apprehended, made contradictory statements accusing other parties of the murder, and ultimately led the police to a place where several human bones were found, among them portions of two skulls, one small, the other larger. Among the fragments of the larger skull was an entire upper jaw (and half a lower jaw) with the teeth attached, and, near the bones, clothes, identified as having been worn by the child, were found. The civil assistant-surgeon, to whom the bones were sent, reported the bones to be those of two children, one about eight years, the other about eight months old. On this Kulloo was convicted of theft only. A re-inquiry was ordered ; and at the trial held fourteen months afterwards, the civil surgeon was of opinion that the assistant surgeon had mistaken the bones of a small adult female for those of a boy, of about eight years old. The judge convicted the prisoner of murder, sentencing him to transportation for life. Here, had the portions of the larger skull been examined, and a record kept of their appearance, and of the teeth in the portions of the jaws, the question whether they belonged to a child of eight or to an adult could probably have been determined without difficulty.—(Chevers, *M.*, 66.)

Case XXIII.—**Teeth and Cartilage-tumour.**—(*a*) Identity of body was established by absence of left lateral incisor and by hair on back of head. Prisoner convicted. (*b*) Remains of cartilaginous tumour of the neck in a body almost skeletonized led to identification.—*I. M. Gazette*, Jany. 1875.

Estimate of stature from one cylindrical bone.—Orfila gives a table for this, which may err to the extent of over 4 inches. Tidy gives the following table :—

Humerus is from	17·4	to	19·5	per cent.	of height.
Radius	„ 13·2	„	14·5	„	„
Femur	„ 22·6	„	27·51	„	„
Tibia	„ 18·5	„	22·15	„	„
Spine	„ 36·8	„	31·54	„	„

To above has to be added 1 to 1½ inches for the soft parts of sole of foot and the scalp. The variation, however, is too great to be of much service.

In a dry skull with a hole in it of an alleged fracture, note if the hole is due merely to the falling in of an os triquetrum (when its margins will be jagged) or to a true fracture.

Even when identification is not established the death-sentence may yet be passed :—

Case XXIV.—**Death-sentence with non-identified remains.** (*a*) Reg. *v.* Sundanem. Deceased was induced by two others to leave his village under the pretext of looking for stolen cattle. On the

way he was murdered. On the fourth day remains were found—"his skull in three or four places, grey hairs, a pair of shoes, and a bag with flint and steel. The jackals, vultures, etc., had nearly picked the bones clean." There was circumstantial evidence, and the sentence was—*death* to first prisoner.—(*Madras Reports of Foujdaree Udalut*, 1859.)

(*b*) Reg. *v.* Mahabalaya. Deceased was a Brahmin, who had been sent to cash a cheque on a Friday. He did not return, and on the following Wednesday the remains of a man, with a Brahminical thread, were found. "The witnesses could not identify the body, as the features were entirely decomposed." Some cloths near the body were identified, and certain persons who had been last seen with deceased were, on the strength of circumstantial evidence, convicted. The sessions judge recommended transportation for life, because the body had not been clearly identified, but the High Court (Foujdaree Udalut) seeing no reason to doubt that the remains were those of the missing man, sentenced to death.—(*Madras Reports of Foujdaree Udalut*, 1859.) Honore, June 1859. See also *case XXVI*, p. 60.

CHAPTER II.

EXAMINATION OF LIVING PERSONS.

This is usually much simpler than the examination of the dead in criminal cases, as it is often little more than a mere matter of surgical diagnosis.

The medical expert should be furnished by the police or others with a note for his guidance, detailing every known circumstance of importance in the case on which his examination and opinion are required. This should be sent along with the person who is to be examined. In practice, the information thus sent in India is generally meagre and omits points of critical importance, and often it is untrustworthy and occasionally false—the hearsay of the village chowkidar and others.

You should note :—

(1) The **exact time and place** of your examination.

(2) The **identification** how made. This, in the case of a living person, is usually made by the police official who brings the person, for examination or by some other mutually known individuals—whose names should be noted by you in your report. In the case of unknown persons, the necessary particulars for identification should be noted from amongst those detailed on page 27, &c.

(3) **Details** of your examination of the alleged **wounds** (Chap. VI), or evidences of **Rape** (Chap. XII), **Poisoning** (Chap. XX), &c., as described in the special chapters.

In the case of persons **accused** of criminal violence, you will look for scratches and other evidences of a struggle, such as the presence of hairs, blood-stains, &c., on the body and clothing. But before making an examination of an accused

person you must first obtain his consent and inform him that any indication which may be found of an incriminating nature will be used as evidence against him, and if he will not consent, the examination must not be made. Neither must you ask 'leading' questions or those which suggest the particular answer.

Your examination in some cases, such as rape, may extend to besides (1) the person of the victim, and (2) the accused, also to (3) **site** of the alleged offence and to (4) **stained clothes, weapons or other articles** submitted to you for examination.

These latter objects should, after examination, be carefully preserved by you as 'exhibits' in evidence. They should, whilst in your custody, be carefully sealed up by yourself and locked away to prevent their being tampered with, and, if sent to the Chemical Examiner, they should be duly labelled, attested and sealed with your personal seal, of which an impression must accompany your letter to that officer. Where there are more than one exhibit, each should be marked by a distinctive letter or number.

As the *alleged cause of injury is not always the true* cause, it is necessary for you to consider other possible causes than that which may be specified in the indictment.

Case XXV.—**Stupor ascribed to a beating found really due to Datura poisoning**—A gentleman beat his punkah coolie with a slipper for going to sleep; some hours after the man was taken seriously ill. He became giddy and partially comatose. In this condition he was immediately taken before the doctor. He was made to vomit and brought up a quantity of datura seeds, which he had taken in a fit of passion after a love quarrel. Now if this circumstance had occurred away from the station and the man had died, the body would have been sent in with the remark "said to have died from the effects of beating." The medical examination would have established death from the effects of datura, or in *default of a thorough examination* 'no apparent traces of injury.'—(Chevers, *M.*, 35.)

CHAPTER III.

EXAMINATION OF THE DEAD.

In all cases of sudden death under suspicious circumstances and in deaths from violence the dead body has, as a rule, to be examined (see p. 2), and such medico-legal examinations form a most important part of the duty of civil surgeons and police-surgeons. The body of a murdered person must as a rule (1) be *produced*, (2) be *identified*, and (3) be *examined*, in order to warrant a conviction in law and even a trial. The many facilities for destroying dead bodies in India (see p. 15) affords the criminal in this country unusual opportunities for destroying this important part of the evidence of his guilt.

"According to Indian law, as administered by the Nizamat Adawlat, the finding of the body is not *indispensably* necessary to warrant even a

capital sentence ; but, in such cases, an irrevocable sentence is not usually passed." (Goodeve, in Beaufort's *Digest*, 1857, Homicide and Murder, Index C., *s.* 3980.) Goodeve here cites the case of Kealal *v.* Chundwa, 2 *Niz. Ad. Repts.*, 82 : bones were found, but these not being identified the court withheld the capital sentence, notwithstanding a confession, and in one of Hanbil *v.* Nuzeer Khan, 3 *Niz. Ad. Repts.*, 122, the result was the same notwithstanding the recognition of the skull by a peculiarity in the jaw-bone.—(Chevers, *M.*, 48.)

On the other hand the sentence of death was confirmed in a case in 1901 where the body was never found :—

Case XXVI.—**Death-sentence when body not found.**—The appeal of Sheomangal Singh, the Raipuri Zemindar, who was convicted of the murder of a woman and sentenced to death by Mr. Stuart, acting Session Judge of Allahabad, came before Mr. Justice Blair and Mr. Justice Chamier in the Allahabad High Court recently. In this case the body of the woman was never found, having been thrown into the Ganges, and Mr. Stuart referred to the question of passing sentence of death when the body of the murdered person had not been recovered. Their Lordships, in the course of their judgment, said : "No case could have been more satisfactorily proved, and it is difficult to imagine a case of grosser brutality. The conviction is thoroughly justified and the sentence is the only sentence possible. Their Lordships confirmed the sentence of death.—(*Pioneer Mail*, July 12th, 1901.)

To determine the exact moment of death (*i.e.*, somatic death) is sometimes of importance in cases of successorship, where it is necessary to prove that a child was or was not born before the death of a testator, as a will takes effect from the moment of the death of the testator, and not from the date of finding or proving the will.

1. **Legal presumption of death.**—In India the law is (*a*) that if a person is proved to have been alive within thirty years, the legal presumption is that he is still alive except (*b*) it is proved that the person has not been heard of for seven years by those who would naturally have heard of him if he had been alive, in which case the law presumes that he is dead (*ss.* 107 & 108, I. Ev. Act). The law, however, presumes nothing as to the time of his death, the period of which, if material (as it often must be in cases of succession and inheritance) must be proved by evidence. In either case, the presumption arising may be rebutted by proof, in case (*a*) of the person's death ; in case (*b*) of his being still alive. In France, a legal presumption of death arises after thirty-five years of absence, or after one hundred years from date of birth.

2. **The Question of Presumption of Survivorship.**—When two or more persons die at almost the same time, or by a common accident, the question may arise who survived longest ; and if no direct evidence on this point is available the question becomes one of presumption of survivorship. As an example of the cases in which this question arises, suppose A to have left property by will to B, and that A and B die by a common accident, no direct evidence being available as to whether A or B died first. Here the question of presumption of survivorship may arise, because if A died before B, B may be considered to have succeeded

to the property left him by A, and B's heirs inherit ; while if B died first, A's heirs inherit, seeing that B never succeeded to the property willed to him by A. In some countries definite rules of law exist by which such cases are decided. In France, for example, some of the rules laid down are : (1) If all those who perished together were under fifteen, the oldest shall be presumed to be the survivor. (2) If all were over sixty, the youngest shall be presumed the survivor. (3) If all were between fifteen and sixty, the males shall be presumed to have been the survivors if the ages were equal, or the difference in age not greater than one year ; in other cases the youngest shall be presumed the survivor. The English law presumes nothing in cases of this kind, and if therefore a person made a claim and had, in order to substantiate it, to prove that A survived B, and had no proof of that fact beyond the assumptions arising from age or sex, he could not succeed. It may, however, be pointed out, that in questions of this kind it is likely that the strongest lived longest. There are, however, certain exceptions ; *e.g.:*

(1) When a mother and child both die during delivery, if the death of the mother has been caused by hæmorrhage, it is probable that the mother died first. (2) If a number of persons die from the effect of excessive heat, it is probable that the adults died first, children and old persons bearing heat better than adults. (3) When the cause of death is drowning, as females are more likely to faint than males, and as the occurrence of syncope delays death by asphyxia, it is possible that females may survive longer than males. If, however, there has been a struggle for life, it is probable that the males, being stronger, survived the females. (4) Where the cause of death is starvation, aged persons (if healthy and robust) requiring less food than adults and children, probably live longest.

Definition of Death.—By 'death' of the body is popularly meant '*somatic*' (as opposed to '*molecular*' death), *i.e.*, the cessation of those animal functions of the body which are kept going by the heart and lungs acting under the control of the brain.

Modes of Dying.—Hence it is usual, following Bichat's classification, to speak of **3 Modes of Death**, according to whether death begins in one or other of these three organs respectively, irrespective of whatever the remote cause of the death may be :—(1) *Syncope* (death in heart) ; (2) *Asphyxia* (in lungs) ; (3) *Coma* (in brain). This distinction is of some importance medico-legally in estimating which of several probable acts of violence caused the death, because the *post-mortem* appearances differ to some extent in these three modes of death.

[On the other hand '*molecular*' death of the individual tissues and cells of the body does not occur till some time after somatic death, and causes the phenomena of the 'cooling of the body.' Until complete molecular death occurs no general putrefaction can set in.]

The immediate mode of death in all cases whether in natural or unnatural deaths, may be said to be one of these three :—

Syncope may be due to (1) anæmia from a deficiency in the quantity of blood, as in death from hæmorrhage, or (2) to

deficiency in the quality of the blood as in poisoning by prussic acid, digitalis, or (3) asthenia, deficient power of the heart muscle, as in fatty degeneration of the heart. The *symptoms* are pallor, lividity of lips, dimness of vision, ringing in ears, coldness of the surface and extremities. Pulse weak, slow, irregular or fluttering (in anæmia) or frequent (in asthenia); gasping respirations followed in anæmia by more or less delirium, insensibility and convulsions.

Coma may arise from (1) deficient quantity of blood, as in plugging of a brain artery, (2) altered quality of blood, as in narcotic poisoning, (3) pressure on the brain from depressed bone, blood, products of inflammation or morbid growths. The *symptoms* are stupor deepening into complete insensibility, slow stertorous irregular breathing and slow laboured pulse as the medulla becomes affected. In this mode of death, unconsciousness precedes the difficulty of breathing.

Asphyxia may arise from (1) arrest of respiration by (*a*) paralysis or exhaustion of the respiratory muscles, (*b*) tetanic spasm of the glottis or respiratory muscles, or (*c*) by mechanical pressure on the chest; (2) exclusion of oxygen from the lungs, partial or complete by (*a*) mechanical obstruction of the air passages by foreign bodies, a ligature, submersion, &c.; (*b*) over-rarified air or by admixture of inert gases with respired air, or by (*c*) diseases of lungs, such as hepatization.

(3) Exclusion of blood from the lungs as by plugging of the pulmonary artery by a clot (embolism).

(4) Non-expansion of the lungs owing to (*a*) presence of air or liquid in the pleura, (*b*) division or compression of the pneumogastric nerve.

The *symptoms* are intense lividity of face, struggle for breath, giddiness followed by unconsciousness and convulsions. Here the difficulty of breathing precedes the unconsciousness.

Post-mortem signs of these modes of death are:—

In *syncope* if death has occurred by anæmia, both sides of the heart are found empty, and the heart itself, if examined soon after death, is contracted. If death occurred by asthenia, or by poisoning with prussic acid the heart is found relaxed, flabby, with its cavities, empty or full—if the latter, both sides are equally full.

In *coma* and *asphyxia* the venous system and right side of heart and lungs are gorged with dark blood, and the left side of heart is usually empty. In coma there is effusion of blood into the cavities, apoplexy, rupture of vessels in fracture of skull, &c. In asphyxia there is much greater engorgement of lungs and venous system than in coma, and the lungs may

show apoplectic effusions into their substance with patches of superficial emphysema and sub-pleural ecchymosis or Tardieu's spots (see Chap. VII).

In some cases of sudden death the most careful examination fails to find any of these positive lesions. In such cases it may be that death occurred by the sudden stoppage of the heart by violent emotion.

SIGNS OF DEATH.

The fact of actual death is ordinarily ascertained with little difficulty. The most patent and positive sign of death is the commencement of general putrefaction of the body, which takes place some time after death. But the exact moment of death, a considerable time before putrefaction has set in, is occasionally the subject of some doubt. Cases have occurred in which persons in a state of deep trance or catalepsy have been supposed to be dead and been buried alive. It is well therefore never to give a death certificate, or think of opening the body until you make quite certain that the body is actually dead (see *case* XXVIII, p. 64). Simulated death for purposes of extortion is easily detected by pricking with a pin or by the application of a flame or the actual cautery to the skin.

The chief signs of death are :—

1. **Cessation of Circulation, complete and continuous.**—The entire cessation of the circulation for over five minutes is usually in itself evidence of death. In cases of fainting and prolonged typhoid of low type and 'suspended animation' the heart may cease to beat for several seconds, and in newly-born infants and in the apparently drowned may cease for ten or fifteen minutes, but continuous and complete cessation means death. M. Rayer, from observations on the dying, assigned *seven seconds* as the maximum interval observed between the last two pulsations of the heart.

Tidy (*Leg. Med.* I., p. 138) quotes a case of a man aged 33, where for eight minutes no heart sounds could be detected, the man ultimately recovering.

Suspended animation.—Cases are recorded of persons who have apparently possessed the power of voluntarily suspending the action of the heart.

Case XXVII.—(*a*) **Case of Colonel Townshend**, quoted from Cheyne (Guy, *For. Med.*, p. 214):—"He (Colonel Townshend) told us that he had sent for us to give him some account of an odd sensation he had for some time observed and felt in himself, which was that, composing himself, he could die or expire when he pleased, and yet by an effort or somehow he could come to life again, which it seems he had sometimes

tried before he had sent for us. We all three felt his pulse first; it was distinct though small and thready, and his heart had its usual beating. He composed himself on his back, and lay in a still posture some time; while I held his right hand, Dr. Baynard laid his hand on his heart, and Mr. Skrine held a clean looking-glass to his mouth. I found his pulse sink gradually, till at last I could not feel any by the most exact and nice touch. Dr. Baynard could not feel the least motion in his heart, nor Mr. Skrine discern the least soil of breath on the bright mirror he held to his mouth. Then each of us by turns examined his arm, heart, and breath, but could not by the nicest scrutiny discover the least symptom of life in him. This continued about half an hour. As we were going away (thinking him dead), we observed some motion about the body, and upon examination found his pulse and the motion of his heart gradually returning; he began to breathe gently and speak softly." Colonel Townshend died the same evening, and on *post-mortem* examination all the viscera were found healthy except the kidneys, for disease of which he had been long under treatment.

(*b*) Dr. Duncan, of Edinburgh, in his lectures used to mention the case of "a medical student who, like Colonel Townshend, simulated successfully the appearance of death; he died, however, some time afterwards of disease of the heart."—Ogston, *M. Jur. Lect.*, 364.

To ascertain whether the circulation has ceased you apply these tests :—

(1) *Pulse.*—Feeble pulsations of the heart may not be perceptible at the wrist, besides the radial arteries are sometimes abnormal in their distribution.

(2) *Auscultation.*—Stethoscope may fail to detect a very feeble pulsation of the heart.

(3) *Tie cord tightly round a finger.*—If any circulation is going on, the finger will swell beyond the ligature.

(4) *Open small artery*, if still in doubt. No jerking spurt will occur if the heart is not beating.

(5) *Heat or a blister on skin* will not produce a true vesicle *with red* margins on a dead body. (See Burns, Chap. VII.)

2. Cessation of Respiration, complete and continuous—Three-and-a-half minutes is considered the extreme limit during which respiration may cease and life be maintained. In divers and in Cheyne-Stokes' respiration, two and one minutes respectively are the probable limits. In newly-born children life has been known to continue for a considerable period without respiratory movements being apparent.

Case XXVIII.—Professor Maschka, of Prague, related in his lectures that "a mature child, which showed no signs of life, was placed in the anatomical rooms of the university, left there for fourteen hours, and then taken to the physiology class-room. On laying open the chest no blood flowed from the integuments and soft parts in front. When the heart was reached, it was seen pulsating at the rate of twenty beats per minute. The lungs were seen to be in the fœtal condition."—Ogston, *ibid*, 365.

Tests :—

(1) *A cool bright looking-glass* held in front of the mouth will be dimmed by the moisture of the breath if respiration is going on.

(2) A feather held over nostrils will move if respiration is continuing.

(3) *A shallow vessel of water or mercury* placed on the chest, will show movement in its reflection of a spot of light from its surface if there be movement of the chest walls.

3. **Changes in the Eye**, *e.g.*, loss of sensibility of the pupil, loss of transparency of the cornea, loss of tension of the eyeball. None of these are reliable. The pupil may for a short time after death still respond to the action of atropia ; and loss of transparency of the cornea, and of tension of the eyeball, may occur during life.

4. **Cooling of the Body.**—After death the temperature of the body tends to fall to that of the surrounding objects, and if these, as is usually the case, are lower in temperature than the body, a gradual cooling of the body takes place. In death from certain diseases, however, the temperature of the body may, at the time of death, be higher than the normal, and may even rise considerably after death. Thus in cases of death from yellow fever, cholera, small-pox, rheumatic fever, Bright's disease, abscess of the liver, peritonitis, tetanus, and injuries to the nervous system generally, &c., a *post-mortem* rise of temperature, amounting in some cases to even 9° F., has been observed,[1] owing to chemical changes in the molecular life of the tissues, and partly in some cases due doubtless to microbic activity. The normal body temperature in India ranges from 97° F. to 99° F.[2], whilst the mean temperature of the air and surrounding objects in India is frequently 90° to 97° F. or even more in the summer and autumn. Hence a body may rapidly 'cool' as far as is possible under these circumstances, and so permit of *rigor mortis* setting in at a very much earlier period than in temperate Europe. The average rate of cooling in a temperate climate is about 4° F. during the first three hours and afterwards about 1° F. per hour. In temperate Europe a dead body is cold in from eight to ten hours. In tropical or sub-tropical India much less time is required as the body has to cool through far fewer degrees of temperature to reach the temperature of the air and its surroundings.

Loss of heat is **delayed** by :—

(1) *Acute fever* as the cause of death.

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[1] Tidy, *Leg. Med.*, I, 46. Waddell, L. A., *Ind. Med. Gaz.*, 1884.

(2) *Sudden death*, as the nutrient material continues to burn after death.

(3) *High temperature* of surrounding air or water.

(4) *Stillness* of air in small room.

(5) *Obesity*. Bodies of children and the aged cool more quickly than middle aged.

(6) *Covering of* body by non-conducting clothes, &c., retards loss of heat.

It is **hastened** by :—

(1) *Chronic wasting disease*.

(2) *Lingering death*.

(3) *Coldness* of air.

(4) Access of *cool draughts* of air.

(5) *Leanness* and extreme youth or old age.

(6) *Exposure* of body without coverings.

(7) *Immersion* in water, especially running water.

5. Cadaveric Hypostasis, or 'Suggilation.'—This *post-mortem* staining of the skin is due to the fluid blood sinking under the effect of gravity to the most dependent parts of the body. It begins to appear a few hours after death (3 to 4 Tidy, 4 to 12 Mann) first at back of neck, chest and calves. In the lungs it is hypostatic congestion. It shows externally as a dark bluish or coppery colour, which might at first sight be mistaken for a bruise. It can be distinguished from the true *ecchymosis* of a bruise by observing that (1) it is only in the most dependent part of the body, (2) it is not elevated above general level, (3) its margins are sharply defined, (4) its surface is not abraded, (5) an incision into it does not show clotted blood outside the vessels but simple staining. This distinction can be made even when decomposition is far advanced.

Case. XXIX (*a*).—**Hypostasis mistaken for marks of injury.** *Reg.* v. *Keir.*—A man named Keir and his mother were tried on the Aberdeen Circuit for the murder of the father of the man. The prisoners were condemned, but the only evidence of any weight against them was the appearance of a broad blue mark on the fore part of the neck, which the witnesses compared to that produced by strangulation. There was, however, great reason to believe, from their own description of it, that it was due to natural changes after death.—(Taylor, I, p. 88.)

(*b*).—Three men left a public house intoxicated and quarrelling with one another. On the next morning one of them was found expiring in a wood, and he died soon afterwards. Two surgeons deposed that they found the marks of numerous contusions all over the body, and upon this deposition the two companions of the deceased were committed and subsequently tried. At the trial, Drs. Bell and Fyfe proved, to the satisfaction of the court, that the apparent contusions were nothing else than the livid patches, or hypostasis, which sometimes occur spontaneously on the dead body after many kinds of death. The accused were acquitted.—(Taylor, I, p. 88.)

It may also afford a useful indication of the position in which the corpse lay, while the blood was still fluid, in cases where the body may have been shifted afterwards to another spot.

6. Cadaveric Rigidity or Rigor Mortis.—This stiffening which occurs after the body has become 'cold' is due to changes in the muscles on their molecular death. After somatic death, the muscles pass through three stages, namely, 1st, *relaxed* with *contractility*; 2nd, *rigid and noncontractile*—the *rigor mortis* stage; and 3rd, *relaxed* with incipient decomposition.

In the 1st stage the muscles are relaxed, but contract on the application of stimuli. This stage in exceptional cases may last only a few minutes, or even be absent, as in the case of soldiers killed in battle clutching their guns or swords, and pistols or knives grasped in the hands of suicides—this form has been called *cadaveric spasm* (see p. 69). It commonly, however, lasts about three hours. There is no case on record where this stage has lasted as long as twenty-four hours. In Bengal, Mackenzie found the average to be 1 hour 51 minutes.

In the 2nd stage, that of cadaveric rigidity or *rigor mortis* proper, the muscles become rigid, partly from coagulation of myosin. All muscles, both involuntary and voluntary, are affected, and the rigidity occurs independently of nerve influence (paralysed limbs becoming rigid unless complete degeneration of the muscles has taken place), and independently also of the rate of cooling of the body. It is *hastened* by any exhausting influence on the muscles immediately before death such as violent muscular exercise or exhausting disease. It is *retarded* in speedy death of healthy individuals in repose.

Time of onset of *rigor mortis*.—This is very variable. Sometimes it commences within a few minutes after death, under the conditions above noted; but usually in temperate climates it begins 5 to 10 hours after, and takes after 2 to 3 hours to develop.[1] In India, owing to the climate and to the body becoming 'cold' more quickly, it usually commences 1 to 2 hours after death and takes 1 to 2 hours to develop.

Onset of cadaveric changes in India different from Europe.—As the time of onset of the cadaveric changes is of

[1] Niderkorn found it to be fully developed before the end of the seventh hour after death in 92 out of 113 cases. (Tidy, *Leg. Med.*, I, p. 62.) Taylor (3rd Ed., 1888, I, 513) gives 5 to 6 hours from death for *rigor mortis* to set in, 16 to 24 for its continuanc, or21 to 30 hours from death on an average. Tidy gives 3 to 6 hours, and from 36 to 48 hours respectively, or 27 to 54 hours from death on an average. But in sudden death in a muscular subject for hæmorrhage *rigor mortis* may continue for 14 *days* or longer. (Tidy, *Leg. Med.*, I, 71).

great importance in fixing the time of death and there were no data on record for India, Dr. Mackenzie undertook in 1883 a series of observations to ascertain these points. The changes were observed in the bodies of persons dying in hospital in Calcutta mostly from chronic diseases.[1] 36 cases were examined between July and September with an average aerial temperature of 85·5°F., and 10 cases in October with an average air temperature of 81·8°F. The chief results are embodied in this chapter, and it will be seen that, as was to be expected, the data differ considerably from those made by Casper in Berlin and by other observers in Europe—the changes generally occurring considerably earlier in India owing to the heat and humidity. See table on page 72 for summary of results.

Of the 36 cases observed by Mackenzie in Calcutta in July to September, the earliest onset of *rigor mortis* was 30 minutes, the latest 7 hours, and the average 1 hour and 56 minutes. In 6 cases it commenced from 30 minutes to 1 hour, in 19 cases from 1 to 2 hours, in 5 cases from 2 to 3 hours, in 2 cases from 3 to 4 hours, in 3 cases from 5 to 7 hours.

In cases where just previous to death the muscles have undergone great fatigue, and also in cases where the irritability of the muscles has been exhausted by a powerful electric discharge, as in death from lightning-stroke, also in death from cholera, tetanus, poisoning by opium or strychnia, rigidity **may come on at once** and the body stiffen in the position it was in at the time of death. On the other hand, in cases of sudden death, except from lightning, rigidity comes on late, provided always, of course, that the muscles just previous to death have not been subject to great fatigue, or to anything tending to exhaust their irritability.

Duration.—This depends greatly on the state of the muscles at the time of death. Generally speaking the **sooner** rigidity sets in the *sooner* it passes off, and the **longer** it is in appearing the *longer* will it last. It averages 24 to 48 hours in temperate climates (Tidy), but may continue for several days. Cold tends to prolong and heat (probably) to shorten it. For India, Dr. Mackenzie[2] observed the following times :—

Of 36 cases the shortest duration was 3 hours, the longest 40 hours, while the average was 19 hours and 12 minutes. In 3 cases it lasted less than 5 hours, in 6 cases from 5 to 10 hours, in 3 cases from 10 to 15 hours, in 6 cases from 15 to 20 hours, in 14 cases from 20 to 30 hours, and in 4 cases from 30 to 40 hours.

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[1] *Ind. Med. Gaz.*, 1889, p. 167.
[2] Brinton, *Amer. Jour. of Medl. Socy.*, January 1870.

Order of onset and disappearance.—In Europe this rigidity *appears*:—1st, in muscles of lower jaw; 2nd, in face, neck and trunk and lastly, in limbs, and it disappears in the same order. In Bengal in the rains it appeared in the majority of cases: 1st, in lower jaw and neck simultaneously; 2nd, in back muscles; 3rd, upper limbs; 4th, lower limbs, and it disappeared in same order.

Case XXX.—**Time of Death determined by Rigor Mortis.**—Case of *Jessie McPherson* (Glasgow, 1862)—*Reg.* v. *McLachlan.* The body was first seen by Dr. Macleod on the night of the 17th July, *i.e.*, in midsummer, when the mean temperature of the air was 50° F. "The *rigor mortis* was present in all the articulations, but it was then departing. The body was perfectly cold, even on the abdomen and at the flexures of the joints. There were no signs of decomposition, and the temperature was usually cool. By 10 A.M. on the next day, *rigor mortis* had disappeared from all the joints except the knees and the ankles. Death had resulted from violence and from profuse hæmorrhage. The victim was free from disease. *Rigor mortis* sets in generally from 10 hours to 3 days after death. When, however, death has been sudden, and is due to violence, it sets in more slowly; and Macleod therefore considered that in this case, at least, 48 hours must have elapsed from the time of death until the rigidity set in. But when the *rigor mortis* sets in slowly, it lasts all the longer and *vice versâ*, the average period of disappearance being from 24 to 36 hours. He, therefore, considered that in this case the rigidity must have lasted 30 hours, and, putting these figures together (48 and 30), he arrived at the conclusion that about 3 days had elapsed since death. The evidence subsequently recorded proved, as nearly as could be, that *this was the time which had passed* between death and the examination of the body."—(Taylor, 3rd ed., I, p. 85.)

See also Gardner's case, p. 77 and Sudabode Bhattacharji—*Case LXX.*

Cadaveric Spasm or Instantaneous Rigor Mortis is a term applied by Taylor and others to rigidity occurring at the moment of death in sudden and violent deaths. This rigidity passes sooner or later into *rigor mortis* though not necessarily identical with it. It is usually muscular contraction. Sometimes, it may be noted, important evidence as to the cause of death may be derived from the presence of objects grasped in the hands under the influence of cadaveric spasm.

Case XXXI.—**Alleged fabrication of evidence of suicide.**—"A man tried in France, in 1835, narrowly escaped conviction as the murderer of his father. The latter had been found dead in a sitting posture, with a recently discharged pistol grasped in his right hand, the weapon resting upon the thigh in such a way that the slightest motion of the part would apparently have caused it to fall. It was assumed that the son had produced the injury to the face, which had been the cause of death, and had afterwards placed the pistol in his father's hand, in order to induce the supposition of suicide. The medical evidence, by showing that the grasping of the weapon could not have been simulated after death, led to an acquittal"[1]—Ogston, *M. J. Lect.*, 365.

See also *Case LXX* of *Imp.* v. *Sudhabode Bhattacharji*, Chap. *Wounds.*

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[1] Ogston, *Brit. For. M. Rev.*, 1857, 303; Tidy, *Leg. Med.*, I. 64.

With the disappearance of rigidity, the 3rd stage of relaxation, due to incipient decomposition, commences ; this softening is not necessarily putrefactive, as micro-organisms are not always found in the relaxed muscles in this stage.

7.—PUTREFACTION, General.—This condition, which begins when *rigor mortis* ceases, is the most absolute and certain of all signs of death.

It is the decomposition of the nitrogenous elements of the tissues by bacteria (chiefly *bacterium termo*) with colour changes and the evolution of foul smelling gases. The changes occur generally in this order :

1. **Colour changes.**—Externally a greenish spot appears on the abdomen with odour of putrefaction and the eyeballs become soft and yielding. Greenish discoloration spreads over body. It is due to destructive decomposition of the red blood corpuscles with the solution of their hæmoglobin in the serum.

In Calcutta during the rains, Mackenzie found that the latest period at which the green discoloration of putrefaction appeared was 41 hours and 30 minutes, the earliest period was 7 hours and 10 minutes, and the average period was 26 hours and 4 minutes. In two cases it occurred under 10 hours, in four cases from 10 to 20 hours, in 18 cases from 20 to 30 hours, in 10 cases upwards of 30 hours, and in 2 cases it was not observed at all.

2. **Blisters form under the epidermis.**—

Mackenzie's latest period for the appearance of vesications on the surface of the body was 72 hours, the earliest period was 35 hours, and the average period was 49 hours and 39 minutes. In 17 cases it occurred in from 35 hours to 48 hours, in 10 cases from 48 to 60 hours, in 5 cases from 60 to 72 hours, and in 4 cases it was not observed at all.

3. **Maggots appear.**—The time of appearance of these is much earlier in India than in Europe.

The latest period at which *immature* maggots (which are chiefly the larva of the house-fly and flies of the 'blue-bottle' class *Lucilia*) appeared was in Mackenzie's cases 41 hours and 30 minutes, the earliest period was 3 hours and 20 minutes, and the average period was 25 hours and 57 minutes. In 2 cases it occurred in less than 10 hours, in 5 cases from 10 to 20 hours, in 11 cases from 20 to 30 hours, in 5 cases upwards of 30 hours, and in 13 cases it was not observable, as the deposit took place in the internal cavities, the mouth, nostrils, etc.

The latest period of the appearance of the *mature* or moving maggots was in Mackenzie's cases 76 hours, the earliest period was 24 hours and 18 minutes, and the average period was 39 hours and 43 minutes. In 6 cases it occurred in from 24 hours and 18 minutes to 30 hours, in 16 cases from 30 to 48 hours, in 11 cases from 48 to 72 hours, in 1 case upwards of 72 hours, and in 2 cases it was not observed.

4. **Gases distend tissues and cavities** till the walls of the body-cavities burst open and discharge their contents, and the brain runs out. These gases are SH_2, CH_4, NH_3, PH_3, CO_2, and N. These gases, developed under considerable pressure, cause various characteristic swellings and displacements of organs and their contents. Thus this gas (1) *Puffs up features* rendering recognition increasingly difficult: (2) *Protrudes eyeballs and sometimes tongue* (this condition is more marked in strangulation): (3) *Forces frothy mucus to lips and nostrils.* (4) *Distends abdomen and other* cavities, causing body to rise in water, if submerged, and eventually bursts open these cavities.

In Mackenzie's 36 cases the latest period at which gases were evolved so as to distend abdomen or cause exudation of froth from mouth and nostrils was 34 hours 30 minutes, and the earliest period was 5 hours 50 minutes, while the average period was 18 hours 17 minutes. In 9 cases it occurred in from 5 hours 5 minutes to 10 hours, in 10 cases from 10 to 20 hours, in 14 cases from 20 to 30 hours, in one case from 30 to 40 hours, and in 2 cases it was not observed at all. In the cases observed during the rains, the latest period at which gases were evolved was 34 hours 30 minutes, the earliest period was 5 hours 50 minutes, and the average period was 18 hours 17 minutes; while in October the latest period of its appearance was 47 hours, the earliest period was 16 hours 10 minutes, and the average period was 29 hours 17 minutes.

Case XXXII.—**Effect of gas on Uterus.**—Chevers quotes a case in which the effect of the gas, generated in a decomposing body, was to eject from the uterus a four months' fœtus, together with the acrid root which had been used for the purpose of procuring abortion and which caused the mother's death. Taylor quotes a similar case, in which the gases had sufficient force to expel the fœtus from the uterus when the woman had died during labour and undelivered.

5. **The softened flesh falls from the bones.**—The last organ to putrefy is the uterus.

Onset and Rapidity.—Putrefaction is so rapid in the hot plains of India that it begins on an average in about 25 hours; but no very definite estimate can be given of its rate of progress. In Europe in summer it occurs within 1 to 3 days after death.[1]

It is **hastened** or delayed respectively by the following conditions:—

1. **Temperature.**—The temperature most favourable to putrefaction seems to be between 70° and 100° F., hence bodies putrefy more rapidly in summer than in winter. Low temperatures below 32° F. arrest putrefaction altogether, hence well-preserved bodies of mammoths are found buried in artic

[1] Casper, I, 33, 37, 40, 52.

ice after thousands of years. Temperatures over 100°F. tend to delay it, and a temperature of 212°F. arrests it entirely.

2. **Access of air.**—Free access of ordinary air promotes putrefaction owing to entry of bacteria of decomposition, hence tight fitting clothes or a tight coffin retard putrefaction, whilst a bruised or mangled body putrefies more rapidly. Bodies putrefy more rapidly in air than in water, and less rapidly in earth.

3. **Moisture.**—Moisture promotes, and absence of moisture retards, putrefaction. Hence, putrefaction is more rapid in moist than in dry air and is much retarded by submersion in water, when the chemical change into adipocere may occur, see p. 73. Bodies, however, after removal from water very rapidly decompose. 'Mummification,' see p. 74, may occur in hot dry air.

4. **Condition of the Body, age and cause of death.**—Putrefaction is more rapid in bodies of persons dying suddenly and in fat flabby or dropsical bodies and in newly-born children and in women dying in child-birth than in cases of death from exhausting diseases and in emaciated bodies, doubtless owing to excess of fluid in the former cases. Parts injured at the time of death usually putrefy more rapidly. The presence in the body of certain poisons, *e.g.*, arsenic, antimony, chloride of zinc, alcohol, chloroform, and phosphorus, tends to delay, and of others, *e.g.*, sulphuretted hydrogen and animal poisons, tends to promote putrefaction.

5. **Antiseptics.**—These, of course, retard putrefaction. Lime, contrary to the popular belief, retards putrefaction.

SUMMARY OF

Onset of Cadaveric Changes in India.[1]

Based on Dr. Mackenzie's data for July to September.

Changes.	Average. H.	Average. M.	Earliest. H.	Earliest. M.	Latest. H.	Latest. M.	Average for Octr.* H.	Average for Octr.* M.
Muscular irritability lasts from death	1	51	0	30	4	30	1	42
Rigor mortis begins	1	56	0	40	7	0	1	10
Do. duration	19	12	3	0	40	0	31	30
Green discoloration appears	26	4	7	10	41	0	24	16
Ova of flies appear	25	57	3	20	41	30	...	...
Moving maggots appear	39	43	24	18	76	0	81	21
Vesications appear	49	34	35	...	72	0	59	8
Evolution of gases	18	17	5	50	34	30	29	17

* Of 10 cases, see p. 68.

[1] Mackenzie, *Ind. Med. Gaz.*, 1889.

Sometimes instead of the decomposition of putrefaction, the corpse may undergo the *post-mortem* change of (1) Saponification forming *Adipocere* or (2) Mummification.

8. **Adipocere.**—This saponification change only occurs in the case of bodies wholly submerged in water or cesspools, or buried in deep moist graves. The substance then formed is chemically a soap of ammonia and lime and is called 'adipocere' on account of its fat (*adeps*) and waxy (*cera*) appearance. It is probably produced by the fatty acids of the fat combining with the ammonia of the decomposed nitrogenous tissues of the body, and latterly as time goes on part of the ammonia is replaced by lime. Physically, it is a soft waxy looking substance, greasy to the touch and varying in colour from a dull white to dark brown and of a disagreeable rancid odour. On fracture it exhibits traces of fibres and the blood vessels between which the soap is deposited. Its specific gravity is less than water, it melts at about 200°F., is soluble in ether and alcohol, and on heating with caustic potash it yields ammonia. It is a very permanent body and may last twenty years and upwards.

The subcutaneous fat and bone-marrow first undergo this change ; the normal internal organs are not often so altered.

Time required for the change. Observers in Europe were of opinion that a low temperature by retarding decomposition favoured this change. Taylor and Casper show that adipocere has been found in bodies immersed in water from five weeks to one year, but rarely in less than three to four months, and all the soft parts had not completely undergone this change after a year's immersion. The process occurs more slowly in damp soil than in water, though in the case of a fœtus buried in a damp cellar it occurred in three weeks (Casper). The bodies of children and obese persons are more rapidly converted on account of the excess of fat, and in the former case the fat contains three times more fatty acid with less oleic acid (Langer).

In India, however, Dr. Coull Mackenzie, police-surgeon of Calcutta, has recorded eight cases[1] in which this change seems to have occurred within three to fifteen days after death, thus apparently disproving the theory that a low temperature conduced to this change. These cases occurred in the submerged bodies of persons drowned in the Hughly river at Calcutta or buried in the hot damp soil of Lower Bengal.

Amongst these cases were the following :—

(1) A male Hindoo was killed in July by the kick of a horse and was buried the following day. Four days after burial, the body was exhumed

[1] *Ind. Med. Gaz.*, 1889, p. 42.

in order that an inquest might be held. It was found in an advanced state of saponification externally, the heart and liver being also saponified. The body was buried in soft porous soil, saturated with moisture, the temperature being high, in the rainy season.

(2) An adult Chinese woman alleged to have died in child-birth was buried in September under circumstances which necessitated an inquest. The body was exhumed seventy-six hours after interment, when it was found to be considerably saponified. Her body was buried in similar soil and temperature, and in a wooden coffin.

(3) A young European was drowned in the river Hughly in September, his body being recovered seven days after. It was in an advanced state of saponification externally, the lungs, heart, liver, kidneys, stomach and intestines were also saponified, and what is very curious is that the stomach contained undigested food (flesh and potatoes) of which the flesh was entirely saponified, the potatoes not being altered in the least.

(4) A European sailor was drowned in the Hughly in October, and his body recovered eight days and ten hours after immersion, was found to have the external parts as well as the heart, liver, spleen, kidneys, stomach, intestines, and bladder saponified.

Similar experiences have been subsequently recorded[1] from Bengal, in which the body of a young Bengali woman buried in September three feet deep in alluvial soil on the bank of a pond, when exhumed three weeks afterwards was found to have undergone "apparent saponification." And in another case, the body of a boy, nine years of age, buried in a shallow grave, covered with nine inches of water, was found to have undergone this change *four days* after death.

It has been objected to these Indian observations[2] that no analysis[3] and microscopical examination of the alleged adipocere was made so as to distinguish it from the bleached and softened tissues of dead bodies which have macerated and putrified in water. Well authenticated cases supported by an authoritative chemical analysis are still required to settle this question for India.

9. Mummification, or dessication or shrivelling up of the body by its losing rapidly its fluids. This occurs only in hot dry climates, with hot air in motion, such as in sandy deserts, bodies perched in trees or between the rafters of a roof.

EXAMINATION OF THE DEAD BODY.

The medico-legal examination of a dead body differs in several important ways from the ordinary *post-mortem* examination for pathological purposes. It should include, if possible,

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[1] By Major D M. Moir, *Ind. Med Gaz.*, 1897, p. 197, and by Dr. V. Ashe, *id.*

[2] *Id.*, 1897, p. 134.

[3] In the last noted case the Chemical Examiner reported that "very partial saponification had taken place in the tissues."

(1) inspection of the position and attitude of the body and its surroundings on the spot where discovered, in addition to an (2) external inspection of the body itself, including its clothes or coverings, and, lastly, (3) internal examination of the body.

You should begin your notes by recording the exact place and date and hour when and where the examination is made and how the body was identified (see *Identification*, p. 27). Identification is all the more difficult when the body is badly mutilated or burnt or only a portion of it is found. When the body is of a person unknown and is not far decomposed a photograph should be taken of it.

I. POSITION, ATTITUDE AND SURROUNDINGS OF BODY.

If summoned to the spot where the dead body has been found and is still lying note carefully :—

1. **Attitude of body** and position relative to surrounding objects. Note whether the body is lying on the ground or floor, or is lying on a bed, couch or other article of furniture, or is seated or supported in a semi-erect or erect attitude and, if so, how supported, or is suspended partly or completely by a ligature round the neck, &c., &c. Note the attitude of the limbs, and the position of the body in regard to surrounding objects ; for example whether the body is lying at the foot of a precipice, tree, or other high object from which it may have fallen, or is immersed wholly or partly in water, or is lying in a room, and if so, in what part of the room, &c., &c.

2. **Nature, condition and position of objects in contact with or lying near body.**— Note if any matters are lying loosely in, or are tightly grasped by the hands (see *Wounds*, Chap. VI), and, if so, their nature and condition. Note the position, nature and condition of any **ligature** on the body, and the exact situation of the knot, whether or not any **stains of blood,** vomit, &c., are present on or near the body, on floor, walls, doors, windows or furniture, or any finger or foot marks, and whether any **weapon** or any vessel likely to have contained **poison** is lying near it, preserving such weapon, vessel, &c., for further examination. Note whether any confusion in the furniture or other signs exist in the neighbourhood of the body indicative of a **struggle** having taken place, or of the employment of weapons, or generally of the presence of persons other than the deceased, at the spot about the time of infliction of the injury.

Although examination of *the spot where a dead body has been found* and of the position of the body in regard to surrounding objects, often affords valuable information as to the circumstances under which death occurred (see cases in chap. on

Wounds), it must be recollected, however, that the spot where the body has been found **may not be** the place at which the act was done which caused death. In such a case the question will arise: What power of locomotion remained to the deceased after the act was done which caused his death, and was this sufficient to enable him to move from the spot at which the act was done, to that where the body was found?[1] The answer to this question may, it is evident, have an important bearing on the question: Was death due to homicide, suicide, or accident?

II. EXTERNAL Inspection of the Body and its Clothes or Coverings.

Examination of the Clothes or other coverings of the body.—First, the general condition of these should be noted, *e.g.*, whether showing marks of fire, or corrosion; or wet, or stained with blood, dirt, secretions, or excretions. The clothes, &c., should then be more particularly examined; note should be taken of any cuts or tears upon them, and of the correspondence or otherwise, of these with wounds on the body. Any peculiarities of the clothes, or of the ornaments found on the body, likely to aid in establishing its identity, should also be recorded.

External examination of the Body.—For this the clothes should be taken off and any marks resembling bruises washed to make certain that it is not dirt or external stains. In India, dead bodies are often submitted for examination in an advanced state of decomposition. Such bodies should nevertheless be examined externally, and as far as possible internally also; the fullest possible examination of the body should invariably be made, not necessarily for report to magistrate, but for inclusion in your own notes for reference, and to establish your own opinion. The plan of making a partial examination is only admissible when the body is extremely putrid and decomposed; but even in such cases, although the medical officer is at liberty to decline to make an internal examination of highly putrid corpses, some distinct evidence as to how death was caused may often be obtained, as for example, when this has been the result of wounds, fractures, or other violence, or of the administration of certain poisons; besides the condition of the uterus might give vital information, and the presence of solid fæces in the gut would negative alleged death from cholera.

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[1] See Wounds, Chap. VI.

External examination of the body should include a search for—

1. **Signs indicating the Time which has elapsed since Death.**—That is, whether the body is warm or cold, its condition as regards rigidity, and the extent to which putrefaction has advanced. It is possible that an estimate formed as to the period which has elapsed since death may bear greatly on the question of (*a*) the identity of the body, and (*b*) the guilt or innocence of accused persons (see *Case XXXIII* below).

The question of how long a body has been dead is sometimes of the utmost importance in cases of murder where accused pleads an *alibi*.

The advanced state of putrefaction of a body may show, for example, that death must have occurred at a period considerably anterior to the date of disappearance of the individual whose body it is alleged to be ; or as in the following case of Gardner the condition of the body of a murdered individual may show, that death must have taken place at a time when the accused had access to the victim, and not subsequently to the time of termination of such access.

Case XXXIII. **Time of committing murder indicated by condition of body.—Gardner, the sweep**—Gardner lived with his wife and another woman, their servant. The wife was found dead in her bedroom, with wounds on her throat, at 8 A.M. Her extremities (which were uncovered) were cold, and rigidity was well marked. The circumstances of the case conclusively indicated murder, and Gardner was suspected and brought to trial. Gardner was proved to have left the house on the morning of the murder at 4 A.M., and was absent until after 8 A.M. The defence alleged that the woman was murdered during Gardner's absence. The medical witnesses in the case gave it as their opinion that, from the condition of the body when first seen at 8 A.M., it was clear that the woman had been dead more than four hours. Hence she must have died before Gardner left the house. This and the other evidence in the case led to the conviction of the prisoner. (Taylor, *M. J.*, i, 83.)

See also case of Sudhabode Bhattacharji *Case LXX.*

Any estimate however based on *post-mortem* examination must necessarily be **only approximate.** You should consider especially the following points :—

(1) **Temperature of the body.**—In the tropics where the temperature of surrounding objects is but little above that of the body the latter "cools" in a few hours. Observations in temperate climates show that the dead body cools down to a temperature a little above that of the external air in fifteen to twenty hours, the fall of temperature being more rapid in the earlier than in the later hours after death.

(2) **Condition of the Muscles.**—If these are relaxed and contractile, it is probable that not more than $1\frac{1}{2}$ to $1\frac{3}{4}$ hours in the plains or 3 to 6 hours in the hills have elapsed since death. If rigid, probably more than 3 and less than 36 hours have elapsed in hills; for plains see table, p. 72 and *Case LXX*.

(3) **Amount of Putrefaction.**—Other things being equal, the greater the amount of this the longer the period which has elapsed since death. The rapidity of putrefaction, however, varies so greatly with the circumstances already detailed that no general rule can be laid down for estimating by its amount the length of time which has elapsed since death occurred.

2. **Marks likely to aid in establishing the Identity of the body.**—Note the sex, probable age, state of the teeth and jaws, height, general condition, the colour of the eyes and hair, and whether any, and if so what, portions of the body have been denuded of hair. Note the presence of any deformities, tumours, old scars, tattoo, sun or other marks on the surface of the body, and of perforations for the insertion of ornaments (see *Identity*, p. 42).

3. **Marks of Violence, or other external marks indicative of the Cause of death.**—Note if there are any *stains* of blood, or other matters, on the surface of the body. In the case of blood stains, it is specially important to note their situation and form, as this may show that they have been produced by some individual other than deceased, *e.g.*, the impress of a right hand on the right hand or forearm of the body. Specially search for bloody *thumb or finger prints* (see p. 49). Note whether or not *cutis anserina*[1] is present, and whether any matters are sticking under the nails. Note whether the *features* are pale and natural, or livid and swollen, the condition of the eyes, and position of the tongue, and whether or not this shows marks of injury from the teeth. Examine the *orifices* of the body for presence of foreign bodies, marks of concealed punctures, and marks of corrosion, and note the nature of any fluid oozing from them. Examine, at first without dissection, the whole body for **Wounds** or **Contusions**, not omitting to examine by palpation the bones for **fractures** and to search for marks of *concealed punctures* under the breasts, scrotum, and eyelids, and in the armpits and nape of the neck, and, in the case of infants, in the fontanelles, and along the whole course of the spine.

Then, employing such **Dissection** as may be requisite, note in regard to all **Wounds** or other marks of injury

[1] Goose-skin, see Drowning, Chap. VII.

(1) exact **Situation.**—This should be recorded with reference to some fixed point on the body, *e.g.*, distance of a wound in inches from the top of the pubis or sternum, angle of the jaw, &c.; position, with reference to the hyoid bone or laryngeal cartilages of a ligature mark on the neck, &c. (2) **Exact Dimensions**, *e.g.*, measured in inches, the length, breadth, and depth of wounds, breadth of ligature marks, &c. (3) **Direction**, *e.g.*, in a punctured wound, whether it is directed from above down or below up, and whether from right to left or left to right; and in incised or other linear wounds or marks of injury, whether or not one end is higher than the other, and, if so, whether the upper end is anterior or posterior to, or to the right or left of, the lower. In the case of certain fractures, *e.g.*, of the ribs, note whether the broken ends of the bone have been driven inwards or outwards, by the violence used to cause the fracture. (4) **Appearance**, and how far this indicates (*a*) the method, and (*b*) the time, of their production. Under (*a*) note in the case of wounds whether the *edges are contused* or lacerated, or apparently clean cut, and in the latter case examine them with the aid of a lens for signs of tearing, or appearance of inversion, indicative of production by a blunt weapon. Note the general shape of any wound, contusion, or burn; this may indicate the shape of the weapon or heated object which has been used. In the case of an *incised* wound, compare the appearance of the two ends of the wound, with the view of ascertaining the direction in which the cutting instrument was drawn in producing it. In **gunshot** wounds, if two orifices exist, compare their appearance, noting any characters indicating one or other to be the orifice of entry or of exit. Note also whether or no any blackening or marks of gunpowder exist round the wound. Examine any wound for the presence of foreign bodies, preserving such as may be found. Under (*b*) note, in the case of wounds, whether or no the edges are retracted or everted, and whether or no blood or blood clots are present in the wound, or signs of *inflammation* exist around it. In the case of **apparent contusions**, note if the skin over them is abraded; examine the edge of the contused surface for changes of colour, and, *by dissection*, ascertain if the underlying tissues contain extravasated blood so as to distinguish ecchymosis from cadaveric lividity.[1] In the case of *ligature marks* also, the condition of the tissues underlying the mark should be ascertained. If the injury is a **burn**, note the presence or absence of vesication about it, or of a line of redness, or signs of inflammation around it.

[1] See p. 47 *et seq.*

Bear in mind, while conducting the examination, the characters which distinguish *ante-mortem* from *post-mortem* wounds[1] and burns.[2] Recollect, also, that under certain circumstances putrefactive changes may *simulate signs of strangulation.* There may, for example, be protrusion of the tongue, due to such changes ; and putrefactive swelling against a string loosely tied round the neck, may result in the production of a depressed mark, somewhat similar to that left by the ligature in death from strangulation.

In **infants** the external examination should, in addition, include examination for (1) **degree of maturity**, namely, length and weight, condition of the eyes, condition of the skin, nails, and scalp hair, and position of the middle point of the body and (2) **live birth, or the reverse,** *e.g.*, exfoliation of the scarf skin, condition of the umbilical cord, presence of signs of intra-uterine maceration (see *Infanticide*, Chap. *XVI*).

III. INTERNAL Examination of the Body.

After the external examination has been thoroughly made, the internal examination or autopsy should be performed as thoroughly as possible, or as is deemed necessary.

Order of conducting the examination.—If on the surface of the body marks of violence exist of such a nature as to indicate injury to the organs contained in any particular cavity, that cavity *should be first dissected*, and the exact effect of the violence ascertained. Incisions made through the skin for this purpose should avoid wounds likely to have penetrated the cavities underlying them, so that there may be no interference with the subsequent tracing of the exact course of the wound. In other cases, where a particular cause of death is *suspected*, that cavity should be first dissected in which appearances indicative of the cause of death are most likely to be found, *e.g.*, in cases where it is suspected that death has been due to asphyxia, the thorax, and in cases of poisoning, the abdomen should be the cavity first dissected.

In cases where the cause of death is *doubtful*, the three chief cavities of the body should be dissected in the following order : (1) head, (2) thorax and (3) abdomen.

In all cases, before opening and dissecting the thorax, the cavity of the abdomen is to be opened, and (without further dissection) the position of the diaphragm, and general appearance of the contents of the abdomen ascertained. Should this preliminary inspection indicate that the cause of

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[1] See *Chap. VI.* [2] See *Chap. VII.*

death is connected with the abdominal viscera, dissection of the abdomen should be proceeded with ; if not, it should be reserved until after the thorax has been dissected.

It should specially be recollected that the condition as to fulness or the reverse of the cavities of the heart, at the time of death, can only be with certainty ascertained when these are opened before removing this or any other organ from the body.

Examination should be complete.—Even if the condition of the parts first examined appears sufficiently to account for death, the remainder of the body should nevertheless be examined, so that, you may be in a position to say, not only what was, but also, as far as possible, what was not, the cause of death. Cases are on record, in which a complete *post-mortem* examination of a body has disclosed indications of a cause of death other than that indicated by the condition of the parts first examined. The appearances first noted may, for example, indicate that death was due to mechanical violence, or to drowning, and yet, on further examination, indications may be found of death from poison (see *Case XXV*, p. 59). Or again, the appearances first noted may indicate death from hanging and yet further examination may show that death was due to strangulation (*Case LXXII*), or to mechanical violence (*Case LXXIII*), and that the appearances indicative of death from hanging have been fabricated in order to make the case seem one of suicide. Again if the *post-mortem* appearances show clearly that death was due to a particular lesion, your examination is not complete unless you have noted all particulars which may assist in arriving at an opinion as to whether the fatal lesion was the result of disease or of violence, and if the latter, whether the violence was accidental, suicidal or homicidal. It has happened that in cases where the medical reports have shown that death was caused (1) by injury to the head, and (2) in case of a woman, by strangulation, that it was subsequently found that in the first case the ribs were crushed, and in the second, rape had been committed.

The order of examination should be that here given, unless special reasons of the nature above indicated exist for departure therefrom. Incisions made through the skin for the purpose of opening cavities should avoid already existing external wounds. If on dissection any internal injury is found likely to have resulted from external violence, careful examination should be made—if this has not already been done—for signs of violence in the tissues between the seat of injury and the surface of the body ; and for marks of violence on the

surface of the body over the seat of injury. Any unusual appearances found, in addition to those already mentioned, should be recorded.

I.—The Head.

The internal examination of the body should commence with dissection of this cavity:—(*a*) in cases where the cause of death is doubtful, and (*b*) when it is suspected that death has been due to head injury, or has occurred by coma.

Procedure.	Appearances to be looked for and recorded.
1. Make an incision through the integuments from ear to ear over the vertex and reflect the scalp, one flap forwards, the other backwards.	(*a*) Extravasations of blood in or under the scalp, their situation and extent. (*b*) Injuries to the bones of the skull-cap visible externally, *viz.*, separation of sutures, fractures, or indentations; their situation, extent, and direction (see 2 *b*, below).
2. Saw through the skull by a circular cut at the level of about an inch above the orbits in front, and of the occipital protuberance behind, detaching the skull-cap without using the chisel and mallet (unless it is certain that there is no fracture of the skull). Raise the skull cap from before backwards, separating the dura mater from it. 3. Divide and reflect the dura mater on either side. *N.B.*—If the dura mater is so firmly adherent to the skull-cap as not to be easily separable, it should be divided carefully and removed with the skull-cap.	(*a*) Unusual thinness of the skull bones. (*b*) Complete I *b*, above, by examining inner surface of skull-cap. (*c*) Fulness (or the reverse) of the longitudinal sinus. (*d*) Condition of the membranes of the brain, *e.g.*, amount of adhesion, if any, of the dura mater to the skull-cap, presence of congestion or signs of disease. (*e*) Extravasations of blood between the skull-cap and the brain, their situation and extent.
4. Remove the brain carefully, place it base downwards, and proceed to slice it horizontally from above.	(*a*) Extravasations at the base of the skull, their situation and extent. (*b*) Volume of any serous fluid found within the skull or ventricles of the brain. (*c*) Weight, colour, and consistence of the brain (and in immature infants its condition of development, see Chap. XIV). (*d*) Apoplectic effusions within the substance of the brain, their situation and extent. (*e*) Freedom or otherwise from disease of the coats of the cerebral arteries.
5. Strip off the dura mater from the interior of the skull.	(*a*) Fractures of the base of lateral portions of the skull, their situation, extent, and direction, and thickness of the bones at the seat of the fracture. (*b*) In infants, presence of air in the cavity of the tympanum.
6. Examine the upper portion of the spinal cord through the foramen magnum.	If any signs of injury to the cord or upper cervical vertebræ are found, proceed at once to IV, returning subsequently to II.

II.—The Thorax (including preliminary examination of the abdominal cavity).

The internal examination of the body should commence here, in cases where death appears to have been due to chest injury, or to have occurred by asphyxia. Also when there is reason to believe that the cause of death is connected with the contents of the abdomen. In this last case after II 1, proceed to III (see N.B. below).

Procedure.	Appearances to be looked for and recorded.
1. Make a long incision from a little above the sternum down to the pubes, reflect the integuments on either side, laying open the abdominal cavity but not the cavity of the thorax. In infants take care to carry the incision a little to the left of the umbilicus.	(*a*) Position, colour, and general appearance of the exposed viscera. (*b*) Presence of abnormal contents, *e.g.*, blood, products of inflammation, or tumours. (*c*) Determine with the hand (especially in new-born infants) the position of the diaphragm, noting whether the upper level of this is between the fifth and sixth ribs (see Chap. XVI), or higher. *N.B.*—Should this preliminary examination indicate, or there be reason to believe, that the cause of death is connected with the contents of the abdomen, proceed at once to III, subsequently returning to II, 2.
2. Complete the reflection of the integuments over the thorax to a point beyond the junction of the cartilages of the ribs.	(*a*) Extravasations of blood or signs of bruising in the integuments of the front of the chest, their situation, and extent. (*b*) Fractures of the anterior portions of the ribs, their situation, and the direction in which the fractured ends appear to have been driven (see also II, 9 *c*).
3. Divide the rib cartilages as far from the sternum as possible, or, if these are ossified, cut through the ribs a little outside the cartilages. Cutting upwards, close under the rib cartilages, raise the sternum and cartilages, and very carefully cut through the sternoclavicular joints, taking care not to wound the underlying large vessels. Remove the sternum and attached rib cartilages.	(*a*) Volume of the lungs, *i.e.*, whether projecting out of the chest (indicating emphysema); or expanded and nearly covering the pericardium, but not projecting; or collapsed, exposing the pericardium. (*b*) Colour of the lungs; in infants, whether dark red or bright red. (*c*) Fluid in the pleural cavities, nature and volume. (*d*) Adhesions of the lungs. (*e*) Condition of the thymus gland. (*f*) Tumours in the thorax.
4. Open the pericardium.	(*a*) Condition of the pericardium; nature and volume of any fluid present therein (see p. 86). (*b*) Size, colour, and consistence of the heart, and condition of fulness of the coronary vessels.

Procedure.	Appearances to be looked for and recorded.
5. Without removing the heart from the body, open its cavities in the following order: (1) R. ventricle; (2) R. auricle; (3) L. auricle; (4) L. ventricle. Incision required: (1) Along the right border of the heart, beginning close to the base and ending short of the apex. (2) Begins midway between the entrances of the venæ cavæ, and ends just in front of the base. (3) Begins at the left superior pulmonary vein, and ends just in front of the base, short of the coronary vein. (4) Begins behind the base and ends short of the apex.	Note, as each cavity is opened, the amount and condition of its contents.
6. Remove the lungs and heart together. *N.B.*—In cases where it is suspected that death has been due to injury to the neck, and in cases where the condition of or presence of foreign matters in the gullet or air-passages is likely to be of importance, proceed after 5 to 10, returning to 6 *et seq.* afterwards.	(*a*) Presence on the surface of the lungs of Tardieu's spots, or patches of emphysema (see Strangulation and Suffocation). (*b*) In new-born infants, note if inflated air-vesicles are visible on the surface of the lung, and distinguish between these and bubbles of gas due to putrefaction (see Chap. XVI); then proceed to the hydrostatic test, noting while dividing the lungs whether they exude frothy blood freely and crepitate, or show signs of disease.
7. Separate the heart, and test the condition of the arterial openings by pouring in water.	(*a*) Condition of the cardiac valves, tufts of fibrin on their edges, &c. (*b*) Livid patches on the endocardium (see Arsenic). (*c*) Condition of the heart tissue. (*d*) In new-born infants, condition of the foramen ovale. (*e*) Conditions of the portions of the large vessels remaining attached to the heart.
8. Make long incisions into each lung, and, if necessary, follow the branches of the bronchial tubes and pulmonary artery by dividing them with scissors.	(*a*) General characters of the lung tissue. (*b*) Disease of the lungs. (*c*) Apoplectic effusions into the lung substance (see Strangulation). (*d*) Condition of the bronchial tubes, nature and quantity of foreign matters present therein (see Drowning). (*e*) Condition of the branches of the pulmonary artery, noting any obstruction.
9. Previous to opening the descending aorta, tie two ligatures round the œsophagus near the diaphragm, divide the œsophagus between them and dissect it out of the way.	(*a*) In new-born infants, note the condition of the ductus arteriosus. (*b*) Examine the aorta for atheroma and aneurism. (*c*) Complete the examination of the ribs for fractures.

Procedure.	Appearances to be looked for and recorded.
10. Prolong the incision upwards to the chin, reflect the skin as far back as possible; separate the soft parts from the inside of the lower jaw, cutting close to the bone. Pull the tongue forwards below the chin, and carry the dissection backwards, separating the pharynx and œsophagus with the larynx and trachea from the spine. Open in succession the larynx, trachea and œsophagus.	(*a*) Foreign bodies, marks of corrosion, &c., in the larynx, trachea, and œsophagus. (*b*) Examine the large vessels of the neck for injury, obstruction, &c., opening them carefully. (*c*) Ascertain the condition of the cervical vertebræ.

III.—The Abdomen.

In infants the condition of the umbilical vessels, and of their continuations within the abdomen, should, so far as can be done without removal of any of the abdominal viscera, now be ascertained, completing the examination after the remaining portions become exposed by removal of the viscera.

In all cases examine first generally, and without further dissection, the abdominal viscera *in situ*. Should this examination show, or should there be reason to believe, that the cause of death is connected with any particular organ, the further examination should commence with the organ or organs, concerned. Thus, **in cases of poisoning** the further examination should commence with the stomach and intestines. Each viscus should be carefully examined *in situ* previous to its removal for further examination, noting particularly any enlargement or unusual appearance, and any wound or sign of injury. If a wound be present, its precise situation, direction, and appearance should be described, and it should be noted whether or not any blood is effused in its neighbourhood. The general consistence of the injured viscus should also be noted. Each viscus is then to be removed, and, after removal, further examined as below.

1. **The Liver.**—Note its weight and appearance on section. This may be (*a*) uniform dark brown = *normal*, or (*b*) either uniform dark red, the cut surface exuding blood pretty freely; or of a nutmeg appearance, *i.e.*, in some places dark red, in others buff or yellow = *congestion*; or (*c*) texture dense and tough, surface irregular = *cirrhosis*; or (*d*) in places soft pale yellow, and greasy = *fatty*; or (*e*) uniformly pale yellow, and reduced in size = *yellow atrophy*; or (*f*) enlarged and heavy, consistence doughy, cut surface greyish and glistening or semi-translucent in appearance = *amyloid or lardaceous*. Note presence of abscesses or tumours. Note also the condition of the gall-bladder, and the nature of its contents. If there be any reason to suspect death from poison, preserve for analysis a large portion of the liver, at least one pound in weight.

2. **The Spleen.**—Note its size, weight, and appearance on section. If death has been due to rupture of this organ, it is of special importance to note its consistence, and whether or not any signs of injury are present on the surface of the body over it, or in the tissues lying between it and the surface of the body.

3. **The Kidneys.**—Note in regard to each its weight, and whether or not the capsule peels off readily. Then commencing at the

convex border make a long incision through it as far as the pelvis, and note if any signs of inflammation of the lining membrane be present. Note the condition of the cut surface. Congestion accompanied by softening and enlargement, or pallor similarly accompanied, indicate inflammation respectively in the early and later stage. Again, the capsule may be adherent, the viscus reduced in size, and its section granular or cystic = *forms of chronic Bright's disease;* or the kidney may be enlarged, the capsule non-adherent, and the section pale, waxy, smooth and glistening = *amyloid degeneration.* Note the presence of morbid growths or tubercular deposit, and in infants note if there is any appearance of blocking or embolism of the kidney tubes with uric acid or urates (see Chap. XVI). In cases of poisoning preserve one or both kidneys for analysis.

4. **The Pelvic Organs.**—Tie two ligatures round the lower part of the large intestine a little above the rectum, and divide the gut between them. Open the urinary bladder *in situ* and determine its contents, preserving any urine found for subsequent analysis. In male infants, note the position of the testicles. Then having examined each organ *in situ*, remove the whole of the pelvic organs together, and complete the examination of the bladder, ureters, and urethra, noting in males the size of the prostate, and the condition of the testicles. Examine the rectum, noting specially in infants the presence or absence of meconium.

In females, examine the generative organs as follows :—

(*a*) **The Vagina.**—This is to be opened first and examined for marks of injury and presence of foreign bodies, preserving any matters found for analysis. Its colour, the presence or absence of rugæ, and the condition of the hymen are also to be noted.

(*b*) **The Uterus.**—Measure externally its length and greatest breadth. Take its weight. Then open it by an incision from fundus to cervix, and note the dimensions of its cavity and the thickness of its walls (see Abortion, Chap. XV). Note the nature of its contents, if any, and if a fœtus be present determine its age (see table, Chap. XVI) Record the condition and colour of the lining membrane and muscular substance, presence of internal injuries, or of morbid growths.

(*c*) **The Ovaries.**—Note in regard to these their size and external appearance, and after section examine for signs of disease and for true and false corpora lutea (see Chap. XV).

5. **The Stomach.**—Before removing this viscus tie two ligatures round the duodenum close to the stomach, and divide between these ligatures the gut between them. (If the abdominal cavity is dissected before the thorax, a similar procedure must, before removing the stomach, be adopted with the œsophagus (see II, 9). In infants, before opening the stomach, note if any air appears to be contained in it (see Chap. XVI). Then place the stomach in a clean jar or photographic developing dish and along its lesser curvature, collecting its contents in the vessel. Note the volume of the fluid contained in the stomach, its general appearance, the character of any matters suspended in it, and any peculiar odour possessed by it. In infants, examine the contents of the stomach for the presence of milk, food, &c. (see Infanticide, Chap. XVI). *If there is any reason to suspect Poisoning, preserve the contents of the stomach for analysis* (see Chap. XX), and note carefully the condition of the mucous membrane, and examine for the presence of adhering particles of poison. Any suspicious-looking

particles should be picked off with a pair of forceps and separately preserved for analysis.

6. **The Intestines.**—These should be removed like the stomach, and, after removal, should be laid open along their whole length, preserving, in cases of suspected poisoning, their contents for analysis, with precautions similar to those observed in preserving the contents of the stomach. In the case of infants note if meconium be present, and its position. Note the condition of the mucous membrane, presence of any erosions, ulcers, or perforations, and the condition of the agminate and solitary glands.

N.B.—After completing the dissection of the abdomen, proceed to the dissection of the thorax, should this cavity not have been already dissected (see II, 2).

IV.—The Spine and Spinal Cord.

These should be examined in all cases where it is likely that any signs of injury thereto, or morbid appearances thereof, are to be found. Procedure : divide the integuments down to the bone by an incision in the middle line along the whole length of the spinal column ; reflect the integuments on either side and cut away the muscles from the arches of the vertebræ. In carrying out this dissection, note any extravasations of blood in the tissues over the spine, and any fracture of the bones which may be exposed. Then saw through the vertebral arches on either side and remove the detached portions of bone. Examine the outer surface of the exposed dura mater, then slit it open carefully along its whole length, and examine the exposed portion of the pia mater *in situ*. Next pass the finger gently down the cord, noting its consistence ; then remove the cord from the body and complete its examination, making for this purpose transverse incisions through it in several places. Finally, remove the dura mater from the interior of the spinal canal, and complete the examination of the vertebræ for fractures.

V.—The Knee Joint.

In new-born infants this joint should be opened by a transverse incision in front, the lower end of the femur pushed out through the wound, and the cartilage at the end of the bone sliced transversely in fine slices until a pink spot appears in the cut surface ; very fine slices are then to be made and the greatest diameter of the bony nucleus ascertained (see pages 348 and 375).

[The instruments used in the *post-mortem* examination should after washing be sterilized by heat. This may be done by dipping the blade into benzine and then applying a light, the flame being sufficient to sterilize the metal]

The weights of the viscera should be ascertained if possible. The following table[1] shows the average weights of

[1] Compiled by Major W. J. Buchanan and Captain Maddox, I.M.S.—*I. M. G.*, June 1902.

the chief viscera of adult *natives* of Bengal and Bihar for adults who have died in jails of disease :—

Native *Males.*

——	No. of cases.	Average weight.	Highest.	Lowest.	Causes of death.
		oz.	oz.	oz.	
Liver	333	44	108(*a*)	13(*b*)	(*a*) Dysentery. (*b*) Do.
Spleen	314	10½	64(*a*)	1(*b*)	(*a*) Malarial fever. (*b*) Chronic dysentery.
Lungs, Right ...	224	16	52(*a*)	5(*b*)	(*a*) Bronchitis. (*b*) Dysentery.
,, Left ..	224	14½	43(*a*)	5(*b*)	(*a*) Lobar Pneumonia. (*b*) Anæmia.
Heart	238	7½	20(*a*)	4(*b*)	(*a*) Apoplexy. (*b*) Pneumonia.
Kidney, Right ...	246	3¾	8(*a*)	2(*b*)	(*a*) Pneumonia. (*b*) Chronic Dysentery.
,, Left ...	246	3¾	8(*a*)	2(*b*)	(*a*) Tubercle of lungs. (*b*) Pneumonia.
Brain	143	44	56(*a*)	33(*b*)	(*a*) Pneumonia. (*b*) Malarial fever.

Average height 5 ft. 3 in. Average weight 110lb. Based on 28,000 cases.—*I. M. G.*, Oct. 1897.

Native *Females.*

	No. of cases.	Average weight.	Highest.	Lowest.
		oz.	oz.	oz.
Liver	88	37½	62	16
Spleen	91	6½	48	1
Lungs, Right	49	9½	20	6
Lungs, Left	49	9½	17	4
Heart	46	6	9	4
Kidneys, Right... ...	68	3½	6	1
,, Left	68	3½	6	1
Brain	7	37	42	26

The average weight for *Europeans* is :—

IN ADULT EUROPEANS.
(According to Tidy.)

Organ.	Male.	Female.
	oz.	oz.
Brain	49½	44
Lungs (together)	45	32
Heart	9½	8¾
(usually about in inches 5×3½×2½)		
Stomach	4½	A little less than 4½.
Liver	50—60	45 - 55
Spleen	5—7	5—7
Pancreas	2¼—3½	2¼—3½
Kidneys (together)	9	8⅝

In the female the brain and lungs are lighter than in males by 5½ and 13 ounces respectively.

To **recapitulate**: the more important viscera for examination after the brain are those of the thorax (the heart and lungs), then those of the abdomen, preserving in cases of suspected poisoning the contents of the stomach and intestines and also large portions of the liver, spleen, and kidneys.

In infants the examination should be directed not only to ascertaining (1) the cause of death, but also (2) the degree of maturity, and (3) whether or not it survived its birth (see *Inheritance*, question 6, Chap. XIV, and *Infanticide*, question 1, Chap. XVI.)

Opinion.—No opinion should be given as to the cause of death that is not fully warranted by the appearances observed. If in any case where, on *post-mortem* examination, you may fail to discover appearances sufficient to account for death, a negative opinion only should be given. You are not justified in reporting the death as due to 'natural causes' simply because you have failed to find *post-mortem* appearances indicative of death from a non-natural cause.

Again, you may find that death was due to a lesion, such as an effusion of blood into the substance of the brain, which may either have been the result of violence or of disease, and the *post-mortem* appearances may do no more than indicate that the fatal lesion was more probably the result of one than of the other. In such a case your opinion should be a guarded one, and be accompanied by the reasons which lead you to consider it to be more probable that death was due to disease or to violence, as the case may be.

The results of the examination should always be duly recorded at the time and on the spot, in a note-book kept for the purpose.

EXHUMATION.

This unpleasant task becomes necessary occasionally where a suspicion of poisoning or other foul play arises some time after the death; or it may be for purposes of identification, as in the case of the body alleged to be that of Livingstone, where identification on disinterment was made by the arm showing a badly united fracture, such as the deceased was known to have had.

In India, the practice of swift cremation of mortal remains upon the very day of death, which is prevalent amongst the more orthodox Hindus, who form the majority of the population, necessarily restricts the frequency of exhumations in this country, where earth-to-earth burial is mostly limited to Muhammadans, non-Hinduized aborigines and Europeans.

In exhuming a body it is desirable that a medical officer be present from the commencement, also any relative or acquaintance of the deceased person who can identify the corpse; and if buried in a coffin, the carpenter who made the coffin should be present. The examination must be made in daylight, preferably the early morning. Disinfectants or deodorants should be ready and should be sprinkled around but not upon the body itself. If the coffin is broken, and in cases where there is no coffin, some of the earth above and below the body should be taken and preserved in cases of suspected poisoning for analysis.

The body should be exposed a short time before inspection to allow effluvia to escape, and the observer should stand on the windward side. The stage of putrefaction should be noted.

In recent interments the usual *post-mortem* examination should be made as far as possible. In the external inspection a sample of any characteristic hair on the face should be preserved for identification. After examining the bodily cavities, the stomach and its contents, also contents of bowels, also the liver, spleen and kidneys should be preserved and sealed in clean bottles for chemical analysis as detailed in appendix. All injured parts should also be removed and preserved when practicable. When a long interval has elapsed since burial, injuries to the bones, especially the skull, and in women to the uterus (which longest resists putrefaction) should be looked for; and where mineral poison is suspected a long bone, such as the femur, should be preserved for analysis.

Limit of Time.—There is practically no limit of time, in English law, to the utility of an exhumation; for so long as the

bones remain, these may in many cases afford valuable evidence, by which the innocence of suspected persons may be proved, or the exhumation may prove murder by arsenic or other mineral poison.

CHAPTER IV.

EXAMINATION OF BLOOD AND SEMINAL STAINS AND OTHER STAINED ARTICLES.

Stained weapons, clothes, bits of furniture, plaster, mud, &c., may be sent for examination in cases of alleged wounds, rape and unnatural crime. These stained articles are usually passed on by civil surgeons, for want of the requisite apparatus and test materials, to the provincial chemical examiner for his expert report. In such a procedure the necessary precautions as to labelling, sealing, &c., must be taken, as in sending articles in poisoning cases (see Chap. XX) for examination.

PRELIMINARY EXAMINATION OF STAINS.

1. **Note** down carefully an exact description of the stained articles, weapons, &c., submitted to you for examination, to enable you afterwards to identify the articles, as the whole case may break down if you cannot identify in court the article from which you have examined the stain. Note the number, shape, size, colour, consistency of stains, on what part of weapon and on which side of the garment, the inside or outside ; and if more than one garment stained, whether they are stained in a corresponding part. In important cases a *photograph* should be taken of the stained garment or article before removing any of the stain.

2. **Cut out part** of the suspected stain from the article, and divide each part into at least three portions for tests and control purposes, and carefully preserve as much as possible of the original stain for exhibit afterwards in court.

Authority to cut out portions of the exhibits must be first obtained from the magistrate of the place whence the stain is received.—See form in appendix III (*b*).

These stains may be (1) blood, (2) seminal, or (3) other.

BLOOD-STAINS.

It is frequently of great importance to determine whether stains on the clothing of an accused person are due to blood or not. The characters of freshly shed blood are so

self-evident that expert opinion is usually only called for when the stain is somewhat old, of small size or of uncertain appearance.

Is the stain blood?—Spots of rust, stains of certain fruits, betel juice, aniline dyes, mineral acids, &c., may resemble blood. A stain of blood not altered by friction, wearing or washing feels stiff like thick starch or gum on a garment and has sharp edges, and on a metal or stone surface it tends to scale off, especially on heating.

Blood is recognised by three methods: (1) Chemical, (2) Microscopical and (3) Spectroscopical.

CHEMICAL TESTS.

1. **Cold water** dissolves the stain, yielding a reddish solution, of which take one portion and heat. It then coagulates and loses its red colour, while the coagulum is soluble in weak ammonia, giving a dichroic solution, red by reflected light and green by transmitted. This reaction is due to *hæmoglobin* being soluble in cold water, while its albuminous part is coagulated by heat, which precipitates also the *hæmatin*. Of the original red solution take a few drops in a watch-glass and add a drop of strong *nitric* acid on the side of the watch-glass a dirty-white ring of coagulated albumen will form at the point of contact and the red colour is discharged.

If the stains are on cloth, or some other similar fabric, cut out and suspend a portion of the stained article by a thread, in a little distilled water contained in a watch-glass or test-tube. If the stain is on a knife-blade or hard body a portion must be scraped off and soaked in water in a test-tube. The water, especially near the bottom of the tube, soon acquires a red colour. This distinguishes blood from various fixed red dyes. The colouring matter of blood may be rendered insoluble in water by the action of various agents, *e.g.*, tannic acid, iron rust, also heat; hence blood stains on leather, and old blood stains on iron weapons, may not yield a red solution to water. In such cases dilute solution of ammonia should be used as a solvent in place of water (see test 2).

2. If the blood-stain is old and cold water does not dissolve the stain, add a **weak solution of ammonia** to get solution of red colour. This insolubility in water is owing to the conversion of the hæmoglobin into **met-hæmoglobin** or into **hæmatin** and **globulin**. Dragendroff recommends a cold saturated solution of borax to dissolve old stains.

Red fruit stains will be turned blue or green by ammonia, cochineal, Brazil wood and madder crimson and sulphocyanide of iron and roseanilin lose their colour. **Betel juice** is such a common-brown stain in India that its distinction from blood is of importance. Dr.

Chuni Lal Bose, F.C.S., favours us with the following tests which he uses for the detection of Betel stains from blood on cloth—they apply also to other vegetable stains :—

Tests.	Results.	
	Blood.	BETEL JUICE.
1. Stained cloth and Tinct. guaiacum with turpentine.	Blue colour	No blue colour.
2. Solution of stain in water and strong nitric or hydrochloric acid.	White precipitate of coagulated albumen; and the red colour of the solution is discharged. On adding a solution of caustic potass, the precipitate dissolves to a clear solution, but the original red colour not restored.	No precipitate; the colour is changed to greenish yellow. On the addition of caustic potass, the original red colour is restored.
3. Solution of the stain in water and heat.	Precipitate of coagulated albumen and the colour is discharged.	No precipitate and the colour is not discharged.
4. Solution of the stain in water with the spectroscope.	The usual double bands of only hæmoglobin or methæmoglobin seen.	No bands to be seen.

3. **Guaiacum test.**—Blood strikes a sapphire blue with guaiacum resin in the presence of ozone or hydrogen dioxide.

Is applied as follows. The stain is first moistened with *freshly-prepared* alcoholic tincture of guaiacum resin on a white porcelain plate, and then a few drops of ethereal solution of hydrogen dioxide (ozonized ether) or *old* oil of turpentine[1] are added; if the stain is of blood, a bright sapphire blue colour rapidly appears. Should the stained fabric or object be so dark in colour as to obscure the reaction, press pieces of white filter paper on the stain after the reagents have been applied. The blue colour, if the stain is of blood, will appear on the paper.

On weapons.—The stains on weapons, apply pieces of blotting paper soaked in water over the suspected stain and leave for about half an hour, then when nearly dry submit to the guaiacum test, and if blood only the portion of paper which was in contact with the stain will be turned blue. A control experiment should be made to see that the paper itself does not give the reaction.

[1] Guaiacum resin can be got in any station bazaar. As Dr. A. Powell notes, two important points are: the tincture of guaiacum must be *fresh*, the turpentine must be *old*.—*Ind. Med. Gaz.*, January 1900. Dragendorff recommends Heunefeld's turpentine solution, which consists of equal parts of absolute alcohol, chloroform and French turpentine to which one part of acetic acid has been added. The chloroform separates and, if blood is present, is of a blue colour.

Many matters, however, other than blood, *e.g.*, copper and its salts, dried fæcal matter containing bile, some iron salts,[1] &c., give this reaction, and hence the guaiacum and ether test by itself cannot be relied on as positive evidence of the presence of blood. The test, however, is useful as a preliminary test, as stains which do not give this reaction cannot be stains of blood.

4. **Tincture of Galls** added to a solution of blood gives a brownish red precipitate, whereas an iron rust stain strikes black, as do catechu and kino with iron salts.

MICROSCOPICAL EXAMINATION OF BLOOD-STAIN.

This is done for (1) corpuscles and (2) Hæmin crystals.

Corpuscles.—If the suspected blood-stain is on cloth, a small piece of the fabric should be cut out and placed on a clean glass and moistened with normal salt solution and the specimen covered with a thin cover-glass, the colouring matter will rapidly tinge the solution ; when, if the stain is not too old the red corpuscles will be seen, with more or less irregular outlines according to the age of the stain. If the stain is on a knife-blade or other weapon or piece of furniture, a small portion of the dry stain should be scraped off with a needle on to a glass-slide and a dry cover-glass pressed firmly down till the material is reduced to powder. The slide is then put on the stage of the microscope and a drop of distilled water or normal salt solution or glycerine solution (1 to 6 or 7 of water) allowed to flow in at the margin of the cover-glass. If blood is present, the corpuscles will appear though almost colourless. In the case of *old blood stains* it is necessary that the scrapings should be kept moistened with normal salt or glycerine solution for at least an hour before examination. The addition of a little weak solution of caustic soda or borax helps to detach the corpuscles.

Another method for dry stains (Moser, *Edin. Med. Jour.*, 1901) is to treat stain with a mixture of equal parts of ether and alcohol for half to two hours according to thickness. Then detach thin layer and place in solution of water 100 ; liq. potass. acct. 10 ; glycerine 20 ; and spread on slide with some eosin stain solution and cover with cover-glass.

By microscopical examination it will not be possible to say whether the blood is human or not, but merely whether it is mammalian or not.

As an exception to this rule should be mentioned a case where the blood-stain was demonstrated by Dr. Chuni Lal

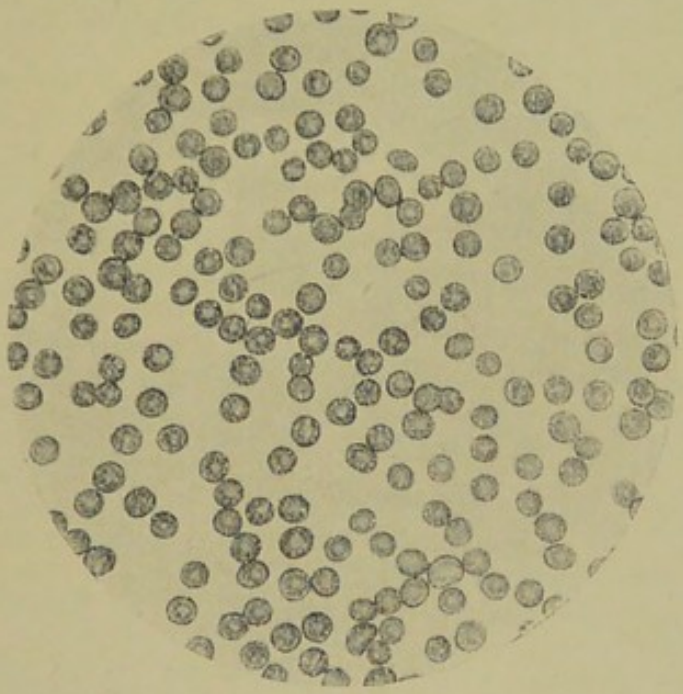
[1] Ferric salts turn blue with simple tincture of guaiacum, whilst ferrous salts do not turn blue till the turpentine is added.

Bose, F.C.S., in 1900 to be human blood, by reason of the presence of *Falaria nocturna* embryos, which were also found present in the blood of the victim of the assault. As far as is known at present, this parasite does not exist in any other animal except man, and the mosquitoes which have fed on the blood of men infested by it. It is not absolutely certain, however, that *F. Bancrofti* may not possibly exist as a parasite in the blood of lower animals, although not yet observed.

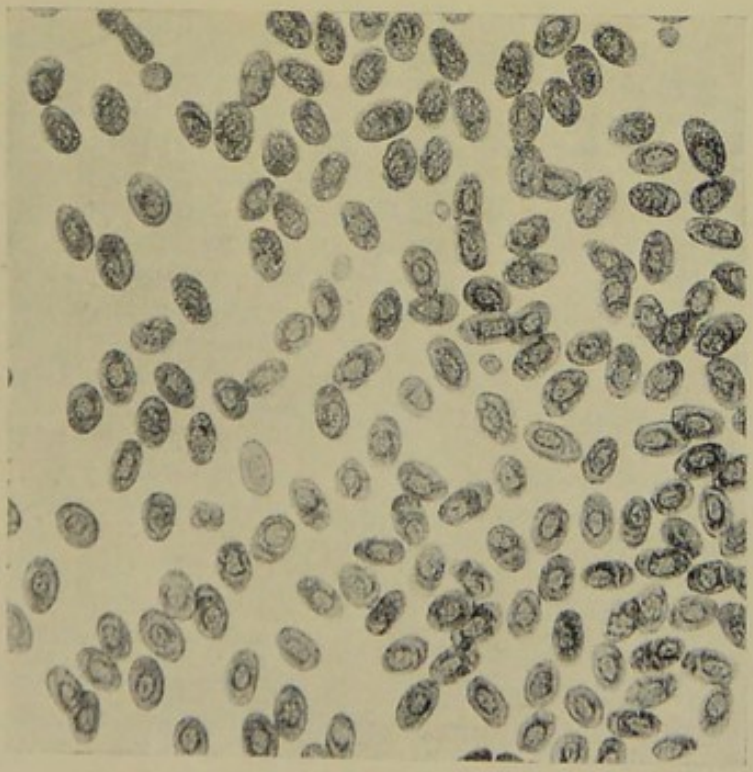
Case XXXIV.—**Human Blood detected by** presence of human blood **filaria.** The Bengal Club Murder Case :—The Commissioner of Police, Calcutta, furnished the following particulars : The defendant, Hurnam Singh, a Sikh, and the murdered man, Munni Tantwa, were both in the service of Mr. S——, the former as a riding boy, and the latter as a *sais*. Both lived in the stables of the Bengal Club at 33, Chowringhi. On the night of the 2nd September 1901, both under the influence of liquor quarrelled and abused each other, and subsequently retired to bed. At 1-30 A.M. of the 3rd idem, the defendant woke up another syce in the stables and told him to see what was the matter with the murdered man, as he was breathing heavily. He did so, and found wounds on the left side of the man's neck, head and shoulders. He was still alive, but unconscious, and was removed to hospital where he died. The shirt sent herewith (to the chemical examiner) was on the person of the defendant when arrested by the police, the weapon used could not be traced by the police. The shirt of the accused was examined by Assistant-Surgeon Chuni Lal Bose, additional chemical examiner to the Government of Bengal, who deposed :—

"There were a few large and small blood-stains on the lower and front part of the shirt in which I detected mammalian blood cells and the embryo of a parasite called *filaria sanguinis hominis*. On finding the worm in the blood-stains on the accused's shirt, the Police Commissioner was requested to send a piece of cloth known to have been stained with the blood of the deceased in order to see whether these parasites were also present in the blood of the deceased. The Commissioner of Police accordingly sent a piece of *gunny* (canvas) which was used as a pillow by the deceased, and which was found under his head with blood-stains on it, after he had met with the injuries which caused his death. The piece of *gunny* bore large patches of blood, in which mammalian blood cells and embryo of *filaria sanguinis hominis* similar to those found in the stains on the shirt of the accused were detected. *Filaria sanguinis hominis* so far as we know at present infect the blood of man only. From their presence in the stains on the shirt and on the piece of gunny, I conclude that these stains were caused by the blood of a human being infected with *filaria sanguinis hominis*. These filaria are also found in those mosquitoes only which have sucked blood of filaria-infected persons. Filaria infection is common in Bengal." The Police Surgeon of Calcutta, who held a *post-mortem* on the body of the deceased on the 3rd September 1901, reported that the neck had been hacked by an assailant standing below and to the right side of the deceased or above and behind the deceased, who was probably lying on his right side. None of the wounds injured vital structures. The wounds in his opinion were not self-inflicted. Some appear to have been caused by a narrow pointed weapon and others by a

a



b.



a.—HUMAN BLOOD CORPUSCLES × 400.

b.—AMPHIBIAN BLOOD CORPUSCLES × 200.

Thacker, Spink & Co., Calcutta. From Micro-Photographs by Dr. Heneage Gibbes.

heavy cutting weapon. Death was due to "effusion of blood on the brain from the concussion of the above injuries and to shock and hæmorrhage."

The case was tried by a special jury in the December session of the High Court in 1901, Mr. Justice Stevens presiding. The jury returned an unanimous verdict of "guilty" against the prisoner, who was sentenced to death.

To distinguish mammalian blood and non-mammalian blood, the shape and size of the red blood corpuscles have to be noted, see *plate Ia.*

The **shape** of the discs in human blood and in all mammalia, except the camel tribe, is circular and biconcave. In the camel tribe they are *oval* and biconcave. In birds, reptiles and fishes, they are oval and *nucleated*, see *plate Ib.*

The **size** of the discs varies in the same animal, and in average size in different animals. In man they range in diameter from $\frac{1}{3\,8\,0\,0}$ to $\frac{1}{4\,0\,0\,0}$ of an inch, averaging $\frac{1}{3\,2\,0\,0}$. The average diameter of the blood corpuscles of the following mammalia ranges from about $\frac{1}{3\,4\,0\,0}$ to $\frac{1}{4\,0\,0\,0}$ of an inch—the animals are named in order of the size of their corpuscles, those with the largest first—the monkey, dog, hare, rabbit, rat, mouse and bat. In the following animals, enumerated in similar order, the average diameter of the corpuscles ranges from about $\frac{1}{4\,0\,0\,0}$ to $\frac{1}{4\,8\,0\,0}$ of an inch—the ass, pig, ox, cat, and horse. In the sheep and goat they average less than $\frac{1}{5\,0\,0\,0}$, and in deer less than $\frac{1}{7\,0\,0\,0}$ of an inch in diameter.

To measure the discs:—For this are required (1) a stage-micrometer, *i.e.*, a glass slide on which lines are engraved at a given distance, say $\frac{1}{1\,0\,0}$ or $\frac{1}{1\,0\,0\,0}$ of an inch apart, and (2) an eye-piece micrometer, *i.e.*, an eye-piece fitted with a disc of glass, on which a scale is engraved. The procedure is as follows: first place the stage-micrometer on the microscope stage, and examine it under the microscope, using the eye-piece micrometer. Note the number of divisions of the scale of the eye-piece micrometer, which appear included between two of the $\frac{1}{1\,0\,0\,0}$ of an inch apart lines of the stage-micrometer; say, for example, four are included, then each division of the scale of the eye-piece micrometer corresponds, for the power in use, to one-fourth of one thousandth, or $\frac{1}{4\,0\,0\,0}$ of an inch. Next remove the stage-micrometer, substitute the slide containing the corpuscles to be measured, view these with the aid of the eye-piece micrometer, and measure them by bringing them between the lines of its scale. Instead of an eye-piece micrometer a camera lucida may be employed. In this case the divisions of the scale of the stage-micrometer are first drawn on paper with the aid of the camera. Then the blood corpuscles are similarly drawn, of course using the same magnifying power, and their size ascertained by comparison of the two drawings.

Hæmin crystals.—The production of these crystals is one of the most conclusive tests for blood, and it is the only available microscopical test from an old dried blood-stain. But it requires very careful technique for its successful application, so that failure to get the crystals must not necessarily imply absence of blood.

It depends on the formation of crystals of *hydrochlorate of hæmatin* ('*Teichmann's* crystals'), which are insoluble in

water, alcohol, ether, dilute acetic and HCl acids, but soluble in the caustic alkalies and in boiling acetic and HCl acids. Fat

Fig. 5.—Hæmin Crystals.[1]

and iron-rust interfere with the production of this test, so that if you have plenty of material you should wash the stain with a few drops of ether to remove fat, and then filter your aqueous solution to get rid of iron.

To apply test.—Mann's directions are :—Cut out a piece of the stained fabric about the size of a postage stamp, much less is sufficient with skilful manipulation. Divide this piece into three equal sized slips and place them one over the other on a microscope slide. Add a minute crystal of sodium chloride and sufficient glacial acetic acid to thoroughly saturate the fabric, and then a few drops more. Roll a glass rod backwards and forwards over the fabric for a minute or two, so as thoroughly to incorporate the acid with the colouring matter. A dirty brown fluid can now be pressed out of the fabric by a final passage of the rod, the fabric itself being at the same time withdrawn with a pair of forceps. Bring the fluid to the middle of the slide by stroking it up at each side with the shaft of the rod, and drop on a thin cover-glass. Hold the slide by one end and pass the centre of it to and fro over the flame of a Bunsen burner; continue until active ebullition, manifested by bubbles rapidly forming under the cover, takes place. Then allow the slide to cool gradually and, when cold, examine under a power of 300 diameters.[2]

N.B.—(1) The amount of sodium chloride must be very small, a crystal the size of a small pin's head being sufficient; if more be added the field is covered by cubes of sodium chloride crystals; (2) plenty of acid must be used; (3) the boiling demands care, but it must be thoroughly done; if too slowly done the margin of the cover-glass will be sealed up and the cover apt to be blown off when ebullition occurs.

Appearance under microscope.—The crystals are brown or claret coloured, with a steely blue hue by reflected light, and usually in the form of rhombic plates, or if very small of a 'whetstone' shape, like uric acid, frequently superposed to form crosses and stars. They give the blue colour with the guaiacum test.

SPECTROSCOPIC EXAMINATION.

This is the most delicate and trustworthy of all the tests for blood-stains, but it does not distinguish human from other vertebrate blood.

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[1] After Virchow.

[2] *For. Med.*, 76.

When the quantity of the stain is small, it is necessary to use themicro-spectroscope, which also gives a simultaneous exhibition of the spectrum of normal blood alongside that from the suspected stain.

It is necessary to obtain the spectra in at least two conditions, namely, the *oxidised* and the *reduced*. This should certainly be done with the hæmoglobin at any rate, but with the hæmatin the reduced form may be sufficient.

A solution of blood examined by the spectroscope shows the following characteristic absorption-bands, see fig. 6.

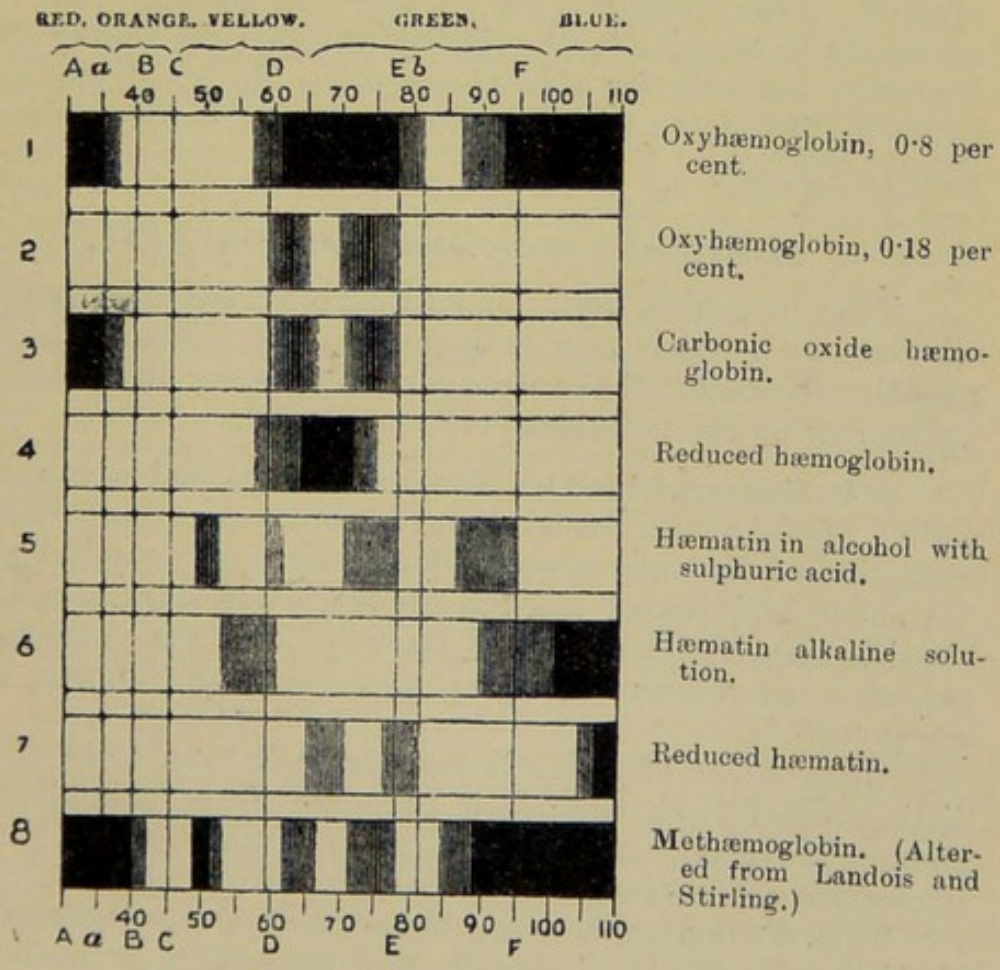

Fig 6.—Blood Spectra.[1]

The spectrum of *oxyhæmoglobin* (O_2 Hb) seen in tolerably fresh arterial blood, is characterised by two absorption-bands in the green between the D and E lines of the solar spectrum. The breadth of the bands varies with the concentration of the solution and is best seen in weaker solutions about 0·2 per cent.

[1] After Guy and Ferrier, p. 384.

The spectrum of *methæmoglobin* is found in blood which is not very fresh. It resembles that of O_2 Hb with the addition of a thin band in the red, and more absorption in the violet.

Reduced Hæmoglobin is formed by adding one or two drops of sulphide of ammonium or Stoke's reagent (an aqueous solution of ferrous sulphate with a little tartaric acid, alkalised with ammonia). Its spectrum is a single broad band between the D and E lines. After shaking up the solution with air, the hæmoglobin regains its oxygen.

Hæmatin.—Hæmoglobin is decomposed by acids and alkalies into *hæmatin* (see p. 98) and *globin*. It is not necessary to examine for the spectra of either the acid or alkaline hæmatin, but only for *reduced hæmatin*. Its spectrum has two bands in the green slightly nearer the violet end than the bands of O_2 Hb.

QUESTIONS REGARDING BLOOD-STAINS.

The foregoing tests should answer the question as to whether or not the stain is blood, and the evidence positive or negative, becomes all the stronger, the greater the number and agreement of the individual tests employed.

Is it Human Blood? The above tests enable you only to state whether the blood is vertebrate or not, with the exception of the microscopical test, which may enable you by the shape and size of the red corpuscles to state whether the blood is mammalian or not, or possibly in a rare instance the presence of filaria embryos may indicate human blood, see p. 96.

Once human blood has become dried, it cannot be so readily distinguished from the blood of many other animals of the mammalian class. An opinion on this point, founded on the size of the corpuscles, is not reliable.

This distinction between mammalian and non-mammalian blood is occasionally of medico-legal importance in this country in discovering the imposture where, in false charges of assault, clothes are occasionally stained with fowl's blood to support the false charge. Bird's blood, also the blood of fishes and reptiles can readily be distinguished from mammalian blood by the shape and size of the red blood discs. Sometimes a domestic animal is killed on the spot where a murder was committed to obscure the human stains.[1]

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[1] Chevers' *M. J.*, p 18.

Specific test for human blood.—The recent discovery in 1901 by Uhlenhuth[1] that the antiserum for human blood causes a precipitate only with human blood and with no other blood, not even with that of monkeys (which latter gives only a faint cloudy reaction) provides a specific test for human blood of great delicacy, and one which has been found applicable to blood-stains which had been dried for three months.

Uhlenhuth,[2] applying to the discrimination of human blood the general discovery made by M. Bordet of the Pasteur Institute in 1898, made the following experiments :—Into the peritoneal cavity of rabbits he injected 10 c.cm. of defibrinated ox-blood every six or eight days, and after five injections obtained a serum which showed itself exclusively destructive with respect to ox-blood. Having prepared a series of 1 per cent. dilutions of the blood of eighteen species of animals, which were then cleared by settling or filtering and further diluted by the addition of an equal quantity of 1·6 per cent. salt solution, they were arranged in a series of test tubes, to all of which by means of a pipette six to eight drops of the rabbit's serum were added. The result was that the liquid in all the tubes, except that which contained the blood of the ox, remained perfectly clear, while in the latter the liquid became turbid, and ultimately a flocculent precipitate formed. A similar experiment with human blood succeeded in distinguishing human from ox-blood stains which had been dried for four weeks upon a plank. These experiments have been confirmed independently by Wassermann and Schütze, who have compared the result in the case of man and the blood of twenty-three different species of animals. The only exception was the blood of the monkey which determined a slight precipitate after some delay. They were able to show the efficacy of this proceeding with blood stains three months old and otherwise hardly recognisable.

The process recommended by them is :—After having soaked the material of the stain to be examined in 6 to 8 c.cm. of physiological salt solution, and having carefully filtered the liquid thus obtained, it is divided into two equal portions in two sterilised tubes. To one is added ½ c.cm. of serum from a rabbit which has received injections of human serum ; to the other tube, which serves as a control, is added ½ c.cm. of the serum of a rabbit which has undergone no such treatment. Finally, a third tube should be filled with 4 or 5 c.cm. of the diluted blood from a different species of animal (for example, sheep or pig), to which should be added ½ c.cm. of the serum from the injected rabbit. The three test tubes should be placed in a stove and kept at a temperature of 37° C. if in about an hour the contents of the first tube become at first turbid, and later precipitated, while those in the other two tubes remain transparent, it is certain that human blood is present, unless there may be any reason for admitting that the blood could come from a monkey.[3]

What is the age of the stain?—This is sometimes an important point. Recently effused blood, if seen before it has

[1] *Brit. Medl. Jour.*, Mar. 30th, 1901, p. 788, continued by Dr. G. Nuttall, May 11th and Sept. 14th.

[2] *Berl. Klin. Woch.*, 1901, No. 7.

[3] For Dr. Nuttall's process see *Jour. of Hygiene* for July 1901.

become dry, is so peculiar in colour, consistence, and general appearance, that it may be identified by these characters alone, by any ordinary unskilled observer. If arterial it is bright red, if venous it is more purple changing to red. After about twenty-four hours or so it changes to reddish brown owing to the formation of methæmoglobin. The naked eye appearance therefore coupled with the spectroscopic indication of a greater proportion of methæmoglobin to oxyhæmoglobin gives some idea of the age of the stain.

Was the blood shed during life?—This is answered in same way as it is regarding wounds inflicted before or after death. If there is evidence of spirting and of any small clot of fibrin, this is absolute proof that it came from a living and not a dead person.

Is it Menstrual blood?—Menstrual blood is said to be of a sour odour, and in the earlier part of the period may contain scaly epithelium and mucous globules derived from the vaginal walls, but in many cases and in the later stages it may not have this accidental epithelium and so may be indistinguishable from ordinary blood. Stains of menstrual blood on linen, &c., cannot be distinguished from stains of other blood.

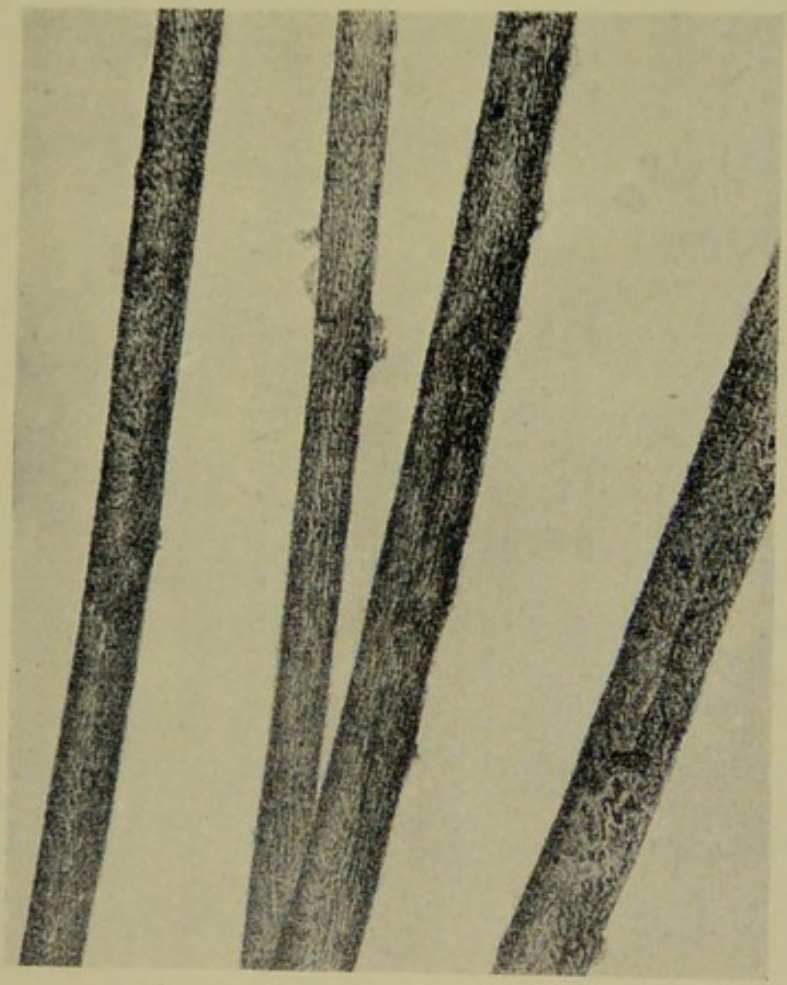
Is it from Assailant or Victim?—For this question it is important to note which side of a garment has most blood on it. Thus an accused person who is also wounded, if he exhibits most blood on the outside of his clothes it would falsify his tale that the blood was his own. Bayard[1] relates a case in which the falsity of a rape charge was proved by the blood which was smeared on the outside of the child's linen and so not derived from the genitals. See also case of Filaria, p. 96. On the other hand, the clothes of the assailant may have no blood-stain, if he washed his clothes, or wounded his victim in front while standing himself behind.

Other Materials than Blood Adherent to Weapons, &c.

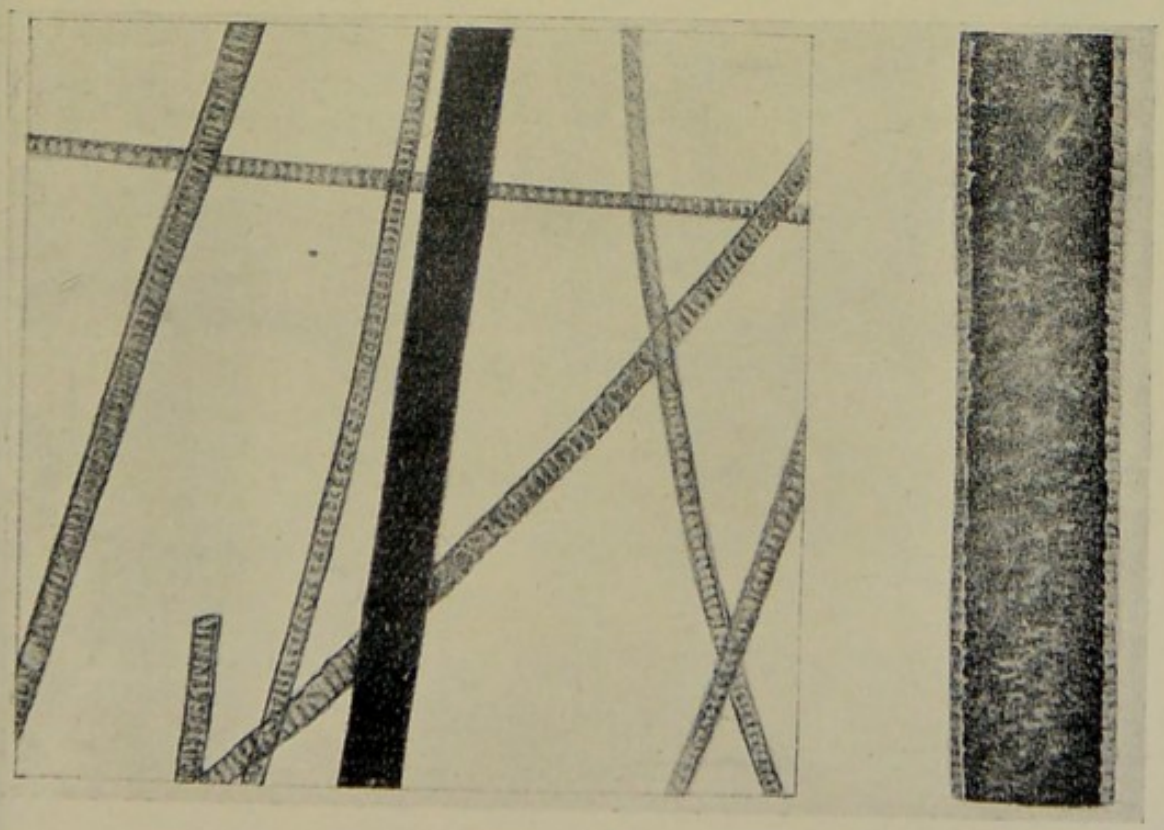
Brain Substance is sometimes found adherent to weapons which have caused fracture of skull with laceration of the brain. It may be recognised by the presence of nerve cells or nerve fibre under the microscope.

Human hairs (see *plate II*, fig. *a*).—These are cylindrical, marked on the surface with very fine transverse cross-markings, of the same nature as those present on wool fibres, but much

[1] *Annales d'Hygiène*. 1847.



a.—HUMAN HAIR × 130.

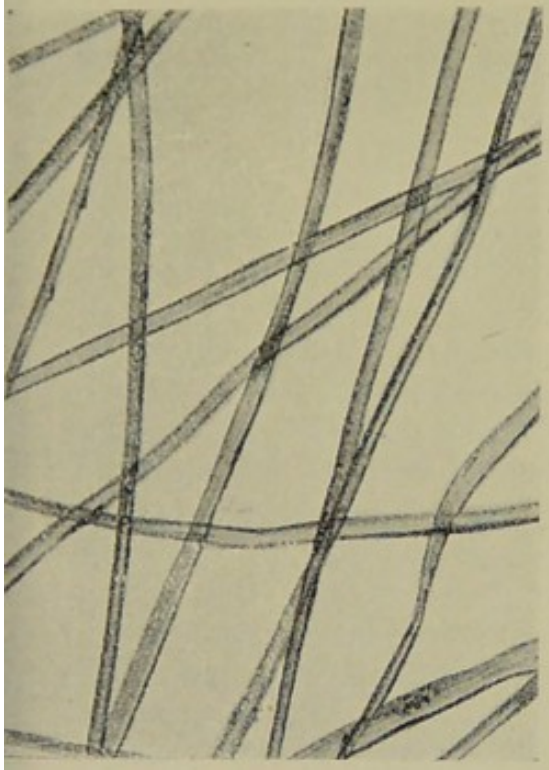


b.—CAT'S HAIR × 130.

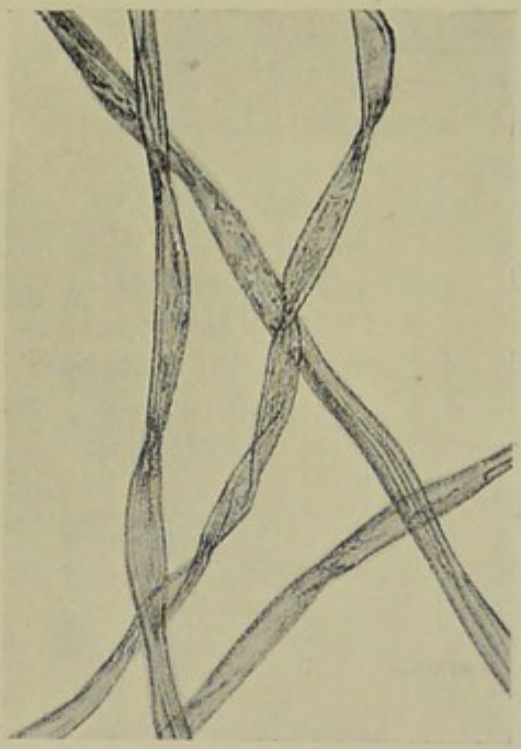
c.—GUINEA-PIG'S HAIR × 130.

Thacker, Spink & Co., Calcutta.

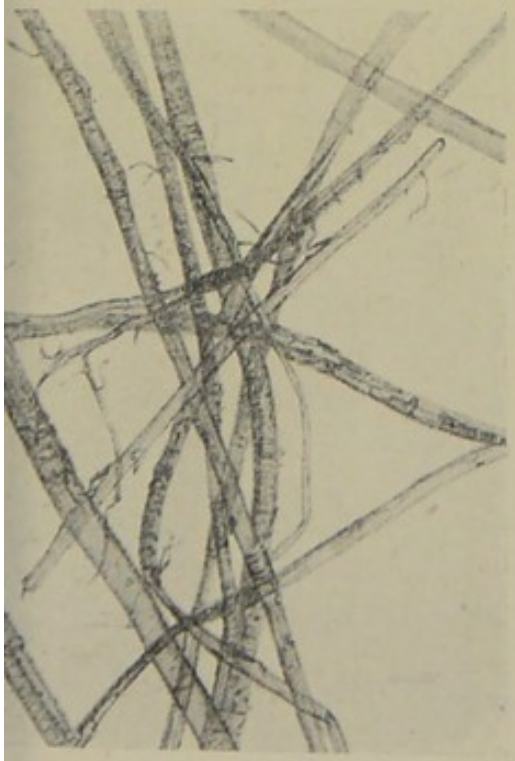
From Micro-Photographs by Dr. Heneage Gibbes.



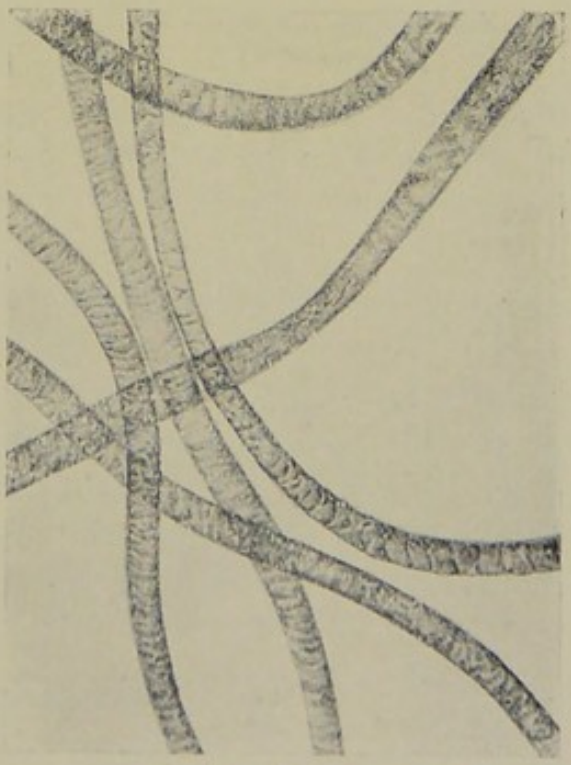
a.—SILK FIBRE × 130.



b.—COTTON FIBRE × 130.



c.—LINEN FIBRE × 130.



d.—SHEEP'S WOOL × 130.

cker, Spink & Co., Calcutta.

From Micro-Photographs by Dr. Heneage Gibbes.

finer. The cortical layer is extremely thin, and the imbricated scales composing it, indicated by the cross-markings, are much smaller in proportion to the width of the hair than is the case in the hair of many of the lower animals. Sometimes in human hairs a narrow axial band of spheroidal cells is visible: this band is broader, and much more distinct, in many varieties of non-human hair. The hair of some of the lower animals, *e.g.*, of a brown dog, very closely resembles human hair. When examining a specimen of hair supposed to be human, it is always advisable to compare it with an authentic specimen of human hair, taken, if possible, from the individual whose body is supposed to have furnished the hair under examination. The condition of the ends of the hairs under examination should be noted, *i.e.*, whether one or both ends appear cut, or whether one end shows a point and the other the bulbous root of the hair. Figs. *b* and *c* show the appearance under the miscroscope of the hair of the cat and guinea-pig. Hairs may be mounted for the miscroscope thus; they should first be washed, then thoroughly dried, next steeped in turpentine, and finally mounted in Canada balsam. Native hair is almost always saturated with vegetable oils.

Silk fibres are cylindrical, transparent, refract light powerfully, and are free, or almost free, from surface markings, see *plate III*, fig. *a*.

Cotton fibres are flattened, transparent bands. Each band is twisted once on itself at intervals, equal in length to about seven or eight times the breadth of the band, see *plate III*, fig. *b*.

Cotton and linen fibres stain blue with chloro-iodide of zinc, prepared by adding iodine to chloride of zinc.

Linen fibres are cylindrical, transparent, and apparently jointed at intervals something like a bamboo, see *plate III*, fig. *c*.

Wool fibres (really animal hairs) are cylindrical, and marked on the surface, at close intervals, with fine, but very distinct, oblique cross-markings, the remains of a cortical layer of large imbricated scales, see *plate III*, fig. *d*.

SEMINAL STAINS.

The examination for seminal stains is in connection with cases of rape and unnatural crime, though in neither of these is the detection of semen essential to the proving of the crime, for the actual emission of semen need not be proved (see *Rape*, Chap. *XII*).

Characters of the seminal stain :—

1. Semen *stiffens* cloth like starch and is of a light greyish yellow colour ; pus and several other discharges stiffen cloth in a somewhat similar manner.
2. The characteristic *odour* may be given out on moistening the stain, if the cloth is otherwise sufficiently clean.
3. *Warmth* applied to the stain by holding it near the fire *deepens the stain* to a yellow fawn colour, other discharges are not so affected.
4. Presence of *spermatozoa*. This is the only positive and trustworthy test for semen, but it is essential that one or more should be seen in a complete form, with filament attached.

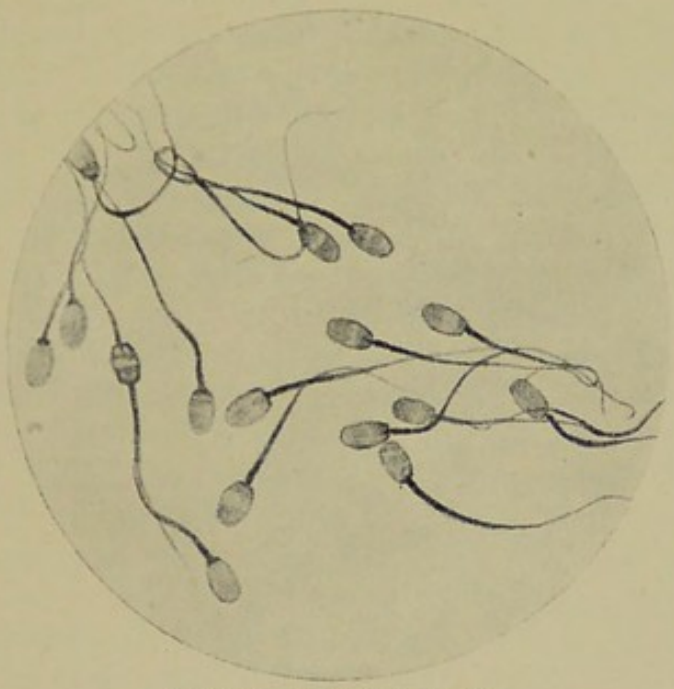
Mode of examination.—If taken direct from the vaginal mucus a drop of the latter placed on a slide and covered with a thin cover-glass, and examined with a power of 300 to 400 diameters.

If the semen has dried on a fabric or on hair (the part of female underclothing most likely to contain semen are the back and front of inner garment over the genitals) the spermatozoa require to be softened and carefully separated without breaking from the material to which they have become glued down by the drying of their albuminous fluid. For this, the stain should be handled as little as possible and kept flat during the softening. A weak solution of hydrochloric acid, one drop to 40 cubic centimetres (as recommended by Ungar) is the best softening solution to avoid undue swelling. A few drops of this solution is put into a watch-glass with a fragment of the stained cloth, which latter is so placed that its lower end dips into the fluid and is allowed to soak for a few minutes to several hours, according to the age of the stain. When the softening is complete, the fragment of cloth is removed by forceps and gently dabbed on the slide to shake out the spermatozoa, the mark or deposit thus obtained is covered with a cover-glass and examined microscopically.

As the spermatozoa are very translucent they may be made more apparent by being *stained*.

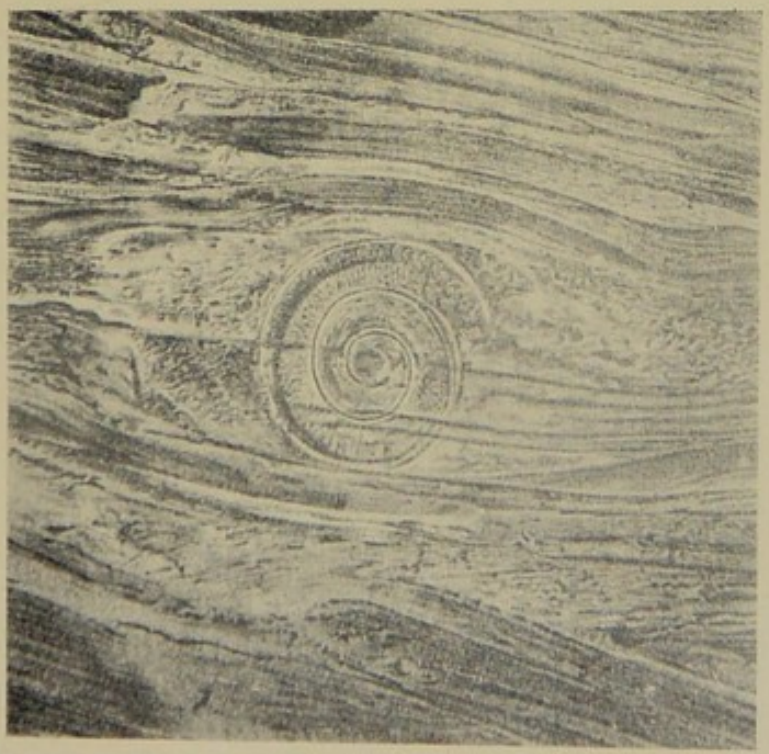
The simplest way of doing this is in the moist way, combining the staining and softening solutions in one. A solution of methyl green ·15 to ·3 grain in 100 cc. of water to which 3 to 6 drops of hydrochloric acid is added, is to be used as above described, but the fabric must steep in it for several hours. By the dry method double staining of the deposit may be made by eosin and logwood (Friedänder's) or by eosin and methyl green, whereby at the base of the

a.



HUMAN SPERMATOZOA × 900.

b.



TRICHINA SPIRALIS IN HUMAN MUSCLE × 130.

Thacker, Spink & Co., Calcutta. From Micro-Photograph by Dr. Heneage Gibbes.

head of the spermatozoon is a hemispherical portion which stains green while the anterior part and tail stain red.

Characters of spermatozoa.—These are minute bodies with an oval or pear-shaped transparent head (which strongly refracts light posteriorly) and a long slender tail. Human spermatozoa have a flattened, almost oval head, and vary in length from $\frac{1}{1000}$ to $\frac{1}{500}$ of an inch, the head being about $\frac{1}{9000}$ of an inch in diameter (see *plate IV*, fig. *a*).

It is not easy to recover spermatozoa from stains on cloth even from spots of undoubted semen. Careful search should be made in several specimens of the deposit. For sometimes the seminal fluid contains numerous spermatozoa, at other times only a few, and frequently they are at times absent from the seminal fluid, even of young healthy men. Hence, while the discovery of spermatozoa in a stain is positive evidence of its seminal origin, their non-discovery does not enable you to swear that the stain is not semen. When a seminal stain is mixed with much blood or the clothes are very dirty, the detection of semen is especially difficult.

Monad animalcules and threads of fibrin or broken pus nuclei in the stain-preparations must not be mistaken for spermatozoa.

The *Trichomonas vaginæ*, of Donné can readily be distinguished from the seminal animalcule by the following characters: (*a*) Its head is at least three times as large, and is granular in the interior, not transparent as in the seminal animalcule; and (*b*) more than one flagellum is attached to its head.

Regarding these monads Dr. A. Powell writes[1]:—I have found two varieties of monad in the vagina—a smaller pear-shaped animal—the body being about the diameter of a blood corpuscle. At one end is a single rod about double the length of the body, at the other end are two flagella inserted at the same spot.

The larger monad is about double the diameter of the smaller and varies more in shape. They are very common where there is a vaginal discharge sufficient to give a moist specimen fresh for the cover-glass. I find them in about four out of every six cases sent for medico-legal examination. I never could examine it properly, as in the living state its movements are too lively. I have never succeeded in staining a fixed specimen. It is hard to count the moving flagella, but there was a single rod at one end, at the other I think there are more than two flagella, and sometimes a flagellum runs down along the body like an undulant membrane. On some of them is a little notch like a mouth, which catches on to a little bit of dirt and may be the "cilia" which Donné and others describe. The single-rodded end is much stiffer than the other flagella. I have never been able to see cilia as drawn in Taylor and Dixon Mann's books.

The bodies of these monads present a granular appearance and what seems to be a vacuole. This, their size, number of flagella and staining re-action must prevent any one mistaking them for spermatozoa.

[1] *Ind. Med. Gaz.*, June 1901.

Part II.—SPECIAL INJURIES AND OFFENCES.

(A.) *INJURIES BY VIOLENCE*, NOT *SEXUAL.*

CHAPTER V.

Kinds of Violent Deaths: their frequency and causes.

In England the average annual death-rate from all causes is about 22·4 per 1,000 of population, and that of the total deaths occurring yearly about 3 per cent. (or about ·70 per 1,000 of population) are due to violence. Indian mortality statistics are not very reliable, but from such as are available it would appear, that while in India the annual death-rate from all causes is higher than in England, the death-rate from violence is lower (·36 to ·52 per 1,000 of population). It is noticeable, also, that while in England about three times as many males as females die annually from violence, in India the death-rate from violence of the two sexes is nearly equal. Both in England and in India, of the deaths from violence by far the largest number are due to *accident*, *suicide* ranking next in order of frequency, and *homicide* last.

Accidents.—In England about 87·5 per cent. of the deaths from violence (= about ·6 per 1,000 of population) are due to accident, the male death-rate from accidental violence being rather more than three times as great as the corresponding female rate. In India, as far as can be gathered from published statistics, the death-rate from accidental violence equals about ·3 to ·4 per 1,000 of population, the male rate in most provinces slightly exceeding the female rate. In India the most common causes of death from accidental violence are (1) drowning, (2) snake-bite, and (3) injuries inflicted by wild animals. In the Bombay Presidency, for example, in 1883, accidental drowning accounted for about one-third of the total deaths from violence of the year ; and in most Indian provinces

about one-fourth to one-third of the violent deaths occurring yearly are reported as due to snake-bite and wild beasts.

VIOLENT DEATHS, *per* MILLION OF POPULATION.

MODE.		Bombay, 1875.	Bengal, 1875. (Selected Circles).	Central Provinces, 1875.	Hyderabad Assigned Districts, 1875.	England and Wales (average of fifteen years).
Females living, per 1,000 males		935	950	965	...	1,053
Death-rate per 1,000, all causes		24·1	24·8	26·3	26·9	22·4
Suicide ...	Males	45·9	53·7	68·7	59·5	98·2
	Females	55·8	74·8	86·3	68·1	33·8
	Total	50·6	64·0	77·3	63·6	65·2
Wounds, homicidal	Males	35·2	107·4	35·0	43·8	29·1[1]
	Females	14·6	72·5	30·8	24·9	14·4
	Total	25·4	90·4	32·9	34·8	21·6
Snakebite & Wild Beasts.	Males	97·1	148·0	152·5	118·2	...
	Females	59·8	164·9	103·4	76·7	...
	Total	79·3	156·2	128·4	98·4	..
Other Violence ...	Males	250·6	160·4	195·0	174·2	940·5[2]
	Females	202·5	146·6	176·5	157·2	307·8
	Total	227·8	153·6	185·9	166·1	616·0
Total, all violent causes.	Males	429·1	469·5	495·3	395·8	1067·8
	Females	332·7	458·8	546·8	327·0	356·0
	Total	383·1	464·3	520·3	362·9	702·7

SUICIDE.

Just under one-tenth of the violent deaths reported yearly in England (about 65·2 per million of population) are cases of suicide. In Bengal and the Panjab excepted,[3] the reported annual death-rate from suicide in the different Indian provinces ranges from about 50 to 80 per million of population. A remarkable difference between English and Indian suicide statistics is, that while in England the suicide death-rate among males is very nearly three times as high as among females, in the different Indian provinces the female suicide rate exceeds the corresponding male rate. Thus in the Madras Presidency, where the rates for the two sexes differ least, the female suicide rate is about one-tenth higher than the male rate ; while in the United Provinces, where the rates differ most, the female suicide death-rate is on an average about two and a half times as high as the male rate.

[1] Homicide.

[2] Accidents of all kinds

[3] "In these two provinces the reported average annual suicide rate for the five years ending 1876, was Bengal 31·3, Panjab 12·7 per million of population."—K. McLeod, "*On Suicide in India.*"

In the five years ending 1876, the average suicide death-rate per million of population was, in Madras, males, 62·6 ; females, 68·5. In the North-West Provinces males, 27·8 ; females, 71·6 ; and in Calcutta, males, 64·2 ; females, 104·6.—K. McLeod, "*On Suicide in India.*"

Suicide by children is not uncommon in India. In Bengal, for example, in 1872, of 1,716 suicides 23 were children; and in Oudh, in the seven years ending 1876, of 4,172 suicides 46 were children.

Modes of Suicide most commonly employed in India are (1) drowning, (2) hanging, and (3) poison. **Drowning** is the mode selected by about three-fourths of the female suicides of the Madras and Bombay Presidencies, while more than three-fourths of the male suicides in the same provinces hang or drown themselves in about equal numbers. In the Panjab one-half the male and nearly one-half of the female suicides choose hanging, while drowning is selected by only about one-third of the females and one-sixth of the males. **Hanging**, also, is the mode chosen by over half of the female and about one-third of the male suicides of Calcutta. **Poison**, usually arsenic or opium, is chiefly used as a means of suicide in certain special localities, *e.g.*, in districts where the poppy is grown, and in the towns of Calcutta and Bombay.

MODE OF SUICIDE IN 1,000 SUICIDES OF EACH SEX.[1]

	Mode.	England and Wales, 1874 & 1875.	Bombay Presidency, 1873 to 1876.	Madras Presidency, 1872 to 1876.	Panjab (2 years, 1872 & 1876).	Calcutta (Town), 1872 to 1876.	Madras (Town), 1872 to 1876.
Males.	Hanging	274	382	471	500	326	163
	Drowning	184	456	443	174	74	623
	Poison	90	91	26	184	453	86
	Cuts, stabs, &c. ...	280	71	49	26	84	96
	Gunshot	82			32	63	32
	Otherwise	90	.....	11	84	.....	.....
Females.	Hanging	284	185	179	464	519	42
	Drowning	309	767	790	354	26	937
	Poison	155	37	26	84	429	21
	Cuts, stabs, &c. ...	182	11	2	18	23	.....
	Gunshot	2			.....	.....	.....
	Otherwise ...	68	.....	3	80	.....	.....

[1] K. McLeod, *On Suicide in India*.

Causes of Suicide in India.—Like the Romans, the Indians approve of suicide under certain conditions—the Greeks did not, and it is curious that the Greek view should agree with the Christian in abhorring suicide.

Pythagoras and Socrates took the sentry view of life : the sentry duty might be bitter and laborious, but man has been placed on guard by one of his superior officers—the gods, and was guilty of desertion if he voluntarily quitted his post. On the other hand, the Roman Epicureans held that if life became no longer enjoyable death was the wiser alternative. The Stoics based their approval of suicide on severer and nobler grounds. "How," argued they, "could a man live according to right reason if his body was distempered by disease, his reason decayed or doting, his better will coerced by a political tyranny .....perhaps crushed by cruel tortures? To these evils the 'ushering of oneself out of life' was a welcome deliverance." Whilst the early Christian view was that pain and sorrow are disciplinary benefits, instead of evils, and that self-destruction is impious and a felony, the body of the suicide was denied burial in consecrated ground, and his property was confiscated.

In modern times there is a tendency to halt between these two extremes, in that whilst discouraging self-destruction, practically no legal penalties are attached to suicide or attempted suicide in Europe or America, although abetment of suicide is held to be equivalent to murder in England. In India an attempt at suicide is an offence.

In India the following causes of suicide deserve special mention, either from the frequency with which they give rise to cases, or on account of their peculiar character.

(1) **Grief or shame.**—This is a frequent cause of suicide in India. Numerous instances are recorded of suicide by wives after quarrels, sometimes trifling in character, with their husbands, or with their husbands' relatives. Pregnancy following illicit intercourse—a not uncommon result of enforced widowhood in Hindu society—has also in many recorded cases led to suicide from shame and distress, and even to homicide (see *cases* in Chaps. XIII & XIV). In the case of males, more or less common causes of mental distress leading to suicide are domestic quarrels and pecuniary losses. Instances are also met with of suicide from distress of mind arising from arrest on criminal charges.

(2) **Physical suffering.**—Chevers, McLeod, and others, notice that severe physical, especially abdominal pain, is in India a frequent more or less direct cause of suicide, particularly among females.

(3) **Revenge.**—In India cases are sometimes met with, in which an individual who has been injured by another kills himself, under the idea that he thereby throws the responsiblity for his death on the person who has injured him. Instances quoted by Chevers shows that, under the name of "*chandî*," this form of a suicide was a well-known custom among the ancient Rajputs. A variety of this description of suicide is the practice known as sitting "*dharna*," or starving himself at the door of an enemy or debtor. Again Chevers mentions a case of a man at Singapur who cut his throat at his neighbour's door in order to get him hanged.

(4) **Religion.**—Self-destruction from religious motives was formerly of somewhat frequent occurrence in India. One variety of this form of suicide consisted in the individual offering himself as sacrifice, in order to propitiate one of the Hindu deities, as, for example, by casting himself under the wheels of the car of Jaggarnath, or drowning himself in the Ganges. No doubt, also, in some cases of "*sati*," or burning of widows on the funeral pile of their husbands, formerly of frequent occurrence in India, the victim was a consenting party willingly or unwillingly. For several forms of religious suicide see p. 19, footnote 3.

For suicide by **poisoning**, see Chapter XX.

The 482 suicides in Bombay city for the five years ending 1899 are analysed in the following tables[1] :—

ACCORDING TO RELIGION.

Per thousand of co-religionists.

Year.	Hindus.	Maho-medans.	Parsis.	Chris-tians.	Jews.	Chinese.	Total popula-tion.
1899 ...	·126	·057	·168	·154	...	...	·113
1898 ...	·138	·083	·379	·044	·189	...	·132
1897 ...	·103	·057	·231	·132	...	...	·099
1896 ...	·143	·064	·316	·044	·199	...	·130
1895 ...	·119	·128	·084	·044	...	·526	·110

[1] By Bomanjee B. Patell, Khan Bahadur, in *Jour. Bombay Anthrop. Socy.* V, pp. 364, &c.

According to Season.

	1899.			1898.			1897.			1896.			1895.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
January...	1	3	4	4	3	7	1	2	3	7	3	10	4	4	8
February	1	1	2	4	1	5	3	2	5	4	2	6	3	1	4
March ...	5	5	10	8	6	14	2	2	4	5	3	8	4	4	8
April ...	3	3	6	7	4	11	4	2	6	4	5	9	6	2	8
May ...	4	2	6	3	5	8	8	2	10	4	4	8	4	3	7
June ...	4	3	7	11	2	13	6	3	9	5	4	9	3	3	6
July ...	4	2	6	10	4	14	5	3	8	4	4	8	4	2	6
August ...	3	5	8	7	2	9	4	2	6	4	3	7	7	2	9
September	7	3	10	2	4	6	6	4	10	6	6	12	5	3	8
October ...	6	5	11	4	5	9	9	3	12	7	5	12	6	4	10
November	8	3	11	6	1	7	3	...	3	4	4	8	5	2	7
December	7	5	12	4	2	6	2	4	6	5	5	10	8	2	10
	53	40	93	70	39	109	53	29	82	59	48	107	59	32	91

According to Age.

	1899.			1898.			1897.			1896.			1895.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
10 to 20 years	4	8	12	7	12	19	9	9	18	6	19	25	6	7	13
21 to 30 ,, ...	26	16	42	36	10	46	22	10	32	28	18	46	26	13	39
31 to 40 ,, ...	12	8	20	12	7	19	12	5	17	13	7	20	10	6	16
41 to 50 ,, ...	5	1	6	6	5	11	8	..	8	5	1	6	10	3	13
51 to 60 ,, ...	3	4	7	7	4	11	1	2	3	1	2	3	3	..	3
61 to 70 ,, ...	2	2	4	..	...	...	...	1	1	4	1	5	3	1	4
71 to 80 ,, ...	1	..	1	2	1	3	...	2	2	2	...	2	1	2	3
81 to 90 ,, ...	...	1	1	...	..	...	...	...	..	...	...	...	..	...	...
91 to 100 ,, ..	...	...	...	...	...	...	...	..	..	...	...	...	...	...	...
101 to 105 ,, ...	.	...	...	...	...	...	1	...	1	...	...	...	...	...	...
	53	40	93	70	39	109	53	29	82	59	48	107	59	32	91

According to Alleged Motive.

Alleged Motive.	1899.			1898.			1897.			1896.			1895.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Tired of life through sickness	23	8	31	24	15	39	12	11	23	23	15	38	12	13	25
Domestic quarrels	2	10	12	5	11	16	2	6	8	.	20	20	4	13	17
Madness and unsoundness of mind.	4	13	17	11	5	16	7	3	10	5	3	8	9	2	11
Debt and pecuniary wants ...	4	1	5	6	...	6	3	...	3	3	...	3	8	1	9
Dissipated and drunken habits	5	...	5	5	...	5	6	..	6	7	...	7	9	.	9
Despondency	2		2	1	1	2	4	...	4	6	3	9	6	1	7
Grief	2	3	5	6	5	11	2	3	5	1	4	5	1	2	3
Loss of money	3	...	3	...	..	..	.	...	...	2	...	2	3	..	3
Want of employment ..	...	...	...	1	...	1	2	..	2	3	1	4	2	..	2
Scolded by parents ...	...	...	...	3	...	3	3	1	4	1	...	1	...	...	...
Sensitiveness through scandal	...	...	...	1	1	2	..	...	...	...	..	. .	...	...	...
Failure in Examination ...	..	...	...	1	.	1	...	.	...	.	...	...	...	..	...
Quarrel with employers ...	...	...	...	2	...	2	...	...	...	2	...	2	2	..	2
Quarrel with friends ...	...	...	...	...	...	...	...	.	...	1	...	1	...	...	...
Accusation of theft ..	1	1	2	...	...	...	4	1	5	2	1	3	1		1
Prisoner in the Jail ...	..	...	...	...	..	...	1	...	1	...	...	...	...	.	...
Fear of being removed to a Plague Hospital.	1	3	4	2	1	3	5	4	9		...	...	..	...	...
Love and jealousy ...	4	.	4	...	...	...	...	...	...	...	..	...	...	..	...
Unknown causes	2	1	3	2	...	2	2	..	2	3	1	4	2	..	2
	53	40	93	70	39	109	53	29	82	59	48	107	59	32	91

According to Mode.

Mode.	1899.			1898.			1897.			1896.			1895.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
Poison	14	11	25	21	8	29	17	5	22	24	19	43	23	14	37
Drowning	27	25	52	36	25	61	23	20	43	27	27	54	22	14	36
Throwing self out of window	5	3	8	6	2	8	1	2	3	4	2	6	5	3	8
Hanging	3	..	3	5	3	8	6	2	8	1	...	1	4	1	5
Throat-cutting	4	...	4	2	.	2	2	..	2	1	...	1	2	...	2
Burning	...	1	1	...	...	1	...	..	...	...	...	...	...	...	..
Throwing self under Railway trains.	..	...	...		1	...	1	..	1	2	...	2	2	..	2
Shooting self with revolver ...	...	...	..		...	...	1	...	1		...	...	1	...	1
Self-inflicted wounds ...	..	...	...	...	...	...	2	..	2	...	..	...	...	...	...
	53	40	93	70	39	109	53	29	82	59	48	107	59	32	91

HOMICIDE.

In England, about 3 per cent. of the total deaths from violence occurring yearly are reported as homicidal cases, equal to a death-rate from homicide of 21·6 per million of population. Reliable statistics as to the death-rate from homicide in India are not available, but in the Bombay Presidency, in 1875, the number of violent deaths classed as "otherwise," *i.e.*, not known to be accidental or suicidal, equalled 26·19 per million of population. Of these (see following table) more than one-half were deaths from drowning, and nearly one-half deaths from wounds.

DEATHS by VIOLENCE in Bombay in 1875, CLASSED as OTHERWISE, *i.e.*, not known to be SUICIDE or ACCIDENT. Actual number of Cases = 425.

Ratio per million of Population.

—	Males.	Females.	Total.
Poison	2·24	0·52	1·41
Wounds	12·61	7·62	10·23
Drowning	15·32	13·68	14·54
Total	30·17	21·82	26·18
Homicide, England and Wales, average of fifteen years.	29·13	14·44	21·59

FORMS OF HOMICIDE IN INDIA.

1. **Homicide connected with sexual relations.**—Under this head may be noticed as more or less common in India (*a*) murders of husbands by their wives. Here the motive is usually either revenge for ill-treatment, or the facilitation of an intrigue, and very frequently poison—often in the latter class of cases supplied by the paramour—is the means resorted to. Possibly, however, in some cases of husband-poisoning, the poison is given as an aphrodisiac, or love-philter and not with homicidal intent.[1] (*b*) Murder by way of punishment for adultery. Here very often mutilation of the body of the victim accompanies the murder. In India, in fact, mutilation of the nose, ears, lips, &c., is a method of punishing a woman for sexual infidelity very commonly resorted to. (*c*) Murder of females pregnant from illicit intercourse (see *cases*, Chaps. XIII and

[1] See Arsenic.

XIV). In cases of this description the victim is frequently a Hindu widow, and very often the fatal result is a consequence of injuries inflicted for the purpose of procuring abortion. (*d*) Murder of females after violation. Many cases are on record in India of this description of homicide, the victim in some instances being a young girl, in others an adult female ; in the latter class of cases usually more than one man is concerned in the crime.

(2) **Connected with acquisition of property.**—More or less common examples of this are (*a*) Homicide arising out of disputes in regard to the possession of land. Often such disputes lead to affrays, in which clubs and other blunt weapons are freely used with fatal results. (*b*) Death from injuries inflicted by gang of robbers or dacoits,[1] the injury being sometimes inflicted by way of torture, often by burning, in order to extort information as to the place in which money or valuables have been hidden. (*c*) Murder of young children for the sake of the ornaments worn by them. This is a variety of homicide of tolerably frequent occurrence in India; (see *cases* in Chaps. XIII and XIV.) (*d*) **Thuggi**[2] or highway robbery accompanied by homicide. This description of murder used formerly to be often met with in India, strangulation being the means commonly employed. Thuggi, however, is now rare, and in such cases as now occur, the death of the victim is usually the result of drugging, **datura** being the agent commonly used. (*e*) Murder by way of punishment for theft. Cases are not infrequently met with in India in which thieves caught in the act are set upon and violently beaten, perhaps killed, mutilation, *e.g.*, severance of the right hand, or of the ears—often accompanying the murder.

(3) **Victims, unoffending persons.**—Murder cases often occur in India in which the victims are numerous, and include children or others who have given the murderer no offence. In cases of arsenical poisoning, for example, the victims are often several in number, some being children, see Chap. XXIII) ; and often in such cases the injury to avenge which the murder is committed is of a very trifling character. Again, in " running **amok** " cases, it frequently happens that some or all

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[1] " Where five or more persons conjointly commit, or attempt to commit, a robbery, or where the whole number of persons conjointly committing, or attempting to commit, a robbery, and persons present and aiding such commission or attempt amount to five or more, every person so committing, attempting, or aiding, is said to commit dacoity." (*I. P. C., s.* 391.)

[2] " Whoever at any time after the passing of this Act shall have been habitually associated with any other, or others, for the purpose of committing robbery, or child-stealing, by means of or accompanied with murder, is a *Thug*." (*I. P. C., s.* 310.)

of the victims are unoffending persons. Cases also are sometimes met with in India in which an individual, in order to revenge himself on an enemy, kills some unoffending person, sometimes a relation or friend, solely for the purpose of bringing a false charge of murder against the person who has injured him (see p. 22).

(4) **Homicide with consent of victim.**—In India it sometimes happens in a case of homicide that the individual killed has consented to suffer death. Thus, for example, in the cases of homicide for accusation just referred to, the victim is sometimes a consenting party to the crime. The custom of the burying alive—"*samádh*"—of lepers, which formerly was widely prevalent in India, affords another example of this description of homicide, as, at any rate in the great majority of cases, the sufferer used to be a consenting party.

(5) **Sacrificial or superstitious.**— Human sacrifice as a religious rite, several cases of which are mentioned by Chevers, formerly widely prevailed in India, but has now been almost suppressed. The same may be said of the practice of "*sati*," or widow burning, before alluded to, and of the practice of burying widows alive in their husbands' graves, formerly prevalent among certain castes. Cases of homicide connected with superstition still, however, occasionally occur in India; *e.g.*, the killing of individuals suspected of witchcraft, and cases in which death results from the subjection of the victim to an ordeal for the discovery of theft (see *case* page 20), or of supposed practice of witchcraft (see *Drowning*, Chap. VI). A case of a father sacrificing his son occurred in Bombay in 1901.

(6) **Murder of infants.**—For the peculiar features of this crime in India (see *Infanticide*).

Injuries and deaths by violence, not sexual, may be divided into :—

(1) Wounds and mechanical injuries ;
(2) Asphyxial deaths (*e.g.*, suffocation ; hanging, strangulation, throttling, drowning ;
(3) Burns and scalds ;
(4) Deaths by lightning and electricity, solar heat, cold and starvation.

CHAPTER VI.

WOUNDS, BLOWS AND OTHER MECHANICAL INJURIES.

THESE form the greater portion of the cases coming under the Surgeon's notice, and sometimes give rise to questions of much complexity, although medical evidence is especially required in cases where the injuries result in death.

Every attack upon the person of another is an **'assault,'** whether it injures or not ; and no provocation by word spoken or written can justify an assault, although it may somewhat mitigate the offence. Beating or wounding constitutes **'battery,'** which includes the slightest touch of the finger. Throwing a stone at a person, but missing, constitutes **'assault,'** whilst throwing and hitting is **assault and battery.**

The legal conception of a **"wound"** is much more extensive than the surgical, which latter restricts the term to an injury accompanied by a breach of the skin, and excludes contusions, simple fractures of bones and ruptures of internal organs. To obviate the use of this ambiguous term and in view of the necessity for defining whether any particular injury is or is not a wound, the statute employs the terms **hurt** and **grievous hurt** which are thus defined :—"Whoever causes bodily pain, disease, or infirmity, to any person is said to cause **hurt**" (*I. P. C.*, *s.* 319). The following kinds of hurt are designated as **'grievous'** (*s.* 320) :—

1. Emasculation.
2. Permanent privation of the sight of either eye.
3. Permanent privation of the hearing of either ear.
4. Privation of any member or joint.
5. Destruction or permanent impairing of the powers of any member or joint.
6. Permanent disfiguration of the head or face.
7. Fracture or dislocation of bone or tooth.
8. Any hurt which endangers life or which causes the sufferer to be during the space of twenty days in severe bodily pain or unable to follow his ordinary pursuits.

[*N.B.*—Sometimes the healing of a simple wound of the scalp, &c, is deliberately delayed or prevented for twenty days so as to bring the severer penalty under this clause.]

When an act done by another has caused grievous hurt, or hurt, the doer of the act may be charged with the offence of **voluntarily causing** grievous hurt, or hurt, as the case may be ; or according to the circumstances of the case, with the graver offence of **attempting to commit murder** (*s.* 307), **or culpable homicide** (*s.* 308), **and causing hurt** in such attempt.

The kind of weapon used affects the gravity of the offence. Thus by *ss.* 324 and 326 (*I. P. C.*), the causing of hurt or grievous hurt by certain specified means is made an offence more severely punishable than when such means have not been used. Amongst the means thus specified are "any instrument for shooting, stabbing or cutting or any instrument which, used as a weapon of offence, is likely to cause death."

Deadly injury.—If an act done by another results in **death,** the doer of the act may be charged with the offence of committing "culpable homicide," or of "causing death by a rash or negligent act."

Culpable homicide is defined in *s.* 298 of the *I. P. C.*,[1] and the accused may be convicted of this offence even if death followed as **an indirect** result of the injury[2] (see *s.* 299, Explanations 1 and 2).[1] **Culpable homicide,** according to the

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[1] Sec. 299 of the I. P. C. is as follows:—"Whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death, or with the knowledge that he is likely by such act to cause death, commits the offence of culpable homicide.

"Explanation 1. A person who causes bodily injury to another who is labouring under a disorder, disease, or bodily infirmity, and thereby accelerates the death of that other, shall be deemed to have caused his death.

"Explanation 2. Where death is caused by bodily injury, the person who caused such bodily injury shall be deemed to have caused the death, although by resorting to proper remedies and skilful treatment the death might have been prevented.

"Explanation 3. The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child if any part of that child has been brought forth, though the child may not have breathed or been completely born."

With reference to Explanation 2 of the above section, it may be pointed out that it has been decided in England that when a wound has been given "which in the judgment of competent medical advisers is dangerous, and the treatment which they *bonâ fide* adopt is the immediate cause of death, the party who inflicted the wound is criminally responsible" (*R.* v. *Pym*, 1 Cox, C. C. 339 ; see Mayne's Penal Code, p. 255). This decision, it will be observed, goes farther than Explanation 2, Sec. 299. Explanation 2 covers all cases where death is due to the effect of neglect or unskilful treatment acting on the injury, but not, like the decision quoted, a case where death is not due to the injury, but to an unnecessary operation undertaken for its cure.

[2] In India the question, has a certain injury caused death, arises irrespective of *the period intervening between the receipt of the injury and death.* By the law of England, a person is not deemed to have committed homicide

circumstances of the case, may or **may not amount to murder.** Again, when a person has committed suicide, any one who has abetted him in doing so is punishable under *ss.* 305 or 306 of the *Code.* By *s.* 305 **abetment of suicide** may be punished with death, if the suicide was under eighteen, or was insane, delirious, or intoxicated at the time. Attempts to commit murder, or culpable homicide, are punishable under respectively *ss.* 307 and 308 of the *Code*, and attempts to commit suicide under *s.* 309.

Death or hurt caused by a rash or negligent act.— Where a person has caused the death of another by an act not amounting to culpable homicide, he may be charged with the minor offence of "*causing death by a rash or negligent act*" (*s.* 304 A). Similarly where a person causes hurt or grievous hurt to another, under circumstances which do not amount to voluntarily causing hurt, he may be charged with the minor offence of causing hurt (*s.* 377), or grievous hurt (*s.* 378), by doing an act "so rashly or negligently as to endanger human life or the personal safety of others." In cases such as these and in other cases also, besides the main question involved, namely, has the injury caused, or is it likely [1] to cause death, grievous hurt, or hurt, a subsidiary medico-legal question may also arise, namely, is the character of the injury such as to indicate intention, or absence of intention, to cause a particular result?

We shall now consider the kinds of injuries and their particular results.

KINDS OF WOUNDS AND INJURIES AND THEIR WEAPONS.

Wounds are usually described as:—(1) incised; (2) contused and lacerated, including bruises (contusions) and gunshot wounds; and (3) punctured. To these may be added

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if this period exceeds a year and a day (inclusive of the day of receipt of the injury). This provision does not appear in the Indian Penal Code. Mayne, however (Penal Code, p. 265), thinks that it would possibly be acted on in India as a matter of evidence.

[1] It may be remarked that the opinion of a medical expert may be required on the point whether an injury which has caused death is one which comes under the description of an injury "sufficient in the ordinary course of nature to cause death" (Penal Code, Sec. 300), or one which comes under the description of an injury "likely to cause death" Sec. 299), *i.e.*, whether the injury is one from which death would most probably result, or one from which death would only be a likely result. In the case of *Reg.* v. *Govinda* (1 Bom., 342), Melvill, J., held that under certain circumstances the infliction of an injury which causes death amounts to murder if the injury is one falling within the first of these two descriptions; but only to the minor offence (culpable homicide not amounting to murder) if it falls within the second.

(4) Internal injuries without any visible wound or visible breach of continuity of skin.

1. Incised **wounds.**—In examining an apparently incised wound with the object of ascertaining the kind of weapon, if any, used in producing it, it is important to note (1) the situation of the wound, (2) the appearance of its edges, and (3) its length and depth in different parts.

(1) **Situation.**—An apparently incised wound situated on a part where the skin closely overlies a bone, or sharp ridge of bone, may be produced without a weapon or by a blunt weapon. Blows with the fist, for example, over sharp ridges of bone such as the chin, or orbital ridge, or blows with a club on the scalp, may produce wounds closely resembling incised wounds. Wounds caused in this way are generally, but not invariably, vertical to the bone.

(2) **Edges.**—These should be examined with a lens. Sharp, clean cut, uninverted edges, indicate the use of a sharp-edged weapon ; tearing and inversion indicate the employment of a blunt weapon, or production without a weapon.

(3) **Length and depth.**—Long incised wounds indicate the use of a sharp-edged weapon, and may either be caused by a single blow from one with a long, tolerably straight edge, such as a sword, or by a drawing cut from one with a short edge, such as a razor. In the former case, the method of production is often indicated by the underlying bones being clean cut through ; and in the latter by the wound tailing off at one end into a superficial scratch (see also (1) *kind of weapons*, (2) *direction of the wound*).

Weapons of the axe or hatchet class usually produce comparatively short incised wounds ; either deep, or accompanied by indentation and extensive fractures of the bones beneath. Cutting instruments with a concave edge and projecting point often cause linear wounds resembling a punctured wound at one end and gradually decreasing in depth towards the other end. Or if the wound has been inflicted on a curved surface, the puncture caused by the point, and the incised wounds caused by the edge, may be separated by an unwounded portion of the skin.

Weapons of assault, more or less commonly used in India, sharp edged, and producing incised wounds are (1) short-edged light weapons, such as the razor (*ustara*) and the knife (*churi*) ; or (2) heavy short-edged weapons of the *hatchet* class such as the axe (*kulhāri*) and the *garasi*, *gandasa*, or *tarash*, an axe-like weapon with a long handle, and sacrificial knife (*khanda*). Weapons allied to this class are the

hoe-spade (*phaora* or *kudāli*) and the Gurkha *kukri*, a short, heavy, convex-edged sword. McLeod also mentions as belonging to the spade class the *khurpa*, or grass-cutter's knife. (3) Long-edged weapons, represented by the curved sword (*talwar*), or the straight sword (*kirich*); and curved-edge weapons with a concave edge and projecting point, such as the bill-hook (*dao*, *koita*,) and the sickle (*haswa*, *daranti*, or *ela*). Wounds caused by broken glass or china resemble incised wounds—one would search for bits of glass, etc.

2. Contused **and lacerated wounds**.—These are often the result of injury by means other than the employment of a weapon. Thus they may result from (1) Injuries by broken-glass—broken-glass wounds, however, if slight, are apt to resemble incised wounds ; (2) Falls on some projecting, more or less sharp object ; (3) Injuries from Wild Animals ; or (4) Machinery and Railway accidents. Severe contused and lacerated wounds are often accompanied by very little hæmorrhage due to (*a*) shock or (*b*) bursting or crushing of vessels.

Slight non-accidental lacerated wounds, produced without a weapon, may be the result of injuries inflicted in forcibly tearing out ornaments, or by the teeth or nails. If a wound of this class has been produced by a weapon, and much contusion or laceration is present, the indication, of course, is that a rounded or blunt-edged weapon has been used. Sharp-edged knives, it should be noted, if used with considerable force, cause bruising and laceration of the parts divided.[1]

Gunshot wounds resemble contused and lacerated wounds in character, and indicate, of course, the employment of a firearm, but not necessarily the discharge therefrom of a hard projectile. If the wound is single, it may have been caused by a firearm loaded with powder and wadding only, if the weapon has been discharged near the body. Nearness of the weapon to the body at the time of discharge is indicated by blackening of the skin from the gunpowder, except with cordite and modern gunpowders, or by scorching, charring or blackening of the clothes at the seat of injury. A single wound, however, may be caused by a firearm loaded with a hard projectile, which in such a case will usually be found lodged in the wound, though a bullet may be so deflected by a bone, &c., as to pass round and out again by the entrance wound. **Two orifices** caused by the same discharge, indicate the employment of a hard projectile. When two orifices are present, the orifice of entry will usually be found to be smaller and more depressed than that of exit, which latter is usually ragged and everted. More than two orifices may be caused by one pro-

[1] Ogston's *Lects. on Med. Jur.*, p. 420.

jectile, *e.g.*, when this has entered the body after traversing a limb, or has split up against a sharp ridge of bone into two pieces, each finding a separate exit ; or more than one orifice of exit may be caused by an intact bullet and a splinter of bone punched off by it. A wound in the neck, produced by a thrust with a "pointed perfectly circular bamboo," was mistaken for a gunshot wound.

In the case of a shot-gun wound, if the distance from which the gun is fired is within 12 inches the wound will, as a rule, be single, while beyond this each shot will make a separate wound,[1] but it will depend also on the charge, size of shot, bore of weapon, and whether 'choke' or cylinder. A single pellet of shot may cause death by penetrating the aorta, or the brain through the eye. Fatal wounds may be caused by gunpowder and wadding alone if fired within about 4 inches from the body.

Contusions **or Bruises.**—Under this term are included all degrees of injury produced by blows, kicks or sudden pressure from explosions where the skin is not divided, ranging from a simple *bruise* on the surface of the body to one accompanied by fracture of underlying bones and rupture of internal organs.

In almost all contusions there is more or less extravasation of blood into the tissues constituting **ecchymosis.** The amount of blood effused is not entirely determined by the severity of the blow, but to some extent by the looseness of the particular tissues at the site of the blow, and by the condition of the blood of the individual or the extensive effusion from a blow on the eye, and the bruises produced by a comparatively gentle grasp on flabby women with thin skins.

Ecchymosis shows itself as a dark dull reddish-blue discoloration of the skin, which in about twenty-four hours begins to change colour, becoming lighter, and changing in tint to violet, then to green, and lastly to yellow, and finally disappears altogether in about five or six days. These changes in colour commence at the circumference of the patch, are due to varying degrees of solubility of the pigments into which the hæmoglobin breaks up and to dilution of the effused blood by the serum of the cellular tissue and subsequent absorption, and occur only during life.

Superficial ecchymosis.—This appears within a few minutes after the injury, and is first of a bluish-black colour. When fading it passes through the chromatic changes from the

[1] Casper, I, 266.

periphery of zones of brown, green and yellow due to changes in the hæmoglobin.

Deep ecchymosis.—This may not appear on the surface for several days after the injury, and not always directly over the site of injury. Where there is yet no discoloration of skin the effused blood may be detected by palpation.

Ecchymosis (*a*) may occur at a distance from the spot to which violence has been applied, *e.g.*, at the seat of fracture of a bone broken by indirect violence ; (*b*) may occur in spots (petechiæ), and as large extravasations indistinguishable from bruises, but without violence in some diseases, *e.g.*, scurvy, and some cases of snake poisoning ; (*c*) other things being equal, is in amount less, the better the bodily condition of the individual injured, and greater the looser the texture of the skin at the seat of injury ; lastly (*d*), its disappearance during life is apt to be extremely slow in old persons ; is more rapid the better the bodily condition of the sufferer. After death it may disappear from, or be masked by decomposition, or the application of antiseptic agents (*e.g.*, charcoal) to the body.

It may be **absent in mortal injuries**, especially when the violence has been applied to a yielding part, *e.g.*, the anterior abdominal wall as by a blow or kick or the passing of a cart-wheel over the body. In the absence of ecchymosis, the fact of the existence of an internal injury caused by external violence, is, during life, a matter of surgical diagnosis. After death, the existence of an internal solution of continuity may be ascertained by dissection, and, in the absence of ecchymosis, its connection with external violence is sometimes indicated by bruising of the parts lying between it and the surface. If such bruising is absent, as well as ecchymosis, the question whether or no the solution of continuity discovered has been caused by external violence, may be a difficult one to decide, requiring consideration of points such as (*a*) The freedom, or otherwise, from disease of the affected part ; (*b*) The situation of the affected part, and its degree of liability to rupture from causes other than external violence ;[1] and (*c*) The history of the case.

Cadaveric lividity, discoloration of the skin due to *post-mortem* staining may, to a certain extent, simulate ecchymosis, especially when this, owing to the pressure of a sheet or other covering on the body, occurs in stripes resembling marks of flogging. It, however, (*a*) affects dependent parts ; (*b*) is usually of great extent ; and (*c*) is unaccompanied by extravasation of blood. An incision through the skin and examination of the underlying cellular tissue, therefore, will always disclose the

[1] See injuries to the brain, thorax, abdomen, &c., p. 132, *et seq.*

true nature of the discoloration. Attempts are sometimes made to **simulate ecchymosis** by applying marking nut juice, or some other irritant, to the skin; such applications, however, usually produce blistering, or a papular eruption, easily distinguished from ecchymosis.

Weapon used.—If a weapon has been used, it will probably have been a blunt or rounded one, such as a stick or club. Frequently the shape, &c., of the weapon or instrument employed can be inferred from the shape, and situation of the patch or patches of ecchymosis. Weapons commonly employed in India in the production of severe injuries of this class are: (1) A bamboo staff or club, often bound with iron (*lathi*, or *sonta*), or when bound with iron (*lohabandi*). Harvey[1] mentions that about 32 per cent. of the medico-legal cases reported in Bengal, &c., during the three years ending 1872 were *lathi* wounds; and (2) The rice-pounder, a club usually of hard wood about 3½ feet long, and 1½ to 2 inches in diameter, shod at one end with a thin iron plate about 1 to 1½ inch long. This latter is a common weapon of assault in the Madras presidency. Instruments more or less frequently used in India in producing slight injuries of this class, requiring special mention are (1) Shoes—beating with a shoe is supposed to add insult to the injury; and (2) Ropes or cords, used either for the purpose of tying up the sufferer as a mode of torture, or to secure the victim during the infliction of other injuries. Usually the arms are secured behind the back by binding together the elbows or wrists. The split-cane (*bet*) used in Assam and Burma for tying often makes a clean-cut wound.

3. Punctured **Wounds.**—Punctured wounds may be caused accidentally by projecting nails, fragments of crockery, &c. If the edges of the puncture are free from laceration or contusion, the indication is that a sharp-pointed weapon has been employed. Sometimes, but not always, the shape of the weapon which has been used is indicated by the shape of the puncture in the skin. Dupuytren found, however, that cylindrical pins produce elongated openings.[2] The obliquity or directness of the thrust, and also the state of tension or relaxation of the skin, may affect the shape of the puncture, and hence two punctures from the same weapon may differ in shape. Very often also, owing to the elasticity of the skin, a punctured wound is of less diameter than the weapon which has been used. Sometimes in a punctured wound, the broken-off point of the weapon employed is found. Punctured

[1] '*Bengal Med. Leg. Rep.*,' 1870-72. p. 20.
[2] *Ibid.*, p. 416.

wounds are occasionally found in concealed situations, *e.g.*, in the rectum or vagina, in the armpit, or under the upper eyelid. A minute puncture in certain situations, *e.g.*, over the fontanelles in infants, or in the nape of the neck, may indicate a mortal wound. The existence of several punctured wounds of course very strongly indicates the employment of a weapon, and if all are similar in size and shape the probabilities are in favour of their being due to repeated thrusts with the same weapon.

Weapons more or less commonly employed in India giving rise to punctured wounds are, besides knives and weapons of the billhook class already mentioned, (1) daggers (*katari*), of various shapes—in some of these the handle is transverse to the axis of the blade; (2) the spear (*bhalam*, *barchi*, or *sulfi*); (3) arrows (*tir*); (4) Sickle (*haswa*). Arrow wounds, it may be pointed out, are frequently fatal. In Bengal, &c., in the three years ending 1872, there were fifteen fatal cases out of a total of twenty-five. *Case XXXV* illustrates the great penetrative power frequently imparted to these projectiles. The pickaxe (*gainti*), hoe-fork (*kanta-kudáli*) may also cause a punctured wound, probably with much contusion; and punctured wounds may be produced by thrusts with a pointed bamboo.

Case XXXV.—**Arrow Wound.** A Hindu female, aged fifty. An arrow, having first passed through the fleshy portion of the right forearm, had penetrated the chest between the eighth and ninth ribs, and was sticking in the body. On opening the chest, the arrow was found to have passed through the diaphragm, having slightly cut the upper surface of the right lobe of the liver, pierced through the lower lobe of the right lung, and penetrated about an inch into the spine behind the heart and root of the lung. There was a large quantity of fluid and clotted blood to the right of the spine, but the heart was uninjured.—(*Ind. Med. Gaz.*, 1875, p. 257, Dr. S. Manook.)

Same weapon may cause wounds of two or more classes.—A heavy weapon of the billhook class may, for example, produce all four varieties. Hence the existence on the body of the same individual of wounds belonging to two or more of these four classes, does not necessarily indicate that two or more weapons were employed, or that more than one person was concerned in their infliction.

Injuries inflicted by animals may produce wounds belonging to, or resembling, wounds of any of the above classes. Injuries without visible solution of continuity, often severe enough to cause death, are sometimes caused by elephants

kicking, trampling on, or butting the injured individual, or by the animal seizing the individual with his trunk and dashing him forcibly on the ground. Apparently incised wounds may be caused by the tusks of the wild boar. Harvey describes such wounds as "long clean rips," and mentions a case in which a wound so produced, on the inside of the left thigh, was twelve inches long, three deep, and one broad, and, dividing the femoral arteries, caused death by hæmorrhage. Fatal contused and lacerated wounds may be caused by various animals; thus they may result from a bite, or from a blow with the paw, or from injury by the claws, of an animal of the tiger class, in which case the neck is often the seat of injury; or they may be the result of a bite from a crocodile, or of an injury inflicted by a bear, in which last case the scalp is often found greatly torn. Again, contused and lacerated wounds may be the result of injuries inflicted by domestic animals, *e.g.*, a kick or bite from a horse or cow. Punctured, and lacerated wounds, may be caused by the tusks, or more frequently by the horns, of animals. In Bengal, &c., in three years, twenty cases of gores by horned cattle, ten of them fatal, were reported. On the whole, injuries caused by animals are so characteristic in appearance that there is seldom any difficulty in deciding as to their origin.

4. **Internal injuries without visible wound.**—These may be accompanied by serious internal solutions of continuity, *e.g.*, fractures of bones, or **rupture of some internal organ** (see p. 141, &c.) such as the spleen, and hence may be of any degree of severity, from extremely slight to mortal wounds.

Case XXXVI.—In 1884 when the insane Rajah of *Kolapur* died suddenly after a struggle and fall from his keeper, it was found that several ribs were broken without any external marks.

EXAMINATION OF WOUND CASES.

Points to be noted in all Wound-cases.[1]

1. *Kind* (incised, lacerated, &c.) ...	With reference to kind of weapon (and degree of offence), danger to life.
2. *Number* ...	... With reference to self-infliction, struggle, kind of weapon, hæmorrhage, &c.
3. *Position* ...	... With reference to self-infliction.
4. *Direction and organ wounded*	... With reference to danger to life, how inflicted.
5. *Size* (length and breadth)	... With reference to how inflicted, danger to life.

[1] Modified from F. T. Smith's *Med. Jurs.* p. 156.

6. *Depth*	...	With reference to danger to life.
7. *Edges and ends*	...	With reference to kind of weapon.
8. *Foreign bodies present*	...	With reference to how inflicted.
9. *Hæmorrhage*, amount	...	With reference to danger to life.
10. *Inflammatory reactions*	...	With reference to time inflicted, *ante, or post, mortem.*
11. *Cuts and stains on garment*	...	With reference to kind of weapon, how inflicted, &c.

In wounds in the dead in addition to the above :—

Carefully examine and note down the appearance of the wound without disturbing the latter and photograph it if possible. Note amount of blood effused and the presence of spirted blood-stains on objects in the neighbourhood where the injury was received. Whether the blood is coagulated, and firmly so; presence of *rigor mortis* and *post-mortem* stains. Then the interior of the wound may be examined as to clots ; and in stab cases the direction and depth explored gently by a blunt bougie, the deeper course of the wound is to be exposed by dissection without interfering with the external wounds which should be preserved for comparison with the alleged weapon. If a bone is injured, the injured portion should be removed as evidence.

Evidence from Foreign Bodies in the wound.

Foreign bodies such as broken pieces of glass, splinters of bamboo or other wood may indicate the means by which a wound was caused, also the broken-off point of a knife or dagger, or the projectile or wadding or pellets of gunpowder of a firearm. Deep punctured and gunshot wounds should specially be searched, for foreign bodies of this latter description, if found, should be preserved for production in Court, as they are frequently of great importance as links in a chain of evidence. For example, the broken-off point of a knife found in a wound, may exactly fit a knife alleged to have been used, or this may have a perfect point, showing that it was not the weapon employed. Again, a projectile found in a gunshot wound may fit, or be too large to have been discharged from, the firearm alleged to have been used ; or a piece of paper or cloth, used as wadding, and found in a gunshot wound, may correspond to similar fragments found in possession of the accused. Foreign bodies are not always found in gunshot wounds, a projectile, for example, may have completely traversed the body or may have lodged and subsequently dropped out, as sometimes happens when the wound is shallow, or when a portion of clothing has been carried into the wound with the projectile.

For detecting foreign bodies in wounds and for the existence and particulars of fractures the **Roentgen rays** may be used.

X-Rays photographs are admissible as evidence in medico-legal cases; but the 'skiagram radiograph' being only a *shadow* picture, is liable to distort the truth unless it is carefully made and its details are interpreted by skilled persons.

Thus rachitic changes may simulate injury of bone, and injury of bone not be shown in certain planes. It does not show injury to the soft tissues. Radiographs should be taken in two different planes and at definitely marked distances. As evidence, the radiograph should have marked upon it the side of the body and the part photographed and also the part of the body in contact with the plate. It is well to have a radiograph of the corresponding limb or part for 'control' purposes. When a radiograph is produced as evidence the defendant should demand the privilege of employing expert testimony to explain its meaning to the judge and jury.

Evidence from Alleged Weapon.

The alleged weapon may affect the question of the guilt or innocence of the accused. Thus the character of the injury may show that it could not have been caused by the weapon produced by the prosecution.

The alleged weapon should be compared with the wounds themselves and with any cuts on the clothes. It should also be examined for stains of bloods, adhering fragments of hair, &c.

If a firearm, it may show signs of recent discharge. Recently discharged firearms will be found blackened inside the barrel, from the residue left by the gunpowder after ignition. This residue consists mainly of finely divided carbon and potassium sulphide, and yields to water a dark-coloured liquid, alkaline in reaction, and which, after filtration, strikes a black colour with a solution of a lead salt. After a time the potassium sulphide becomes oxidised into potassium sulphate, rust (hydrated ferric oxide) also forming. Hence, owing to the oxidation of the sulphide into a sulphate, washings from a firearm which has been some time discharged, may show no alkaline reaction, and give no blackening with lead salts. The 'fouling' of the modern gunpowders, cordite, &c., is different. Again, the weapon alleged to have been used may show signs of recent fracture, or be bent or otherwise injured as the result of its use.

INFLICTED INJURY WAS DURING LIFE OR AFTER DEATH?

Injuries inflicted after death, although often the result of accident, may also be the result of design, the motive being

either concealment of a crime, or fabrication of evidence in support of a false charge. Further, the fact that an injury severe enough to cause death was inflicted during life, is evidence in favour of its having been the cause of death. Hence the importance of this question.

Case XXXVII.—**Fabricating wounds and mutilating bodies of the dead.** Decapitation is done by rest of a gang to prevent identification in cases of wounded or killed thieves as related by Chevers, or the mutilation may be done with a dead body to fabricate a false charge of murder against a particular party. Thus in the *Nizamat Adalat Report* for Bengal, Vol. VI, 1856, p. 834, and 1855, p 180, a case is reported from Tirhut. The body of a deaf and dumb beggar who had died of disease was found fearfully hacked and cut, leaning against the house of a person against whom the accused had a grudge. Four persons were convicted by the judge, but were acquitted by the higher court. For instances of mutilation, see Chevers *Med. Jur.*, 479 to 500.

Ante-mortem injuries are distinguished from *post-mortem* injuries by the presence of signs indicative of vital action. These may conveniently be considered under the heads of (1) Ecchymosis ; (2) Effusion of blood ; and (3) Other signs.

1. **Ecchymosis.**—Contusions inflicted during life, if severe, are generally, but not invariably, followed by ecchymosis. Ecchymosis may appear even if the individual has lived only a very short time after receipt of the injury ; and further, ecchymosis from blows inflicted during life, may not appear until after death has taken place. The presence of ecchymosis, however, does not necessarily indicate that the injury producing it was inflicted during life. Christison found that blows inflicted on dead bodies, within two or three hours after death, were followed by ecchymosis, not distinguishable from ecchymosis the result of blows inflicted during life. If the individual has lived for some time, say more than twenty-four hours after receiving the injury, changes in colour will probably be found at the circumference of the ecchymosed patch, from purple to black, violet green to yellow—thus affording a clue to length of time inflicted. Thus the purplish-black becomes by the third day violet, by the fifth day green and by eighth to tenth day yellow and the injured part will probably be found swollen. The presence at the circumference of the ecchymosed patch of changes in colour of the above kind and the presence of swelling of the injured part, show that the injury was inflicted some time before death.

2. **Effusion of Blood.**—In a dead body the blood remains fluid for some time after death, rarely beginning to coagulate until four hours, and sometimes not until twelve hours, after

death. Hence an injury inflicted after death, while the blood is still fluid, may be followed by effusion of blood. Owing, however, to arrest of the heart's action, no arterial spouting occurs, and the quantity of blood effused is much less than would be effused from a similar injury inflicted during life. Further, blood effused from a wound, made more than ten minutes after death, rarely coagulates. Hence, marks of arterial spouting indicate infliction while the heart is beating. Much hæmorrhage also indicates *ante-mortem* infliction, and if the blood effused is found coagulated, the presumption is strong that the injury was inflicted either during life, or very shortly after death. *Post-mortem* infliction is indicated if the effused blood is found fluid, but not necessarily by the quantity of effused blood being small, seeing that severe contused and lacerated wounds, inflicted during life, are sometimes followed by but little hæmorrhage.

3. **Retraction and eversion of the edges of wound** follow the infliction of an *incised* wound made **during life** or shortly after death. Wounds other than incised wounds, inflicted during life, exhibit this character in proportion to the closeness with which they approximate in nature to incised wounds. Hence in incised wounds, or wounds approaching in character to incised wounds, indications of infliction during life, or shortly after death, are :—(*a*) retraction and eversion of the edges of the wound ; (*b*) hæmorrhage into the wound, and into the cellular tissue around it ; and (*c*) the presence of coagula.

In throat wounds, Dr. A. Powell has remarked *inversion* of the edges in the wounds due to the retraction of the platysma muscle in the cut skin.

4. **Inflammatory or reparative action.**—The existence of these about a wound of course proves *ante-mortem* infliction, and the more developed these signs are, the longer probably the period which intervened between the infliction of the wound and death. It should, however, be recollected that the rapidity with which inflammatory action sets in, and its amount, are likely to be greater, the more the amount of contusion and laceration about the wound.

Summary of Ante or Post-Mortem Infliction :—

Signs	Indicate infliction
Signs of inflammation round the injury. Changes of colour at the circumference of a patch of ecchymosis.	**Certainly before,** and probably more than twenty-four hours before, death.

SUMMARY OF ANTE OR POST-MORTEM INFLICTION—(*Contd.*)

Signs	Indicate infliction
Marks of arterial spouting. Extensive hæmorrhage.	**Before** death.
Coagula.	**During** life, or very shortly after death.
Retraction and eversion of the edges of the wound. Ecchymosis.	**During** life, or probably not more than three hours after death.
Complete absence of all the above characters.	Probably more than twelve hours **after** death.

SPECIAL WOUNDS AND INJURIES ACCORDING TO REGIONS.

HEAD.

Scalp.—Contused and lacerated, and even apparently incised wounds penetrating to the skull are especially likely to follow blows from blunt weapons on the scalp. Occasionally from such blows, the inner surface of the scalp is found ruptured without there being any rupture of the outer surface. Wounds of the scalp only, are not likely to cause danger to life, except from the supervention of inflammation and erysipelas. Other things being equal, these are more likely to follow contused and lacerated, than clean-cut wounds. Erysipelatous inflammation, although a common sequel of scalp wounds in temperate climates, appears rarely to follow such wounds in India. On the other hand, the scalp may seem uninjured, yet the brain may be injured by fracture of the skull or concussion or hæmorrhage.

Skull.—Separation of the sutures without fracture, may occur even in old persons, from mechanical violence. Harvey records sixteen cases—one an old man of seventy—in which this was the result of *láthi* blows. **Fractures** of the skull may be simple or compound, direct or indirect. Simple fracture is a usual result of a fall on a flat surface, while fractures from blows with blunt weapons are, unless the head is protected by a thick turban or some similar covering, usually compound. Fractures from blows with blunt weapons are in the great majority of cases direct, *i.e.*, at the site of the blow. Indirect

fracture, *i.e.*, fracture by counterstroke, common as a result of falls, is comparatively rare as a result of blows with weapons. In fractures of the skull, the danger to life mainly depends on the amount of injury to the brain; and other things being equal, the amount of such injury is likely to be greater, the thinner the bones at the seat of fracture. Hence blows on the temple and punctured wounds of the orbit are specially likely to be attended with danger to life.

Case XXXVIII.—**Pounding of skull.** At Almora a robbery case is reported by Lieut.-Colonel L. A. Waddell, in 1901, in which the skull of the victim was smashed in and almost pulpified by beating with a large stone. Several such cases are cited by Chevers: In 1852, three persons were sentenced to death, at Bareilly, for murdering a man, by beating him on the face with "*lattees* and an iron coulter," the bones of the head and face were shattered to pieces, so that even the jaws and teeth were broken into small pieces. A woman was sentenced to death at the same town, for the murder of a girl of ten, for the sake of her ornaments. The civil surgeon found the poor child's face brutally wounded and beaten into a mass by repeated blows.

Sword-cuts of skull are especially common amongst the excitable Burmese who use their heavy powerful *dahs* on slight provocation. In these cuts a shaving of the skull and scalp may be sliced off, or nearly so, with a glancing cut, but the vertical wounds passing through one or fracturing both tables of skull and those accompanied by depression of the skull and injury to the brain substance are the most serious. In the vertical wounds the inner table is frequently fractured although there may at first be an absence of head symptoms.[1] For extensive sword-cuts of the skull, see Jhelum case, *No. XXXIX.*

Case XXXIX.—**Multiple Sword-cuts through skull and other bones.** A tragedy is reported by Lieut.-Colonel L. A. Waddell from Jhelum in May 1881, where he saw a *sais* (groom) caught red-handed in the act of killing his wife and her paramour with an Afghan sword, inflicting remarkably extensive cuts through bones, in which the latter were sliced through almost as if they were cheese. The wife endeavouring to save her paramour received a cut which bisected the left side of her chest from the spine to the sternum as if the thorax were sawn through in half, cutting through the ribs, spinal column and vertebræ, across left lung and into the heart. The same cut also severed both bones of the right forearm above the wrist, which had been clasping her paramour, and the hand was left hanging only by about two inches of skin. Death was instantaneous in a pool of blood. Turning to the man, the infuriated *sais* dealt him a cut at his head, which nearly sliced off the whole top of the skull with its contained brain, the cut extended from above the level of the eyebrows transversely through the skull and brain to the other side, leaving only about three inches

[1] C. C. Barry, *Ind. Med. Gaz.*, 1901, 377.

of the skull uncut to complete the circuit. This same sword-cut also cut into the man's axilla incising several ribs as the man had ducked his head and was protecting it by his uplifted arm. After the man fell the *sais* nearly severed the remaining portion of the head from the body by two cuts, one of which sliced off the angle of right lower jaw and the other cut through the neck down cervical spine. The sword was one-edged and exhibited after the tragedy a somewhat sinuous edge, through being wrenched out of the cut bone into which it had become embedded. The *sais* was a muscular, middle-aged man. He made no attempt to deny the crime, but pleaded provocation. He suffered the death penalty.

Brain.—Injury to the brain frequently follows a fracture, especially a depressed fracture, of the skull, and, as stated above, is the main source of danger in such fractures. Injury to the brain may, however, occur without fracture of the skull, and sometimes results from a comparatively slight blow on the head. As in the case of fracture of the skull by counterstroke, the seat of the injury to the brain may be at a point opposite to the spot to which the violence was applied.

The brain injury may be a Contusion followed by Concussion.—An injury of this kind may prove immediately fatal, or produce temporary insensibility, which may closely resemble intoxication, and be only distinguishable from it by the absence of alcoholic odour in the breath ; or may produce only slight immediate effects, but be followed after an interval by inflammation, ending in death. Guy, for example, mentions the case of a woman who received an injury on the head, and after remaining well for twelve days, fell ill and died with symptoms of compression ; and also the case of a girl who, after a fall on the head, suffered simply from headache for six weeks but died two months after the fall, from brain affection.

The brain injury may be Compression, caused by depressed bone, effused blood, or the products of inflammation. The brain is specially likely to be injured by—**depressed bone,** in punctured fractures, and in fractures in situations where the bones are thin.

Effusion of blood on the surface, or into the substance of the brain, may occur with or without fracture of the skull, and may cause immediate insensibility, followed by death in a few minutes, or, when the effusion occurs slowly, insensibility may not set in for an hour or more. **Effusion of blood from violence without fracture** of the skull, may or may not be accompanied by appearances of contusion of the integuments covering the skull. If accompanied by such appearances, the question may arise whether the effusion was the result of the external violence which gave rise to these

appearances, or the result of disease or excitement. A similar question also may arise even in cases where no marks of external violence are apparent, as effusions of blood from violence may occur without any external signs of injury being present. An effusion of blood from violence is generally, unless the brain itself be torn, on the surface, and not in the substance, of the brain. It is commonly situated immediately below the seat of violence, but in some cases is found at a point directly opposite thereto. **Effusion of blood from Disease or Excitement** is sometimes extremely difficult to distinguish from effusion caused by violence. **Effusion from Disease,** however, rarely occurs in persons under the age of forty ; most commonly takes place in the substance of the brain, and careful examination will generally disclose a diseased condition of the vessels. **Effusion from Excitement**—alcoholic or non-alcoholic—may occur in persons of any age. Signs of congestion of the cerebral vessels co-existing with effusion, are to a certain extent in favour of disease or excitement being its cause. It must further be pointed out that even if the probabilities are in favour of an effusion being due to violence, the question may still arise whether the violence was a blow, or the result of a fall. Questions of this kind not infrequently arise in a case of a fight between intoxicated persons. Blows are interchanged ; the individuals perhaps are separated ; one of them is then seen to stagger and fall, becomes insensible, and dies. *Post-mortem* examination shows the cause of death to be effusion of blood on the surface, or into the substance of the brain. In such a case it is often difficult in the extreme to arrive at a definite conclusion on the question as to whether the effusion of blood was the result of (*a*) a blow received during the fight, or (*b*) excitement or disease, or (*c*) the fall after the termination of the struggle. **Compression from the products of inflammation** may set in and prove fatal several days or weeks after receipt of the injury.

Lacerations of the brain may be caused by a weapon or projectile penetrating the skull, or by fragments of depressed bone ; or may occur without injury to the skull, either immediately below, or at a point directly opposite to, the seat of the violence. Wounds of the brain are of course attended by great danger to life. Very severe wounds of the brain, accompanied even by loss of substance, may not cause immediate death, or even immediate insensibility, and in exceptional cases recovery may take place.

Face.—Wounds of the face are not likely to be dangerous to life unless the orbit is involved or the injury or resulting

inflammation extends to the brain. Injuries to the face by causing permanent disfiguration, loss of sight, or teeth, &c., often come within the definition of "grievous hurt." Wounds, with or without partial removal, of the **nose** and **ears**, are often met with in India, the motive leading to the infliction of the injury being usually sexual in character. This is specially so when the victim is a female, and a sharp-edged weapon has been used. Often when the victim is a female the **lips** or breasts are also wounded, but no other injury may be present, indicating either submission of the sufferer to the punishment, or the participation of several persons in the outrage. When the victim is a male the motive is commonly either sexual, or punishment for theft: or, if the teeth have been employed, the injury may have been inflicted in the course of a struggle, and indicate no special motive. Injuries to the nose and ears caused by forcibly pulling out ornaments are not uncommon, especially in females, and may, by causing permanent disfiguration, amount to grievous hurt. In such cases the motive may either be theft, or desire to cause hurt. Injuries to the **eyes** also are not uncommon, and may be the result of direct violence, *e.g.*, *gouging out* by the fingers, or injury by a sharp-pointed weapon, the motive for infliction of the injury being similar to those leading to wounds of the nose or ears. Or the injury may be the result of indirect violence, and indicate no special motive. As examples of injury to the eyes from indirect violence, it may be mentioned that blows with a club on the head, sometimes cause rupture of the eyeball; and wounds of the eyebrows, are sometimes followed by amaurosis.

Case XL.—(*a*) **Gouging out the eyes**. In 1854, a very brutal case was tried at Mangalore, in which the paramour of a married woman, becoming tired of her or jealous, gouged out her eyes with a curved knife and a needle. The woman recovered.—(*Faujdar Adalat*, 1854.) (*b*) Chevers gives a case of a man who gouged out both the eyes of his wife with his fingers, and otherwise maltreated her, because she declined to have connection with him, being very young. (*c*) In Macnaghten's Reports Vol II, 427), a case is given of a man who, having tied the hands and (feet ofhis wife, threw her down, sat upon her breast, and put out her eyes with a heated iron. In the case of bodies found exposed in the fields or jungle, it should be remembered that the *eyes* are generally the parts first attacked by birds of prey.

The loss of a **tooth** from a blow is a common complaint, but it is usually false and intended to establish a charge of '*grievous* hurt.' The knocking out of teeth is rather rare in India as the fist is seldom used for assaults. When blows are delivered over the mouth or eyes it is usually with a shoe.

In false cases there will likely be no signs of injury to lips or gums or adjacent teeth, although the alleged weapon is usually a thick *lathi* or a large stone, the cavity is usually old and contracted, and the teeth of complainants, usually an old man or old woman, are generally loose. The incisor tooth produced is usually unbroken and old and dry.[1]

SPINE AND SPINAL CORD.

Generally the danger is in proportion to the extent of spine injured. Death occurs instantaneously if the medulla and upper part of the cord be wounded. Serious injuries to the cord above the third cervical vertebra, are immediately fatal from paralysis of the muscles of respiration. Serious injuries lower down give rise to secondary effects, from which death may follow long after the receipt of the injury. Injury to the spinal cord may occur without fracture or dislocation of the vertebræ. A blow, for example, on the spine, may cause concussion of the cord followed by paralysis, or may set up inflammation followed by softening of the cord.

Concussion of the cord sometimes results from a railway accident, and in actions for damages in cases where this injury is alleged to have been received, the question whether the plaintiff's symptoms resulted from the accident or from disease, or are pure malingering, is sometimes a very difficult one to deal with.

Fracture of the second *cervical vertebra* with displacement and immediate death, is a not infrequent result of a fall from a height on the vertex. If the bones or ligaments are diseased, very slight violence may cause displacement and fatal injury to the cord, and Taylor mentions a case in which displacement of the odontoid process, and fatal injury to the cord, appear to have been caused simply by the muscular effort of throwing the head forcibly back. Fatal injury to the cord from non-accidental violence, may be caused without a weapon. Among the medico-legal cases reported in Bengal, &c., during the three years ending 1872, were three in which violence used in wrestling resulted in fracture of one of the cervical vertebræ and death. In two of these cases the third and in one the fifth cervical vertebra was fractured. The same author mentions a case in which fatal injury to the cord in a boy *æt.* six, resulted from dislocation of the sixth from the seventh cervical vertebra caused by twisting the neck ; in this case no external marks of violence were present on the body. Fatal injury to

[1] W. D. Sutherland, *Ind. Med. Gaz.*, 1899, 241.

the cord, unaccompanied by injury to any portion of the body other than the spine, is rare as a result of blows from blunt weapons, but may occur when the neck is the seat of the injury, and may even occur without any external marks of violence being present. In one of Harvey's cases, for example, a woman aged sixty was killed by a blow with a club on the neck. Death resulted from injury to the cord due to displacement of the vertebræ, but no external marks of violence could be seen, although on dissection blood was found effused into the muscles of the nape.

Case XLI.—**Laceration of Cord without external injury.** This is a usual way of causing death in this country, especially in the case of children. The neck is twisted and dislocated, causing laceration of the spinal cord. In 1860 a woman was condemned to death, at Combaconum, for murdering a child in this manner, for the sake of stealing his jewels. There were in this case no external marks of violence.—(*Madras Faujdari Adalat*, 1860.)

Hacking the spine with a sword, bill-hook, or other heavy cutting weapon—causing sometimes decapitation—is a common mode of murder all over India, and specially so in the Central Provinces, Oudh, and the Panjab.

NECK.

Injuries of this region from mechanical violence other than the use of edged weapons, are chiefly dangerous to life from their effect on the spinal cord. A case cited by Harvey, however, shows that mechanical violence may cause very extensive, possibly fatal, injury to the soft parts in front of the neck without dividing the skin. **Wounds of the neck from edged weapons** are often suicidal, and often also homicidal. **In cut throat,** suicide is more or less contra-indicated, if the wounds are multiple, unless one only is severe ; or if the wound is single and of great severity, more than sufficient to destroy life ; or if the wound is low down on the neck. Wounds of the neck vary in danger to life according to their situation and depth. From the position of the large blood-vessels lateral wounds are more dangerous to life than wounds in front, and wounds low down on the neck more dangerous than wounds high up. Wounds of the *windpipe only* are attended with little danger to life. Wounds of the neck dividing the *gullet* are almost always fatal. Wounds of the *large vessels* are mortal injuries, death resulting either from hæmorrhage, or from entry of air into the circulation. Wounds of the *carotids* are not necessarily immediately fatal.

Case XLII.—(*a*) **Survival in cut throat.** Chevers (*Med. Jur.*, p 427) quotes a case in which a man, with the *carotid artery* divided survived until the following day. It appeared that a man was aroused in the night by two thieves, who were in the act of stealing in the house. In the struggle which ensued one of them cut him in the neck, and they escaped. After receiving the cut, he said that he had seen the prisoners, whom he named, stealing his *goor*, that he had seized one of them, and that the other cut him on the neck with a *dhao*, or knife, and both made their escape. The accused not having come with the neighbours, were sent for and confronted with the wounded man, who accused them as above. The man's brother stated that the occurrence happened late at night, and that it was then moonlight. The man died the *following day.* The civil surgeon's evidence was as follows : "I found an irregular deep wound on the neck, apparently caused by a sharp pointed instrument ; the wound, in my opinion, was not caused by the man's own hand ; the *carotid artery was divided*, and deceased had bled to death." It is to be regretted in this case that it is not recorded whether it was the *external* or the *common* carotid artery that was divided. If it was the latter, Chevers says that this is the only recorded case of so long a survival ; but Taylor (ed. of 1883, Vol. 1, p. 631) says : "There are several cases on record, which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and even running a certain distance, for instance."

(*b*) In 1863, a man committed suicide by cutting his throat. The external carotid artery and the internal jugular vein on the right side were cut through, and a large quantity of blood was lost. The wound extended from the front of the angle of the right jaw to near the windpipe, which was not wounded. The man survived half an hour, but was speechless and insensible (Taylor, *Med. Jur.*, p. 631).

THORAX.

Penetrating wounds of the chest **perforating the heart** or one of the large vessels, are mortal, but not necessarily immediately mortal, wounds. In such wounds the rapidity with which death occurs, greatly depends on the rapidity with which hæmorrhage takes place.

Wounds of the heart may be penetrating or non-penetrating according as they injure the wall or penetrate the cavity. Ninety per cent. are penetrating. The chief dangers of the former are shock and injury to the coronary artery. A needle puncture rarely causes hæmorrhage from the ventricle, but from the auricle it does. Pericarditis, endocarditis and empyæma are secondary complications. Loss of blood may occur comparatively slowly if a large vessel is only punctured, and the puncture is small ; or if the heart is wounded, if the wound is small, or oblique in direction. After a wound of the heart an individual may even survive several days. Taylor mentions two cases, one of survival for eleven days with a bullet one-third of an inch in diameter lodged in the septum between the

ventricles ; and another of survival for five weeks with a mass of wood, lodged in the substance of the heart. Recovery may occur.[1]

Taylor mentions that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others death took place from four to twenty-eight days.

Case XLIII.—**Wound of heart.** A case narrated by Mr. William White of Rangoon. "A soldier was wounded in the storming of the Great Pagoda on 14th April 1852. The ball entered a little above the anterior fold of the left axilla, taking an oblique direction to the cavity of the chest. At first he appeared to be doing well, and the wound closed. Subsequently, his health declined with feverish symptoms and evidence of pulmonary disease. A few days before his death it was noticed that the action of the heart was weak but natural, its systole or contraction and diastole or relaxation regular and equal. He died worn out and emaciated on the 24th June. On examination, the bullet was found in the left ventricle of the heart, in its most interior part.—Chevers, *Med. Jur.*

Even when death occurs rapidly, considerable power of locomotion may remain after receipt of a wound of the heart, as in the case already mentioned, where a man ran eighteen yards after a stab penetrating the right ventricle. Taylor also mentions a case in which it is probable that a man ran over eighteen feet after a gunshot wound "shattering to atoms" the auricles and part of the aorta. If the lungs are wounded, death may occur rapidly from hæmorrhage, or after a time from inflammation, but wounds of the lungs are not necessarily mortal. A wound completely transfixing the chest, other things being equal, is not more dangerous than a simple penetrating wound.

Non-penetrating wounds and injuries of the thorax are dangerous to life in proportion to the amount of internal injury. Serious internal injuries of this class are usually, but not invariably, accompanied by **fractures of the ribs,** but fractures of the ribs may be present without other internal injury. If a rib has been fractured by direct violence, *e.g.*, a blow from a blunt weapon, it is usually found broken in one place only, and the ends are driven inwards. When the fracture has been the result of indirect violence, the broken ends are usually driven outwards, and the fracture, if single, is generally at the point of greatest convexity. Ribs when fractured by indirect violence are often broken in two places, one in front and the other behind. Very often also when the violence is of the nature of a force compressing the thorax, the fractures are symmetrical or nearly so ; *i.e.*, fracture of a rib on one side of the body, is accompanied by fracture of the corresponding rib on the other side.

[1] See cases cited by Powell, *Ind. Med. Gaz.*, 1902.

Compression of the thorax, causing symmetrical indirect **fractures of the ribs**, may be due to accidental violence, *e.g.*, "buffer-crushing" on railways, the fall of a heavy weight on the front of the chest, or more rarely to a fall from a height. More frequently it is the result of homicidal violence, and may be due to pressure with the knees, trampling under foot, or to compression of the body between two bamboos, a process known as "*bans-dola.*" Again, it may be due to kneading with the knees and elbow or "*kil kani*" (see also injuries to the liver). Dr. Harvey mentions a case in which symmetrical rib fractures were present, but no external marks of injury were to be seen on the chest, and suggests that in the case in question the compressing force was probably pressure with the knees.

Non-penetrating injuries of the thorax may injure the Lungs or Heart in falls from a height, compression of chest by falls of heavy weights, wheels, buffers, or by blows. **If the Lungs** are injured, hæmothorax or inflammation, either of them ending fatally, may follow, even when there is no fracture of the ribs. Emphysema may be present, but this is only dangerous to life from mechanical impediment to respiration. The *phrenic nerve* was ruptured with instant death in nine cases reported by Dr. Coull Mackenzie, *Ind. Med. Gaz.*, 1889, p. 204.

Rupture of the Heart is a comparatively rare result of non-penetrating chest injuries. Dr. Harvey mentions fourteen cases, in the three years 1870—72, five of them homicidal, and in several the heart was healthy, but in most there was fracture of rib or sternum and external signs of violence. Dr. Coull Mackenzie describes five cases[1] of rupture of heart alone, one with rupture of spleen and one with rupture of other organs. The five former were caused by heavy weights falling and the other two by running over by laden carts. In four no external injury was visible, and in two no fractures of bones were present. Dr. Gibbons reports *one case*[2] caused by blow of a thin stick with death in three hours and without fracture of bones. Rupture of the heart may occur independently of external violence, or if the heart is diseased, from a comparatively slight amount of violence. Again, external violence may cause rupture of an even healthy heart, and yet no external marks of injury be present. Hence, when the heart is found ruptured and no marks, or slight marks only of external violence are present, it may be difficult to say what was the cause of the rupture. Non-penetrating chest injuries may

[1] *Ind. Med. Gaz.*, 1889. [2] *Ind. Med. Gaz.*, 1897, p. 443.

cause rupture of a large thoracic blood-vessel, *e.g.*, of the pulmonary artery, pulmonary veins, or superior vena cava. Rupture of the diaphragm also may occur (see below).

ABDOMEN.

Penetrating wounds unaccompanied by any internal injury are, even if accompanied by protrusion of viscera, not necessarily fatal. Death when occurring rapidly is usually from shock, or after an interval from peritonitis. Moreover, such wounds, and also wounds or rupture of the diaphragm, are liable to be followed by hernia, and may hence (from strangulation) cause death indirectly, after a long interval. With a penetrating wound of the abdomen, there may be a wound of a vascular organ or large vessel leading to death from hæmorrhage ; or a hollow viscus may be wounded and extravasation of its contents be followed by fatal peritonitis.

Fatal non-penetrating injuries of the abdomen may leave no external marks of violence. In some, but not all such cases, the tissues immediately underlying the skin at the seat of injury, may on dissection be found to show signs of bruising and to contain extravasated blood. Blood, however, it must be recollected, may in rare cases be found extravasated in the muscles of the abdominal wall, without violence having been applied. Taylor[1] mentions two such cases ; in both the extravasation was into the muscles around the navel. **A non-penetrating injury unaccompanied by any wound of the contents** of the abdominal cavity, may cause immediate death from shock. This is specially liable to occur from a blow over the region of the solar plexus, and in such a case, after death, no marks of violence, external or internal, may be discoverable.

Case XLIV.—**Death from a Blow on the Abdomen.**—Chevers quotes a case in which a man who was said to have been struck with a thick pole on the right loin died immediately. No trace of injury or of grave disease could be discovered on the most careful examination. "I therefore reported that, as blows inflicted upon the front of the abdomen had been known, in several instances to cause death by a shock to the nervous system, it was probable that in this case like force applied to the side of the belly had acted in a similar manner."

Or an injury of this class may cause death from peritonitis, in which case after death, no lesion other than signs of inflammation of the peritoneum may be found. More frequently the cause of death in fatal non-penetrating abdominal injuries is rupture of a viscus such as the spleen or liver. **Rupture of a**

[1] *Med. Jur.*, i., p 667.

viscus, however, it must be recollected, may occur from *post-mortem* violence, especially when decomposition is far advanced. An idea of the relative frequency of occurrence in India of rupture from violence of the different abdominal viscera may be gathered from the following figures. Among the fatal medico-legal cases reported in Bengal, &c., during the three years ending 1872, rupture of the spleen occurred in 564, liver in 129, bowels in 25, kidney in 24, urinary bladder in 8, and of the stomach in four or five cases.

SPLEEN.

Rupture of the spleen is of somewhat frequent occurrence in India,[1] especially in the more fever-saturated districts where the spleen is often much enlarged by disease[2] and thus rendered liable to rupture from very slight violence. Indeed the enlarged spleen sometimes undergoes *spontaneous* rupture with fatal results without the application of any external violence.

Case XLV.—**Spontaneous Rupture of Enlarged Spleen** (*a*) Ali Bux, a fine-looking old Mohamedan, aged about 50 years, was engaged in a law-suit in the Umballa Deputy Commissioner's court on October 10th, 1900. He appeared to be in good health and took a very ively interest in the proceedings in which he was the complainant. While engaged in cross-questioning one of the witnesses, he suddenly became faint, fell down and was carried out of court and expired in the compound. The death was so sudden and so unexpected that the Deputy Commissioner ordered the body to be sent to the Civil Surgeon for examination. The man had been in court the whole morning and appeared to be in perfect health. The friends, who brought the body to the Civil Hospital, were most emphatic that he had not received any blow or knock of any kind, and an inspection of the Court where he became faint, convinced me that there was no furniture or projecting

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[1] Lt.-Col. D. G. Crawford's analysis of 304 cases of ruptured spleen showed that it occurred in 3 08 per cent of the fatal cases sent by the police for medico-legal examination.—*Ind. Med. Gaz.*, 1902, p. 212.

[2] McLeod, quoted by Chevers, *Med. Jur.* (p. 462), points out that rupture of the spleen is liable to occur in cases of (1), simple engorged spleen ; (2) hypertrophied engorged spleen ; (3) small hard spleen ; (4) large hard spleen. The normal form and size of spleen according to Gray are as follows :—The spleen has two surfaces, one external and convex, the other internal and concave ; two ends, the upper thick and rounded, the lower thin and pointed ; and two margins, anterior and posterior, the former often being notched. Gray gives the normal size and weight of the adult (European) spleen as follows length, about 5 inches ; breadth, 3-4 inches ; thickness, 1-1½ inch, weight about 7 ozs. In natives of this country, whose size and weight is usually much less than those of Europeans, the weight and dimensions of the spleen should presumably be somewhat less than the above But in many parts of Bengal normal spleen are less common than are enlarged, and the *average* size and weight of the spleens in the adult native of Bengal would probably be greater than those quoted above.

angles where he could accidentally have knocked against something to cause internal injuries.

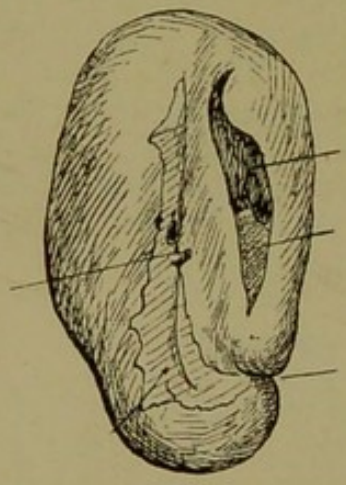

Fig. 7.—Showing rent in the spleen capsule half-filled up with blood clot.

On opening the abdomen on 11th October, I found the peritoneal cavity full of a blood-stained fluid. There were also fresh blood clots. The amount of the fluid could not be measured, but probably there were several pints. The spleen weighed 3 lbs. 13 ozs, and measured 9½ inches by 6½, and was 3½ inches thick. On its inner surface, anterior to and parallel with the hilus, was a rent in the capsule, 6 inches in length. The opening was plugged with fresh black blood clot. The substance of the spleen was soft and friable. There were no other injuries or signs of disease.—C. H. James, *Ind. Med. Gaz.*, 1902, p. 222.

(*b*) On 5th March, 1878, a beggar woman, Kamini, 30 years of age, who had been suffering from enlargement of the spleen for several years, at 3-30 o'clock in the morning complained of severe pain in her abdomen in the region of the spleen. No remedies were applied or given to her internally, and very shortly after she expired. At the autopsy on the body on the same forenoon: The body was much emaciated, the abdomen was somewhat enlarged, but there were no external marks of violence on it. The abdominal walls were not bruised. The liver was large, fatty and anæmic. The kidneys were fatty and anæmic. The other organs except spleen were healthy. The spleen was 12 inches long, 7 inches broad, and weighed 3 lbs. 14 ozs. Its substance was very hard, and there were two ruptures, each an inch long on the inner surface and lower end. There were several pints of serum in the abdominal cavity. There was 40 ozs. of dark blood of the colour and consistence of black currant jelly in and around the spleen. No bones were fractured.

(*c*) A native male of about 25, suffering from malarious fever and enlargement of spleen, on the evening of the 29th December, 1878, applied for medical relief at the dispensary of the Mayo Hospital. After receiving medicine he walked away slowly, with the assistance of a thick stick along the bank of the river Hooghly for a distance of about half-a-mile to a landing-place; on reaching this spot he sat down, and shortly after had several convulsions, vomited a good deal, and died in about half-an-hour. I examined the body about 12 hours after death when I found it to be well nourished and to have no external marks of violence on it. The lungs were healthy, and there were extensive recent pleuritic adhesions of the outer surface of the left lung to the inner surface of the thorax. The spleen was about 12 inches long, 8 inches broad at its lower and 3 inches at its upper end. It was hard.

There were two ruptures on its inner surface and through its hilus, each 2 inches long. All the other internal organs were healthy and were anæmic. There was a large quantity of dark fluid blood extravasated into the abdominal cavity. I gave it as my opinion that the deceased died from spontaneous rupture of spleen.—Mackenzie, *Ind. Med. Gaz.*, 1889, p. 322.

This liability of the enlarged spleen to be so easily ruptured is taken into account judicially in awarding punishment to cases where a blow, kick, &c., has caused death in this way. For so slight often is the force required to rupture a diseased spleen, that in many cases where this occurs from violence inflicted by another, there is no intention of causing death.

Rupture of the spleen may be **caused by accidental violence**, *e.g.*, a fall, or from the sufferer having been run over by a wheeled vehicle. **In non-accidental** cases it is often the result of a blow or a kick or a push against a wall or other hard body, without a weapon.

In 102 of the 304 cases of Dr. Crawford the cause was beating with a *lathi* or other heavy blunt instrument. Blows with fist, kicks or slaps or two or more of these combined accounted for 62, or over one-fifth. Falls from trees and in one case from a bridge gave 22 cases, 17 were run over by carts, and 23 were said to have been murdered.

How trivial a blow may cause fatal rupture is seen in the following case :—

Case XLVI.—**Rupture of Spleen by slight blow.**—Nabu Sheikh, Musalman male, 40, of Diwanganj, 14th November 1886, said to have been killed by a stab. A small wound, $\frac{3}{4}$ inch long, gaping $\frac{1}{2}$ inch wide over eighth left rib, about five inches above and external to the umbilicus. From its outer end a slight scratch runs upwards and outwards for three inches. This wound was quite superficial, $\frac{1}{8}$th inch deep, *penetrating only into and not through the subcutaneous cellular tissue.* Peritoneum healthy, contained about half a pint of dark fluid blood round spleen. Stomach healthy, empty. Liver enlarged and congested. Spleen enlarged, about twice normal size ; a rupture, three inches long, crossing outer side half-way between upper and lower ends. Death was due to rupture of the spleen, probably caused by the blow, trifling in itself, which inflicted the wound over eighth rib."—Dr. D. G. Crawford, *Ind. Med. Gaz.*, 1902, p. 215.

It may occur without any external marks of violence being present—this was so in about one-third of Harvey's cases—but in about one-fifth of these the tissues under the skin over the region of the spleen, on dissection, showed signs of bruising. Rupture even of an apparently healthy spleen, may be unaccompanied by external marks of violence, but in such cases the subcutaneous tissues will probably (but not certainly) show signs of bruising.

Period of survival.—Death may occur in a few minutes or not for several days. Chevers mentions one case of survival for five days and another of death on the eighteenth day from

pleurisy and pericarditis. Considerable power of locomotion may remain after receipt of the injury.

Lieutenant-Colonel E. G. Russell, I.M.S., gives two[1] cases in which recovery apparently took place after rupture or bruise of the spleen ; the diagnosis, in one case, being confirmed by dissection of the victim, who died several years afterwards. He also quotes four cases in which the victim survived the injury for over twenty-four hours ; in one case five, in two four, and in one two-and-a-half days. Dr. A. Powell relates a case of a European lady, aged 60, who was knocked down by a cart, drove to hospital in a springless cart and lived eight days. Her spleen was found ruptured at the *post-mortem.*

Lieutenant-Colonel D. G. Crawford gives three cases which bear on this point :—

Case XLVII.—Dakka, Hindu male, 31, said to have been beaten on 2nd January 1888, and to have died "a few days later." *Post-mortem* on 7th January 1888. Peritoneum contained a pint of fluid effused blood ; large omentum bruised, small gut bruised in many places ; stomach empty; spleen much enlarged, ruptured at upper part of external surface.

Case XLVIII.—Mymensingh, Musalman male, ten, said to have died three days after being knocked down. No external marks of injury. Peritoneum healthy; stomach healthy, contained a little muddy fluid ; spleen slightly enlarged, a small rupture ¾ inch long at lower end of anterior border, ʒ ii—ʒ iii of blood effused around the rupture.

Case XLIX.—24-Parganas, Musalman male, fifteen, said to have been beaten with *lathis* on 20th July 1897, was admitted to the Campbell Hospital on the same day, and died there on the 6th of August ; *post-mortem* on 7th August. There was an oblique longitudinal mark, five inches long, across the left side of the back, with fracture of four ribs, the 8th to 11th left ribs. The left temporal and parietal bones, and the left wing of the sphenoid bone were fractured, liver pale, waxy, bloodless ; spleen much enlarged, weight 1 lb., a rupture, ¾ inch long, on inner aspect ; left kidney weighed 6 ozs., a rupture in it, ¼ inch long There can be no doubt about the facts of this case, as the boy was in hospital from the day of the injury till his death. He had undergone fracture of three of the bones of the skull, four ribs, and rupture of two viscera. Yet he survived for no less than seventeen days ; and, in the end, the immediate cause of his death appears to have been inflammation of the meninges of the brain.—*I. M. G.*, 1902, p. 219.

Wounds of the Spleen are rarer than rupture.—In Lt.-Col. Crawford's series there was only one case to every fifty of rupture :—

Case L.—Dinajpur, 19th April 1883 ; Musalman male, 30, said to have been murdered with a knife. There were four wounds, three of which were trivial ; the fourth was a wound, 2½ inches long, one inch broad, between 9th and 10th left ribs near junction with costal cartilages, piercing the diaphragm, gastrosplenic omentum, spleen and part of greater omentum, completely dividing the lower part of the duodenum, and striking left

[1] Malaria its causes and effects, 1880, pp. 217–221.

side of spine. Left pleura contained a pint of dark fluid blood and some clot, abdominal cavity contained some fæcal matter, 2½ pints dark fluid blood, and 10 oz. clot over liver and omentum ; stomach full ; spleen pierced through middle.

Case LI.—Dakka, 2nd January 1872 ; Musalman male, age not noted, said to have been killed with a needle. Marks of puncture in left hypochondrium. Abdominal cavity contained a great quantity of fluid blood, and a clot weighing 1 lb. 15 oz. Spleen weighed 3 lb. 15 oz. and on its outer surface were punctures corresponding with those in abdominal wall, made by a sharp instrument. The examination was made by Dr. J. N. B. Wise, an authority on native customs, who made the following remarks :—"Death due to hæmorrhage from puncture of spleen. *It is customary for kabirajes, under certain circumstances, to plunge iron needles into the spleen, when enlarged.* This case was an unfortunate selection, as the organ was soft and vascular."

Case LII.—Dakka, 14th November 1880 ; Hindu female, 45, said to have died of wounds. A wound between scapulæ, six inches long, one broad, one deep. A second wound between tenth and eleventh ribs on left side, six inches long, 1½ broad, penetrating abdominal cavity. Peritoneum contained 4 or 5 coagula ; stomach protruded through wound, contained half-digested rice and *dâl*. Spleen escaped through wound, completely divided in two parts transversely.

Case LIII.—Backàrganj, 6th May 1885 ; Hindu female, 25, said to have been killed by a spear. A punctured wound, 2¼ inches long by half an inch broad, behind left side of chest. It divided all superficial structures, and ninth rib, near its angle. The wound had penetrated and nearly divided the spleen, and penetrated the stomach at its cardiac end, making a wound 1½ inches long by half an inch broad. Pleural and abdominal cavities both contained quantities of effused blood.

Case LIV.—24-Parganas, 10th June 1887; Hindu male, 40, said to have been murdered. An incised wound four inches long, beginning 1½ inches below inferior angle of left scapula, passing downwards and inwards, penetrating left thoracic cavity, and cutting lower border of tenth rib, lower border of left lungs, diaphragm and spleen. Left pleura contained 8 oz. fluid blood and some clot ; peritoneum contained a small quantity of bloody fluid and some clot ; stomach contained a few particles of half digested rice ; spleen, an oblique wound, two inches long, cutting through capsule, and one inch deep into organ, about two inches from inferior border.

Case LV.—24-Parganas, 27th October 1895 ; Hindu male, 30, said to have been shot. Two bullet wounds on left loin, ¼ inch apart, and one on left nates, one the size of an eight-anna piece, the other two the size of four-anna pieces, margins lacerated and blackened, all three wounds penetrated abdominal cavity, tenth and twelfth left ribs fractured. Peritoneum contained three pints fluid and clotted blood ; stomach healthy, contained about 3 oz. half-digested rice and *dâl ;* spleen ruptured, no other viscus injured.

Liver.—Rupture of the liver is usually the result of extreme violence accidentally applied. Of 33 cases Dr. Coull Mackenzie found the *cause* to be :—14 cases by being knocked down by runaway horses in or outside carriages and by bullock carts ; 8 resulted from falls into the holds of ships and boats ; 2 resulted from falls on piles of bricks ; 1 was a man knocked down while helping to remove a boiler—the boiler rolled on his back and crushed him to death ; 1 was that of a man

struck by a tub full of salt, which was being removed from a ship's hold; 1 a porter, who, while carrying a heavy box on his head, slipped and fell on his back with the box on the front of his chest and abdomen; 1 was a man, who, while working on board a ship, was struck by a sling containing three 2-maund bags of *dab;* 1, a drunken man, fell heavily on a hard metal rod; 1, a sais kicked over the abdomen by a horse he was grooming; 1, a lad in a fishing boat which collided with a pontoon of the Hughli Bridge, was precipitated into the river, and either was driven by the current against the pontoon, or its mooring chains a few yards below; 1 was a man struck by the handle of a winch in motion.

The right lobe is most frequently ruptured, and in only 2·9 per cent. were the injured persons found to have diseased organs.

There is reason to suppose that in very exceptional cases recovery may take place after a slight rupture of this viscus and also that in very exceptional cases, rupture of the liver may occur during life, without application of external violence. Non-accidental rupture of the liver may be caused without a weapon. Harvey, for example, mentions a case where it was ruptured by a kick, and two others in which the rupture was caused by kneading with the knees and elbows, or "*kíl kaní*" (see above).

Rupture of the liver may occur from violence inflicted during life without any external marks of injury being left. In about one-fifth of the Bengal cases no external marks of injury were present.

Considerable power of locomotion may remain after receipt of the injury. Taylor remarks, that unless the large veins at the back of the liver are injured, bleeding from a ruptured liver may occur only slowly, and the patient survive some time; but thereafter die rapidly from sudden copious effusion of blood, caused by muscular exertion, or fresh violence. The same author mentions one case of survival for eight days, and two of survival for ten days, after rupture of the liver.

In 34 fatal cases reported by Dr. Mackenzie in 6, or 17·6 per cent., death was reported to have occurred instantaneously, in 11, or 32·3 per cent., within an hour, in 4, or 11·7 per cent., in from one to two hours, in 1, or 2·9 per cent., from two to three hours, in 4, or 11·7 per cent., in three to seven hours, in 1, or 2·9 per cent., in three days, and in 7, or 20·5 per cent., the time was not mentioned by the police authorities.

Case LVI.—**Homicidal rupture of liver.**—In 1880 a drunken native in an altercation pushed another, Suk Chand Karmokar, who fell heavily to the ground and died "very shortly after." *Post-mortem* examination showed no marks of injury on abdomen or thorax, but a rent in right lobe of liver five inches long. Liver was hard and not enlarged. Prisoner was tried for culpable homicide not amounting to murder. Dr. Coull Mackenzie.—*Ind. Med. Gaz.*, 1889, p. 299.

The gall bladder may be ruptured by violence, as in a case mentioned by Harvey, in which the subject was a boy *æt.* five, who had been strangled, and in which the rupture was probably caused by pressure with the knees. Ogston, however, remarks that "ruptures of the gall bladder proper have usually been the result of emetics given to ensure the expulsion of gall stones."

Intestines.—*Rupture* of the intestines is usually fatal, the cause of death being commonly peritonitis, the result of extravasation of their contents. Rupture may occur solely from disease, or from violence acting on a diseased portion of the intestine, or solely from violence. Hence, when this injury is found, careful examination of the ruptured portion for signs of disease, *e.g.*, ulceration or softening, is of special importance.

The position of the rupture was the upper jejunum in four cases, the lower in two, the middle in one, the ileum and the sigmoid flexure in one, in Dr. Mackenzie's cases.

Rupture even of a healthy portion of the intestines may occur from a comparatively slight amount of violence. The violence causing the rupture may leave no external marks. Out of twenty-five Bengal cases, in twelve, external marks were absent ; but in five of these, on dissection, signs of bruising were found in the subcutaneous tissues. Rupture of the intestines may be the result of accidental or non-accidental violence, seven of Harvey's cases apparently were accidental. Ten out of Mackenzie's eleven were accidental, due to horse-kicks, blows or crushing. When non-accidental, the injury is often the result of a blow without a weapon. Usually, after the receipt of the injury, the sufferer is capable of considerable muscular exertion. (*For injuries to the Rectum*, see p. 151.)

In Dr. Mackenzie's fatal cases, 1 died in 7 hours, 1 in 12 hours, 2 in 24, 1 in 29, 2 in 30, 1 in 58 hours, 1 in 3 days and 1 each in 5 and 8 days. The cause of death was peritonitis in 9 out of the 11 cases and shock in the 2 others.

Case LVII.—**Rupture of Intestine.**—In 1883, Newal Kissori Chaube in a dispute with a Chinese shoemaker Aghain in Calcutta about the price of shoes, in which the Chinaman struck Newal with a bamboo and another Chinaman kicked him in the abdomen. The injured man refused to stay in a hospital and went to his house, where he died about five days after the assault. The *Post-mortem* examination showed the organs generally to be healthy, but there was a circular rupture of the size of a three-penny piece in the lower third of the jejunum, around which lymph was extravasated. The abdomen contained 72 ounces of fæcal smelling

brown fluid and there was acute peritonitis. Death was reported due to peritonitis following rupture of intestine. The two Chinamen were tried on two counts—culpable homicide not amounting to murder, and doing a rash and negligent act, but were acquitted by the jury on both charges.—Dr. C. Mackenzie, *Ind. Med. Gaz.*, 1890, p. 70.

Case LVIII.—**Gunshot blow of Intestine without wound.**—Dr. A. Powell reports a case of an officer struck at Sanna's Post in 1900, on the anterior abdominal wall by what he thought was a Mauser bullet. There was only slight bruising and abrasion of skin. A few days later obstruction set in. Abdomen opened showed several inches of the gut gangrenous.

Stomach.—This viscus is liable to *rupture* from disease. Cases also are recorded of rupture from over-distension and violent ineffectual efforts to vomit, and of spontaneous rupture without any very apparent cause. Taylor mentions a case in which rupture both of the stomach and the spleen occurred from a fall of about twenty feet, and in which no bruises or other external signs of injury were present. In one of Harvey's cases, also, although there was a fracture of the skull, and bruises on various parts of the body, the result of *láthi* blows, no external sign of injury could be found over the region of the stomach, although this viscus was ruptured. It is possible, therefore, that rupture of the stomach from accidental or non-accidental violence may occur, and no external signs of injury be present.

Pancreas.—Injury to this viscus from external violence is very rare. McLeod and Harvey, however, each mention a case; in the first the viscus was ruptured but no external marks of injury were present; in the second the viscus was "injured," and contusions, not visible externally, were present on both sides of the spine. In both, the injury appears to have been caused by kicks or trampling with the feet.

Kidneys.—Rupture of the kidney solely from disease is extremely rare. Disease or abnormal formation of this viscus may, however, conduce to rupture from violence. Rupture of the kidney usually occurs only from great violence, and hence is often accompanied by other lesions. Notwithstanding this, in nearly one-half of the cases, signs of external violence over the region of the kidneys were absent. In sixteen of Harvey's cases, the nature of the violence causing the rupture was stated. This was in eight, blows from blunt weapons; in two, kicks; in one, trampling; and five resulted from falls from a height. Two accidental cases are reported by Dr. Mackenzie (*Ind. Med. Gaz.*, 1890, p. 205). One, a man, lived 38 hours and died of shock, the other, a girl, died within half an hour, of hæmorrhage. Taylor mentions a case in which a man walked

some distance after an accident whereby one kidney was torn completely across, death occurring suddenly, within six hours after receipt of the injury.

Bladder.—In rare cases, **rupture** of the bladder occurs solely from disease, either of the bladder itself or disease, *e.g.*, paralysis or stricture, leading to over-distension. In the great majority of cases, however, the cause of the rupture is violence applied directly to the region of the distended organ. Often in cases of rupture from violence, no external marks of injury are to be found. The injury is usually fatal, either from shock, or peritonitis due to extravasation of urine ; recovery, however, sometimes takes place. The violence leading to the rupture may be accidental, *e.g.*, a fall from a height, or a fall on some projecting object or a crush, or non-accidental, *e.g.*, a kick in the pubic region. In females, rupture of the bladder sometimes occurs from pressure of the child's head during delivery.

Uterus.—Rupture of the unimpregnated uterus is only likely to occur from very great violence. Rupture of the pregnant uterus may occur independently of violence, as an accident during delivery, and, in rare cases, may be partial only, affecting the peritoneal coat and muscular tissue, but not extending into the cavity. Rupture of the pregnant uterus may occur from external violence without any external marks of injury being present. The uterus often apparently escapes injury, even when great violence is applied to the abdominal wall in attempts to cause miscarriage (see *cases* '*Abortion*'). Harvey, however, mentions a case, in which extensive bruising —not rupture—of the uterus caused in this way, resulted in death ; in this case also, no external marks of violence were present. The uterus may be wounded per vaginam, in an attempt to cause miscarriage. Injury to the uterus per vaginam also sometimes results from thrusting sticks, &c., into the vagina **after rape**, or in revenge for infidelity. Rupture of an ovary, or fallopian tube, may be found : this, it must be remembered, may occur as a result of ovarian or tubal pregnancy, and hence blood-clots, &c., found in the abdominal cavity should in such cases be carefully searched for an embryo.

Large abdominal blood-vessels —Harvey mentions three cases of rupture of the inferior vena cava from external violence. In one—caused by the sufferer being jammed between two boats—bruising of the mesentery was the only other serious injury present. In another—the result of a fall from a high tree—the skull was also fractured ; and in the third, the liver was ruptured. The same author also mentions a case of probable rupture of the splenic vein.

External Genitals.—(a) **The male genitals.**—Severe contusions may cause death, or severe compression of the testicles may prove fatal from shock (see *Case* LIX*b*).

Case LIX (*a*).—A 'playful' kick on a boy's perineum is reported by Dr. A. Powell to have caused death by rupture of urethra with extravasation of urine.

(*b*).—**Compression of testes.**—Moobrack was capitally sentenced in the Konkan (Bombay Presidency) in 1845, for having murdered a man with whose wife he had an intrigue, by seizing him by the testicles, which he wrenched in the most violent manner. It was shown that the deceased was a man in rude health, that he was not suffering from any disease, and that after the violence described "his testicles (scrotum) were swollen to the size of a cocoa-nut."—Chevers' *Med. Jur.*, 479.

Seizing by the testicles is a common method of assault in India, and Chevers mentions a case in which a man dragged another along in this way with such violence "that the whole preputial integument was torn away." Incised wounds may be attended with severe and even fatal hæmorrhage, or by extravasation of urine, ultimately terminating fatally. Incised wounds, amputation of the penis, even removing the whole of the external genitals, are sometimes **self-inflicted**; generally, however, in such cases the individual is insane, but individuals apparently perfectly sane, may mutilate themselves by cutting off a portion of the penis. In India, removal of the male genital organs used formerly to be largely practised, in order to manufacture eunuchs for immoral purposes. Young boys were generally selected, and a clean sweep made of the whole of the organs. Chevers, on the authority of Dr. Ebden, appears to consider that, in 1870, this practice still existed extensively in the Rajputana States, and Harvey (1870-72) mentions the case of "a Chamar boy, aged eight, at Banisal, whose genitals were completely cut away, probably to fit him for the duties of a eunuch." Cases of this kind excluded, incised wounds of the male genitals inflicted by another, indicate, as a rule, a sexual motive. Occasionally, the person inflicting the injury is a female, as in a case cited by Harvey, of a woman at Kachar, who "seized a weapon and inflicted a deep and severe wound on the penis of her father-in-law, who wished to take liberties with her." He also mentions an exceptional case, in which a eunuch possessed of a penis, had it shaved off by some of his fellow-eunuchs, apparently from motives of jealousy.

(*b*) **The female genitals.**—Incised, or even contused, wounds of these may prove fatal from loss of blood. Some years ago, several cases occurred in Scotland of murder by

wounding the female genitals. In one of these, death occurred in ten minutes ; and in another, a wound of the labium three-quarters of an inch long and three inches deep, proved rapidly fatal from loss of blood. A kick on the vulva—like a blow on the head—may cause an apparently incised wound, and prove fatal from hæmorrhage (see *Case LX*).

Case LX.—**Death from a kick on the vulva.**—A woman, *aet.* thirty-six, while in a stooping posture, was kicked by her husband in the lower part of the abdomen, and died in about an hour from loss of blood. There was no injury to the vagina or uterus. There was a wound about 1 inch long and ½ inch deep, situated at the edge of the vulva, extending from the pubes along the ramus. The left crus clitoridis was crushed throughout its length, and from this the fatal hæmorrhage had taken place.—Taylor, *Med. Jur.*, I., 678.

Fatal hæmorrhage may, however, occur without external violence, from spontaneous rupture of a large vein in one of the labia, as in a case referred to by Ogston.[1] Wounds of the female genitals are sometimes the result of an accidental fall on some projecting sharp or pointed object. In India, cases of injury by thrusting a stick into the vagina are not uncommon. Harvey states that twenty-five such cases, ten of them fatal, were included in the Bengal, &c., returns for 1870-72. Sometimes such injuries are inflicted after rape has been committed. Similar injuries are sometimes produced in attempts to procure abortion.

Rectum.—Thrusting a stick or other similar object into the anus is a mode of torture or murder, occasionally resorted to in India, and the threat to do this is a very common form of abuse. Injuries produced in this way may cause death. Fifteen cases—eleven of them fatal—of the infliction of this form of violence were included in the three years' returns for Bengal, &c., reported on by Harvey. Very often other injuries accompany this form of violence. An individual, for example, is attacked and violently beaten by several others, and finally thrown down and subjected to it. In the majority of such assaults, the victim is a male, and the motive leading to the infliction of the injuries appears to be most commonly punishment for adultery or theft. Possibly, also, in some cases, the injury is connected with sodomy, in the same way as similar injuries to the vagina are sometimes connected with rape. Chevers mentions a case, in which several children, of about eight or nine years old, threw down a boy, one of their number, and killed him by thrusting a small stick into his rectum, and Harvey mentions a similar case,

[1] *Lect. Med. Jur.*, p. 486.

said to have been accidental. But it is to be remembered that dilatation of the rectum, and protrusion of the gut, is a common effect of putrefaction, and hence that such a condition does not necessarily indicate the infliction of this form of injury. Injuries to the rectum and anus are sometimes the result of an act of sodomy (see *Evidence of Sodomy*).

Extremities.—Injuries to the extremities vary greatly in gravity, according to their situation and extent. Death may result if a large vessel is wounded, directly from loss of blood, or, if the injury is severe, from shock ; and slight injuries may contribute to the production of fatal shock in cases where this results from numerous slight injuries. Again, injuries to the extremities may prove indirectly fatal from inflammation and exhaustion, or from supervention of disease ; or, if the large vessels or nerves are divided, may necessitate amputation, followed by similar consequences. Injuries to the extremities necessitating amputation, or permanently impairing their power, of course amount to grievous hurt. Obviously, injuries to the extremities may be **accidental**, or **self-inflicted**. No further remarks are called for here in regard to these. As regards injuries **inflicted by another,** it may be pointed out that very severe injuries of the extremities may be produced without a weapon. Violent twisting of a limb, for example, may cause dislocation of a joint. Again, comparatively slight injuries to the extremities, especially when caused by ropes or cords, may indicate the infliction of very severe **torture**. The nature of the torture thus indicated may be : torture by compression, as when the fingers are tied together and wedges driven in between them, or torture by binding the body or limbs in a constrained position, or torture by suspension. Harvey mentions a case which shows that suspension head downwards may cause death from congestion of the brain. Cases in which the right hand is completely severed from the body are tolerably often met with in India. This, especially if accompanied by mutilating wounds of the ears or nose, usually indicates punishment for adultery or for theft, as the motive leading to the infliction of the injury.

QUESTIONS IN WOUND CASES.

CAUSATION.

IS IT ACCIDENTAL, SELF-INFLICTED (INCLUDING SUICIDAL) OR INFLICTED BY ANOTHER (HOMICIDAL)?

The importance of this question is obvious. In considering it, it is desirable to bear in mind that in India severe, even mortal, injuries are sometimes inflicted on an individual with

his consent, by another or others, for the purpose of supporting a false charge.

Case LXI.—**Wounds inflicted by consent in support of false charges.** (*a*) Chevers (*Med. Jur.*, p. 358) states on the authority of Mr. Perceval that at one time two or three gangs existed in Bombay who cut and wounded each other for the purposes of extortion. "They used to cut one another's necks and arms by turns as the lot fell, and accuse some rich passer-by of having done it. . . . It fell to the lot of a youthful member of one of these gangs to have his neck cut. The person appointed to cut him was a drunken barber, who, instead of making a slight cut, inflicted a mortal wound. The gang fled, abandoning the youth, whose dying confession led to their arrest."

(*b*) In a case tried before the High Court, Bombay (the Ahmedabad Conspiracy Case), the evidence went to show that certain individuals, A B and others, wishing to injure C D and others, proceeded as follows :—They hired two men to wound a third, E, instructing E, after receiving the injury, to first of all accuse them (A B and others) of the assault, and then to make a pretended confession that this was a false charge brought at the instigation of C D and others. This programme was carried out, E very nearly dying, owing to the severity of the wounds inflicted on him, and C D and others were convicted of instigating E to bring a false charge against A B and others. After C D and others had suffered a considerable portion of their sentence of imprisonment the truth was discovered. A and B having brought a civil action for damages for malicious prosecution against C D and others, who were then in gaol, it appeared on the civil trial that A B and others had been instigated by an individual who had kept himself in the back-ground, but was the real mover in the whole plot. A and B having succeeded in convicting C and D, had caused an attorney's letter to be written to this individual demanding payment of the promised reward ! And it was principally by proof of this fact that the real truth came out.

Case LXII.—**Murder in support of a false charge.**—*Reg.* v. *Muhammad Amanji and Husan Amanji* (Bo. H. C. Rep., vol. viii, 1871, p. 110).—A summary of the main facts in this case and two others connected with it (*Reg.* v. *Muhammad Valli*) and (*Reg.* v. *Alibhai Mitha*) is as follows :—It appeared that two factions existed in the village of Karmar in the Broach Collectorate—A and B. Alibhai Mitha and Muhammad Amanji were members of faction A, and Muhammad Valli was a member of faction B. The two factions had a scuffle, in which one of the members of faction B got a blow on the head, and was taken into Broach. On this, faction A held a consultation, at which it was determined to break or bruise the head of one of their own party (Alibhai Mitha's old mother), and take her into Broach as a sort of make-weight against the broken head on the side of faction B. This was done apparently with the consent of the sufferer, and a false charge laid against faction B. While Alibhai's mother was in hospital, Alibhai's faction (faction A) held another consultation, the result of which was that they determined to poison Alibhai's mother in order to have a death on their side instead of simply a broken head. Accordingly they put arsenic into some food, gave it to the old woman, who thereupon was attacked by violent vomiting, which it was stated brought on rupture of the spleen, from which she died On this, Muhammad Valli (a member of faction B) brought his sister out of his father's house and killed her by striking her on the head with an axe. She was heard just before she

was struck to say, "Why do you kill me for other people?" Muhammad Valli then dashed his own head violently against a wall—all this appears to have taken place in presence of the girl's father and other witnesses—and a false charge of murder and assault was then laid against faction A. Next Muhammad Amanji, a member of faction A, expressed his intention of killing himself as a set-off against the girl's death. On this his old mother begged that she might be killed instead. Thereupon Muhammad Amanji and his mother went into the back-yard of their house, and shortly afterwards the former rushed out, with a wound on his chest, calling for the police *patel* to come and take the deposition of his wounded mother. This was done, and the mother taken into Broach to the hospital There her wounds were considered slight, and fifteen days after her admission she was discharged, and went back, to her village. About six days afterwards her corpse was brought back to hospital. The civil surgeon certified that "these wounds did not bring about the death of this woman; she died of old age." This, however, the Court appeared to doubt. In giving judgment, Gibbs, J., remarked: "The evidence shows . . . that there are two factions in this village, and that murders have been committed on each side—not, as would be naturally expected, by members of one faction on a member of the other, but by members of one faction on a helpless female of their own, so as to throw either the guilt of blood or the blame of the crime on the other party. Such a state of things is hardly credible, but this is an instance of truth being stranger than fiction."

The chief points bearing on this question are:—1. The character and position of the injury. 2. The direction of the wound. 3. The number of wounds or injuries. 4. The position and surroundings of the injured individual.

1. CHARACTER AND POSITION OF THE WOUND OR INJURY.

In many cases, these characters afford no indication as to how, or by whom, the injury was inflicted. A presumption more or less strong, however, arises:

Against Self-infliction and in favour of Homicide or Accident, in the case of stabs passing right through the body, and cut throat extending to the vertebræ, these being rarely self-inflicted wounds.

Case LXIII. **Suicidal cut throat, wounding vertebra.** (*a*) Dr. A. Powell relates a case of a European who committed suicide with a razor and hacked the vertebra without wounding the carotids. He did this by throwing his head back during the operation. In this position the carotids are on a plane posterior to the anterior surface of the vertebra.

(*b*) A Hindu male, aged 35 years, committed suicide in the court lock-up, Bankipore, on 17th July 1897, by cutting his throat with a knife. His body was examined the same day. Marks of injuries; a *transverse* incised wound in front of the neck, about five inches long and four inches broad, reaching down to the spine; the trachea was divided just below the cricoid cartilage; the œsophagus and the right carotid artery were cut through. The divided portions of the trachea were much retracted. Purno C. Singh, *Ind. Med. Gaz.*, 1902, p. 236.

SELF-INFLICTED WOUNDS, FEIGNING ATTEMPTED HOMICIDAL (on left upper arm).

See Case LXIV, Page 155.

(*c*) Taylor, *Med. Jur.*, i., pp. 512 and 513, mentions two suicidal cut throat cases, in which the spine was wounded. In the first (Ryan's case) there were three cuts on the spine, but the large vessels of the neck were unwounded. In the second (Marc's case), respecting which Taylor remarks that a wound so extensive is rarely seen in a case of suicide, the large vessels were wounded, the windpipe and gullet cut through, and the spine grazed.

So also stabs, and incised wounds on the back, and gunshot wounds, unaccompanied by any blackening of the skin or scorching of the clothes, are only likely to be self-inflicted if some special contrivance has been used to fix, or in the case of a gunshot wound to fix and discharge from a distance, the weapon employed. Several *contused* wounds are only likely to be self-inflicted if the person is insane, or the case is one of suicide by precipitation from a height.

In favour of Self-infliction.—In the case of incised wounds, if these are all *slight*, or if severe they tail off at one end into a superficial scratch, and are in the accessible position on the left side in the case of a right-handed individual (see *Plate VI*), the presumption is in favour of self-infliction. In suicidal cases, in about four-fifths of the cases the head is chosen for injury.

Case LXIV.—**Self-inflicted wounds feigning homicidal.** *The Lansdowne Road Mystery.* Flora McLeod (see *Pltae VI*) was nurse to a European family in Calcutta in 1901. She had the baby of the family in her charge, and one night it was found dead. The nurse ran out into the verandah and alleged that a native had come into her room at midnight and stolen her jewellery, had knocked her down in the bathroom and stabbed her repeatedly and killed the child. The stabs, 14 in number, were skin deep and evidently self-inflicted. The scratches were all on the left upper arm. All were distinct scratches, and considering their length compared with the circumference of the arm, could not have been inflicted by stabbing thrusts with a dagger or knife. The police believed she produced them with the point of a pair of scissors. They were in a position where she could conveniently produce them with her right hand. The police surgeon gave it as his opinion that they were self-inflicted. The child was 16 months old and was reported to have died of suffocation. It transpired that proceedings for a divorce were being taken against accused by her husband. No trace of the alleged burglar was found.

Case LXV.—**Wounds self-inflicted in support of false charge** (*a*) "In 1853 three native women and two children were found lying dead in a heap with their throats cut in their bungalow at Betul. The husband of one of the females gave the alarm, stating that the crime had been committed by dacoits (gang-robbers), who had also wounded and bound him! It, however, soon became evident that this man was the murderer." . . . His wounds were very slight, the chief one being on the thigh, about "three inches long, and in no part penetrating completely through the true skin;" the others were shallow scratches exactly parallel to the first, and the amount of blood on his clothes and body was much greater than could have flowed from his wounds.

Chevers, *Med. Jur.*, p. 357. (*b*) "A Mussulmani at Dehra Ismail Khan, examined by Surgeon G. P. Mackenzie, in September 1872, had a slight cut scarcely skin deep, and two or three smaller scratches on throat. She accused her husband of attempting to murder her. The injuries were pronounced to be very trifling, and probably self-inflicted. She was convicted of bringing a false charge, and sentenced to six months' imprisonment.—Harvey's *Beng. Med. Leg. Rep.*, p. 117.

In favour of infliction by another person, in cases where severe incised wounds are accompanied by cuts on the hands of the injured individual, and in female subjects—if the circumstances exclude accident—in cases of wounds of the **genitals** or castration, or mutilating wounds of the nose, ears or breasts. In India, wounds in females in the situations just mentioned, indicate jealousy, or punishment for adultery as the motive for their infliction ; and wounds of the genitals in male subjects often also indicate the existence of the last-mentioned motive or religious monomania—as melancholics sometimes make a clean sweep of penis, scrotum and testes. Blows or cuts on the head inflicted by a right-handed person are usually on the left side of the victim, if on front.

In favour of accident—the location of the wound on an exposed part of the body and on one side only.

2. DIRECTION OF THE WOUND.

It may first be noted that while a non-self-inflicted wound may have any direction, a self-inflicted wound usually has a particular direction, dependent on the part wounded, and the hand employed. Hence it is important, where possible, to ascertain whether the injured individual is, or was, right or left-handed, or ambidextrous. Next, an endeavour should be made to **determine the beginning and ending** of the wound ; this, of course, presents no difficulty in the case of punctured and non-traversing gunshot wounds. **In traversing gunshot wounds**, the beginning and ending of the wound are indicated by respectively the orifice of **entry** and the orifice of **exit**. It however by no means follows that the direction of such a wound is represented by a straight line drawn from one orifice to the other. For example, a projectile may be deflected by a bone or by tough fascia, and take a circuitous course, *e.g.*, may be deflected by a rib, and pass half round the body without penetrating the chest, or pass half round the head without penetrating the skull.

Dr. A. Powell cites a case in a sergeant of the 8th Mounted Infantry in the Boer War hit by a Mauser bullet close to the spine. The entrance wound was linear. The bullet travelled right round the ribs and was removed from below the skin close to the sternum between the third

and fourth costal cartilage. Had it come out of itself the exit would doubtless have been much smaller than the entrance wound.

In the case of **incised wounds** made by a drawing-cut, if one end is abrupt, deep, and unbifurcated, and the other shallow, and **tailing off**, or bifurcated, the probabilities are that the former is the beginning, and the latter the ending of the wound. In deep incised wounds, the plane of the wound must be noted (see *Cases LXIII & LXX*).

Self-inflicted incised wounds, as a rule, (1) end on the same side as the hand employed, and (2) begin from below if on the lower part, or from above if on the upper part of the body. **Self-inflicted incised wounds of the throat**, as a rule, possess the first of these characters, but may or may not possess the second, *i.e.*, they may be transverse, or run from above down,[1] or from below up. Self-inflicted stabs and gunshot wounds (in right-handed persons) run, as a rule, from right to left.

Homicidal wounds may have any direction, and are specially liable to have the same direction as self-inflicted wounds if the assailant was standing behind his victim, at the time of inflicting the injury (see *Case LXX*). Frequently in homicidal wounds, the direction of the wound indicates the relative position of the assailant and victim ; it must be recollected, however, that the direction of the cutting edge of some weapons is transverse to the line of the handle. This is the case in the carpenter's adze, and the mattock (*gainti*) or spade-hoe (*phaora or kudali*) commonly employed by cultivators in India.

3. NUMBER OF WOUNDS OR INJURIES.

A single wound or injury may be the result of accident, self-inflicted, or inflicted by another. When many wounds are present, self-infliction and accident are, to a certain extent, contra-indicated. **Multiple wounds** may, however, be ;

(1) Self-inflicted. Several incised wounds, all slight, are sometimes self-inflicted, with the object of averting suspicion (see *Case LXIV*); or of supporting a false charge (see *Case LXV*). In suicidal cases also, *e.g.*, cut-throat, one severe incised wound is sometimes found accompanied by other slight cuts. More

[1] K. McLeod, from the cases reported in Bengal in 1869, considers that suicidal wounds of the throat are generally high up on the neck, between the hyoid and thyroid, more on the right than on the left side, and are either transverse or incline from below upwards.—*Beng. Med. Leg. Rep.*, 1869, p. 57. Casper, however, while admitting the difficulty of ascertaining the commencement and end of wounds, states : " In suicidal wounds of the throat the wound certainly usually runs from left to right and from above downwards."—ii, p. 13.

than one severe incised wound may, of course, be self-inflicted, but the greater the number, the stronger the indication in favour of homicide. **Several contused wounds** are only likely to have been self-inflicted in the case of insanes, or in cases of suicide by precipitation from a height. Suicide by precipitation excluded, **self-infliction is contra-indicated**, if each of two or more wounds is of such nature as to cause immediate insensibility, or immediate death. Very severe wounds, however, may not cause immediate death, or immediate insensibility, and hence the existence of two such wounds may still be consistent with self-infliction ; *e.g.*, Hayes Agnew concludes from recorded cases that it is possible for a suicide to shoot himself "first in the head, and within the lapse of a minute inflict a similar wound on the heart," or *vice versa*.[1] Very great caution, therefore, must be exercised in drawing a positive inference against self-infliction, simply from the fact that more than one severe wound is present on the body.

(2.) **The result of accident**, *e.g.*, a fall from a height, an accident from machinery, &c. In such a case, however, homicidal violence is not contra-indicated, unless all the injuries are to be accounted for by the supposed accident. Thus when the accident indicated is a fall from a height, and there are no projecting objects against which the body could have struck during its descent, severe injuries on both sides of the head contra-indicate accident (see *Case LXVI*).

4. POSITION AND SURROUNDINGS OF INJURED INDIVIDUAL.

Under this head should be noted—

(1.) **The position and attitude of the body and its relation to surrounding fixed or large objects.**—This may directly indicate self-infliction or accident, as, for example, when the body is found at the foot of some high object, from the top of which it may have fallen. It must be borne in mind, however, that an attempt is sometimes made to conceal murder, by placing the body of the victim in such a position as to point to accident or self-infliction as the cause of the injuries. With this object the body (as in *Case LXVI*) may be placed at the foot of a high tree, or on a railway line, &c.

Case LXVI.—**Attempt to conceal homicide by fabricating evidence of accident.**—The body of a man was found at the foot of a mango tree, with a bundle of mangoes tied round the neck. On the body was : (1) Around the lower part of the neck, extending from right side of trachea to posterior edge of left sternomastoid muscle, a brown mark, as if from pressure of a cloth or large cord. (2) Abrasions

[1] *Annals of Surgery*, vol. vi, p. 152.

and scratches with dust adhering, on right front of chest and anterior and outer aspect of right arm. (3) On right side of face and neck several bruises elongated in shape. (4) Bruises and abrasion over right parietal protuberance. Blood in large quantity extravasated under scalp. All right half of the skull broken into fragments, fissures radiate in all directions, all the fragments irregular in shape, and lying loose on the brain. An opinion was given that the injuries were caused by blows from a weapon, not by a fall from a tree. Subsequently one of the accused confessed that he, deceased, and several others, had been stealing mangoes, when a dispute arose as to the division of the plunder, and some one knocked deceased down with a lathi. The body was then conveyed some distance (probably dragged along the ground) and placed under the tree, so that it might appear that a fall therefrom was the cause of death. (Asst.-Surg. Duncan, in McLeod's *Beng. Med. Leg. Rep.*, p. 31).

In such cases discrepancies between the nature and situation of the injuries, and the method of production indicated by the position of the body, point indirectly to the employment of homicidal violence. In other cases also indirect indications of the employment of homicidal violence may be afforded by the position and attitude of the body. This is so when the injuries present are of such a nature as to make it improbable that the position and attitude in which the body was found resulted from effort on the part of the injured individual. For example, the body may be found at a distance from the place of infliction of the injury, or in an attitude widely differing from that in which it must have been in, directly after its receipt, *e.g.*, the cause of death being fracture of the skull from a blow on the back of the head, the body is found in an upright position, supported against a high thick hedge at its back. The possibility, however, even when the injuries are extremely severe, of considerable effort on the part of the injured individual must not be overlooked. It has already been pointed out that a certain amount of power of voluntary movement may still be retained after receipt of very severe wounds, and it now may be pointed out that very considerable power of locomotion may remain, even after the receipt of almost immediately mortal injuries.

Case LXVII.—**Locomotion after mortal injuries.** (*a*) Dr. A. Powell relates a recent case, in which a boy of 18 ran at least 120 yards from where he was mortally shot through the heart. *Post-mortem* examination showed that a buckshot had pierced the anterior wall of left ventricle and lodged in the interventricular septum. (*b*) He also gives a case of a man who was stabbed by a pitchfork and was driven three miles and lived in hospital for four hours before he died. The *post-mortem* examination showed left auricle to have been penetrated.

(*c*) An old man was severely beaten with a split bamboo: after the beating he walked to his house, a distance of about half a mile, and died almost immediately. On *post-mortem* examination, the seventh and eighth ribs on each side were found fractured, the spleen ruptured and the right lobe of the liver all but divided transversely by a

bifurcated rupture 8 inches long and 1½ inches deep and broad.—*Ind. Med. Gaz.*, 1867, p. 200, Dr. Hutchinson.

(2.) **Condition of surface of the Body, or of the Clothes or other Coverings thereof.**—Important points to note under this head are: (*a*) Peculiarities of the clothes likely to have modified the injury received, or to affect the condition of the weapon used, *e.g.*, a thick turban may cause a severe blow from a blunt weapon to produce a simple, instead of a compound fracture of the skull; or fibres derived from an article of clothing worn over the injured part, may be found adhering to a weapon and thus indicate it to be the one which was used. (*b*) Stains of blood or other matters. It is possible that these by their nature or position may indicate homicidal violence, *e.g.*, stains of seminal fluid on the clothes or body of a female corpse, or a mark of a bloody right hand on the right hand or arm of injured person. Again, in the case of gunshot wounds, blackening of the skin at, or of the clothes worn over, the seat of the wound, by indicating nearness to the body of the weapon at the time of its discharge, is confirmatory evidence in favour of self-infliction; just as the absence of such marks by affording a contrary indication, is evidence of more or less weight against self-infliction. Stains of mud or dust on the surface of the body, with abrasions in certain situations on the skin, may indicate dragging of the body along the ground, and afford possibly, confirmatory evidence of homicidal violence. (*c*) Cuts or rents on the clothes. Want of correspondence in situation between cuts on the clothes, and wounds on the body, is often found when the wounds have been self-inflicted for the purpose of supporting a false charge, or averting suspicion.

(3.) **Nature, position and condition of objects on and near the SPOT where the body was found or the injury inflicted.**—The objects found may be weapons, sharp stones, articles of clothing, fragments of clothes, &c., and these or other objects may bear stains of blood. Again, near the body or place of injury may be found bullet-marks, footprints of persons other than the deceased, or marks indicating that a struggle has taken place. If **a weapon** is found **its position** is of importance. This may indicate self-infliction, as for example when the weapon used is found *tightly* grasped in the hand of the dead body as already instanced. A weapon, however, found *loosely* lying in the hand of a dead body, may have been placed there, with the view of fabricating evidence in favour of suicide (see *Case LXX*). The discovery of the weapon used, at a distance from the body, indicates homicide, in proportion to the improbability of its having been placed where it was found,

by the deceased. Here, obviously, the question of what power of effort or locomotion remained to the deceased after receipt of the injury, must be considered. As regards the nature and **condition of the weapon** found, it may be pointed out that peculiarities in its shape, &c., by their agreement with the shape of the wounds on the body, may indicate it to be the weapon which has been used, and this again may be confirmed by the weapon showing signs of recent use. Marks, again, indicating ownership, present on the weapon, may be important as evidence in favour of the guilt or innocence of the accused. The non-discovery of the weapon used, especially if the injuries are likely to have caused rapid death or insensibility, obviously points to homicide. As regards **sharp stones**, the presence or absence of these is of importance as indicating the possibility or otherwise of the injuries being caused by forcible accidental contact therewith. A compound fracture of the skull, for example, a common result of a blow with a blunt weapon, may be caused by a fall on a sharp stone, but is an exceptional result of a fall on a flat surface.[1] As regards **articles of clothing or fragments of clothes**, the presence of these near the body, or grasped in the hands of the deceased, may indicate that a struggle took place shortly before death, between the deceased and some other person, and thus indicate homicide. **Fragments of hair**, again, belonging or not belonging to the injured person, may be found in similar situations, or adhering to weapons, and may prove of much importance in evidence. **Stains of blood** may be found on a weapon indicating its recent use, or on other objects in the neighbourhood of the body or the spot where the injury was inflicted. Sometimes the appearance and position of such stains is important as indicating the circumstances under which the injury was inflicted (see *Case LXVIII*).

Case LXVIII.—**Circumstances under which wounds were inflicted inferred from position and form of blood spots.**—In the case of Spicer, a woman was killed by a fall down a stair, fracturing her skull and spine. A branch of the right temporal artery of the deceased was found divided, and on the wall at the top of the stair, on the right hand going up, several spots of blood were found, of the form and appearance of spots resulting from the spouting of a small artery. From the form and position of these spots, it was probable that deceased received a blow on the head while ascending the stair, and fell backwards to the bottom, the fall causing the injuries which resulted in her death.—(Taylor, *Med. Jur.*, i, p. 549).

Bullet-marks or shot-holes, by their situation, may indicate the position of the assailant at the time the weapon was

[1] *Beng. Med. Leg. Rep.*, p. 53.

discharged (see *Case LXIX*, *a* and *b*). The distance at which the shot was fired is usually related to the question of premeditation as it is manifest that a shot fired from a considerable distance could not have been fired in the heat of a sudden quarrel.

Case LXIX.—**Evidence from bullet marks.**—(*a*) Several shots were maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and struck against a wall on the other side of the church. A straight line from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained that the shots had been fired.—Taylor, *Med. Jur.*, i., p 689. (*b*) "Sir Astley Cooper called to see Mr. Blight, of Deptford, who had been mortally wounded by a pistol shot, inferred from an examination of the localities that the shot must have been fired by a left-handed man. The only left-handed man on the premises at the time was a Mr Patch, a particular friend of the deceased, who was not in the least suspected. This man was, however, subsequently tried and convicted of the crime, and made a full confession of his guilt before execution."—Woodman and Tidy, *Med. Jur.*, 1091.

As regards **footprints**, Ogston[1] remarks that the impression left by the naked foot varies in the same individual according as to whether he was standing, walking or running at the time.[2] Lastly, objects in the neighbourhood may be found overturned, broken, or showing marks of injury, pointing to a struggle having taken place.

As an illustration of the application of many of these points to a particular case, which in itself exhibits so many points of interest, the analysis of the case of the *Empress* v. *Sudhabode* by Surgeon-Major E. G. Russell, I.M.S., Police-Surgeon of Calcutta,[3] is worthy of record in considerable detail:—

Case LXX.—**Fabrication of Evidence of Suicide in Homicidal Cut-throat.—Imp. *v.* Sudhabode Bhattacharji.**—A native girl, aged 11 years, was found dead in her bed with her throat cut, and a blood-stained razor in her right hand. She and her husband had retired to their bedroom together at 10 P.M. on the 12th September (1888); the husband left the house at 4 A M on 13th; information of the girl's death was given to the police at about 1-30 P. M. on 13th; *post-mortem* examination was held at 7-30 A M. on 14th.

The body was identified by the police as that of Kristo Manini Debi, wife of Sudhabode Bhattacharji.

Post-mortem appearances.—Body of a native girl, aged about 11 years; immature, well-nourished, not decomposed; fat, not muscular.

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[1] '*Lect. on Med. Jur.*,' p. 63.

[2] Casts of footprints may be obtained by Hugolin's method, *viz.*, heat the ground by holding over it a pan of burning charcoal, then dust stearic acid into the foot-print, let this solidify, and from the mould thus obtained take a cast in plaster of Paris.

[3] *Ind. Med. Gaz.*, 1889, pp. 33, &c.

Rigor mortis universal and well marked. Face calm; eyes half open, pupils normal. Hair smooth and tied in a knot at upper back of head; no cut ends anywhere. The trunk was wrapped in a *chuddar* (cloth), the head, neck, and extremities bare. The *chuddar* was soaked with blood posteriorly and at the sides; posterior parts of body blood-stained. Except the wounds of throat (hereafter described) there were no marks of injury on any part of the body, either on skin surface or in the tissues beneath it. The sub-cutaneous tissues of every part were dissected into to ascertain this. No mark of disease having been held, tied, or otherwise restrained; no mark of compression of lips, nose, throat, &c. There was no sign of ecchymosis of lips or nostrils, nor were the former wounded or dented by the teeth; no mark of bloody fingers on any part of body or clothes.

The left arm lay by side of body; this hand was semi-clenched, *i.e.*, the two distal joints of each of the fingers and the distal joints of thumb were half-flexed; on this wrist was a shell bangle, unbroken; there was blood along the undermost portion of this arm, and on every part of the hand.

The right arm was flexed at the elbow; the hand rested on lower right chest; the lower arm was free of blood except on its inner and lower surface, where it lay in contact with the blood-stained clothes described; the right hand was covered with blood, irregularly, over every part, over palm and back, and between the fingers. The fingers of this (right) hand were not clenched; the proximal phalanges were straight, the middle and distal phalanges of fingers and the distal one of thumb semi-flexed—*i.e.*, in identically the same attitude, finger for finger, joint for joint, as those of the left hand.

In the right hand was a razor; its blade open, with edge upwards, towards the throat. The handle of razor was between the proximal phalanx of thumb and the palm of the hand above the root of fingers, none of which touched it; it was, therefore, not grasped; it was loose, could be (and was, by me) removed and replaced without altering the position of any part of the hand.

The handle of razor was covered with irregular smudged dry stains of blood; but no definite impressions of fingers, &c. There was much blood between the two plates forming the handle; the blade was covered with blood, its edge sharp, but turned and finely notched. (I could not find any particles of steel in the wounds of neck or spine. I could not wash the blood off, in order to determine whether the notches on edge were recent, as the razor had to be sent to Chemical Examiner for report as to the blood stains.) All the posterior parts of body were covered with blood, as if from lying in a pool of blood.

No blood had flowed (from the neck wound) down the front or sides of chest or trunk (*i.e.*, in direction from head to feet); the blood effused had all poured towards back of body. The clothes on sides of body were stained, as if from sopping up from behind.

There was a gaping wound of the throat, extending completely round its circumference except for 1¼ inch behind where alone the skin was unwounded. The upper margin of the wound measured 11½ inches, and was entire, not jagged or notched; it looked as if made by a single sweeping cut; its *right* extremity ended in a shallow tail 1½ inch long (the skin being the last part wounded); its *left* extremity was shallow for ⅔ (two-thirds) inch, aud then rapidly deepened.

About the lower part of middle of front of throat, two other incisions joined in to form the main wound; these commenced about one inch to left of middle of vertical line of the throat, lying over inner

end of left clavicle ; one was half an inch below the other ; they ran, with a depth of half an inch, for half an inch, and then disappeared in the great gaping wound. All these wounds appeared to have been inflicted in a direction from left to right. Except for these two lower incisions jagging it, the lower margin of the great wound is clean-cut and entire. The terminations of the upper margin are about 1½ inch higher than its middle part ; but the relative positions have been much altered by great retraction of the tissues ; the ends were on same level on each side. There was ecchymosed blood in tissues and muscles forming the margins of the wound.

All the structures of front and sides of neck have been severed, and the spine wounded in three places.

The muscles of front and side of neck had been divided, as had both common carotid arteries, both internal jugular veins, both pneumogastric and both phrenic nerves.

All these structures had only a single division on the right side—as on the left (important point—see later).

The trachea was completely divided between its 4th and 5th rings ; the 4th ring being cut through, obliquely upwards, at its posterior ends.

The œsophagus was divided on the front of body of the 5th cervical vertebra, and its right half cut by *two other* incisions below this.

The vertebral column had three wounds on it. An upper one, notching the lower front of body of 5th cervical vertebra ; one inch long, ⅛th inch deep at right side, shallow at centre. A lower one of same length and depth as the upper, on upper front of body of 6th cervical vertebra. A middle one, 1½ inch long, running from left side of central line of inter-vertebral substance between 5th and 6th cervical vertebra, and cutting its way out of right side, where it had a depth of one-third of an inch. All these three were horizontally transverse in direction ; their plane was slightly upwards. There was slight ecchymosis of the tissues on the spine at margins of these wounds.

On internal examination, all tissues and viscera were found exsanguine ;—drained of blood.

Lungs, healthy, crepitant, bloodless, pale.

Pericardium, healthy, empty.

Heart, healthy ; all cavities contracted and empty.

Stomach, healthy, empty.

Intestines, healthy. In upper small intestines—duodenum and upper jejunum—there was thick fluid, bile-tinged food which had recently undergone gastric digestion. The colon contained fæcal matter ; the rectum, formed fæces ; none extruded externally.

Liver, healthy, bloodless. *Spleen*, small, firm, bloodless.

Generative organs, healthy ; no sign of injury on any part ; not pregnant ; sexually immature ; intercourse appeared to have taken place at some period (vagina shallow, short, dilated, &c.).

Bladder, healthy, six ounces of pale, healthy, urine present.

Œsophagus, divided in one place, on body of 5th cervical vertebra ; its right half severed in two places below this ; corresponding to the wounds of the spine.

Pharynx, healthy, not injured.

Trachea, divided between 4th and 5th rings, the incision sloping upwards posteriorly and dividing obliquely the posterior ends of 4th ring.

Some bloody froth in trachea below the incision, and in the bronchi.

Larynx, healthy ; no sign of compression or injury.

Tongue, normal ; not swollen, or marked by teeth.

Brain, healthy, bloodless ; no injury or effusion.

Points worthy of Special Notice.

1. Absence of all signs of a struggle, such as cuts on hands, bruises, (either on, or beneath, skin), marks of ligature, compression of nose, or mouth : hair not disarranged or cut ; clothes not torn or cut.

2. Face calm, eyes half open.

3. Trachea divided between 4th and 5th rings (*i.e.*, near sternum), while the wounds of spine were 1½ inch or more higher up.

4. *Three* wounds of spine and of gullet, although tissues of right side of neck marked by *one* incision only like those on left side ; tracheal wound also single.

5. Plane of wound upwards ; direction transverse, crescent-shaped ; both ends equally high.

6. Stomach empty ; chyme in duodenum and upper jejunum.

7. *Rigor-mortis* well marked and universal ; both hands in identically same attitude as regards fingers, and firmly fixed so by *rigor mortis*.

8. Razor loose in right hand, not clasped or even touched by the fingers.

The case went before the Coroner's Court, and for some days (December 10th to 15th) occupied the High Court, Calcutta. In each court, the jury returned a unanimous verdict of guilty against the husband, who was sentenced to death.

While frankly and fully stating the points (see 1 above) which appeared to favour the theory of suicide, I expressed strongly the opinion that the wounds were homicidal, not suicidal ; that deceased was lying on her back during the whole time bleeding was going on, *i.e.*, at the time of infliction of the wounds and from then till death ; that the great incision dividing all the structures of the neck was first inflicted, the two lower incisions being subsequent ; that the wounds had been inflicted from left to right ; that the razor had never been fixed in a grasp of the hand by cadaveric spasm ; that digestion had ceased (by death) well within six hours of the last meal taken by deceased.

All the appearances when taken together seem to point to deceased having had the great and disabling incision of the throat inflicted, while she was lying on her back asleep, by some person standing behind the head of her bed ; the absence of cries and of signs of any struggle, the direction of flow of the whole of the effused blood ; the direction, shape, and upward plane of the wounds being on this theory completely accounted for.

The points involved may be conveniently divided into,—*those establishing homicide* (as against suicide), and *those tending to fix the crime on the prisoner.*

POINTS establishing HOMICIDE.

I. *Wounds—Points connected with.*

(*a*) Severity. (*b*) Order. (*c*) Direction. (*d*) Redundancy. (*e*) Plane. (*f*) Lowness on neck. (*g*) Regularity.

II. *The bleeding.*

(*a*) Direction.

(*b*) Nature of stains on right hand and arm and on clothes.

III. Razor in right hand—value of this fact.

IV. Death almost instantaneous.

V. Wounds were inflicted during life, and were the cause of death.

VI. Absence of cries and of signs of struggle.

Each of these points deserves separate consideration.

A.—Severity of the Wounds.

The head was nearly cut off; the great wound extended all round the neck except for 1½ inch behind; both common carotid arteries, both internal jugular veins, the pneumogastric and phrenic nerves on both sides, all the muscles of front and sides of the neck were divided, as were the trachea and œsophagus; the cervical spine was cut. In addition to this wound, there were two others, each reaching to and wounding the spine.

It will be shown (*b*), that the upper and great wound, which divided every structure of front and both sides of the neck, was probably the first inflicted. After infliction of such a wound, could deceased have inflicted two others, each penetrating to and wounding the spine, and each involving a distinct and determined act of volition? Taking the wounds in any other order, could a suicide have inflicted the two others after any one of them?

It is true that authorities on legal medicine have stated that severe and extensive wounds of the throat have been inflicted by suicides (Guy, 3rd Edn, p. 298). Taylor (3rd Edn., 1883, Vol. I, p. 513) also says "there is no ground for the assertion that extensive wounds of the throat are incompatible with self-destruction." This is, however, qualified by a further opinion expressed by Taylor (*idem*, p. 519) peculiarly applicable to the present case, which will be quoted later on (in case *Reg.* v. *Edmunds*).

The extensive nature of the wounds must, moreover, in the present case, be considered in relation to the age, sex, and state of mind of deceased, the race tendencies, and the nature of the weapon used.

Deceased was an immature, non-muscular-girl of 11 years. The tendency of female suicides in India, especially of those of tender years is to destroy themselves by means (poison, hanging, &c.), other than the use of cutting weapons. Moreover, although, as is well known, insanes will inflict on themselves injuries extreme in severity, and showing astonishing persistence and determination (see Taylor, 3rd Edn., 1883, Vol. I, p. 512), yet there was no allegation or question of insanity in the case of deceased—the evidence, in fact, indirectly establishing the reverse.

With regard to the weapon found in the right hand, and with which the wounds must have been inflicted had they been suicidal, this was a razor of ordinary pattern. Deceased can have had no skill in the use of such a weapon; could have had no occasion probably ever to have handled one. Yet to have inflicted wounds in any way approaching in severity those found on deceased, a suicide would require some knowledge of the use of a razor, and must certainly have exerted a degree of muscular strength which the deceased, an immature non-muscular girl of 11, did not in my opinion possess.

In most of the cases in which exceptionally severe injuries have been self-inflicted—more especially by women—the weapon has been a knife with a fixed handle, lending itself readily to a firm grip not a razor, with a loose blade. (See below.)

It will be instructive to compare with the present case, certain others which are collected by Taylor as typical of exceptionally severe injury in cut-throat cases.

(*a.*) *Three cases held to be Suicidal.*

1. Woman; spine wounded in two places, *but* through muscles of *back*, and of *side* of neck; left internal jugular vein opened; *all* other

large vessels escaped, and *all* the large nerves ; other incisions. (Taylor, 3rd Edn., 1883, Vol. I., p. 528.)

Note.—Person, an adult ; maniacal ; weapon, a table knife, *i.e.*, with a firmly fixed handle easy to grip) ; all large vessels and nerves escaped injury—except left internal jugular vein ; the spine was reached (and wounded) through the back parts of neck, not through the *front*, where the important structures lie.

Taylor says of this case that it " *might* be suicidal ; but the verdict was one of murder.

Compare present case :—All large vessels and nerves of neck divided ; spine cut in three places ; girl of 11, weapon (razor), with loosely jointed handle, no grip ; no suspicion of lunacy.

2. *Ryan's case.* Man ; three cuts on spine of neck ; *but* both carotids and jugulars escaped, and therefore, almost necessarily, all large nerves. (*Ibid*, p. 512). Quoted as a case of exceptionally severe injuries for a suicide—even for an adult male, probably accustomed to to use of a razor.

3. *Marc's case.*—All muscles of front of neck, the windpipe, gullet, both jugulars, both carotid arteries, divided ; and the weapon had " *even grazed the anterior ligaments of the spine.*"

Taylor adds (*Ibid*, p. 513). " A wound so extensive as this is rarely seen in a case of suicide * * * * *."

Compare present case :—All great arteries and veins and nerves of neck divided and not merely anterior ligaments of spine " *even grazed*, " *but* three incisions into spine of neck.

Although the above three cases are placed on record as of exceptional severity for suicide, yet in no one of them is there an approach to the severity of injury found in the present case ; even though in the former, all the conditions favoured exceptional severity, *viz.*—adult age, male sex, or if a woman, the presence of mania and the use of a knife with fixed handle.

(*b*). *Cases in which the severity of wounds was held to, in itself, rebut the theory of suicide.*

1. *Reg.* v. *Edmunds.*—Three incisions, front of neck ; all the great vessels and nerves divided, also trachea and gullet ; two wounds of spine, deep ones. This greatly resembles the present case (K. Manini Debi). Held (although deceased was an *adult*) that " it was impossible for any person to inflict such injuries on himself." Taylor adds :—" The hacking of the spinal column in two distinct places * * * after the carotid arteries and jugular veins had been cut through was alone sufficient to justify this opinion." He also expresses the opinion :—" Suicide may graze the ligaments in front of the spinal column, but that they should make deep incisions into the bones * * * * is a proposition contrary to all experience and probability." (*Ibid*, p. 518.)

2. *Case of Earl of Essex.*—To the effect that repeated wounds of the front of spine could not have been self-inflicted, because th division of the vessels and nerves, which must have first been cut, would have rendered the person powerless. When, in these cases, the injuries were held to have been impossible of self-infliction, even by adults, can it, for a moment, be accepted that injuries of as great severity could, in the present case, have been self-inflicted by an immature girl of 11 years of age? I maintained the improbability—nay impossibility—a view which the jury unanimously endorsed. His

Lordship, in summing up, observed :—"On this point, there was not a doubt in the world the wounds were homicidal, and not suicidal."

B. & C.—Direction and order of infliction of the three wounds of the neck.

The great wound had the appearance of having been inflicted from left to right; for its left extremity was shallow for two-thirds of an inch, and then rapidly deepened; while its right extremity ended in a shallow tail 1½ inches long, the skin being alone injured at its termination. This great wound had apparently been caused by a single sweeping incision; for its upper margin was entire and clean cut: neither skin nor tissues showing any sign of two incisions having run into one another; no notch or tag anywhere. Now, although the spine and gullet had three incisions in them, the windpipe and the divided tissues of the right side of neck had only a single incision through (or touching) them, just as those of left side had. How was this to be accounted for? It seems clear that the two lower wounds, which showed superficially a little to left of median line of neck for ½ inch, and then disappeared into the great wound, must have found a gaping opening and dropped into it straight to the spine which each wounded. A previous incision must have existed, and the tissues have been gaping from its retraction.

If it be assumed that either of these lower wounds was the first inflicted, then the tissues of right side of neck must have been divided by it; these had only one incision; therefore, in that case, the great upper incision which began on left side of neck cannot have cut the tissues of right side, and therefore must have joined in, towards the median line, with the pre-existing one of right side. Had this been so, it is scarcely possible that there should have been no sign of the junction. There was none. The upper margin of the great wound was clean cut and entire through its whole length. The great incision round both sides of neck was then the one first inflicted. This being granted, the improbability of deceased having been able to inflict the other two wounds is far greater than if either of the lower ones had been the first; as the former divided the structures of both sides of neck, the latter could only have divided those of the right side. Not only the great upper wound, but also the two lower ones must have been inflicted from left to right. For, had they been inflicted in reverse direction, what could have caused them to leap up almost vertically from the spine (which they cut) nearly 1½ inches to become superficial almost at once! It was not contact with the inner end of left clavicle, for this was untouched; nor mere contact with the spine, for the great incision wounded the spine equally, and still kept on its deep path.

The appearances were only capable of explanation on the supposition of the two lower incisions having *begun* as the shallow incisions described on the right side of median line, and, therefore, having been inflicted from left to right.

The mere direction of all the incisions---from *left* to *right*--had no great practical bearing in the question of homicide *v.* suicide, for deceased, a right-handed person, would herself have cut in that direction.

The direction is, however, that in which a right-handed person inflicting the wounds, homicidally, from behind deceased, would have made them; this fact supports the theory advanced as to the method of commission of the homicide.

D.—Redundancy and Severity of the wounds.

This was well marked. The injuries were far in excess of what was necessary to take life. That redundancy is far more frequent in homicidal than in suicidal wounds is well known. The frequency of cases of "attempt to commit suicide" in the Police Courts and Hospitals is confirmatory of this question Dr. K. McLeod has shown that Indian records firmly establish this fact (see Report on Medico-legal Returns, Bengal Presidency, for 1869—also by Dr. Harvey, for years 1870-71-72, p. 126). "A homicidal wound is generally very severe, while a suicidal wound, if fatal, is barely sufficient to destroy life; there is never any evidence of redundant vigour."

E.—Plane of wounds, upwards.

This is rare in *suicidal* wounds; more common in *homicidal* ones; most common when the latter have been inflicted, from behind, on a person lying down. In the latter case, the plane of the wound is almost necessarily upwards.

Proofs that the plane was, in this case, upwards:—

1. *Skin and soft parts*.—Although retraction had greatly altered the relative position of the parts; yet, taking the upper margin of the great wound, its ends were from 1½ to 2 inches higher than its middle.

2 *Tracheal wound*.—This was, in front, between the 4th and 5th rings; posteriorly, it divided, obliquely upwards, the ends of 4th ring.

3. *Incision of spine*.—Plane upwards.

4. The difference in level between the wound of the trachea and those of the spine (behind it) was about 1½ to 2 inches. The tracheal wound, between 4th and 5th rings, was on a height with lower third of body of 7th cervical vertebra. (My dissections at Campbell Hospital on 23rd and 24th September 1888): The lower wound of spine was at upper part of body of 6th cervical vertebra; the higher was on lower part of body of 5th.

The wound had, in passing from windpipe backwards to spine risen about 1½ to 2 inches.

If the head of deceased had been drawn backwards at time of infliction of the wounds, this would, no doubt, account for much of the difference of level; but not, I think, for all For, in my experiments (on the dead subject), I could not raise the level of the 5th ring of the trachea more than one inch, even by traction of the head backwards, which sufficed to draw the body along the table.

F.—Lowness in the neck of the wounds.

Suicidal wounds are rarely low in the neck; they are usually high up, in region of hyoid bone or larynx.

Homicidal wounds are frequently low down. General experience confirms this (see also, Taylor, 3rd Edn, 1883, Vol. I, p. 512).

G.—Regularity of the wound.

This has been held as indicative of suicide by some, of homicide by others. In the case of a struggle having occurred, it is probable that a homicidal wound would be irregular. But, on the other hand, "a murderer by surprising his victim from behind, * * by directing his attack against one who is asleep * * * may easily produce a regular and clean incision of the throat." (*Ibid*, p. 513.)

A suicide requires a steady nerve to make a regular, clean-cut wound, especially when a large one. Could a girl of 11 years of age be credited with the amount of nerve required to nearly decapitate herself with steadiness and regularity?

Head II.—The Bleeding.

A.—Direction of the blood effused.

All the blood effused from the wounds of the neck had run directly backwards, towards the back, sopping with blood the posterior parts of the body and trunk.

There were no marks of any stream of blood having run down the neck, chest, shoulders or clothes—*i.e.*, in direction from head to feet.

This shows that deceased must have been lying on her back during the whole time that bleeding was going on, *i.e.*, from infliction of wound to death. This fact was of the highest practical importance in the case. For I gave it as my opinion that it was impossible for deceased, while lying on her back, to carry a razor so far round the throat as the wound extended (*i.e.*, all round, except for 1½ inches behind), and at the same time keep the cutting edge against the throat; on the right side (the right hand being used), the hand could not be got round so far unless the head were raised to enable it to get beneath. That deceased's head was not so raised is almost certain, for had it been, even for a moment, blood would have streamed down the neck and chest or shoulders, and told the tale; for bleeding was at that time going on, the vessels having been severed. There were no marks of any such streams.

Moreover, it is rare for a suicide to cut the throat in a recumbent posture (Taylor, Vol. I, p. 545) See also cases:—*Reg.* v. *Courvoisier*, *Reg.* v. *Constance Kent*, and *Reg.* v. *Gardner*.

B.—Nature of the blood stains on right hand and arm.

The right hand had blood stains over every part, as if it had been dipped in blood. The right forearm was free from marks of blood, except along its lower and inner edge, where it had lain in contact with the blood-sopped clothes.

There was no mark of a jet, or spurt of blood, nor of any individual drops, on this hand or arm or on clothes of deceased.

If the case had been one of suicide, the right hand (containing the razor) must, at the moment of severing the vessels, have been in close contiguity with them. The arteries, especially the smaller ones, would have at once jetted out blood on being cut. Could the hand and forearm if naked, or the clothes, if covering them, have completely escaped being marked by such jets? They had entirely escaped.

Head III.—Razor in right hand—Value of this fact.

At the time of *post-mortem* examination, the razor was found loosely supported in the right hand between the upper phalanx of thumb and the palm; the fingers did not touch.

The case was, however, complicated by the razor having been removed while the body was being conveyed to the dead-house, and afterwards replaced before I saw it.

The Inspector, who saw the body *in situ* on the bed before removal, deposed that the razor was at that time not tightly clenched, that he removed it easily without any force, his object being to prevent it, falling out and getting lost on the way.

The defence strongly contested the point whether the razor could not at some earlier period than that at which I examined the body, have been firmly grasped by cadaveric spasm.

It was admitted that, had the razor been firmly grasped by cadaveric spasm, it would have been telling evidence in favour of suicide.

Taylor notes (Vol. I, p. 65) : "Razors and pistols are thus *frequently* found in the hands of suicides." Had it ever been so grasped, in the present case, it could scarcely have arisen from any cause other than the fixation by cadaveric spasm, at the moment of death, of a voluntary grip of the weapon during life. For this condition cannot be artificially induced after death.

I maintained that there was proof that the weapon had never been fixed in a tight grasp by cadaveric spasm.

For, had it ever been so clenched, the razor could only have come into the loose state found by me owing to one of two causes, *viz.*— either by the fingers having been opened by some one—or by the subsidence of cadaveric spasm.

That neither of these causes had come into play was clear from the fact that *rigor mortis* was still present and well marked in the fingers of the right hand, as elsewhere, at the time of my examination.

Had the fingers been unclasped, by any person, from a grasp of the knife, cadaveric rigidity (*rigor mortis*) would have, to that extent, been destroyed so far as these fingers were concerned, and once destroyed, could not have been restored. Yet I found it strongly present; the fingers were rigid and resisted flexion. The hand had, therefore, never been unclasped—and, therefore, can never have had a tight grasp of the razor fixed by cadaveric spasm.

It was suggested by the defence that a tight grasp of the razor may have been fixed by cadaveric spasm at the moment of death, but that a supervening stage of general relaxation may have loosened it, and this loosened stage have been found and fixed by supervening *rigor mortis;* and that this would explain the condition found. The answer is plain : That cadaveric spasm is *rigor mortis* (early in setting in), and that, when relaxation ensued, there would be no further (or second) *rigor mortis.*

There were two other points indicating that the position of the fingers of the right hand had not been altered by any person, namely, that the position of the fingers of both hands was identical, finger for finger, joint for joint ; and that the members of both hands were in the position commonly found in death from whatever cause, *i.e.*, thumb close to palm, its last phalanx and the two lower ones of each finger semi-flexed.

It would have been a remarkable coincidence if the right hand had, after having been opened, been re-composed into such identity of position with the left.

The absence of a tight grasp on the razor is, however, no direct proof of homicide, it merely destroys *one* proof of suicide.

For a razor may be found loosely held in the hand of a suicide owing to cadaveric spasm not having occurred, the weapon having continued to lie in the hand during the ordinary after-death stage of relaxation, and this relaxed state of the hand having become fixed by *rigor mortis* eventually.

On the other hand, a razor put into the hand of deceased after death would have been found in precisely the condition in which I found the weapon in the present case. (For cases illustrating this, see Taylor,

3rd Edn., 1883, pp. 67 and 519; the Saville case, the Gardner case, also Tidy, part I, p. 121, *et seq.*)

Head IV.—Death almost instantaneous.

This naturally follows from the whole of the large vessels and nerves of the neck having been severed. That death was not quite immediate is shown by the presence of blood-stained froth in the larynx, below its severance, and in the bronchi: deceased must have breathed after division of the trachea and blood-vessels.

Head V.—The wounds were inflicted during life.

For the defence, it was argued that the wounds of the neck might have been inflicted *after death* from some other (natural) cause: and that wounds, caused immediately or soon after death, were not distinguishable with certainty from those inflicted during life, that therefore I was not warranted in giving a definite opinion that they were actually inflicted during life and were the cause of death.

So far as the appearance merely of an incised wound is concerned, Taylor and Aston Key found that one inflicted within two or three minutes after death showed considerable resemblance to one inflicted during life.

In the present case, however, the extreme retraction of the divided skin and muscles, and the free ecchymosis into margins of tissues bounding the wound, show this to have been inflicted during life.

But it was not necessary to look to the wounds alone for evidence on this point; the amount of blood loss, every part of the body being drained of blood, even parts so remote from the wounds as the kidney, vagina, &c., the empty and contracted condition of the heart cavities, all confirmed the conclusion that the large vessels were opened by the wounds during life. Division of these vessels, after the heart had ceased beating, could not have emptied the body of blood to anything approaching the degree found in the present case.

Head VI.—Absence of cries and of signs of struggle.

This was *primâ facie* evidence in favour of suicide.

This absence can, on the other hand, be accounted for on the supposition that deceased was taken unawares and a disabling wound at once inflicted. There is much other evidence to support the theory that this really occurred. Ecchymosis might reasonably have been absent, even had deceased struggled, if restraint had been applied with the interposition of some soft medium, such as the prisoner's own clothes. If such a medium had been used over head and face, it would probably have been stained with jets of blood. It should be noted that the clothes which the prisoner is believed to have worn at the time of the alleged murder, were not forthcoming for examination. There may have been marks of jets of blood on them. I further expressed the opinion that even had (say) the face, mouth, hands, &c, been subjected to firm holding or compresssou, such as would ordinarily have left bruise marks, yet in the case of deceased, the hæmorrhage must have been (from the great size and numbers of the vessels divided) so rapid and copious, that it is quite conceivable that no blood would be left to effuse and ecchymose at the region compressed.

Deceased was not *drugged* into helplessness; the stomach was found healthy, empty and free from anything which could excite suspicion.

POINTS TENDING TO FIX THE CRIME ON THE PRISONER.

These were :—

(1) The period at which death of deceased occurred.

(2) Could the wounds have been caused by the razor found in the right hand of deceased ?

(3) Were the wounds inflicted on the deceased while asleep ?

(4) *Rigor mortis*, as a test of the time dead.

I.—*Hour of death of deceased.*

This point was of the gravest importance to the prisoner ; and, as such, the opinion expressed was subjected, by the defence, to prolonged and searching criticism.

The following were the facts involved :—Deceased had taken a meal of *chupatties*, curry and rice a little before retiring to rest at 10 P.M. with her husband (the prisoner) ; she was not again seen alive ; prisoner left the house at 4 A.M. ; deceased was found dead with her throat cut before he returned.

The question to be determined was—did death occur during the period 10 P.M. to 4 A.M., during which the prisoner was in her room, or did it occur after his leaving the house ?

If the murder was not committed before his leaving the house, then the prisoner was not guilty.

The degree to which digestion had advanced was the factor employed to determine whether or not death occurred between the hours mentioned.

At the *port-mortem* examination the stomach was found quite empty ; food, thick and fluid, which had recently undergone gastric digestion, was present in the upper small intestines, duodenum and jejunum. From the fact of this food being present in the duodenum, it was clear that the stomach had but quite recently become empty. The period of ingestion of the meal was known and the nature of the food taken.

The question remained—in how many hours would the gastric digestion of such a meal be completed and the stomach left empty ?

If this had taken more than 6 hours (*i.e.*, from 10 P. M. to 4 A.M.) then deceased died after prisoner left the house, and during his absence.

Dr. Beaumont (in experiments on Alexis St. Martin) found that rice was digested in one hour ; barley, milk, fish, in 2 hours. He refers to gastric digestion. His conclusions have never been disputed by any authority (see appendix V for details, also for Indian observations).

Other authorities have given periods of from 2½ to 5 hours as those required for the stomach to become empty after an *ordinary* meal. (McKendrick, Pavy, M. Foster, Todd and Bowman, Carpenter, &c.)

By an *ordinary* meal, they mean an ordinary European meal, consisting of meat, vegetables, bread, &c. Meat and other highly nitrogenised foods take longer to undergo *gastric* digestion than such starchy foods as rice, wheat, &c.

For a meal of rice and *chupatties*, then, a shorter time must be allowed for gastric digestion.

Sleep retards digestion ; though it is impossible to express this retardation definitely in hours.

Digestion is more active in the young.

Deceased was 11 years of age ; and was, presumably, asleep during all, or some part of, the time she was in bed, between 10 P.M. and 4 A.M.

It will be seen that it was not possible to state, in hours, the exact time occupied in digesting her last meal ; so many modifying circumstances, including those above noted, being present.

Taking everything into account, I gave the opinion that the period required to bring her last meal into the condition found on *post-mortem* examination would be, at the outside, 6 hours—more probably some hours less.

Dr K. McLeod, speaking as medical expert, gave the period as from 3 to 6 hours—nearer the former than latter. The death was thus shown to have occurred before the prisoner left the house—in all probability.

II.—*Could the razor found in the hand of deceased have been the weapon with which the wounds were inflicted?*

I held that it could.

The question was raised by the defence, in the interest of the prisoner ; this razor having been proved to be the property of the prisoner.

To have caused the clean-cut, even, upper margin of the first and great incision, the razor must at that time have been sharp edged The soft tissues in front of spine must necessarily have been divided before the razor could have cut the bone of the spine and have thereby become notched. The edge would, therefore, have remained uninjured during the incision through the tissues of the left side of neck ; that part of the razor—the point—which penetrated to the spine may then have become notched on its edge, but the remaining part of the incision through the tissues in front of spine (*i.e.*, on right side of neck) would be made (even and clean-cut) by the heel of the razor which, being less deep in the wound, would impinge on the less deep tissues, and which would not have engaged the deep-lying spinal bones, and so not have lost its keen edge.

The second and third wounds scarcely touched the tissues of the neck ; they fell almost immediately, through the gaping first wound, on to the spine ; so that the whole length of razor probably impinged on the bone, and became notched on its fine edge.

Could a sharp razor have had its edge turned, and finely notched (as was that found in hand of deceased) by contact with the bones of the spine (these three wounds of spine) ?

It probably could.

On this point, see case of Earl of Essex (Taylor, 3rd Edn., 1883, Vol. I., p. 519) ; in discussing which, Taylor does not dispute the fact that the edge of a sharp razor could be notched by wounding the bones of the spine—he merely affirms that deceased could not have himself done this.

III.—*Was deceased murdered while asleep?*—There are a number of reasons for thinking so :—

1. The placid appearance of the face was eminently consistent with the taking of life during sleep.
2. The characters of the wounds of neck. Its crescentic shape, the ends being 1½ inches higher than the middle ; its plane being sharply upwards, point to the great wound having been inflicted from behind while deceased was lying on her back ; its clean-cut regular margin points to it having been caused by a steady stroke while deceased was quiet and unresisting, probably asleep. (See case *Lord W. Russell, Reg.* v. *Courvoisier*, Taylor, 3rd ed., p. 513.)

3. The direction taken by the effused blood, shows her to have been lying on her back when the great wound was inflicted and to have been so disabled by it as to have not moved afterwards.
4. The absence of marks of a struggle, although deceased was not drugged nor apparently forcibly held.

IV. *Rigor mortis* as test of time dead. The defence made an attempt to fix the death by this means at a period subsequent to the prisoner having left the house and thus to clear him of the murder. As the body after death had to cool through one degree of temperature only, the existence of *rigor mortis* at the time of the *post-mortem* examination was in keeping with death occurring before prisoner left house. The accused was convicted.

WHAT RESULTS have FOLLOWED, or are LIKELY to FOLLOW, from the INJURY?

The reply to this question must be cautiously given as the result of injuries, whether disabling, mortal or otherwise, depends on a variety of circumstances, especially on :—

(1) the part injured ;
(2) the nature and extent of injury ;
(3) the state of health and age of the injured individual.

Where death has not occurred, the questions will be :—*Is the wound dangerous to Life?* ' or ' *Is it likely to leave permanent injury or incapacity?* ' The former question can be answered from the details already given with reference to the particular part injured. Secondary dangers are, secondary hæmorrhage, tetanus, septicæmia, and erysipelas.

The second question is more likely to arise in civil cases claiming compensation for loss in wage-earning capacity than in criminal, where the intent to injure is the chief factor in awarding punishment. This would be answered on general principles. The question of whether nervous shock is temporary or permanent is the most difficult to answer.

' *Grievous hurt* ' may sometimes follow, secondarily, as an indirect consequence of an injury, when inflammatory action leads to a stiff joint, loss of hearing, &c., &c.

Where death has followed the injury, it is necessary to satisfy yourself that all the organs are healthy before you can ascribe the death entirely to the wound or other injury.

CAUSES of DEATH, &c., in WOUNDS and MORTAL INJURIES.

Some injuries causing death may be called **conditionally mortal injuries**, *i.e.*, such as cause death owing to either :

(1) **Disease or infirmity** under which the injured individual labours, *e.g.*, an enlarged spleen ; or (2) **The supervention of disease**, *e.g.*, tetanus, septicæmia, erysipelas ; or (3) **Want of resort to proper remedies** or treatment, as when death occurs owing to loss of blood from a wounded artery of moderate size, such as the brachial.

Others may be called **mortal injuries**, or injuries intrinsically sufficient to cause death, irrespective of the existence of any conditions such as those above-mentioned.

Death from a mortal injury may occur by : (1) **Coma**, *e.g.*, from pressure on the brain of fragments of bone or effused blood ; (2) **Asphyxia**, *e.g.*, from paralysis of the movements of respiration, or mechanical interference with this process ; (3) **Syncope** from loss of blood, or from mechanical impediment to the heart's action ; or (4) **Shock**, as in death from concussion of the brain, or from the effects of a violent blow over the region of the solar plexus.

In some cases, **difficulty may be experienced in tracing the Connection between Death and an Injury** proved or alleged to have been received ; thus in the case of injuries alleged to have been caused by the action of external violence on a diseased organ, it may be difficult to determine whether the injury to the organ in question was or was not the result of external violence. In cases of this class, much will depend on (*a*) the liability or otherwise of the affected part to rupture from causes other than externally applied violence (see *Rupture of the Spleen*, *Injuries to the Brain*, *&c.*) ; and (*b*) the presence or absence of marks of violence on the surface of the body over the injured part, or in the tissues situated between it and the surface of the body.

Case LXXI.—(*a*) **Assault not homicide** in rupture of enlarged *spleen*. *Reg.* v. *Bysagoo Noshyo*. Accused quarrelled with his wife and gave her a kick, which ruptured her spleen. He repented immediately and was found with the woman in his arms helping her. Acquitted under Sections 320 and 322 of the Penal Code, but found guilty under Sections 319 and 321. Sentence : One year's rigorous imprisonment—*Cal. W. R.*, *Vol. VIII*, *September*, 1867.

(*b*) *Reg.* v. *Robert Bruce*. Accused was tried for 'causing hurt' by kicking a boy who was suffering from diseased spleen. Death was the result of the kick. The judge held that the prisoner had no intention of causing death, but, considering the dangerous consequences of such an act, especially when inflicted on a native of this country, sentenced him to six months' rigorous imprisonment. (*Calcutta Criminal Court*, *June* 1868.)

Again, when a conditionally mortal injury has, it is alleged, caused death owing to the supervention of disease, it may in

some cases be very difficult to decide whether or not the disease is really to be attributed to the injury.

In England the law seems different, for, according to Lord Hale "if a man be wounded and the wound, although not in itself mortal turn to gangrene or fever, this is homicide in the aggressor; for though the fever or gangrene be the immediate cause of death, yet the wound, being the cause of the gangrene or fever, is held the cause of death—*causa causati*. It is sufficient to constitute murder that the party dies of the wound given by the prisoner, although the wound was not originally mortal but became so in consequence of negligence or unskilful treatment." "If a man," says Lord Hale, "has a disease which, in all likelihood would terminate his life in a short time, and another gives him such a blow as hastens his death, *this is such a killing as constitutes murder.*" Disease of the spleen, however, is not even a disease which need necessarily prove fatal.

Mortal injuries causing death by coma, asphyxia, or hæmorrhage leading directly or indirectly to syncope, are not likely to present difficulties of the kind just alluded to. In some cases, however, of death from shock, it is possible that it may be very difficult to trace the connection between death and the alleged violence. With reference to this, it may be pointed out that death from shock may occur: (1) without any mark of violence being present—this has been often observed in cases where the fatal shock has been due to a violent blow over the region of the solar plexus; or (2) a single slight bruise only may be present as in many reported cases of fatal concussion of the brain; or (3), as often occurs in cases where persons have been severely beaten, from the combined effect of a number of slight injuries, each by itself totally insufficient to account for death. In cases such as these, it is especially important that the *post-mortem* examination should be complete, as much may depend on your being able to state (if it be so) that no appearances were present indicative of a cause of death, other than the alleged violence.

CHAPTER VII.

Asphyxial Deaths.

The violent deaths which result chiefly from asphyxia are : (1) *Hanging*, (2) *Strangulation and Throttling*, (3) *Suffocation and* (4) *Drowning*.

The symptoms and *post-mortem* appearances of asphyxia have already been generally indicated (p. 62).

The **post-mortem signs** are :—

External : (1) Lividity of lips, finger nails, and skin, to be distinguished from hypostasis by not being confined to the most dependent parts.

(2) Prominence of eyes, especially in strangulation.

(3) *Rigor mortis* slow in onset. None of these are very characteristic.

Internal : (1) Blood unusually fluid from excess of carbonic oxide.

(2) Lungs and meninges may be either congested or anæmic.

(3) **Petechiæ beneath serous membranes.** These minute extravasations of blood, from the size of a pin's head to a small bean, beneath the pleural covering of the lung ('*Tardieu's* spots') or under the pericardium, are very characteristic of asphyxia, if the deceased was not previously suffering from blood diseases, such as scurvy and purpura, in which petechiæ are apt to occur. They may, however, be absent in undoubted asphyxia and are most likely to be present when the asphyxia occurs rapidly. They should be looked for especially at the root, base, and lower margin of the lungs, on the pericardium, under the scalp, and in infants on the thymus gland. They should be distinguished carefully from hypostasis which by their colour and small punctate size they resemble somewhat in general appearance.

HANGING.

In this form of asphyxial death the body is suspended by the neck and the constricting force is the weight of the body or head. It is unnecessary that the body should be suspended

off the ground or other support, or even that it should be in the upright posture.

Suicidal Hanging is the commonest form of suicide in all countries. In India, statistics (see table in Appendix IV) show that between one-third and one-half of the suicides of both the sexes in the town of Calcutta and in the Panjab, and of the male suicides in the presidencies of Madras and Bombay, hang themselves. Hanging also is the mode selected by about 18 per cent. of the female suicides in the two last-mentioned presidencies. All the 130 cases of hanging seen by Dr. Mackenzie[1] during 9 years in Calcutta were suicidal. Sixty-five were male and sixty-five were female and all were adults. The alleged **causes** in these cases were :—

Family disagreement	38
Ill-health	35
No reason assigned	24
Drunkenness	9
Insanity	9
Poverty	4
False accusations	2
Found in possession of counterfeit coins	2
Remorse at having led immoral lives	2
Grief on account of the death of a near relation	1
Serious illness of a child	1
Disappointment in love	1
Jealousy	1
Theft	1
	130

The **nature of the rope** by means of which these 130 persons committed suicide : Seventy-three used ropes of various materials and thickness. Thirty suspended themselves by means of their *dhoties*, *saries* or *chadars*. Twenty-five cases were not noted. One person, a determined suicide, used both a rope and the cloth he wore to destroy himself, *and a Brahman hung himself by his Brahmanical thread!*

Case LXXII.—**Suicide by Brahmanical thread.** This man was a big stout Brahmin ; he returned home late at night boisterously drunk, and commenced to abuse his own family and his neighbours. The family expecting that he would assault them, locked him out of the house into the outer court-yard, where he entered a cow-shed and hanged himself. He twisted his Brahmanical thread into several ply, and was found suspended off the ground by means of it. The mark of the cord round the neck corresponded with the Brahmanical thread. It was very narrow and deeply indented into the skin of the neck, which was parchment-like in appearance.

Homicidal cases are rare, but are sometimes met with in India. Chevers mentions three, one where a woman, with

[1] *Ind. Med. Gaz.*, 1888, p. 299.

the aid of three men, hung her husband in revenge for having beaten her some days previously; another where a husband hung his wife as a punishment for adultery; and a third where the inhabitants of a village, discovering a man from a neighbouring village in the act of committing a theft, hung him on a tree in the middle of their village. More frequently in India, in homicidal cases where the body is found hanging, the cause of death is strangulation or mechanical violence, and the body has been hung to avert suspicion (see *Cases LXXIII & LXXIV*). **Accidental cases** also are rare, but are sometimes met with. **Judicial hanging**: this is the judicial mode of execution in India.

Case LXXIII.—**Murder by strangulation; subsequent suspension of the body** (*a*) (Chevers, *Med. Jur.*, p. 592).—A man, of Mymensing, having intrigued with a widow, and not giving her sufficient means for her support, she complained to the village *panchayet*, who decided that both parties should be beaten. The man was seized by his father, and was struck several blows, but the woman managed to escape. The paramour, enraged at having been summoned and beaten before the *panchayet*, pursued her with three of his relatives. On coming up with her, they strangled her, and, hanging her body on a tree hard by, reported that she had committed suicide.—(*b*) (Chevers, *ibid*, p. 592).—The father and brothers of a girl, of Tipperah, finding her in company with a man with whom she was intriguing, seized the man, and, holding him down by the neck, arms, and legs, strangled him. They then hung up the corpse, and reported that he had destroyed himself.—(*c*) (Chevers, *ibid*, p. 593).—A Bogra woman was found hanging. *Post-mortem* examination showed clearly that strangulation by hand, and not by hanging, was the cause of death.

Case LXXIV.—**Murder by mechanical violence; subsequent suspension of the body.**—(*a*) (Chevers, *Med. Jur.*, p. 597). A man of Sylhet struck his wife with a piece of split bamboo about the body, for eating more than her share of *pān* (betel), until she died. He then hanged her body on a tree.—(*b*) (Chevers, *ibid*, p. 598). The wife of a man living in the 24-Pergunnahs having a criminal intrigue with another Hindu, she and her paramour enticed the unfortunate man out of his house at night, killed him, or rendered him insensible (it would seem by severe blows), and suspended his body to a tree.—(*c*) (Chevers, *ibid*, p. 598). It appeared, in a trial at Cuttak, that a Hindu, charging another with theft, beat him to death. The man's body was afterwards found suspended, with marks of violence upon it, in such a position as to render it evident that he had not hanged himself. (*d*) **A man, probably trampled to death, body found hanging** (Harvey's *Beng. Med. Leg. Rep.*, p. 83). A Hindu, aged about sixty. *Post-mortem* appearances—"Face livid, and slightly swollen, especially on right side, on which the body had been laid. The tongue was not swollen or bitten by the teeth. A bruise about 1½ inches in diameter on right side of the forehead. A *livid depressed mark*, about ½ inch in diameter, round the neck and behind right ear. In front of the neck the mark was between os hyoides and thyroid cartillage. There was another depressed mark under the forehead. *Head.*—Considerable amount of coagulated blood in tissues of pericranium,

corresponding to bruise on forehead. Brain healthy, slightly congested on surface. A considerable quantity of fluid in ventricles, and at base of brain. *Chest.*—A large quantity of extravasated coagulated blood among muscles and tissues covering the ribs The ribs, from the third to the last, were fractured in two places on both sides; lungs healthy, uncongested; heart empty. *Abdomen.*—Extensive rupture of liver on its posterior aspect; all other organs healthy." (*e*) **Punctured wound mistaken for a gunshot wound, body suspended after death** (*ibid*, p. 214).—In this case, a Mussulmani, aged thirty-eight, was at first reported to have died from hanging. There was a rope close under the chin, passing upwards behind the ears, and the head was bent on the chest. On lifting the head, a wound, described by the medical officer who made the examination as a gunshot wound, was found between the attachments of the sterno-mastoid muscle, a little above the clavicle. The wound contained a large clot of blood, and its edges were turned downwards and inwards. Apparently it was not seen until the head was lifted. The right lung was torn through from apex to base, and a circular hole, of the same size as the one in the neck, passed right through the liver. The right kidney was bruised, but not wounded A large quantity of blood was found in the cavity of the thorax, and a large quantity also in the abdomen. Deeming the wound a gunshot wound, the medical officer, not being able to find the bullet, gave as his opinion that it had probably passed behind the kidney into the thigh. The woman's husband afterwards confessed to having killed his wife, by thrusting a pointed perfectly circular solid bamboo into her body. The body was afterwads hung up to avert suspicion.

Case LXXV—**Suicidal hanging, suspension partial** (Ogston, *Med. Jur. Lect.*, p. 534)—"A young woman, who had been in a desponding state for some days, was found dead in bed one morning, sitting in a reclining posture with a ligature attached to the top frame of the bed. All that had been required to effect her purpose of suicide had been to lean back after the cord was fixed. Two young girls who were in bed with her had not been awakened by the transaction, so quietly must it have been effected."

Case LXXVI.—**Accidental hanging** (*ibid*, p. 528)—"During the breakfast hour at a cotton mill near Aberdeen, one of the men was toying with a female fellow-worker to whom he was attached, and in sport threw around her neck a loose leather strap suspended from the roof of the apartment. At this moment the machinery was set a-going, and the girl was drawn up to the roof by the strap, and suspended there for a few minutes before the engine could be stopped, too late for saving her life."

Case LXXVII.—**Death from hanging. Arsenic found in the viscera,? self-administered.**—In a case from Shahapur (Thana district), the body of a Mahar was found hanging to a tree outside a village On examination, there was found an abrasion of the skin round the neck just below the chin, commencing from the thyroid cartilage, and extending backwards and upwards on both sides, with discoloration of the parts around. Both lungs were found gorged with blood, and the brain was congested. The mucous membrane of the stomach was red, and had yellow patches on it. On analysis, arsenic was found in the viscera, about four grains being present in the contents of the stomach.

Mode of Death in hanging depends on the way the cord is applied and on other circumstances. It may be by :

(1.) **Fracture or dislocation of cervical vertebræ** followed by almost instant death from pressure on the spinal cord. This occurs when the body falls some distance before the strain comes on the rope, and is the mode of death sought to be attained in judicial hanging.

(2.) **Asphyxia**, from constriction of the air passages with rapid death. Death from pure asphyxia does not often occur in hanging, though Dr. Mackenzie states it was the most common mode in his 130 cases.[1] It may, however, occur if the rope is tied low down the neck and a knot or some hard object contained in the ligature presses directly on the trachea.

(3.) **Apoplexy,** from pressure of the ligature on the large veins of the neck, if the tape is tied too high up the neck.

(4.) **Mixed asphyxia and apoplexy.**—This, except in judicial hanging, is the most common mode of death, occurring in about 77 per cent. of those cases of death from hanging in which the cause of death is other than fracture of the neck.

In Dr. Mackenzie's 130 cases no less than 119 or 91·54 per cent. died from asphyxia ; 8 or 6·15 per cent. from asphyxia as well as apoplexy ; 2 or 1·53 per cent. from syncope, and 1 or ·76 per cent. from apoplexy.

Rapidity with which death occurs varies.—It occurs almost instantaneously if the neck is fractured, rapidly if death takes place by apnœa ; and least rapidly if apoplexy is the mode of death. If there is no injury to the spinal cord, and the stoppage of air is not complete, five to eight minutes is the common fatal period; but it is possible that life may be restored after even half an hour's suspension[2] (see *Case LXXI*).

Treatment.—As in drowning which see. In addition, moderate bleeding may be employed to relieve cerebral, or general venous congestion.

Post-mortem Appearances.—These are generally those of asphyxia with the special signs in addition. They may be classed under three heads, namely :

(1.) **Appearances of the "mode" of death**, *e.g.*, fracture or dislocation of the cervical vertebræ ; or the post-mortem appearances of asphyxia or apoplexy, one or both.

In all the 130 suicidal cases examined by Dr. Mackenzie no fracture or dislocation of neck was found.

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[1] *loc cit, Ind. Med. Gaz.*, p. 299.
[2] Tidy's *Legal Medicine*, ii, p. 191.

(2.) **Mark of cord.**—This in death from hanging is usually, but not always oblique and non-continuous, *i.e.*, does not completely encircle the neck. It is usually (in about 81 per cent. of cases) situated between the chin and the larynx, and is very seldom (in about 2 per cent. of cases) below the larynx. In appearance it is usually a well-defined furrow, which, according to the length of the period of suspension, may (*a*) show no change of colour, or at most a red blush, or (*b*) be condensed and white at the bottom, the edges presenting either no change of colour, or being red, and the skin beyond violet, or (*c*) if the period of suspension has been long, be dry, hard, yellowish-brown, and horny, resembling parchment.

In Dr. Mackenzie's cases in which a rope was used, the mark on the neck was well defined, indented and parchment-like, while in the cases where cloth ligatures were used, the marks were faint, of a reddish colour and not parchment like, except in places where the cloth was twisted, and where the pressure was great.

Abrasions are sometimes found in the course of the mark, but ecchymosis is rare ; and sometime *there may be no mark.* After noting the exact situation and external appearance of the mark on the neck, two incisions should be made round the neck, one about an inch above, and the other about an inch below the mark. These should be connected at the back of the neck by a vertical cut, and the skin carefully dissected up from behind forward. The sub-cutaneous cellular tissue will then usually be found to show a condensed white or yellow line. The underlying soft parts and the spine should then be examined. Such dissection should be made also in all cases where strangulation is suspected.

In not one of Dr. Mackenzie's 130 cases were the muscles of the neck, the larynx, trachea or large bronchi injured, and in none of them was there any extravasation beneath the skin of the neck or blisters above the constriction of the cord.

Much local injury may be found in cases where, as in judicial hanging, the body falls some distance before the strain comes on the cord. Such cases excepted, much local injury points to strangulation rather than to hanging ; or if hanging be the cause of death, to homicidal, rather than to suicidal hanging.

(3.) **Other appearances.**—**The face** may be found pale, the features placid, and the eyes not unduly prominent. This Harvey found to be the most usual condition in fresh bodies ; or, especially if decomposition has set in, the face may be found swollen and the **eyes protruding.** In only 37·5 per cent.

of Dr. Mackenzie's cases were the eyelids open and eyeballs protruding. **Pupils** are nearly always dilated. **Tongue** is usually found swollen and pressed against the teeth, or partly protruding between them and bitten. **Genital organs** frequently show signs indicative of excitement, accompanied by discharge of mucus, or sometimes of blood, and in males by emission of seminal fluid. Expulsion of urine and fæces sometimes takes place. **Lungs**—Congestion of the lungs is by no means invariably present. Out of 834 cases of death from hanging included in the returns reported on by Harvey, in 738 the lungs were congested, in seventy-seven natural, and in nineteen collapsed. Rupture of the superficial air cells, spots of sub-pleural ecchymosis, and apoplectic effusions into the substance of the lungs, are all infrequent in hanging, but may be present.

Saliva running in straight lines down the chin and chest are usually found, and if present are important as indicating suspension during life.

In Dr. Mackenzie's 130 cases, in 81 the **position of the tongue** was noted, and in 41, or 50·61 per cent., it was found to be protruded between the teeth but not injured; in 61 cases a note was made as to whether it was bitten, and of these the tongue was found injured in 16 or 26·22 per cent. A note was made in 40 cases regarding the **eyes**, and in 15 or 37·15 per cent. the eyes were open and the eye-balls were protruded. In 21 cases **frothy mucus** was looked for around the **mouth** and nostrils, and in 20 or 95·23 per cent. it was found; 91 cases were noted regarding two lines of mucus at the angles of the mouth, and it was present in 23 or 25·57 per cent. The condition of the **fingers** was noted in 42 of the persons hanged, and they were found to be flexed or clenched in 17 or 40·47. The condition of the **nails** was noted in 15 cases, and in every one of them they were found to be of a blue colour. In 92 cases 30 or 32·60 per cent. had **vaginal** or **urethral discharges.** Out of 23 cases noted, 8 or 34·78 per cent. had discharge of fæces from the rectum. In 8 cases the condition of the penis was noted, and in 3 or 37·50 per cent. it was found to be erected. The **hyoid bone** was found **fractured** in 24 cases or 25·80 per cent. out of total of 93 observed. Notes were made regarding the **thyroid cartilage** in 64 persons suspended, and of the cricoid cartilage in 11, and in not one of either set of cases was it found to be fractured. Of the 90 cases in which the **coats of the carotid arteries** were observed, in 31 or 34·44 they were found to be ruptured. In 16 or 51·61 per cent of these 31 cases, the internal coat, in 4 or 12·90 per cent. the middle coats, and in 11 or 35·48 per cent. both the internal and middle coats, were ruptured.

QUESTIONS regarding Hanging.

The chief medico-legal questions connected with death by hanging, are :—(I.) Was Death due to Hanging? and (II.) Was the hanging Suicidal, Accidental, or Homicidal?

I. Was Death due to Hanging?

With reference to this question, it may first be pointed out that in a case of death from hanging, where the period of suspension has been short, or a very soft ligature has been used, there may be no mark at all on the neck. **Hence the absence of a ligature mark on the neck does not absolutely contra-indicate hanging** as the cause of death.

Ligature mark on the neck does not necessarily indicate suspension of the body (see *Strangulation*). A ligature mark due to suspension of the body is, as a rule, high up on the neck, oblique, and non-continuous. Suspension of the body, therefore, is indicated by the presence of a ligature mark on the neck, with a force proportionate to the degree of agreement of the mark with these characters. In very exceptional cases, however, a mark, possessing all these characters, may be produced without suspension; *e.g.*, when the body has been dragged along the ground, during life or after death, by a ligature round the neck. In such a case, abrasions of the skin, due to the dragging, will probably be found (see *case*, p. 158). Suppose, however, **suspension of the body** to be **proved** by direct evidence, or strongly indicated by the characters of the ligature mark on the neck, death may yet have been due to a cause other than hanging, and the suspension of the body effected after death. That a ligature mark on the neck, in all respects resembling the mark left by the cord in a case of death from hanging, may be produced by suspension of the body after death has been amply proved. Casper found that such a mark was produced when bodies were suspended within two hours after death; and Tidy states that an ecchymosed mark may be produced within three, and a non-ecchymosed mark within six hours, after death. This being so, to establish the fact that death was due to hanging, requires not only proof of suspension of the body, but also **proof that such suspension was the cause of death.** Such proof may be afforded by the presence of the general *post-mortem* appearances, already enumerated, of death from hanging. If these are absent, careful search should be made for the presence of signs of death from a violent cause other than hanging. This is extremely important, as murder cases are not infrequently met with in India, in which the murderer suspends the body of his victim after death, with the object of imitating suicidal hanging (see *Cases LXXIII & LXXIV*). In such cases (see *Case LXXIII*) the cause of death sometimes is strangulation, and when this is so, the general *post-mortem* appearances present may closely resemble those of death from hanging (see *Strangulation*).

II. Was the hanging Suicidal, Accidental, or Homicidal?

In cases of death from hanging **the presumption is always in favour of suicide,** even if the body is found only **partly suspended.** Numerous suicidal cases are on record, in which the body was found partly suspended, with the feet touching the ground, or in a sitting, reclining, or kneeling posture. Ogston mentions a remarkable case of this kind (see *Case LXXV*). Suicide, however, may be negatived by the body being found suspended in such a manner as to show that the individual could not have hung himself. Again, supposing the *post-mortem* appearances to show that death was due to hanging, the discovery of an **irritant poison**—*e.g.*, arsenic—in the body but little affects the presumption in favour of suicide. Harvey mentions two cases in which individuals, after having taken arsenic, hung themselves apparently in order to escape the suffering caused by the action of the poison. (See, however, *Case LXXVII.*) Death being due to hanging, marks of **mechanical violence** present on the body only positively contra-indicate suicide when the violence indicated is sufficient to have caused immediate insensibility. Mechanical violence short of this, if from its characters self-inflicted, strengthens the presumption in favour of suicide. That suicidal hanging may follow self-infliction of a very severe wound, is shown by a case cited by Harvey, in which a man hung himself after inflicting a wound on his throat four inches long, dividing the thyroid cartilage and œsophagus. Non-self-inflicted violence, not sufficient to have caused immediate insensibility, may be present in a case of suicide, and in fact form the motive leading to it. Age of deceased is important, as children rarely commit suicide.

Accidental hanging is rare.—It is sometimes however met with, chiefly in cases where children have been playing at hanging. Cases also are recorded where individuals giving a hanging exhibition have been allowed to remain too long suspended, with fatal results. In one case an adult was found accidentally hung in a gymnasium ; and a very exceptional case of accidental hanging mentioned by Ogston (see *Case LXXVI*).

Homicidal cases are also rare.—A few, however, are on record where hanging, pure and simple, appears to have been the cause of death ; *e.g.*, the three cases mentioned by Chevers, already referred to. In such cases, as a rule, a number of persons are concerned in the murder. A person, however, who is weak, or insensible, or even asleep, may be murdered by hanging by a single other individual. Ogston, for example, mentions a case " where a woman tied a ligature round the neck of her husband while he was asleep, and then pulled him

up." Cases are more common where individuals are first rendered insensible (or, it may be killed) by mechanical violence, or by strangulation, and then subsequently hung.

The presence of marks of self-inflicted **mechanical violence** tends, as already pointed out, to strengthen the presumption of suicidal hanging. When marks are present, clearly due to the infliction of mechanical violence by another, such marks may indicate the employment of violence sufficient to have caused (*a*) death, or (*b*) immediate insensibility, or (*c*) insufficient to have caused either of these effects. In case (*a*), the absence of the general *post-mortem* appearances of death by hanging obviously confirms the indication of homicide. In case (*b*), the general *post-mortem* appearances of death by hanging may be present, but still homicide is indicated. In case (*c*) it is often quite impossible from the *post-mortem* appearances, to arrive at any conclusion as to whether the hanging was suicidal or homicidal.

If strangulation has been employed previous to suspension, evidence of this may be afforded by the presence on the neck, in addition to the mark due to suspension of the body, of marks indicating strangulation (see *Strangulation*). It may here, however, be pointed out that two cord marks on the neck, one having the characters of a strangulation, and the other those of a hanging mark, may be found in a case of simple hanging, if the cord has been passed twice round the neck.

If very **severe injuries** are found to have been **produced by the cord**, *e.g.*, laceration of the muscles or other underlining soft parts, the presumption is generally in favour of homicide. Much injury to the soft parts may, however, be met with in suicidal hanging, if the individual has arranged matters so that his body falls some distance before the strain comes on the cord. Homicide is obviously indicated if the body is found suspended in such a manner, or the hands are found secured in such a way, as to show that the individual could not have hung himself.

STRANGULATION AND THROTTLING.

In strangulation the constriction of the throat is produced by other means than the weight of the body or head. The means used may be fingers (= 'throttling'), the foot, knee, clothing, &c. Strangulation differs from hanging in that it may be effected without a ligature, *e.g.*, by pressure with the fingers, or some hard object. The modes of death in strangulation are the same as in hanging, hence the *post-mortem* appearances are also very similar. The main points of difference

between the *post-mortem* appearances of strangulation and those of hanging, are important as strangulation is usually homicidal, whereas hanging is suicidal.

1. **Mark or Marks on the neck** :—

(1.) **If a ligature has been used**, there will, save in very exceptional cases, be found a mark on the neck. This usually, but not invariably, differs from a hanging mark, in being transverse in direction, low down on the neck, and continuous, *i.e.*, completely encircling the neck. In exceptional cases of strangulation, especially if the body has been dragged by the ligature, the mark may be found high up on the neck, and oblique in direction, like a hanging mark. Again, in exceptional cases of hanging, the mark may be found low down on the neck, and, if the cord has been tightly applied, the mark left by it may be transverse in direction, like a strangulation mark. Abrasions and ecchymoses in the course of the mark, and injury to the underlying soft parts, are much more common in strangulation than in hanging; but the hard yellow brown parchmenty appearance of the skin in the course of the mark is more seldom met with.

(2.) Strangulation **by manual pressure** is tolerably common in India, the victim being usually a child or a female. Where this mode has been employed, marks made by the thumb and fingers are invariably, or almost invariably, found on the neck, sometimes, however, these marks of violence are only visible on dissection. Usually the marks found on the neck in such cases clearly indicate how the strangulation has been effected.

(3.) Strangulation **by compression of neck with a stick or other hard substance**, although not so common as strangulation by hand, is still often met with in India. Usually, one stick placed across the front of the neck is used ; but sometimes two sticks are employed, one placed behind, and the other in front of the neck. This mode of strangulation causes a central bruise on the front of the neck, and usually severe local injury.

2. **Asphyxial** and other appearances.—**The lungs**, as in hanging, may be found uncongested. According to Tardieu,

patches of emphysema on the surface of the lungs, due to rupture of the superficial air-cells, are invariably, and apoplectic effusions into the substance of the lungs commonly, present in death from strangulation ; while punctiform sub-pleural ecchymoses (Tardieu's spots), common in suffocation, are rare in strangulation. These appearances are all infrequent in hanging. **Effusion of bloody serum into the pericardium** is very common in death from strangulation, and comparatively rare in death from hanging ; it, however, is present in some cases of hanging, especially when death has occurred slowly.

Saliva running in straight lines down the chin and chest, a common appearance in death from hanging, are not likely to be present in strangulation.

In three cases reported by Dr. Mackenzie, in none of them were the appearances in the air cells of the lungs or about the skin of the face, neck and chest and conjunctiva mentioned by Tardieu found. In all these cases the eyes were closed. In none of them were muscles or other deep structures of the neck injured. In these cases the tongue was not swollen; in two it was protruded between the teeth and was bitten into but not through. In none were the fingers clenched.

Questions Regarding Strangulation.

As in hanging, the chief medico-legal questions connected with death by strangulation, are:—(I) Was Death due to Strangulation ? and (II) Was the strangulation Homicidal, Suicidal, or Accidental ?

I. Was Death Due to Strangulation ?

It may first be pointed out, that in very exceptional cases, death may occur by strangulation, without any mark being present on the neck. This may happen if a soft ligature has been used. It rarely, however, occurs, as even when a soft ligature is employed, much superfluous violence is commonly applied, and a distinct mark on the neck is usually present. If no marks of violence, either external or internal, are to be found on the neck, strangulation is very strongly, but not positively, contra-indicated. **When strangulation has been effected by means other than the use of a ligature** much violence is almost always used—often to other parts of the body as well as the neck—and there is seldom any difficulty in arriving at a conclusion as to the cause of death. Here, however, it must be remarked, that in very exceptional cases of death from natural causes, finger marks may be found on the neck, accompanied by the *post-mortem* appearances of death from asphyxia. An individual dying from asphyxia the result of disease, *e.g.*

epilepsy, may, in his struggles for breath, by clutching at his throat, produce such marks (see *Case LXXVIII*). Hence if the only marks of violence present on the body are slight finger marks on the neck, a guarded opinion must be given as to the cause of death.

Case LXXVIII.—**Strangulation (? Suicidal); finger marks on the neck, probably caused by deceased himself** (Chevers, *Med. Jur.*, p. 580).—A man was found dead in the house of a prostitute, who had been his mistress for three years. Deceased's cousin was sleeping in the same house with another prostitute, and was called early in the morning by deceased's mistress, who appeared to be much alarmed at his (deceased's) condition. The cousin found him apparently dying, and removed him to his own house. A *post-mortem* examination was made, and showed death to be due to apnœa. Three marks were found on deceased's throat such as would be produced by finger-nails. The surgeon who made the examination thereupon reported strangulation to be the cause of death, and deceased's mistress was tried and convicted of the murder. It, however, appeared, that deceased had been subject to epileptic fits, and many of the circumstances of the case being strongly against the supposition of homicide, the High Court reversed the conviction, holding that the marks on the throat might have been produced by deceased himself.

Ligature mark on the neck corresponding in external appearance to a strangulation mark, cannot of itself be taken as evidence of death by strangulation. Such a mark may be the result of the application of a ligature to the neck after death, or have been accidentally produced by the pressure of a tight-fitting article of dress, or be the result of putrefactive swelling against a string tied loosely round the neck. In the last two cases, however, injury to the underlying soft parts, common in strangulation, is not likely to be found. Hence, even when a ligature mark is found on the neck, corresponding in appearance to a strangulation mark, to establish the fact that death was due to strangulation, requires proof that the pressure of such ligature was the cause of death. Such proof may be afforded by the presence of the general *post-mortem* appearances of death by strangulation. It must, however, be recollected that in hanging, as well as in strangulation by a ligature, death is due to the pressure of a ligature on the neck. Further, that in hanging, the presumption is always in favour of suicide, while in strangulation, it is in favour of homicide. Hence, in all cases of death from pressure of a ligature on the neck, all appearances indicating the cause of death to be hanging, rather than strangulation, or *vice versâ*, should be most carefully noted.

Case LXXIX.—**Accidental strangulation** (Guy, *For. Med.*, p. 262).—Elizabeth Kenchan, an extremely dissipated, drunken, and disorderly woman, went to bed intoxicated with her bonnet on, and in the morning was found strangled in its strings. She had fallen out of bed, her bonnet became fixed between the bedstead and the wall, and she, being too drunk to loosen the strings, was strangled.

Case LXXX.—**Accidental strangulation** (Ogston, *Med. Jur. Lect.*, p. 543).—A man was carried to bed very drunk, and left there with his clothes on. It was supposed that afterwards he had got up so far as to lean over the front of his bed to vomit, with his hands pressed on the pit of his stomach, as he was found dead in this posture in the morning. His neckerchief was so tight around his neck, that the contraction thus caused would have sufficed to produce strangulation, from his inability to change his position, in the helpless condition he was in at the time. The inspection, by presenting all the appearances which were to have been expected under such circumstances, left no doubt but that accidenta strangulation was the cause of death.

Case LXXXI.—**Accidental strangulation** (Taylor, *Med. Jur.*, ii, p. 67).—A girl was accidentally strangled in the following manner : She was employed in carrying fish in a basket at her back, supported by a leather strap passing round the front of her neck above her shoulders. She was found dead sitting on a stone wall ; the basket had slipped off, probably while she was resting and had thus raised the strap which had firmly compressed the wind pipe.

II. Was the Strangulation Homicidal, Suicidal or Accidental?

Accidental cases are rare ; a few, however, are on record (*Cases LXXIX, LXXX & LXXXI*).

Suicidal cases of strangulation by a ligature are sometimes met with. To effect suicide in this way requires the employment of some means whereby the ligature is kept tight, independently of any muscular effort on the part of the suicide ; so that relaxation may not occur when insensibility supervenes. This end may be arrived at in various ways, *e.g.*, by simply passing the ligature more than once round the neck ; or, by securing the ends of the ligature to the foot, or to the wrists in such a manner that the ligature is tightened when the arms are extended ; or to some fixed object. Or, it may be arrived at by twisting a stick in the tied ligature, and securing the end of the stick ; or by simply knotting the ligature. As regards this last method, it may be noted that the presence of more than one knot raises a suspicion of homicide, two knots have, however, occasionally been found in suicidal cases ; more than two knots very strongly indicates homicide.

Homicidal cases.—Just as in hanging the presumption is always in favour of suicide, so in strangulation the presumption is always in favour of homicide. Homicide is very strongly indicated, (*a*) when a ligature has been employed, by the absence of evidence indicating the use of some means for the purpose of keeping it tight after insensibility has occurred ; (*b*) by the presence of signs indicating the application of much violence to the neck or to other parts of the body, and (*c*) when the strangulation has been effected by means other than the use of a ligature. Obviously homicide also is almost conclusively

indicated, if the hands are found tied together in such a way as to show that they could not have been so secured by the individual himself.

Case LXXXII.—**Homicidal Strangulation.**—Dr. Mackenzie reports in *Ind. Med. Gaz.*, 1888, p. 232, this case. The body of Shaikh Haru (who left his home in good health on April 4th, 1888) was found tied up in a box the same evening, and Mihir Ali, Khansamah, of the Doveton Institution was suspected of the crime. At the *post-mortem* examination made on the day of the death, the body was found tied by means of three cords, one made of jute, another of hemp, and the third of cotton. The thighs flexed on the abdomen, the legs on the thighs, the knees resting on the left side, and middle of the chest 3½ inches above the left nipple. The left arm was tied above the wrist to the left leg, ten inches below the left knee. The right arm was tied to the right thigh six inches above the right knee.

The first cord was made of jute. It was about ½ inch in diameter, it was tied round the lower part of the neck, the knot was double; it was tied on the front of the lower part of the neck just above the manubrium of the sternum. It was then carried downwards over the middle of the chest behind the knees, then upwards along the left side of the chest round the back of the lower part of the neck, then downwards along the right side of the chest to the right wrist, where it was tied to a narrow hempen cord.

This hempen cord was ⅛th of an inch in diameter; at its commencement it was double; it passed from the back of the right wrist downwards for about three inches to the middle, and outer side of the right thigh; it then passed backwards round the lumbar region to the back of the left elbow: at this place the cord became single; it then passed round the left forearm, three inches above the back of the left wrist; then across the middle and front of the right thigh, and was tied here to a part of the same cord, where it turned backwards round the lumbar region.

The third cord was made of soft cloth; it was twisted first into two ply, and then doubled; it was tied tightly round the lower part of the neck; the colour of this cord was white with a streak of pale red and another streak of light pale blue in it. It was tied tightly round the lower part of the back of the neck by means of an ordinary double knot. This cord was beneath the jute cord first described.

N.B.—The stick on the left side of the chin was put to enable the photographer to obtain a better view of the man's features, and had nothing to do with the tying up of the deceased.

The deceased's head was flexed towards the front of the chest, and the stick was placed to raise the head and show the face better.

The body was well nourished and the following *post-mortem* appearances were recorded:—

A circular mark of a cord, ¼th of an inch in diameter, round the lower part of the neck. It was indistinctly marked in front of the neck, but well marked in the sides and back of the neck. The skin beneath this cord was the colour and consistence of parchment. None of the muscles of the neck were lacerated. The hyoid bone, the thyroid, and cricoid cartilages and the rings of the large trachea were not injured.

There were three superficial abrasions, each the size of a six pence on the inner or the mucous surface of the lips, one on the centre of the upper lip, and two at the middle of the lower lip.

There was an abrasion three inches long and $\frac{1}{8}$th of an inch broad on the right cheek, extending outwards from the right angle of the mouth.

The abrasions of the lips and the abrasion at the right angle of the mouth and on the right cheek had the appearance as if a gag had been applied to the mouth.

Besides these abrasions above-mentioned, there were seven abrasions varying in size from $\frac{1}{2}$ of an inch to 12 inches in length on the left forearm, the left knee, the right knee, the right forearm, the back of the right wrist, the right cheek and the front of left shoulder. These had the appearance of having been caused by the jute and hemp cords by which the body had been tied after death and by pressure while the body was compressed into the box. There were two faint marks of blisters, each about the size of a rupee on the temples.

Rigor mortis was well marked all over the body in the morning, but was absent at 2 P.M.

The face was swollen and livid. The eyes were closed. The conjunctivæ were congested. The corneæ were hazy. The pupils were normal. The tongue was protruded between the teeth and was bitten; it was not, however, large and swollen.

Fluid blood was oozing out of the mouth and nostrils.

On reflecting the scalp dark clotted blood was found to be extravasated between the scalp and the skull in the left temporal region for a space of about $1\frac{1}{2}$ inches in length and $\frac{1}{2}$ an inch in breadth.

The fingers were not clenched.

The mucous membrane of the larynx, trachea and bronchi was highly congested and was empty.

The lungs were found to be highly congested. They were adherent to the walls of the thorax by means of extensive old pleuritic adhesions.

The heart was healthy. There was some dark fluid blood in the right side of the heart. The left side was empty.

The liver was highly congested; spleen was slightly enlarged, hard and congested. Kidneys were congested.

There was a single patch of congestion, the size of a rupee along the centre of the greater curvature of the stomach. The stomach contained four ounces of half digested rice and fish which emitted an acid odour.

The intestines were healthy and contained semi-consistent fæces.

The bladder was healthy and contained four ounces of urine.

The gullet was healthy and contained some food from the stomach.

The substance of the brain was healthy.

The vessels of the brain were congested. There was no effusion of serum over the surface or into the lateral ventricles of the brain.

No bones were found to be fractured.

Opinion: that the deceased died from asphyxia due to strangulation. Mihir Ali was found guilty of murder, and sentenced to be hanged, but his sentence was commuted by the Government to transportation for life.

Case LXXXIII.— **Homicidal Strangulation.**—A *gharami* or thatcher named Gopal Bairagi who eloped from his native village in the Birbhum district with a young woman named Bow *alias* Mukta, came to Calcutta and lived as husband and wife. The neighbours said they frequently quarrelled. On the night of the 8th July 1878 they retired to bed, and on the next morning the man was found absent, and the body of the woman covered with a quilt and a gunny bag, her mouth gagged with a piece of cloth, and a coir rope tied tightly round her neck.

The body examined on the 9th July was that of a native woman of about 25 years of age ; well nourished, and the external marks of violence on it were a mark of a cord round the neck immediately below the thyroid cartilage and a contusion of the left eye-ball.

A piece of cloth was twisted twice tightly round the mouth and a double cord made of two twists of thin coir rope tied tightly across the middle of the neck. The skin beneath this cord was parchment-like. There was no extravasation of blood beneath the skin or into the muscles of the neck. There was no injury to the muscles of the neck or to the windpipe.

The eyes were closed. The face was not flushed ; the tongue was not protruded or bitten by the teeth. The hands were not clenched.

The lungs, the kidneys, the larynx, the trachæ, and the vessels of the brain were congested.

The heart was healthy, the right side was full of dark fluid blood, the left side contained a small quantity of fluid blood.

The liver was large and congested.

The spleen was soft and congested. Other organs healthy.

No bones were fractured.

Opinion : that the deceased died from asphyxia due to strangulation.

Gopal Bairagi after some months returned to his native village, where he was apprehended. He was tried at the High Court and acquitted, as the only evidence against him was circumstantial, which the majority of the jury (natives) would not rely on.

SUFFOCATION.

Under "Suffocation" are included all cases of Asphyxia (drowning excepted) caused by violent means *other than direct pressure on the wind-pipe*, as for example :—(1) By closing the mouth and nostrils ; (2) by pressure on the chest ; (3) by blocking of the lumen of the glottis or air tubes.

(1.) **Closing the mouth and nostrils.**—This may be (*a*) **Homicidal,** as in cases of infanticide effected by closing the mouth and nostrils with the hand. The mouth and nostrils in homicidal cases, also, may be closed by plasters applied to the face ; this was the way in which the resurrection men, Burke and Hare, murdered their victims in Edinburgh. Burke, after conviction, confessed to sixteen murders effected in this way in a few months. Again, soft pillows may be employed, as in the case of the two Princes murdered in the Tower of London. (*b*) **Accidental,** as in cases where children are accidentally smothered by their *mothers overlying the infants* in bed. (*c*) **Suicidal.** Cases of suicide effected in this way are extremely rare. Taylor, however, mentions a case of a woman who is reported to have committed suicide, by simply leaning with her mouth and nostrils pressed against the bed-clothes.

(2.) **Pressure on the chest.**—Suffocation caused in this way is **generally accidental,** usually occurring from either accidental smothering by burial under the *débris* of falling buildings, earth, &c. ; or pressure in a crowd, as in the case

which occurred in Paris in 1837, in which twenty-three persons were suffocated in this way, in a crowd in one of the streets. A case also is recorded of a man who, while a plaster cast of his trunk was being taken, was nearly killed by the pressure on his chest of the solidifying plaster. **Homicidal cases** are sometimes met with in India. In homicidal cases, if the victim is an adult, and was not first rendered insensible, or was not a consenting party, probably several persons will be found to have been concerned in the murder. Often great violence is used, sometimes causing symmetrical, or nearly symmetrical, fractures of the ribs (see p. 138). In children, great violence may be employed, sufficient, in fact, to cause extensive injury to the lungs, without fracture of the ribs (see *Case XC b*). If the pressure on the chest has been steady and long continued, it is probable, as pointed out by McLeod, that broad horny marks will be found on the skin. Under the head of homicidal suffocation by pressure on the chest, may also be mentioned (1) the burial alive of widows with their husbands' body, a custom formerly prevailing, to a certain extent, in India, and (2) the *samádh* or burial alive of lepers—often with the consent or at the entreaty of the victim—cases of which used formerly to be not infrequently met with in India.[1] **Suicidal suffocation** by pressure on the chest is hardly possible.

(3.) **Closure of the glottis.**—Suffocation thus caused often occurs **accidentally** from the impaction of foreign bodies—masses of food, for example—in the throat or air passages, often by pieces of food during an inspiratory act whilst vomiting or by swallowing false teeth, &c.; or from spasm of the glottis, the result of disease or of the inhalation *of poisonous or irrespirable gases*. Powell reports a case of this sort by impaction of a round worm in larynx. **Suicidal suffocation** by closure of the glottis, effected by forcing rags, articles of dress, &c., into the fauces is sometimes met with. **Homicidal cases** are rare in adults. Children in India, however, are sometimes murdered by filling their mouths with mud or other soft material (see *Cases LXXXVIII, LXXXIX*); this also is a common method of infanticide in India.

Post-Mortem Appearances in Death from Suffocation.

(1.) **Appearances of Asphyxia.**—Cases, however, have occurred of undoubted death from suffocation, where most of the

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[1] Cases of live burial of lepers occurred in Rajputana in 1868. Harvey (*Beng. Med. Leg. Rept.*, 1870-72) points out that the victim is often buried in a squatting posture up to the neck only, with the earth loosely packed around him, death taking place from exposure and exhaustion. After death the head is covered with earth.

post-mortem appearances of asphyxia were absent. On this point, Christison, in the case of the woman Campbell, murdered by Burke, the resurrectionist, remarked, "the conviction in the public mind, that a well-informed medical man should always be able to detect death by suffocation, simply by an inspection of the body, and without a knowledge of collateral circumstances, is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly marked appearances in every case of death from suffocation. That such appearances are very far from being always present, ought to be distinctly understood by every medical man."

(2.) **Punctiform sub-pleural ecchymoses** or "Tardieu's spots" (p. 178) are usually absent in cases of suffocation. Powell reports two large apoplectic effusions in a child whose death was caused by plugging the larynx with a rag.

(3.) **Appearances of violence sufficient to cause suffocation**, *e.g.*, marks of violence on the chest, marks indicating the application of manual pressure, or of plasters over the mouth and nostrils, foreign bodies impacted in the throat, &c. Cases, however, of death from suffocation by violence may occur, and no appearance of this class be present.

Questions Regarding Suffocation.

As in hanging and strangulation these are :—(I) Was death due to suffocation? and (II) Was the suffocation Accidental, Suicidal or Homicidal?

I.—Was Death due to Suffocation?

The chief points bearing on this question are :—

(1.) **The post-mortem appearances of asphyxia may be nearly entirely absent**, and yet death may have been caused by suffocation (see Christison's remarks just quoted).

(2.) **The post-mortem appearances of asphyxia may be present, and those of drowning, hanging, and strangulation absent**, and yet death may not have been the result of suffocation by violence, but may have been due to asphyxia, the result of disease, or poison, *e.g.*, epilepsy, tetanus, or strychnia poisoning. Hence, in cases of alleged suffocation by violence, much depends on the presence or absence of **signs indicative of the employment of violence**, such as would produce suffocation. If these are absent, no positive opinion can be given, from the *post-mortem* examination alone, as to the cause of death.

(3.) **Tardieu's spots,** if numerous, well-defined in shape, and limited in size, present on the lungs and thymus gland, strongly contra-indicate strangulation, and **indicate suffocation** to be the cause of death. **Their presence,** however, is **consistent with death from causes other than suffocation.** They have been met with in the bodies of adults after death from drowning, hanging, strangulation, scarlatina, heart-disease, apoplexy, pneumonia, &c.; and in the bodies of still-born, and even unborn infants. Further, **their absence does not,** at any rate in the case of adults, conclusively **contra-indicate suffocation.** Ogston failed to find them in nine cases of death from suffocation in adults.

II.—Was the Suffocation Accidental, Suicidal, or Homicidal?

(1.) **If the deceased is an adult,** the presumption is always in favour of **accident.** Curious accidents leading to suffocation by closure of the glottis sometimes occur (see *Cases LXXXV, LXXXVI & LXXXVII*). **Suicidal** cases are rare, but are sometimes met with, *e.g.*, the case of suicide by closure of the mouth and nostrils already referred to. A case also is reported in which a prisoner committed suicide by stuffing his mouth with rags, another in which a young woman suffocated herself by stuffing a large ball of hay into her throat, and another of a young woman who committed suicide by shutting herself up in a trunk. **Homicidal** cases are not often met with. In a homicidal case unless the victim was suffocated while insensible, marks showing the employment of much violence will probably be found.

Case LXXXIV (a).—**Accidental Suffocation by Plums.**—Dr. Mackenzie relates (*Ind. Med. Gaz.*, 1890, p. 295) that of a native female child of about four years of age, who, while playing about under a country plum tree, ate a quantity of its unripe fruit, and was shortly seized with a severe attack of vomiting. The parents took her to a native practitioner, who, after giving some medicines, recommended that she should be removed to hospital, but on arrival the child was dead. The body, examined the next day, was found well-nourished with no external marks of violence. The finger nails were of a blue colour, the eyes not sunken, and the skin of the fingers and toes not shrunken. The lungs, the liver, the spleen, the kidneys, and the vessels of the brain were congested. The heart was healthy, the right side full of dark fluid blood, the left side empty. The stomach, the intestines, the bladder, the uterus, the ovaries, the vagina, and the substance of the brain were healthy. The larynx, trachea, and large bronchi were full of half-digested green plums, and the stomach contained a quantity of half-digested green plums. The intestines contained well formed fæces and half-digested green plum. No bones were fractured. *Opinion:* that the child died from suffocation owing to the half-digested green plums passing into the air passages during a deep inspiration while in the act of vomiting.

Case LXXXIV (b).—**Accidental Suffocation by Meat.**—On the 23rd September 1886, a European sailor, James Kelley, who had been drinking heavily for about 9 days, went to the kitchen of a sailor's boarding-house, and asked for some food. He was supplied with a mutton chop, while eating which he began to vomit and was assisted to the side of a drain when he suddenly became insensible, and was immediately after removed in a carriage to hospital, where on arrival, he was found to be dead. Body examined 24 hours after death, was found to be that of an adult European male of about 50 years of age, well-nourished. Rigor mortis was well marked all over the body. The lungs, the liver, the spleen, the kidneys, the stomach, and the vessels of the brain were congested. The heart was healthy; there was dark fluid blood in the right side; the left side was empty. The intestines, the bladder, the œsophagus, and the substance of the brain were healthy. The stomach contained an ounce of a reddish coloured liquid emitting a strong smell of alcohol, all the internal organs also emitted a strong odour of alcohol. The mucous membrane of the larynx, the trachea and large bronchi were congested. There was a piece of undigested cooked meat, 3½ inches long and one inch and a half broad, firmly wedged into the entrance of the larynx. *Opinion:* that this piece of meat, which was found fixed at the entrance to the larynx, had prevented the ingress of air into the lungs and thus suffocated the man.

Case LXXXV.—**Accidental suffocation** (Chevers, *Med. Jur.*, p. 619).—"In 1859, Dr. Whyte reported the case of a strong Madras water-carrier into whose mouth a fish had jumped while he was bathing. On opening the mouth, the tail of a large cat-fish presented itself, with the body firmly fixed within the fauces, and filling up the isthmus completely. It had entered flat, so that the fin of one side was posterior to the velum, and opened out on any attempt being made to withdraw the fish. The operation of œsophagotomy was commenced and was abandoned. A piece of cane was made into a probang, and, with it, attempts were made to press the fish downwards into the œsophagus. It did pass downwards when the patient at once ceased to breathe, gave one convulsive struggle and died to all appearance. The trachea was immediately opened, and respiration was restored. In the course of the night the man coughed up the fish, the fins having become softened by decomposition."

Case LXXXVI.—**Accidental suffocation** (Chevers, *ib.*, p. 619).—"In 1865, a native boy about four years old was brought to the Calcutta Medical College Hospital, with a *coir* fish impacted in his glottis. These fish are very tenacious of life out of water. The poor child appears to have taken up the fish, and to have put its head into his mouth. In its struggles, its head passed the glottis, and all attempts to withdraw it were prevented by the catching of its gill-plates, anchor-wise, below the vocal chords. The child was suffocated."

Case LXXXVII.—**Accidental suffocation** (Chevers, *ib*, p. 618).—"A private soldier, *æt.* 28, was discovered, at night, by the man lying next to him: to be breathing loudly and with great difficulty, as if there were some obstruction about the lower part of the trachea. He was at once removed to the dispensary, where he died in about fifteen minutes. Several small pieces of potato were found in both bronchial tubes, where these subdivided into small branches. There was great œdema of the glottis, no doubt from the irritation caused by a foreign body. The deceased had drunk some beer and also rum in the course of the evening, before retiring to rest.—He had been sick, and had vomited while in bed."

Case LXXXVIII.—**Homicidal suffocation** (Chevers, *ib.*, p 166).—A very young man of Mirzapore was sentenced to death for murdering a boy of twelve for his ornaments, by filling his mouth with mud. The civil surgeon deposed that the cause of death was, in his opinion, suffocation and consequent congestion of the brain, produced by the mouth and air passages of the deceased having been filled with mud, whilst he was alive.

(2.) **If the deceased is a child or infant,** suicide is of course contra-indicated, and the question lies between accident and homicide. Accidental cases often arise from overlying, or from accident during birth (see *Infanticide*, Chapr. XVI). Homicidal cases are sometimes met with in children (see *Cases LXXXVIII to XC*), and are frequently met with in infants; stuffing the mouth with rags, or filling it with cow-dung or dirt, being common modes of infanticide in India.

Case LXXXIX.—**Homicidal suffocation** (Chevers, *ib.*, p. 616)—A lad from thirteen to fifteen years of age was sentenced, at Agra, to transportation for life for having robbed a girl of four, his near relative, of her ornaments after having filled her mouth with *bhusa* (bran). The civil surgeon deposed that death had been caused by suffocation, consequent upon the mouth of the deceased being filled with *bhusa*.

Case XC. **Homicidal suffocation** (*a*). (Chevers, *ib.*, p. 616).—An old woman of Tirhoot, finding a little girl of six digging up some grain from her field, felled the child with a heavy clod, and then suffocated her by pressing her clothes against her mouth, until she ceased to breathe. She then stripped off the clothes and ornaments, and buried the corpse. (*b*) Dr. McReddie, in McLeod's *Bengal Med. Leg. Rep.*, 1868-69, p 36.—A girl aged about twelve. Body far advanced in decomposition; no marks of violence externally, but on cutting into the skin of the chest, extensive bruises and bloody effusions were found over the whole front aspect of the ribs. The ribs were not fractured. The right lung was natural, but the left had been most severely injured by compression and had become a jelly-like mass. The girl had probably been thrown down, and then had her chest compressed by the weight of her assailant's body.

DROWNING.

This mode of death from asphyxia is by submersion of the mouth and nostrils under water or other fluid, so that access of air to the lungs is cut off. This form of asphyxial death differs from the other forms in that water or other submersing fluid is drawn into the lungs during attempts at respiration.

Causes.—Accidental cases are common in all countries among the seafaring population of the coast. Accidental cases also are common throughout India generally, especially among females, from falls into wells and tanks. In the Bombay presidency in 1883 nearly one-half of the violent deaths of the year were cases of drowning, and of these over three-fourths

were accidental. This proportion also obtained in Calcutta in Dr. Mackenzie's cases, which gave 75·73 per cent. as due to accident.

Causes of Drowning per 1,000 *deaths in Bombay.*

Deaths by drowning in Bombay in 1883, actual number of deaths=			2,713
Death-rate from all injuries per 1,000 of population			0·36
Death-rate from drowning ,, ,, ...			0·16
Suicide	Males	51	
	Females	103	
			154
Accident—Falls into tanks and wells	Males	175	
	Females	275	
			450
Other accident	Males	188	
	Females	142	
			330
Unknown	Males	38	
	Females	28	
			66
Total ...			1,000

Suicidal cases are also common in India. In the Madras and Bombay Presidencies, over three-fourths of the female, and nearly one-half of the male suicides, drown themselves. In European countries also, drowning is a mode of suicide often selected, ranking, as a rule, second in order of frequency, hanging ranking first. In Dr. Mackenzie's 305 cases of drowning at Calcutta, only 2·62 per cent. were suicidal, the reasons assigned being family disputes, insanity and bodily disease. **Homicidal cases** are rare, but are sometimes met with in India. Dr. Mackenzie had only one such out of 305 cases.

Mode of drowning.—When a person falls into water he sinks, but usually, if not stunned, rises again to the surface, probably by the movements of his limbs, and tries to breathe. In his struggle, he takes in some water which striking the glottis causes cough and forcible expiratory efforts and the raising of a portion of his body out of the water, causing him to sink a second time. He may again rise to the surface by the movements of his limbs, again struggle, and sink. Ultimately, in consequence of the expulsion of air from the lungs, and the specific gravity of the body being greater than that of water in the proportion of 1·08 to 1, the body ceases to rise. The subjective sensations are said by the resuscitated to be mental confusion followed by pleasing dreams.

Submersion of the whole body is not necessary for drowning, as drunkards, epileptics, and children have been drowned

in shallow puddles or vessels containing only a few inches of water.

Case XCI.—**Drowning in shallow water.**—Dr. A. Powell gives these two cases (*Ind. Med. Gaz.*, 1897, p. 300) :—

(*a*) Patu m., *æt.* 20, liable to epileptic fits, for which he had been under treatment at intervals for two years, went to work in some muddy rice land on 14th May 1890. An hour later he was found dead, lying with his face downwards in a shallow pool. The water was so shallow that only his mouth, nose and the right side of his face were immersed, the left eye and side of face being above the surface. The rest of his body from the neck downwards was on dry ground. *Post-mortem.*—The mouth, nasal cavities and air passages contained mud and green water weeds.

(*b*) Mazli, *æt.* 26, had attended hospital for epilepsy. On August 23rd, 1890, she was found dead, face downwards in an almost dry drain. I measured the depth of the water at once and found the maximum for some distance to be 2 inches, except a depression 3½ inches where her head had lain. *Post-mortem.*—Air passages contained sand and muddy water with a few blades of grass; skin of face soddened *à la blanchisseuse;* elsewhere *cutis anserina* marked. Uterus contained an eight months' fœtus.

Mode of death.—In 87·5 per cent. of cases, death occurs either by pure asphyxia (25 per cent.), or a combination of asphyxia with syncope or cerebral congestion (62·5 per cent.) In the remaining 12·5 per cent., death takes place by apoplexy, or cerebral congestion, or syncope, or shock (asthenia).

In Dr. Mackenzie's 305 cases, 297 or 97·37 per cent. persons died from asphyxia ; 1 or ·32 per cent. from syncope ; 1 or ·32 per cent. from asphyxia and apoplexy, and in 6 or 1·96 per cent. the mode of death could not be ascertained, on account of the bodies being in a very advanced state of putrefaction.

Death by shock is met with in cases where the individual, in falling into the water, strikes his head, chest, or abdomen, forcibly against some hard object, or against the surface of the water simply, if the fall is from a great height. In such a case the signs of drowning will be absent.

Period at which death takes place.—This varies with the mode of death. It is instantaneous if from shock, rapid if from pure asphyxia, less rapid if from a combination of asphyxia with syncope or cerebral congestion. When death occurs from pure asphyxia, asphyxia commences as an outside limit after two minutes' complete submersion, and death takes place within five minutes. Recovery is rare after five minutes' complete submersion.

The longest record dive under water is 4 minutes 45½ seconds by Miss E. Wallenda in a tank at the Alhambra Music Hall, as tested by expert athletic time-keepers.—*Whitaker's Almanack.*

Treatment should, however, be persevered with, until it is certain that death has taken place, (*a*) because in exceptional cases animation has been restored after more than five minutes' complete submersion, (*b*) because the submersion, although alleged to have been complete, may not have been so, and (*c*) because by persevering treatment, individuals have been recovered, who have shown no signs of animation for several hours; in one case of recovery it is said that there were no signs of animation for 8½ hours.

Period at which dead body floats.—The body eventually comes to the surface, if not entangled, when putrefactive gases make it sufficiently light to float. The length of time for this varies with the temperature of the air, water, the sex, &c. Fat bodies float sooner than thin. In hot weather it may float within 24 hours after drowning, but it is seldom possible to estimate from the bodies the length of time since death.

In a boat accident in Calcutta bodies were not found floating till the third day, and one was not found till sixth day after accident. In the Hughli river at Calcutta Dr. Mackenzie found that if there was no obstacle to impede the rising of bodies they generally floated in the hot and rainy season within 24 hours of the immersion and in the cold season in from two to three days.[1] In Dr. Mackenzie's 305 cases, in 138 or 45·28 per cent putrefaction was present; in 5 or 1·63 per cent. the bodies were saponified; in 124 or 40·65 per cent. the bodies were fresh; and in the remaining 38 or 12·45 per cent. no note was made as to their condition.

Case XCII.—**Buoyancy of decomposed body.**—A woman was killed on the night of a Friday, and the evidence went to show that the body must have been thrown into a well* about midnight. On the following Sunday morning, about meal-time, which was about 8 or 9 A.M., the body was found floating with a heavy stone attached to it. The woman was said to have been of slight figure and short stature, and therefore probably, when alive, did not weigh more than 100 to 105 lbs. The stone itself weighed 92 lbs, so that the decomposition in 30 hours must have been so rapid as to generate gas capable of raising, not only the body itself, but the dead-weight attached to it. The stone was attached to the waist, and the body, when found, was lying horizontally on the surface of the water on its side. The water was from ten to twelve feet in depth, and the specific gravity of the stone was 2·7. This case is of interest, as showing the extreme buoyancy of a decomposed body in water, and the rapidity with which gases can be generated. The murder occurred in September 1883.—Gribble, *Med. Jur.*, p. 99.

Treatment of apparently drowned persons.

Attempts at resuscitation should be commenced at once. First get rid of any water in the mouth, and upper air passages, &c., by placing the body for a **few seconds**, face down with the

[1] *Ind. Med. Gaz.*, 1889, 131.

head a little lower than the **feet**, keeping the mouth open, and the tongue drawn forwards. Next turn the body on the back, as quickly as possible, strip it, rub it dry, and apply warmth to the surface and weak ammonia or snuff may be held to the nostrils by some other person. If respiration is not restored commence artificial respiration immediately. Galvanism may also be employed if available (one pole to the nape of the neck and the other to the epigastrium). All crowding round the patient should be avoided.

Artificial respiration.—There are three principal methods of employing artificial respiration, *viz.* (1) Marshall Hall's, (2) Silvester's, and (3) Howard's direct method. Of these No. 2 is better than No. 1, and No. 3 is said to be better even than No. 2.

(1.) **Marshall Hall's method.**—This consists in turning the patient alternately on his face and side, making pressure on the back each time the patient is turned on his face. When the patient is turned on his face, his chest must be supported on some suitable cushion, and his head should be supported and kept raised by placing one of his arms under his forehead.

(2.) **Silvester's method.**—In this the patient is laid on his back with his head and shoulders slightly raised. The operator takes up his position behind the patient's head, grasps the patient's arms just above the elbows, one in either hand, draws them up above the patient's head in a line with the patient's body, and keeps them well stretched upwards for two or three seconds. The patient's arms are then to be turned down and pressed for a couple of seconds firmly against the sides of his chest, then raised as before, and again pressed down about fifteen times a minute.

(3.) **Howard's direct method.**—Dr. Howard's instructions for carrying out this method are as follows :—

"(*a*) **Instantly** turn the patient **face downwards** with a large firm roll of clothing under the stomach and chest. Press with your weight two or three times, for four or five seconds each time, upon the patient's back, so that the water is pressed out of the lungs and stomach, and drains feebly downwards out of the mouth. Then (*b*) **Quickly** turn the patient **face upwards**, the roll of clothing being now put **under his back just below the shoulder blades**, the head hanging back as low as possible. Place the patient's hands together above his head ; kneel with the patient's hips between your knees ; fix your elbows against your hips. Now, grasping the lower part of the patient's chest, squeeze the two sides together, pressing gradually forward with all your weight for about three seconds until your mouth is nearly over the mouth of the patient; then,

with a push, **suddenly** jerk yourself backwards. Rest about three seconds, then begin again. Repeat these bellows-blowing movements, so that the air may be sucked into the lungs about eight or ten times a minute.

"Remember the above directions must be used **on the spot,** the instant the patient is taken from the water. A moment's delay, and success may be hopeless. As soon as the water is pressed from the lungs, all clothing should be ripped away from the chest and throat. In making the pressure either for the removal of the water or for breathing, increase it **gradually** and thoroughly, and **suddenly** let go with a jerk. With women and children use less force. Do not stop these movements under an hour unless the patient breathes. Be careful not to interrupt first short natural breaths. If they be long apart, carefully continue between them the bellows-blowing movements as before."

When spontaneous breathing returns, apply heat by water-bath or friction, and when swallowing returns give a little brandy and water. This treatment should be persisted in for several hours—flushing and convulsive twitchings of face and gasping indicate returning breathing.

Questions Regarding Drowning.

The chief medico-legal questions connected with drowning are :—(I.) Was death due to drowning or to some other cause operating before immersion? and (II.) Was the drowning Accidental, Suicidal, or Homicidal?

Was death due to drowning or to some other cause operating before immersion?

Signs of drowning in body.—The external signs will vary according to length of time the body has been submerged. As in 87·5 per cent. of cases of death from drowning, the mode of death is asphyxia, pure or mixed, the *post-mortem* appearances of death from asphyxia will usually, but not invariably, be found. Thus usually the right side of the heart will be full, and the left side empty, and the lungs and venous system engorged. Great congestion of the lungs, especially if accompanied by sub-pleural ecchymosis, indicates that the struggle for life has been great. Whether, however, the *post-mortem* appearances of apnœa are present or not, other appearances indicative of death from drowning must be searched for, because (*a*) asphyxia, if present, may have been the result of causes other than drowning, and (*b*) the mode of death may not have been apnœa, and yet death may be due to drowning.

Post-mortem appearances other than those of asphyxia which indicate death by drowning are as follows :—

EXTERNALLY.

(1.) **Froth in the mouth and nostrils.**—This, although usually present in death from drowning, may be absent, especially in cases where the body has not risen to the surface after its first submersion. It is often also present in death from causes other than drowning, *e.g.*, in epilepsy, and in cases of death from asphyxia not due to drowning.

(2.) **Cutis anserina,** or goose-skin, if present, indicates that immersion took place either during life or shortly after death. No conclusion can, however, be drawn from the absence of this appearance. Powell believes that it disappears with *rigor mortis*.

(3.) **Retraction of the penis.**—This, according to Casper, if present, affords evidence of some weight in favour of drowning. Ogston, however, found this condition present in only six out of thirty cases. The colder the water, the more marked is the shrinking. It may be absent in tropical waters.

(4.) **Sand, mud, weeds, sticks, &c., grasped in the hands or sticking under the nails,** are evidence of struggles in the water during life, and hence presumptive evidence in favour of death having been caused by drowning. Abrasions on skin, especially hands.

INTERNALLY.

(1.) **Water in the stomach**, especially if this contains matters such as are present in the water of immersion, *e.g.*, algæ, diatoms, &c. Water is usually found in the stomach if the individual was sensible at the time of immersion. It is highly improbable that after death, water can enter the stomach, hence the presence of this *post-mortem* appearance indicates it to be highly probable (*a*) that the individual was sensible at the time of immersion, and (*b*) that as a consequence death was due to drowning, though not necessarily negativing either of those probabilities absolutely.

Powell found water in the stomach in about 60 per cent. of cases of drowning.

(2.) **Water in lungs.**—The lungs are distended with indrawn water and full of bloody froth in bronchi, so that, Powell points out, the distended lungs feel sodden and œdematous and do not collapse on opening the pleura. Water may transude into the pleural cavities.

(3.) **Mud, sand, or floating matters mixed with water in the lungs or windpipe.**—This is evidence of even greater value than the last-mentioned appearance in favour of the supposition that the individual was sensible at the time of immersion, and that, therefore, death was most probably due to drowning.

Lastly, it should be noted that **the post-mortem appearances of death by drowning may be altogether absent,** and yet drowning may have been the cause of death. Obviously in such cases the absence of appearances indicative of death from a cause other than drowning, *e.g.*, violence, poison, or disease, must be ascertained by careful search.

Was the drowning Accidental, Suicidal, or Homicidal?

Death from drowning is, as above noted, usually accidental, more seldom suicidal and rarely homicidal, except in infants.

The fact, however, of the body being found in water does not necessarily imply death from drowning, as the person may have been murdered first and afterwards thrown into the water. Thus the body found in water should always first be examined for marks of violence. On the other hand, some suicides inflict wounds on themselves before drowning and have even tied their feet together and weighted their bodies with stones, &c. Sometimes no indications are afforded as to whether accidental or suicidal.

(1.) **Marks of violence are present on the body.**—Very often, however, such marks are due to accidental injury at the time of immersion, or, but less often, to injury after immersion. Hence in a case of death from drowning such marks do not indicate homicide, unless from their nature or from the circumstances of the case, the possibility is excluded of their being due to—(*a*) **Injuries received at the time of immersion,** owing to the body striking in its fall against some hard object, or if the fall has been from a great height against the surface of the water. Bodies found in wells frequently exhibit severe injuries caused in the first of these two ways; and fracture and dislocation of the cervical vertebræ has resulted from the head striking forcibly against the bottom of a shallow bath. Again, a case is recorded in which dislocation of both arms backwards was caused, by the body after falling from a great height striking the surface of the water with the arms outstretched. (*b*) **Injuries received after immersion,** during life or after death, *e.g.*, a case is reported where a mark of a ligature on the neck was produced by the string of a cloak getting tightly drawn round the neck during the struggles of the drowning person; and another where fracture of one of

the cervical vertebræ was caused by the muscular effort of throwing the head violently back on contact of the body with the water. Obviously also severe injuries may result from the body during life or after death being forcibly dashed against some hard object, *e g.*, a rock or wall, or the pier of a bridge; or from the bites of animals.

(2.) **Ligatures** are found round the hands or feet, or weights are found attached to the body. In such cases accident is contra-indicated. If the ligatures are found tied in such a way that the individual himself could not have tied them (but not unless this is the case) suicide also is contra-indicated.

(3.) **The body is found in shallow water.**—In this case accident is contra-indicated, unless the individual was intoxicated or insensible at the time of immersion or a child in a tub of water. Suicide is not contra-indicated, as cases are known of individuals drowning themselves in water only a few inches deep. If drowning in shallow water is homicidal, marks of violence due to the force employed in holding the victim under water will usually be present. Here it may be mentioned that in some parts of India a form of ordeal, to which women suspected of witchcraft are in some instances subjected, is holding the head under water during the time an arrow is shot from a bow and brought back to the place from which it was shot.[1]

Case XCIII.—**Weeds in mouth indicate site of drowning.**—The body of a child was found in a tank at a considerable distance from his own house, and suspicion was naturally excited that he had been conveyed thither and made away with. Dissection afforded clear evidence of death from drowning: the fauces, larynx, and trachea contained small portions of green vegetable matter, and the right bronchus was almost completely filled with so large a portion of an aquatic weed, doubled together, that it appeared astonishing how any such body could pass the *rima*. It was afterwards proved distinctly that no weed of the kind grew in the tank where the body was found. Further enquiry led to the discovery that the boy's body had been found by a woman in a tank near his home, in which the weed, lodged in the air passages, grew abundantly. This female had conveyed the corpse to the more distant tank which belonged to a person against whom she bore a grudge. —Chevers, *Med. Jur.*

Case XCIV.—**Mistaken case of drowning.**—Chevers gives the following remarkable case of mistaken *post-mortem* signs, which shows how cautious a medical man should be before committing himself to an opinion. Dr. Woodford, at Calcutta, made a *post-mortem* examination of the body of a European sailor at the police dead-house. He found the clothes saturated with water. Sanious froth was round the nostrils; the hands were somewhat soddened, but the boots, which were wet, had preserved the feet. It was twenty-four hours after death, and decomposition was advancing rapidly. The skin was vesicated, and the

[1] Gribble, *Med. Jur.*, p. 154.

body covered with particles of sand. The vessels of the brain and the right side of the heart were engorged with blood. The lungs and other viscera were highly congested. He certified that deceased died from submersion in water. The coroner returned the certificate for explanation, as the police reported that the deceased had died in the police lock-up from apoplexy. The clear explanation was, that the body had been carried from the lock-up to the dead-house, a very small godown, with open windows, only three feet from the ground. It was placed on a table under a window on the west side, rain had fallen in torrents all night, and the wind blew from the west. Dr. Woodford found the body on a table in the centre of the room. The clothes were, as we have seen, saturated, and the body was covered with particles of sand. Dr. Woodford observes that in Bengal, drowned bodies, which have not been disturbed, are invariably covered with particles of fine sand. The sand had been driven on to the body by the rain from the loose plaster at the upper part of the window cornice. Chevers remarks: "Thus all the usual external appearances of drowning presented themselves, and the internal morbid appearances were simulated by those of apoplectic death." It seems, however, that in this case two important internal symptoms were wanting, which should have led Dr. Woodford to make further enquiries, *viz.*, the absence of any water in the stomach or lungs, and the absence of mucous froth in the lungs or air-vessels. If a person had been drowned and had presented the internal symptoms recorded, it is exceedingly improbable, though not impossible, that there should have been no water in the stomach and lungs and no mucous froth in the air-vessels. The fact of mucous froth round the nostrils should have shown that the water could not have escaped from the stomach, and cleared the air-vesicles, by rough handling of the body. The above case is very interesting as showing what care is needed in a *post-mortem* examination of bodies found drowned, and how little confidence can be placed upon the superficial signs.

CHAPTER VIII.

BURNS AND SCALDS.

'BURNS' are injuries produced by the application of flame or heated substances to the body, while 'scalds' result from the application of steam or hot liquid at or near its boiling point. The effects of burns and scalds are essentially the same.

Injuries caused by the application to the surface of the body of corrosive substances, *i.e.*, such substances as cause chemical destruction of the tissues, may also, for medico-legal purposes, be classed as burns.

The chief medico-legal questions connected with burns and scalds are :—(1) Is the injury a burn or scald, and if so, how was it caused? (2) Was the injury inflicted during life? (3) Was the injury the result of accident, self-inflicted, or inflicted by another? and (4) What results followed, or are likely to follow, from the injury?

I.—Is the Injury a Burn, or Scald, and if so how was it caused.

A conclusion arrived at in regard to this question may be of importance, because—

(1.) By *sects.* 324 and 326 of the *Indian Penal Code*, the causing of hurt, or grievous hurt, by certain specified means, is made an offence punishable more severely than when such means have not been used. Among the means specified in these two sections are not only what may be called lethal weapons (see p. 117 *et seq.*), but also "fire or any heated substance," or any "corrosive substance," or "explosive substance."

(2.) It may affect the question of the guilt or innocence of an accused person. In this respect it may be of much importance to determine, if possible, the precise means whereby the injury, if a burn, was produced, *e.g.*, whether produced by the application of a particular heated solid, or of a heated liquid, or by the application of a particular corrosive substance.

Degrees of Burns.—For medico-legal purposes, injuries caused by the application of heated substances to the body may be divided into (1) Burns producing mere redness. (2) Burns causing mere vesication. (3) Burns causing the death of the part injured. And to these three classes may be added a

fourth, *viz.* : (4) Burns caused by the external application of corrosive substances.

(1.) **Burns producing mere redness** are usually caused by the momentary application to the part of a hot solid, or of a fluid at a temperature several degrees below the boiling-point of water. They are followed by superficial inflammation, with or without desquamation of the cuticle. Burns of this class may be simulated by the application of various mild irritants to the skin.

(2.) **Burns causing vesication** are produced by the application of liquids at a temperature about that of boiling-water ; or by the momentary application to the part of a flame, or of a highly-heated solid. Burns of this second class, caused by flame or by highly-heated solids, may be accompanied by blackening of the skin and scorching of the hair at the seat of injury. In mild burns of this second class, the vesicles simply dry up and heal, and no permanent marks are left. In severe cases, or in unhealthy subjects, suppuration of the vesicles may occur, followed by ulcers, leaving permanent cicatrices. Burns of this second class may be simulated by the application to the skin of various strong irritants, *e.g.*, cantharides and tartar emetic. In badly-nourished persons vesication of the skin, resembling a burn, may occur without the application of heat.[1]

(3.) **Burns causing the death of the part injured** are produced by prolonged contact with flame or with highly-heated solids or by contact with liquids at a temperature considerably above that of boiling water, *e.g.*, boiling oils or melted metals. They vary in appearance and degree of gravity, according to the depth to which the injury extends, *e.g.*, the death of a portion of the skin only may have been caused (*Dupuytren's 3rd and 4th degrees ;* or the underlying soft parts, as well as the skin, may be affected (*Dupuytren's 5th degree*) ; or an entire limb, bones and all, may be destroyed (*Dupuytren's 6th degree*). Burns of this class often leave sores difficult to heal, or so large in extent as to require the performance of an amputation. They leave permanent cicatrices, which frequently contract considerably, causing by their contraction considerable deformity, or impairment of the use of members or joints. If a burn of this class has been caused by the application of a heated solid, the form of the solid employed may frequently be inferred from the shape of the burn.

It may be noted, in regard to burns produced by highly-heated solids or liquids, that the skin, if moist, may be brought

[1] Guy's '*For. Med.*,' p. 305.

into contact for a short time with substances at a high temperature, *e.g.*, red-hot solids or melted metals, without a burn being produced. This depends on the assumption of the spheroidal state by the moisture on the surface of the skin, and as a high temperature is necessary for the production of this spheroidal state, the temperature of the substance brought into contact with the skin must be high, otherwise a burn will be produced.

(4.) **Burns caused by the application of corrosive substances to the body** seldom extend deeper than the true skin. Vesication does not accompany burns of this description, and there is no scorching of the hair in the neighbourhood of the burn. Further, if the corrosive substance is, as is commonly the case, a liquid, marks left by it will usually be found on the clothes of the person injured. The particular corrosive employed may frequently be inferred from the colour of the marks on the skin, or definitely ascertained by chemical examination of the stained portions of clothing (see *Corrosive Poisons*, Chap. XXI).

II.—Was the Injury inflicted during Life?

This question sometimes arises, *e.g.*, in cases where, in order to conceal a murder, an attempt is made to burn the body of the murdered person. The chief appearances whereby burns inflicted during life may be distinguished from *post-mortem* burns are presence of (1) signs of inflammation; (2) a line of redness; and (3) vesication.

(1.) **Signs of inflammation** and reparative action, such the presence of granulations or pus on the injured surface, indicate that the injury was inflicted some considerable time before death. The absence of such signs, of course, does not indicate that the injury was inflicted after death.

(2.) **A line of redness.**—If a burn is inflicted during life, in the great majority of cases, a line of redness almost immediately forms round the injured surface. This line of redness, although it may be surrounded externally by a blush, disappearing on pressure or after death, does not itself disappear on pressure, and remains visible after death has taken place. The presence of a line of redness possessing the above characters is almost certain evidence that the burn was inflicted during life, and conclusive evidence that it was inflicted during life, or within ten minutes after death. Its absence, however, is not positive evidence that the burn was inflicted after death.

(3.) **Vesication.**—Here it is convenient to distinguish between what may be called respectively true and false vesication. In true vesication the vesicles contain serum very rich in albumen. In false vesication the vesicles either contain air only,

or (especially in dropsical bodies) a small quantity of serum, in which traces only of albumen are present. The presence of true vesication, as the result of a burn, is proof that the injury was inflicted during life. The presence of false vesication, as the result of a burn, shows that the injury was inflicted after death. The entire absence of all vesication is quite consistent with the supposition that the burn was inflicted during life.

III.—Was the Injury the result of accident, self-inflicted, or inflicted by another?

Accidental cases are common, so common, in fact, that in temperate climates (and in tropical climates also, but to a less degree) the presumption is always in favour of accident. Accidental cases arise in various ways: an individual's clothes catch fire, or heated liquid, such as boiling water, is spilt accidentally over him; or a petroleum lamp breaks, and the oil it contained catches fire and falls on him. In a few cases, again, individuals in a state of intoxication or insensibility fall asleep near a fire and are accidentally burnt to death (see also cases of so-called spontaneous combustion, p. 271). In the majority of accidental cases, examination of the body throws little or no light on the question whether the injury was, or was not, the result of accident. It may, however, be noted that—

(1.) **If there are burns on several distinct and separate portions of the body**, or if a dead body show signs of having been ignited in two or more distinct places, accident is contra-indicated.

(2.) **The discovery of the body** in a case of death from burning—**at the spot where ignition first took place**—is quite consistent with the supposition of accident, if the individual was narcotised or insensible at the time ignition occurred.

(3.) **Marks of violence** present on the body do not necessarily contra-indicate accident. Such marks may, for example, be due to injuries received prior to, or at the time of, accidental ignition. It must be borne in mind, also, that sometimes marks closely resembling wounds are produced as the result of a burn (see *Case XCVIII*).

Suicidal cases are rare, hence, in a case of death from burns, the presumption is always strongly against suicide. Taylor, however, mentions a case where a prisoner attempted to commit suicide by setting fire to his bed, and a case has recently been reported in England of a lunatic, a gardener, who having dug a sort of grave, placed therein a quantity of dry wood saturated with benzoline. He then laid himself face

down, on the wood and set fire to it. The body was almost entirely consumed.

Burns are sometimes self-inflicted in order to support a **false charge**. Where this is suspected, the question whether or no the injuries correspond in appearance to the alleged method of production must be carefully considered (see *Case XCV*).

Case XCV.—**False charge of burning** (Chevers, *Med. Jur.*, p. 532). —"In March, 1865, the assistant magistrate of Howrah sent me a girl about ten years old, for my opinion as to how certain marks on her cheeks, arms, and back were caused. She asserted that they were burned with a hot *chillum* [tobacco-pipe], whereas the accused declared that they had been made with some paint. I found a large circular brown mark on either cheek; each of these marks had a clean and perfectly-defined edge. The marks on the arms and back were parallel brown streaks, with clean edges; there was no vesication, but the cuticle was beginning to separate. Such even, clear-edged, symmetrical marks could not have been inflicted with a heated body upon any person who was not in a state of complete insensibility, and from their shape it was evident that they could not have been caused by the application of a *chillum*. I gave it as my opinion that a fluid irritant had been applied, and that the case had been trumped up."

It must be recollected that the application of the actual cautery, or of moxas, or of strong blistering agents, to the body, is a favourite method of treatment among *hakims* in India, and that false charges may be founded on burns so produced. The presence also of such burns on a dead body may give rise to an erroneous suspicion as to the cause of death.

Homicidal cases, and cases of the infliction of hurt by burning, are not infrequent in India. Chevers mentions a number of cases, the means employed being, in many of them, the application of heated iron instruments, *e.g.*, sickles or ladles or spoons, to the part. In other cases, placing the victim over a fire, applying a lighted torch or a piece of ignited charcoal or a heated pipe-bowl, or pouring heated oil on the body, or covering a portion of the body with tow or rags steeped in oil and setting fire thereto, were the means resorted to.

Case XCVI.—**Homicidal Scalding.**—Several *darwans* of the Bengal Paper Mills at Raniganj attacked a European assistant, Mr. Ironside, and threw him into a hot water tank on the 11th July 1899. The surgeon of Burdwan examined the body on the morning of the 13th, and found bruises on the left side and left shoulder, and marks on the throat and neck, bruises on the chest and severe bruises on the left side of the head above the temple. The *post-mortem* examination showed an effusion of blood into the thorax. The immediate cause of death was considered to be immersion in the hot water tank, the temperature of which was 130. Deceased died immediately after immersion, as a result of the extreme shock. The severe bruise on the head was caused by some blunt

instrument, and may have caused insensibility, but not death. The defence set up was that Mr. Ironside accidentally fell in the tank while running away from the natives with whom he had quarrelled.

In several of Chevers' cases the victims were females, and the burns were inflicted on the pudenda, as a punishment for suspected adultery. In others the victims were children, the burns being inflicted as a punishment for trifling offences. Chevers also mentions numerous cases of the use by dacoits of torture by fire, for the purpose of extorting information from their victims, as to the place of concealment of money or valuables; and also cases in which thieves, or persons suspected of theft, have been tortured by burning, as a punishment, or in order to extort confession. Again, plunging the arm into boiling oil, is a form of ordeal to which women suspected of witchcraft are subjected in some part of India.

Along with homicidal cases may be classed cases where an attempt is made to **conceal a murder by burning the body** of the murdered person. In such cases nothing but fragments of partially charred bones may be discovered (see *Case XCVII*).

Case XCVII.—**Supposed attempt to conceal murder by burning the body.** (Bombay *Chemical Analyser's Report* for 1883, p. 9).—In a case forwarded from Sakkar (Sind) some fragments of partly-burnt bones were sent for opinion as to whether the same were or were not fragments of human bones. Several of the fragments forwarded were clearly identified as fragments of the bones of an adult human being. A summary of the history of this case is as follows:—Two men started out together, one carrying an axe; after a time one of the two returned, the other seemingly having disappeared. Trackers were placed on the trail made by the two men, and they, on following the trail came to a place where the double trail ended, and a return single trail began; at this place the fragments of bone sent for examination were found.

In other cases the soft part may be more or less entire, and then two questions obviously arise, *viz.* (*a*) Have the burns the character of *post-mortem* or *ante-mortem* burns? and (*b*) Does examination of the body reveal a cause for death (or for the occurrence of insensibility) irrespective of the burns? The first of these questions has already been discussed (see *Quest. II*). In regard to the second question, the only special point to be noted is, that, as already mentioned, injuries resembling to a certain extent wounds caused by mechanical violence may be produced on a body by the action of heat alone (see *Case XCVIII*).

IV.—What results followed, or are likely to follow, from the Injury?

For medico-legal purposes in India this question, as in the case of wounds (see p. 175) becomes: Has the injury caused,

or is it likely to cause, death ; and if not, has it caused one or other of those forms of hurt which are by the law of India designated as "grievous hurt"? In regard to this question, the following points may be noted.

(1.) **Death may occur from burns** (1) **Before reaction** sets in, *i.e.*, within about forty-eight hours of the receipt of the injury, from (*a*) **Shock or collapse** ; or (*b*) **Coma**, due to congestion of the brain and serous effusion into the ventricles (this may be mistaken for opium poisoning). (2) **After reaction** has set in, from (*c*) **Various internal inflammations**, *e.g.*, pneumonia, bronchitis, pleurisy, enteritis. Enteritis with ulceration, followed by peritonitis, is a not infrequent cause of death from burning, especially in young people ; (*d*) **Surgical complications** connected with the injury, *e.g.*, gangrene, erysipelas, tetanus, pyæmia, &c. ; or (*e*) **From exhaustion.**

(2.) **The danger to life in burns** depends chiefly on (1) **Extent of surface injured**.—Burns involving a great extent of surface are specially dangerous to life. "A burn involving two-thirds, or even one-half of the entire skin, may be regarded as certain to destroy life, and the same practically may be said of a burn (if severe) involving one-third of the body" (Tidy). Deep burns involving a limited portion of the body, are not nearly so dangerous to life as burns involving a wide extent of surface. (2) **Part burnt**.—Burns on the trunk are more dangerous to life than burns on the extremities. Death before reaction has set in is specially likely to occur in the case of burns involving a wide extent of surface on the trunk. (3) **The Depth of the burn, and** (4) **Age of the patient.**—Children, as a rule, bear burns badly, whilst old people bear them comparatively well (Tidy).

The most fatal period after a burn is the first week. Erichsen found that in 54 per cent. of fatal cases death occurred within four days, and in 66 per cent. within eight days, after receipt of the injury.

(3.) **The post-mortem appearances of death from burns**.—The soft parts (as in *Case XCVII*) may be entirely destroyed, and it may be impossible from the *post-mortem* appearances to form any opinion as to whether death was due to burning, or to some other cause operating before cremation of the body. If the soft parts are more or less entire, the *post-mortem* appearances present may be—

(1.) **External**: *viz.*, marks on the surface of the body, having the characters possessed by burns inflicted during life, and varying in appearance according to the length of time which has elapsed between receipt of the injury and death.

(2.) **Internal.**—In cases of death from burning, no special internal *post-mortem* appearances may be present; in other cases there may be found:—(*a*) **Serous effusion** into the cavity of the arachnoid, pleura, pericardium, or peritoneum; (*b*) **Congestion of the mucous membrane** of the air-passages and of the mucous membrane of the alimentary canal, especially of the œsophagus, duodenum, and ileum (Tidy). Perforating ulcers of the duodenum, resulting from inflammation of Brunner's glands, are common in cases of death from burns, especially in young children (Curling). Peyer's patches, and the solitary glands generally, are often greatly inflamed and sometimes ulcerated (Tidy); (*c*) **Congestion of various organs,** *e.g.*, the brain, lungs, liver, kidneys, &c.

In making a post-mortem examination in a case of alleged death from burns it must always be borne in mind that death (or insensibility) may have been produced by causes operating previously to the infliction of the burns. Hence, in cases of alleged death from burning, it is extremely important to note:—(*a*) Whether or not the burns possess the characters of burns inflicted during life; and (*b*) Whether the examination of the body reveals any cause for the occurrence of death (or insensibility) other than burning; and if wounds are present on the body, to note whether they appear (as in *Case XCVIII*) to have been caused by the action of fire or not.

Case XCVIII.—**Apparent Wounds caused by Burning** (Taylor, *Med. Jur.*, i, p. 715).—A boy, *æt.* two, was brought to hospital severely burnt, and died in three-quarters of an hour. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella, or knee-pan, where it became somewhat jagged, and making a sudden turn inwards, passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh, a little above the left knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the fatty tissue, had not yielded with it. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue its exemption from the action of the fire, and the irregular character and appearance of the fissures, Mr. Curling considered them to have been occasioned by the influence of heat.

(4.) **"Grievous hurt" may be caused by burns.**—The injuries which, by sect. 320 of the Indian Penal Code, are

designated as "grievous hurt," have already been enumerated. Burns are especially likely to cause the following forms of "grievous hurt":—(*a*) Hurt "**which endangers life, or which causes the sufferer to be, during the space of twenty days, in severe bodily pain or unable to follow his ordinary pursuits.**" It has before been noted that burns involving a wide extent of surface (especially of the trunk) are specially dangerous to life. (*b*) If the burns are on the head or face, especially if the true skin is affected to any depth, "**permanent disfiguration of the head or face**" is likely to result. (*c*) "**Permanent privation of the sight of either eye**" is a not unfrequent result of the throwing of corrosive fluids, *e.g.*, oil of vitriol, over the body. (*d*) "**Permanent impairment of the powers of**" a "**member or joint**" is specially likely to occur (from contraction of cicatrices) in the case of severe burns in the neighbourhood of joints.

SPONTANEOUS COMBUSTION.

The question whether the human body is liable to spontaneous combustion has arisen in the following way: It is well known that in ordinary circumstances, long exposure to a high temperature, and the expenditure of a considerable amount of fuel, is required in order to cause any considerable amount of charring of a human body. Several cases, however, are on record where the bodies of persons, generally old obese females addicted to spirits, have been found near a fire or partly-burned candle, half consumed, and exhaling a fœtid empyreumatic odour. In many of these cases, articles near the body have been found covered with a greasy stinking soot, but although combustible, unburnt, indicating that the temperature of combustion has been comparatively low (see *Case XCIX*).

Case XCIX—**So-called 'spontaneous' combustion of the human body** (Woodman and Tidy, *For. Med.*, p. 1010).—In the Phil. Trans., vol. xliii, p. 463, it is recorded that "Grace Pett, the wife of a fishmonger of St. Clement's, Ipswich, *used to go downstairs every night, half-dressed to smoke a pipe.* On the 9th of April 1744, she got up from bed as usual. Her daughter, who slept with her, did not perceive that her mother was absent till next morning when she awoke. Soon after this she put on her clothes, and, going down into the kitchen, found her mother stretched out on her right side, with her head near the grate. The body was extended on the hearth, with the legs on the deal floor, and it had the appearance of a log of wood consumed by a fire without apparent flame. On beholding the spectacle, the girl ran in great haste and poured some water over her mother's body, to extinguish the fire. The fœtid odour and smoke which exhaled from the body almost suffocated some of the neighbours, who had hastened to the girl's assistance. The trunk was in some measure incinerated, and resembled a heap of coals covered with white ashes. The head, the arms, the legs, and the thighs had also participated in the burning. This

woman, it is said, *had drunk a large quantity of spirituous liquor*, in consequence of being overjoyed to hear that one of her daughters had returned from Gibraltar. There was no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick, which was close to her. There were also found near the consumed body, the clothes of a child, and a paper screen, which had sustained no injury. Her dress consisted of a cotton gown.

Taking into consideration what we know as to the quantity of heat required to effect even partial combustion of a human body these cases are obviously exceptional, and indicate that, under certain circumstances, the human body acquires a condition of preternatural combustibility ; a condition, in fact, in which the body instead of requiring, in order to effect its combustion, a long continued application of flame, appears to require—for at any rate partial combustion—contact with flame for a short period only. A consideration of the circumstances recorded in authentic cases of this class fails to support the hypothesis of spontaneous combustion, *i.e.*, of ignition without contact with flame, which was at one time put forward to account for them. It may be mentioned that spontaneous combustion has been put forward as a defence in a case of murder, as in the case of the murder of the Countess of Gœrlitz (*Case C*).

Case C.—**Spontaneous combustion put forward as a defence to a charge of murder** (Taylor, *Manual*, p. 348).—"In March, 1850, a man named *Stauff*, was tried at Darmstadt for the murder of the *Countess of Gœrlitz*. He had assaulted the deceased in her chamber, and then set fire to the furniture, with a view to conceal his crime. The body and dress were partially consumed. As the means by which the fire was applied were not at once apparent, and the assassin had locked the doors of the room, some medical men took up the theory that the deceased had died from spontaneous combustion. The facts of the case were referred to Professors Liebig and Bischoff, of Giessen, and their report was issued in March 1850, at which date the man Stauff was put on his trial. They found no difficulty in concluding that a murder had been perpetrated, and the body wilfully *burnt after death*, for the purpose of concealing the crime." Stauff was convicted, and subsequently confessed that he had strangled the Countess, and then, heaping articles of furniture around the body, had set fire to them, with the object of concealing the murder.

In order to start the combustion of an inflammable substance a portion of it—no matter how small—must be raised to a particular temperature. The temperature required varies with the substance. A mass of phosphorus will take fire if any portion of it be raised to the comparatively low temperature of 140° F. Hydrogen, on the other hand, requires a high temperature for its ignition. When a portion of an inflammable substance, or mixture of inflammable substances, is capable of acquiring the temperature necessary for ignition either *per se*, or on contact with air only ; such substance, or mixture of substances, is liable to catch fire spontaneously. In such substances, the self-acquirement of the temperature necessary for ignition, is the result of the development of heat by chemical action, such chemical action taking

place either between the substance and the oxygen of the air, or, in a few cases, between two of the constituents of a mixture. The principal substances liable to spontaneous combustion are—

(1.) **Certain simple bodies.**—Phosphorus is the best known example of this class. This substance, in its ordinary condition, oxidises in air even at a temperature of 50° F. and requires only a comparatively low temperature for ignition; hence, it is peculiarly liable to catch fire spontaneously. Certain of the metals, if in a finely divided condition, *e.g.*, iron, are liable to take fire on exposure to air, owing to heat developed by the combination of the metal with oxygen.

(2.) **Certain compound bodies** take fire at on ceon exposure to air, *e.g.*, silicon hydride, liquid phosphide of hydrogen and zinc ethyl. The presence of a small quantity of the vapour of liquid phosphide of hydrogen also, it may be remarked, confers the property of spontaneous inflammability on combustible gases.

(3.) **Certain mixtures of substances** are liable to spontaneous combustion from:—(*a*) **The occurrence of chemical action between the constituents of the mixture**, *e.g.*, phosphorus takes fire on being brought into contact with iodine. Many finely divided metals and paper moistened with turpentine, take fire in chlorine. Turpentine takes fire if mixed with fuming nitric acid, &c. Probably the occasional spontaneous combustion of red fire (a mixture of sulphur, carbon, antimony sulphide, potassic chlorate, and strontium nitrate) is due to this cause. (*b*) **The oxidation of one of the constituents of the mixture**.—The constituent undergoing oxidation may be an **inorganic** substance, *e.g.*, a metallic sulphide. Some varieties of coal contain iron pyrites (sulphide of iron) in considerable quantity, and are liable to spontaneous combustion from heat developed by the combination of this with the oxygen of the air. Again, the coustituent undergoing oxidation may be an **organic** substance, *e.g.*, a drying oil. Numerous cases are on record of the spontaneous ignition of fibrous and other combustible substances moistened with a drying oil, *i.e.*, an oil capable of drying readily into a resin by taking up oxygen from the air. Cotton, wool, hemp, flax, jute, woody fibre, and lamp-black, have all been known to catch fire spontaneously when moistened with linseed or other drying oils. Woody fibre moistened with turpentine, has been known to catch fire from a similar action.

Organic matters moistened with water only, *e.g.*, damp hay, cotton, tow, flax, cocoanut fibre, leaves, &c., are liable to become heated from oxidation. Spontaneous ignition of damp hay and cotton and, of damp oats and esparto grass, has been known to occur. It may also be remarked that certain **explosive substances** are liable to explode either spontaneously, *e.g.*, chloride of nitrogen; or from a very slight amount of percussion or friction, *e.g.*, nitro-glycerine, the metallic fulminates, and mixtures of combustible substances with potassic chlorate.

CHAPTER IX.

DEATH FROM EXTREMES OF TEMPERATURE, LIGHTNING AND ELECTRICITY.

DEATH FROM HEAT.

Sunstroke, Insolation, 'Coup de Soleil,' Heat-Apoplexy.

DEATH from heat seldom becomes the subject of medico-legal inquiry except in cases of sudden death in heated engine-rooms or factories, where there is suspicion of foul play.

The temperature of the human body in health, taken in the mouth or axilla, averages 98·4 F.; and in India it may range from 97·3 in the morning to 99·9 in the evening.[1] In the rectum or vagina it is usually about 1° higher. In many diseases the temperature of the body rises considerably: thus a temperature of 105° F. is common in severe agues; 113° F. has been recorded in typhoid fever, and 115° F. in a case of scarlet fever. Death is inevitable if the temperature of the body rises and remains for any length of time 12° F. above the normal.

Death from heat frequently **occurs without direct exposure** to the sun. According to Dr. H. C. Wood[2] it may occur in three ways: *viz.* (1) From exhaustion or collapse. (2) From thermic fever: and (3) in rare cases, from meningitis or phrenitis.

Circumstances modifying the effect on the system of exposure to heat are:—

(1.) **Moisture** present in the atmosphere. Other things being equal, the less this is, the better exposure to heat is borne. The presence of a large amount of moisture in the atmosphere interferes with evaporation from the surface of the body, and favours the action of heat on the system.

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[1] It has been shown by Dr. C. Albutt (*Jour. An. and Phys.*, Nov. 1872), Dr. Rattray (*Proc. Roy. Soc.*, 1870), Dr. W. Ogilvie (St. Geo. Hosptl. Repts.), 1866, that 98.6°, as given by Wünderlich and others, is an over-estimate.

[2] Dr. A. Crombie, *Ind. Annals Med. Science*, XVI, 1874, p. 550; L. A. Waddell in *Ind. Med. Gaz.*, 1883; also H. Hamilton and N. Lalor on temperature of Gurkhas, in *Ind. Med. Gaz.*, 1900.

(2.) **Length of Exposure.**—Very high temperatures can be borne for a short time, but not for long, without ill effects, Chabert, "the Fire King," was in the habit of entering an oven, the temperature of which was from 400° to 600° F.

(3.) **Habit.**—This appears, to a certain extent, to lessen the effect of exposure to heat. Individuals accustomed to carry on their daily work in an atmosphere of high temperature, apparently withstand the action of heat better than others.

(4.) **Bodily condition of individual.**—The action of heat on the system is favoured by exhaustion, indulgence in alcoholic liquors, or anything which checks elimination, or embarrasses the normal working of the organic system. (Tidy.)

Symptoms.—These may set in suddenly, or there may be premonitory symptoms, such as headache and vomiting. These are followed usually by confusion of vision, flushing of the face, and stupor or coma. The temperature is invariably high. The pupils are generally dilated in the earlier, and contracted to a fine point in the later stages. In a few cases delirium and convulsions are present. Death has been known to occur in five minutes, or as late as three days, after the commencement of the attack.

Post-mortem appearances.—In some cases no abnormal appearance has been present. In the majority of cases, congestion of the brain and its membranes, engorgement of the right side of the heart and congestion of the lungs and abdominal viscera are found. The blood is frequently fluid and dark in colour.

DEATH FROM COLD.

If, from exposure to cold, the temperature of the human body becomes reduced for any length of time much below the normal, death occurs. In exceptional cases the temperature of the body has been known to fall as low as 79°, or even 75° F., without life being extinguished.

Constitutional symptoms produced by exposure to cold are, depression of the heart's action, and torpor, succeeded by stupor, or coma, from congestion of the nervous centres. In addition, exposure to cold may produce certain **local effects**, *e.g.*, chilblains, or, in severe cases, frost-bite, the part affected becoming when frost-bitten, bloodless, ash-grey, and insensible. If a part affected with frost-bite is warmed too suddenly, gangrene is apt to set in, hence warmth should be restored to frost-bitten parts gradually, as for example, by friction with snow.

Circumstances modifying the action on the system of exposure to cold are :—

(1.) **Movement of the atmosphere.**—Air being a bad conductor of heat, cold still air produces much less effect on the body, than cold air in motion.

(2.) **Moisture.**—If the surface of the body be wet, or covered with wet clothing, and exposed to cold air, heat, owing to evaporation, is withdrawn more rapidly than if the surface of the body be dry.

(3.) **Length of exposure.**—Of course the longer the exposure to cold, the more likely are ill effects to occur. Adopting proper precautions, however, an extremely low atmospheric temperature may, as in the case of arctic voyagers, be borne for long periods.

(4.) **Age.**—Adults bear cold better than the very young and very old.

(5.) **Bodily condition.**—The action of cold on the system is favoured by anything which tends to lower the vital powers, *e.g.*, fatigue, exhaustion, intoxication, want of food, &c.

Post-mortem appearances are not very characteristic, they are, according to Ogston :—(a^1) **An arterial hue of the blood** generally, except when viewed in mass within the heart. (b^1) **An unusual accumulation of blood on both sides of the heart,** and in the large thoracic arteries and veins. (c^1) **Irregular diffused dusky-red patches** on limited portions of the surface of the body, even in the non-dependent parts. (d^1) **Pallor of the surface of the body,** accompanied, according to Ogston, with anæmia, but, according to other authorities, with congestion of the viscera most largely supplied with blood. Ogston, however, found moderate congestion of the brain in three, and of the liver in seven, out of sixteen cases.

Death from cold is, as a rule, accidental as in drunkards falling asleep in the snow or people lost in snow-drifts. Exposure to cold is a common method of infanticide in temperate climates, death taking place rapidly. Cases where insane persons have, it is alleged, been killed by exposure to cold, sometimes form the subject of a medico-legal inquiry. Taylor mentions a case where the death of a lunatic appears to have occurred from the combined effect of a shower-bath at 45° F. for half an hour, followed by a full dose of tartar emetic.

DEATH FROM LIGHTNING AND ELECTRICITY.

Deaths by lightning with marks of violence on the body which have been attributed to murder sometimes require medico-legal investigation.

When a sudden discharge of electricity occurs through a bad or feeble conductor, accompanied by a spark or flash, disruptive discharge is said to have taken place. The discharge of atmospheric electricity by lightning; of sparks from an induction coil, or from the prime conductor of an electrical machine, are examples of this form of discharge. Disruptive discharge is attended by forcible mechanical separation of the particles of the bad or feeble conductor through which it occurs.

The human body is a feeble conductor of electricity; it allows of the passage through it, by conduction, of charges of electricity up to a certain pitch of intensity; but if this be exceeded, discharge taking place through the body becomes of the nature of a disruptive discharge. The passage of a feeble charge of electricity by conduction through the body usually produces no ill-effects A strong charge—strong enough to kill by shock—may pass through the body by conduction, or at any rate without producing visible separation of its particles. Hence, in some cases of death from discharge of electricity, no wounds can be discovered. Very strong charges of electricity discharge themselves through the body by disruption, producing visible wounds.

In addition to forcible mechanical separation of the particles of a bad or feeble conductor, three **other effects** may accompany electrical discharge: (*a*) Production of **chemical action**; (*b*) Development of **heat**; and (*c*) Development of **magnetism.** In cases of death from lightning, the production of these effects, especially the two last, often affords strong confirmatory evidence as to the cause of death. Thus, in such cases, the skin or clothes often show marks of burning; metal articles attached to the clothes, such as buttons, or carried in the pockets, show signs of fusion; and steel articles, a knife for example, are found to have acquired magnetism.

Circumstances of lightning stroke.—Lightning stroke has occurred in almost every situation. Thus persons have been struck by lightning in the open, in houses (in one case a boy in bed was struck by lightning), under trees, &c., &c. Not infrequently, of two or three persons standing near one another, one is struck, the others escaping. During a thunderstorm, the neighbourhood of a high projecting bad or feeble conductor, such as a solitary tree, is a specially dangerous situation. The projecting object attracts the accumulated electricity, but, being a bad or feeble conductor, opposes such resistance to its passage, that lateral discharge takes place into neighbouring objects, *e.g.*, into the body of an individual standing near. The neighbourhood of a good conductor, if of insufficient thickness, is dangerous, for a precisely similar reason. Telegraph clerks, for example have, during thunderstorms, been killed while standing

at their instruments, owing to the wires in connection therewith, from their insufficient thickness, opposing so much resistance as to cause lateral discharge. The attraction of projecting objects for electricity necessitates the protection of high buildings by lightning conductors. These are thick rods of copper, one end of which projects above the building, while the other is buried in wet earth. All metal work on the surface of the building should be in electrical connection with the lightning conductor by thick wires. A peculiar class of cases of death resulting from the discharge of atmospheric electricity are the cases in which individuals are killed by what is called the "**return shock.**" In these cases the person killed is sometimes at a considerable distance from the spot where the discharge of lightning takes place. Cases of this kind are explained as follows: A cloud charged with electricity induces a charge of the opposite kind in objects —*e.g.*, the bodies of individuals—in its neighbourhood. When the cloud discharges itself, the inducing influence being suddenly withdrawn, these objects suddenly discharge their induced charge of electricity. Sometimes this discharge of induced electricity from the body of an individual is so violent as to produce a severe or even fatal shock. In cases of this kind no marks of injury are found on the body of the sufferer.

Death or injury from electricity other than atmospheric electricity.—This usually by accident. Powerful "arc" electric lamps (*i.e.*, lamps in which the light is produced by disruptive discharge between carbon terminals), require currents of great intensity. Two or three cases have lately been recorded where individuals have been killed by accidentally "short-circuiting" such currents through their bodies, *e.g.*, by grasping the wires conveying the current one in either hand, or by standing on one wire and laying hold of the other, or passers-bye near leaks at broken wires on the electric tramway lines in Calcutta and other cities.

Electrocuting is the judicial form of execution in the United States of America and some other countries in place of the time-honoured method of hanging.

The Effects produced on the Body by the passage through it of an electrical discharge may be—1, Local; 2, Constitutional.

Local effects produced may be burns, blisters, or wounds; or ecchymosed streaks, spots, or patches. **Burns and blisters** are sometimes the result of the clothes having caught fire, but may occur independently of any ignition of the clothes. The *hair* is often found singed. If a **wound** is found it may be lacerated, punctured, or contused in character. **Ecchymosed**

or **livid patches, spots** or **streaks,** are frequently met with. Sometimes the streaks present a peculiar arborescent appearance. **Fractures** are rare, but have been found in a few cases (Tidy). No marks whatever may be found on the body, even in fatal cases, in which the clothes have been burned.

(2.) **Constitutional** effects produced may be **immediate death** from shock ; or the individual may fall down insensible and **die after an interval,** varying from a few minutes to several days. In one case death occurred as late as the thirty-third day after the receipt of the injury. If immediate death is not caused, the probabilities appear to be in favour of recovery taking place. In non-fatal cases **various nervous affections** have been found, *e.g.*, paralysis (hemiplegia or paraplegia), loss of sight, hearing, speech, or memory ; or there may be no apparent after effect if the shock is slight.[1]

Signs of Death or Injury from Electricity may be :

(1.) **External Marks on body.**—The nature of these has been already described. The livid arborescent streaks found on the body in some cases are peculiarly characteristic of death from lightning stroke. The marks present on the body may simulate in appearance marks of mechanical violence.

(2.) **Internal appearances.**—Injury to the brain or its membranes is frequently found. The membranes may be congested or lacerated. The brain may be congested or disorganised. Blood may be found effused on the surface or into the interior of the brain.

(3.) **Objects on or near the body** may show signs of the passage of electric discharge. The clothes may be found burnt or torn ; the boots have sometimes been found burst open. In one case the whole of a man's clothes were torn off his body and scattered about. Metal articles attached to the clothes or carried in the pockets may be found fused ; and steel articles may be found to have become magnetic. Objects in the neighbourhood of the body may be found to show signs of injury ; *e.g.*, a wall or building may be found cracked, or shattered and thrown down. Trees may be found split, and combustible objects, especially if dry, may be set on fire, or show marks of burning.

Rigor mortis sets in rapidly and putrefaction may be hastened.

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[1] As in my own case, when I was struck by the outer current of a lightning flash at Lansdowne, in the Garhwal Himalayas in 1900.—W.

CHAPTER X.

DEATH FROM STARVATION.

ACUTE and chronic starvation have similar symptoms. In acute starvation death takes place usually in ten to twelve days accompanied by mania and convulsions.

The Essential Nutritive Constituents of Food are: 1, **Albuminates**; 2, **Carbohydrates**; 3, **Fats**; and, 4, **Salts.** In order to maintain health and strength, a certain amount of each of these, plus a certain amount of water, must be daily supplied.

Of the essential nutritive constituents of food the albuminates, *e.g.*, albumen and casein, contain both carbon and nitrogen. The carbohydrates, *e.g.*, starch and sugar, contain carbon but no nitrogen. The fats, like the carbohydrates, contain no nitrogen, they, however, contain a larger percentage of carbon than the carbohydrates. For convenience, we may call the nitrogen contained in albuminates nutritive nitrogen, and the carbon contained in albuminates, carbohydrates and fats, nutritive carbon.

Daily food requirements of the body depend (*a*) **on the weight** (in health) of the individual to be fed, (*b*) **on the amount of work** performed; and (*c*) **on the age** of the individual (children require more food in proportion to their weight than adults, seeing that in their case growth as well as nutrition must be provided for).

Daily food requirements of an adult may be stated as follows:—

(1.) **An adult requires daily if at rest** 25 grains, or if at about 30 to 45 or 50 grains (according to the amount of work done) **of nutritive carbon** per 1lb. of body weight.

(2.) **With this amount of carbon, nutritive nitrogen** must be supplied in amount equal to one-twentieth to one-fifteenth of the weight of the carbon.

(3.) **The food supplied must contain** fat in a certain amount, say about 1 to 3 ounces per diem.

(4.) **The food supplied must contain** salts in a certain amount *e.g.*, phosphates, required for the nutrition of the body. A certain amount of common salt, say ¼ to ½ an ounce, must also be daily supplied.

(5.) Water in a certain amount, 3 to 6 pints daily, and **condiments** are required.

(6.) Lastly, the food should be **varied** in character, of **good quality**, properly cooked, and the intervals between meals should not be too long.

A rough rule for calculating the daily food requirements of adult natives of India is as follows :—Given (*a*) that the food consists solely of cereals and pulses fairly free from husk, and that the dietary contains a sufficiency of fat, and (*b*) that the amount of nutritive nitrogen in the dietary equals about one-twentieth of the carbon, then the number of ounces of food daily supplied must be not less than the average body weight in pounds, of the individuals to be fed, multiplied by :

For bare subsistence, ·16.

For light work, say not over 1 foot-ton per 1 lb. of body weight, ·21.

For moderate work, say not over 2 foot-tons per 1 lb. of body weight, ·26.

For hard work, say up to 3 foot-tons per 1 lb. of body weight, ·31.

Rapidity with which ill effects follow deficient supply of nourishment, is affected by :—

(1.) **Age.**—Old persons bear deprivation of food better than adults, and adults bear it better than children.

(2.) **Condition of body.**—Fat people bear deprivation of food best. Diminished activity of the vital functions (as in catalepsy) delays the occurrence of ill effects from deprivation of food (see *Case CI*).

Case CI.—**Prolonged sleep with starvation** (Taylor, *Med. Jur.*, i, p. 43).—A man of healthy habits, 43 years of age, was at intervals subject to attacks of long and persistent sleep. He would retire to bed at his usual hour, and without any warning symptoms, suddenly and almost immediately fall into a profound sleep, from which all the usual means would fail to arouse him. In this state his face and ears were pale; the skin was pale, and generally warm, but his feet were cold and livid, and the limbs quite relaxed. His pulse was soft, slow, and feeble; his respirations almost imperceptible, about eight or nine in a minute. He appeared like a person in a refreshing, tranquil slumber. There was no stertor or snoring. The longest period he ever passed in profound sleep was five days and five nights. He frequently slept three days, and occasionally four days, without waking, but his average period was two days. His secretions were suppressed, and no food was required. He commonly awoke suddenly, had no consciousness of the lapse of time, and retained a good remembrance of the last occurrences before he fell into this state. He had no dreams.

(3.) **Exposure to cold.**—Where the loss of heat from the surface of the body is rapid, the effects resulting from a deficient supply of the matters (food) required to maintain the normal temperature are more quickly felt than when the loss of heat from the surface is slow.

(4.) **Deprivation of water.**—Complete abstinence from both food and water kills more rapidly than abstinence from food alone. Taylor[1] states that it is probable, that in a healthy person under perfect abstinence (from both water and food),

[1] *Med. Jur.*, ii, p. 139.

death would not commonly take place in a shorter period than a week or ten days. Guy[1] mentions a case of shipwreck, where, of eighteen persons deprived of food and water, only one survived the eighteenth day. Where the abstinence is from food only, an individual may survive for a much longer period, thus a case is recorded of a madman who survived forty-seven days, and another of survival for sixty-one days; in the first of these two cases water only was taken, in the second water and a little orange-juice.

Symptoms of Starvation.—The chief are :—

(1.) **Emaciation, loss of weight,** the subcutaneous fat disappears, and the muscles waste. So that the skin of the face becomes wrinkled, and that of the body, especially in previously plump persons, becomes baggy. Chossat, from a series of experiments on animals, found, as a rule, death to occur when the animal had lost two-fifths of its weight. Observation seems to indicate that this rule holds fairly good in the case of human beings.

(2.) **Exhaustion and weakening of voice.**

(3.) **Pallor and cadaverous look.**

(4.) **Thirst, pain and irritation of the stomach,** and **usually a costive condition** of the bowels. The outlets of the body are frequently found inflamed.

(5.) **Pulse** is at first quickened, but subsequently becomes slow. It usually, however, becomes greatly quickened on the approach of danger (Tidy).

(6.) **In chronic cases especially, the skin** frequently becomes covered with "a brown filthy-looking coating," and the body emits a fœtid odour. "**The gums** become swollen and ulcerated, and there is great tendency to ulceration and sloughing on the receipt of slight injuries.—" (Cornish.)

(7.) **Wild looking eyes and finally delirium and convulsions** in some cases precede death, in other cases the mind remains unaffected.

Post-mortem Appearances.—These are chiefly great emaciation, a shrunken and contracted condition of the stomach and intestines with pale pearly and translucent coats, a more or less atrophied condition of the viscera, and absence—not necessarily complete in acute cases—(see *Case CII*) of fat. It should be noted, however, that all these appearances may be present in death from exhausting diseases. Hence in cases of

[1] *For. Med.*, p. 312.

death from alleged homicidal starvation, the body should be carefully examined for appearances indicating the existence of such diseases. It may, in such cases, be an extremely difficult matter to form a definite opinion as to whether death was due to disease or starvation (for a case in which this question arose, see *Case CII*).

Case CII.—**Homicidal starvation.—Death from disease set up as a defence** (*Reg.* v. *Staunton*, Taylor's *Manual*, p. 469). Deceased, Harriet Staunton, had been kept in close confinement by the accused. She was seen, a few hours before her death, by a medical man, and was then insensible and collapsed. She died in a state of complete exhaustion. On *post-mortem* examination appearances indicative of death from starvation were found, the body-weight being only 74 lbs. instead of about 120 lbs., as it would have been in a healthy adult of the same age. The following *post-mortem* appearances of disease were present:—1. A slight tubercular deposit at the apex of the left lung. 2. A congested appearance of the cardiac extremity of the stomach, as well as of the duodenum. 3. Two small patches of miliary tubercular deposit (recent) upon the arachnoid on the upper surface of the left cerebral hemisphere. There was no trace of meningitis, or of disease of the brain. In this case the defence was set up that death was the result of disease. The medical men who examined the body were of opinion that death was due to starvation. Three of the four accused were convicted.

Starvation may be Accidental, Homicidal, or Suicidal.—The most common causes of **accidental starvation** are: (1) Shipwreck, as in the case just quoted; (2) Mining accidents—individuals by a fall of earth getting shut up in a mine; (3) Disease, *e.g.*, stricture of the œsophagus; and (4) Famine.

In homicidal cases the victim is usually an infant or child. The withholding of food, with or without exposure to cold, is a not infrequent method of infanticide (see *Infanticide*). Cases also are not infrequent where children have been starved by their parents or other persons having charge of them,—'baby-farmers.' In fatal cases of this kind, as already pointed out, the body should be carefully examined for signs of disease, especially chronic wasting disease. In non-fatal cases, an unusually low body-weight, coupled with a rapid gain in weight when proper nourishment is administered, is very strong evidence in favour of starvation (see *Case CIII*).

Case CIII.—**Starvation; rapid gain of weight under proper feeding** (Tidy, *Leg. Med.*, i, p. 603; *Lancet*, August 14, 1880).—Prisoner charged with starving her servant, *æt.* 13½ years. The girl weighed thirty-five pounds. She suffered, in the cold weather, from chilblains and sloughing of the toes. When removed and properly fed she recovered her health, and gained weight at the rate of five ounces per diem for 129 days.

As already pointed out under suffocation, in one form of *Samadh* or burial alive of lepers, the head is left uncovered, and death takes place from exhaustion, the result of starvation and exposure; and not—as in cases where the burial is complete—from suffocation. **Suicidal cases** are rare, but are sometimes met with, especially in the insane and prisoners who sometimes attempt to commit suicide by starving themselves.

Pretended fasting.—Cases are on record where individuals, as a rule hysterical girls or young women, have pretended to an ability to abstain for long periods from food. A medical man should in such cases be cautious about undertaking the duty of watching the impostor with a view to detection, as if death results he may be held criminally responsible. In the case of the Welsh fasting-girl, the medical men who had accepted the responsibility of superintending the watching were indicted before the magistrates along with the parents of the girl; the parents only, however, were committed for trial.

CHAPTER XI.

SEXUAL DEFECTS—IMPOTENCE AND STERILITY WITH REFERENCE TO NULLITY OF MARRIAGE, &c.

SEXUAL capacity is a question that may arise with reference to marriage, charges of rape, &c.

Marriage, according to the law of England, is a contract which may be declared null and void by the Court on proof that either of the parties thereto is incapable of fulfilling its terms, *i.e.*, of consummating the marriage. Hence a suit for the declaration of nullity of marriage may be brought by one of the parties to the contract on the ground that the other is **impotent** or incapable of sexual intercourse. To obtain a decree declaring the marriage null and void on this ground it must, however, be proved : (*a*) **That the incapacity existed at the time of the marriage** ; and (*b*) **That it is of such a nature as to be incurable,** or only curable by an operation to which the individual refuses to submit (see *Case CIV*).

A marriage may also be declared null and void on the ground of the **insanity** of one of the parties thereto. For the questions arising in such a case, see *Insanity*.

IMPOTENCE AND STERILITY.

Impotence (or incapacity for performing the sexual act) and **sterility may exist in either sex,** but the existence of one of these conditions does not necessarily imply the existence of the other, *e.g.*, an individual may be sterile, but not impotent ; or impotent, but not sterile. Besides nullity of marriage suits, the question of the impotence, or sterility, of an individual may arise :—(1) **In rape cases.** Here impotence may be pleaded as a defence by the accused (see *Rape*, p. 259), and similarly, in other cases, impotence may be set up as an answer to a charge of adultery. (2) **In cases of disputed right to inherit** (see this subject), where an individual is alleged to be an illegitimate, or a supposititious child. (3) In some cases where, under certain circumstances, a woman seeks to have absolute control given to her over money, on the ground that she has no children, and is past the age of

child-bearing. We may now proceed to the consideration of impotence and sterility in each sex.

(A.) IMPOTENCE AND STERILITY IN THE MALE.

A male may be impotent or sterile owing to, 1. Extreme youth. 2. Advanced age. 3. Malformation or defect. 4. Disease. 5. Mental causes.

(1.) **Extreme youth.**—According to the **law of England,** the earliest age at which a male can contract a valid marriage is fourteen ; and a male under the age of fourteen is held incapable of committing a rape. It appears, therefore, to be a presumption of English law, that a boy does not attain puberty, and become potent for coitus, until he has reached the age of fourteen. The **law of India** contains no similar presumption ; a boy under the age of seven is (*I. P. Code, s.* 82) held to be incapable of committing rape or any other offence. Over that age, the question of his capacity to commit rape is a question left to the Courts to decide according to the evidence produced in the case.

Age at which males attain Puberty, and so become capable of performing sexual intercourse, varies. The general age among Europeans is probably about fourteen, and among natives of India somewhat earlier. In exceptional cases puberty is attained at a very early age. Tidy mentions a case of a boy who was given to masturbation from the age of three, and of another boy aged four and a half, who attempted intercourse with his sister aged two.[1] In other cases puberty is not attained until a comparatively late age. Taylor mentions a case of a man whose penis and testicles at the age of twenty-six, "but little exceeded in size those of a youth of eight years of age." This individual married, became the father of a family, and at the age of twenty-eight the organs became fully developed.[2]

Attainment of puberty and Potency does **not,** however, **necessarily** imply coincident attainment of **Fertility.** Until spermatozoa appear in the seminal fluid, an individual is sterile. Casper considers that the power of procreation commences later (and ceases earlier) than the capacity for coitus. Taylor gives fourteen as the earliest age at which the procreative power has been recorded to appear in the male.[3] **Aspermatism** can be detected by the microscope.

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[1] Tidy, *Leg. Med.*, ii, p. 77. [2] Taylor, *Med. Jur.*, ii, p. 290.
[3] Taylor, *Med. Jur.*, ii, p. 285.

(2.) **Advanced age** may of course be a cause of impotence or sterility in the male. Cases, however, are recorded of the procreation of children by men of seventy-one, eighty-one, and ninety-two ; and spermatozoa have in several cases been found in the seminal fluid (indicating fertility) of men over ninety.[1] Casper once found them in a man aged ninety-six.[2]

(3.) **Malformation or defect.**—Impregnation may result from the mere deposition of semen within the vulva.[3] No malformation or defect of the penis, therefore, can be regarded as an undoubted cause of impotence, unless it is of such a nature as to completely prevent such deposition. This being so, impotence results from **complete loss or absence of the penis,** or from its **orifice being situated,** as in complete hypospadias or epispadias, in such a position, that deposition of semen within the vulva during coitus is impossible. Impotence has thus resulted from **Perinæal fistula.** For the reason above mentioned, impotence is not necessarily the result of partial absence or loss of the penis, or of partial hypospadias or epispadias. **Adhesion of the penis** to the scrotum or abdomen, may cause impotence remediable by a slight operation.

Individuals impotent from malformation or defect of the penis are **not necessarily sterile,** it being possible to effect impregnation by artificial injection of the seminal fluid.

Loss of both testicles, or absence of both testicles, of course involves impotence and sterility. The power of procreation may, however, remain for a limited period after the removal of both testicles, owing to presence of accumulated seminal fluid in the vesiculæ seminales.

Loss of one testicle only does not result in impotence, nor are those who have one testicle only (*monorchids*) impotent (see *Case CVII*). Individuals in whom the testicles have not descended (*cryptorchids*) are not necessarily impotent ; many, but not all, are, however, sterile (see *Cases CV and CVI*).

Case CIV.—**A nullity of mar riage case** (Tidy's *Leg. Med.*, ii, p. 102).—In the case of L. *v.* L., it appeared that the woman was impotent, but that she might possibly be cured by an operation involving no great risk of life, to which, however, she refused to submit. The Court, in granting the decree, said that it could not compel her to submit, and the man can only be expected to take all reasonable means to persuade her. This he has done, and she has distinctly refused (L. R. 7, P. Div. 16).

Case CV.—**Procreation by cryptorchid** (Taylor, *Med. Jur.*, ii, p. 288).—A man, in whom the testicles had not descended at the age of

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[1] Taylor, *Med. Jur.*, ii, p. 291. [2] Casper, ii, pp. 258, 291.
[3] Tidy, *Leg. Med.*, ii, p. 14.

30, had been twice married, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service.

Case CVI.—**A similar Case** (*ibid*).—Case of a man in whom the testicles had not descended, reported by Mr. Poland. This man married when he was 20, had two children by his first wife ; and at the time of his admission into hospital (for hernia) had been married two years to a second wife.

Case CVII.—**Procreation by a monorchid** (Case of John Bury temp. Queen Elizabeth, Guy, *For. Med.*, p. 48).—"Willimet, the first wife of one John Bury, alleged that he was impotent ; and on inspection by two physicians, he was found to have but one testicle, the size of a small bean, while she was a virgin. On this and other circumstantial evidence, the Ecclesiastical Court annulled the marriage. But Bury took a second wife, by whom he had a son."

(4.) **Disease.—Local disease** may cause temporary and remediable impotence ; *e.g.*, elephantiasis and large hydrocele, from mechanical obstacle to coition ; and stricture of the urethra, from mechanical obstruction to the flow of semen. Local disease may also cause permanent and incurable sterility, *e.g.*, advanced disease of the testicles, or wasting of the testicles after inflammation ; this last has been observed as a result of metastatic parotitis. **Lithotomy** has been known to cause sterility, probably from injury to the ejaculatory ducts.

Constitutional diseases, if of an exhausting nature, may produce temporary impotence ; but general diseases, not affecting the brain or spinal cord, or not producing great debility, do not usually cause impotence.[2] Injury or disease of the brain or spinal cord may cause impotence or sterility. Curling relates several cases of impotence caused by blows on the head, especially on the back and under-part of it ; in some cases of this class recovery takes place, but in others wasting of the testicles and permanent sterility follows.[3] **Paraplegia** from injury to or disease of the cord, according to Curling (and probably also locomotor ataxy),[4] has no direct effect on the testicles, but may cause impotence by destroying the power to copulate. Wasting of the testicles and sterility may, however, follow. In one case quoted by Curling, a man suffering from paraplegia of some years' duration, retained sufficient sexual power to have prolific intercourse. **Hemiplegia** may cause impotence, but Guy mentions two cases where men, within three weeks of an attack of

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[1] Teevan, quoted by Woodman and Tidy, *For. Med.*, p. 685.
[2] Taylor, *Med. Jur.*, ii, p. 292.
[3] *Ibid*, p. 294.
[4] In the case of *Bagot* v. *Bagot* (Irish Probate Court, 1878) Dr. Radcliff stated that he himself had seen cases of ataxy in which sexual capacity and fruitfulness were retained (Guy, *For. Med.*, p. 49).

hemiplegia, had sexual intercourse with their wives, and begat children[1] (see *Case CVIII*). **Over-indulgence in** certain **intoxicating** or narcotic **drugs**, *e.g.*, alcohol, opium, cannabis and tobacco, is said to cause sterility. Sterility has by some been stated to occur in chronic lead-poisoning.

Case CVIII.—**Procreation after an attack of hemiplegia** (Guy, *For. Med.*, p. 50.)—"E. K., æt. 58, when 33 years of age, had a well-marked attack of hemiplegia of the right side, which has left him lame, and with his speech slightly affected. He alleges that he had connection with his wife within a week of his seizure, that his sexual powers have not been impaired, and that since his attack he has had three children always considered as his own. His wife gives three weeks as the extreme limit of time after the attack, at which connection took place."

(5.) **Mental causes.**—Excess of passion, timidity, fear, &c., may cause temporary impotence. Individuals may, it is alleged, be impotent or sterile as regards a particular female, but not as regards others (see *Cases CIX and CX*).

Case CIX.—**Alleged impotence in respect to one female, but not to others** (Woodman and Tidy, *For. Med.*, p. 679, from Hargraves' *State Trials*, i, p. 315).—"In the reign of King James I of England, the Earl of Essex was sued by his Countess for divorce on the ground that he was impotent. She claimed to be a *virgo intacta*, but is said to have substituted one of her maids for herself when examined. The Earl appears to have admitted the charge as regards the Countess, although he denied it *quoad* others."

Case CX.—**A similar case** (Ogston, *Med. Jur. Lect.*, p. 81, quoted on the authority of Pitaval).—"Two gentlemen of rank, very much of the same age and personal appearance, were married to wives who proved unfruitful after several years of marriage. The two couples at last determined to proceed to a celebrated watering-place, in the hope of deriving some benefit from the change and the use of the springs. On the way they put up at an inn and retired for the night. But the two wives had preceded their husbands to bed, and each of the latter mistook his friend's room for his own. In consequence of the mistake each of the ladies proved with child."

(B.) IMPOTENCE AND STERILITY IN THE FEMALE.

A Female may be impotent or sterile owing to (1) Extreme youth; (2) Advanced age; (3) Malformation or defect; (4) Disease.

(1.) **Extreme youth.**—According to the **law of England** twelve is the earliest age at which a female can contract a valid marriage; it would therefore appear that the law of England presumes that a girl attains puberty and becomes potent at the age of twelve, though she cannot give her consent

[1] *For. Med.*, p. 49.

to the sexual act till she is sixteen years of age. *Age of Consent in India.*—According to the law of India (*P. Code, s.* 375), any female over the age of twelve can give a valid consent to sexual intercourse; and "sexual intercourse by a man with his own wife, the wife not being under twelve years of age, is not rape." Hence it would appear that the law of India presumes that a female attains puberty and becomes potent at the age of twelve.

Commencement of Fertility in the female is, as a rule, indicated by the commencement of menstruation. In a few cases, however, pregnancy has occurred before the appearance of menstruation, but no case of pregnancy at an earlier age than eight to nine has been recorded. Menstruation is not a sign of bodily maturity, it is in most cases merely a sign puberty and ovulation with possible pregnability or capacity to conceive.

Age of Commencement of Menstruation.—This varies greatly with the individual and climate. Among natives of Europe the general age at which it first appears is fourteen to fifteen. Out of 2,000 cases, menstruation appeared in 211 between the ages of ten and twelve, in 1462 between thirteen and sixteen, and in 318 between seventeen and twenty. In one case only did it appear as early as nine, and in one only as late as twenty-two.[1]

Among natives of warm climates menstruation occurs earlier than among natives of temperate climates. Among natives of India menstruation so early as ten is uncommon, but its appearance is seldom delayed beyond the fifteenth year. The menstrual flow commonly lasts three to four and a half days. The menstrual period, reckoned from commencement of flow to commencement of flow, save in exceptional cases, is twenty-eight days.

The influence of a tropical climate, in causing early menstruation seems to have been over-estimated. In the following table are given the comparative results of Dr. Joubert's observations in 3,194 cases amongst European, Eurasian and Indian-born girls as to the age at which menstruation first appeared. In the class of pure native Hindus and Muhammadans, but chiefly the former, the greatest percentage of dates for first menstruation occurs between the 12th and 14th years, amounting to 65·7 of the whole class. Eurasians approach the native

[1] Hogg in *Med. Times and Gaz.*, 1871, vol. ii, p 555, but in exceptional cases a periodical discharge of blood from the genitals, if not precocious menstruation is recorded at age of nine months, 2 years and 7 years by Lenhosseky d'Outremont in hot climates.

type between the ages of 12 to 14 years but diverge again towards the European type between 14 to 16 years of age.

Ages of first Menstruation in India in years.

Race.		10—11	11—12	12—13	13—14	14—15	15—16	16—17	17—18	18—19
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Europeans	174	2·7	6·1	13·4	23·4	21·2	16·7	8·3	6·1	1·6
European, Country-born	387	0·7	3·6	10 8	25·8	24·8	17·3	12·4	3·1	1·2
Eurasians	795	0·7	0·2	22·0	31·8	22·0	10·5	4·2	1·7	0·6
Natives	1,752	2·0	10·4	36·4	29·3	13·9	4·5	2·2	0·2	0·04
Jewesses	73	..	2·7	9·5	34·2	34·2	17·8	1·3	1·3	...
Chinese	8	...	...	12·5	62·5	12·5	...	12·5	...	...
Total	3,194	...	...	...	...	...	...	...	...	...

The cause of the earlier menstruation in hot climates seems partly due to the shorter duration of life, with its consequent earlier maturity; and partly to the *social* differences, whereby in the tropics, where children early gain precocious knowledge of sexual matters, owing to the want of privacy in oriental domestic life. Thus an experienced observer states that it is doubtful "if there are any little boys and girls in native houses in this country who have reached the age of 10 years who do not have a very fair knowledge of what the sexual relations and child-bearing really mean." In addition, there is the precocious sexual excitement of too early marriages at the age of ten to twelve years with its many possibilities of sexual intercourse, authorized by native customs, though now made illegal by British law.

(2.) **Advanced age.**—Menstruation usually ceases between the ages of forty and fifty, but has been known to cease as early as twenty-three. On the other hand, there are on record several cases of menstruation at over sixty years of age, and one as late

[1] The average age at which the menstrual period begins varies with the coldness of the climate in Europe. In France it begins at 13, North Germany and Sweden 15 to 16; in Norway, 17½. In Lapland, 18 (Racibosky); and amongst the Esquimaux not till 19 to 20, notwithstanding that cohabitation in the latter case begins about the 14th year. (Dr. V. J. Pinto, *Ind. Med. Gaz*, 1895, 289, and *New York Journal Gynecology*, Mar. 1894).

as seventy-seven. As a rule fertility ceases with the cessation of menstruation, but Taylor[1] mentions a case of a lady aged forty-four, who was delivered of her tenth child eighteen months after the entire cessation of the menses. No general rule can be laid down as to the age at which, in the female, fertility ceases.

The question whether a woman is past child-bearing is of practical importance in cases where money has been settled on or bequeathed to a woman absolutely, in case she has no children, but in case of having children, only for her life with remainder to her children. In these and similar cases, where the woman has attained an advanced age without having had children, it is presumed she is incapable of having issue, and she is held absolutely entitled to the money, in which, if she had children, she would only have a life interest. No particular age is fixed as the period when such presumption arises.

The earliest age on which such a presumption has been acted on is that of a woman aged forty-nine years and nine months (see *in re Millner's Estate*, L. R., 14 Eq., p. 245), but in that case she had been married for twenty-six years and there had never been any children. In the case of *in re Widdow's Trusts* (L. R., 11 Eq., p. 408) the presumption was acted on in the case of a widow aged fifty-five years and four months, and a spinster aged fifty-three years and nine months. In *Norton* v. *May* (9 Ch. Div., p. 388) the Court refused to presume no possibility of issue in the case of a woman aged fifty-four years and six months, who, although she had been married several years, had separated from her husband soon after marriage, and had only lived with him for about three years before the filing of the case in Court. In *Davidson* v. *Kimpton* (18 Ch. Div., p. 213), the presumption was acted on in the case of a spinster in her fifty-fifth year. There is no similar presumption as to a male being incapable of begetting issue.

(3.) **Malformation or defect.**—Complete absence or occlusion of the vagina of course causes impotence. Occlusion may be remediable by operation. For occlusion to act as a cause of sterility it must be complete; "the slightest aperture will often suffice for impregnation."[2] Many cases are recorded where during labour the vagina has been found occluded to so great an extent as to require incision in order to effect delivery. Ogston mentions a case of "a woman who had a vagina so narrow as scarcely to admit a quill," but who, after being married eleven years, became pregnant, when the vagina "dilated of itself sufficiently to admit of delivery at the full term."[3] Absence of the ovaries or uterus of course causes incurable sterility. In such cases, however, there may be no external defect or malformation, and the cause of the sterility may in consequence only be ascertainable after death.

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[1] *Med. Jur.*, vol. ii, p. 299. [2] Taylor, *Med. Jur.*, ii, p. 302.
[3] *Lect., Med. Jur.*, p. 85.

(4.) **Disease.**—Impotence or sterility in the female may arise from a variety of diseased conditions. There may, for example, be excessive irritability of the vagina, preventing coitus and causing impotence (see *Cases CXI and CXII*). Again, effective coitus may be prevented by ruptured perinæum, or recto-vaginal fistula. Sterility may result from disease of the ovaries; obstruction of the Fallopian tubes, or of the neck of the uterus; displacements of the uterus, &c., &c. Acid discharges from the vagina or uterus may cause sterility by acting destructively on the spermatozoa, or preventing their access to the ovum. Paraplegia in the female, it may be noted, does not always prevent either impregnation or delivery."[1]

Case CXI.—**Hysteria a cause of impotence in the female** (Tidy, *Leg. Med.*, ii, p. 102, *G.* v. *G.*, L. R., 2 P. & D., p. 287).—"In this case, where the parties had cohabited for two years and ten months, and the man's capacity and desire to consummate were not questioned, the Court being satisfied of the *bona fides* of the suit, and of the practical impossibility of consummation in consequence of the hysteria of the woman, pronounced a decree of nullity, although there was no structural defect in the woman."

Case CXII.—**A similar Case** (Tidy, *Leg. Med.*, ii, p. 103. Case of *H.* v. *P.*, L. R., 3 P. & D., p. 126).—"In a suit for nullity of marriage, it appeared from the husband's evidence that whenever he attempted to have intercourse with his wife the act had produced hysteria on her part; and that, although he had cohabited with her for more than three years, the marriage had never been consummated. The wife refused to submit to inspection. Decree *nisi* granted."

VIRGINITY.

It has already been pointed out that one of the questions which may rise in nullity of marriage suits is, **is a certain female "*virgo intacta*" or not?** The same question may also arise in other cases; *e.g.*, (1) **In divorce cases and defamation cases.** (2) **In cases where an unmarried female is alleged to be a prostitute,** and as such liable to be dealt with under the Contagious Diseases Act, or other similar law (see *Case CXIII*). (3) **In rape cases.** In these, however, it is not an essential question, seeing that vulval penetration is all that is necessary to constitute the offence of rape (see *Rape*, p. 244), and this may be effected without destruction of the signs of virginity.

Case CXIII.—**Two women afterwards found to be prostitutes; result of examination as to virginity doubtful in the case of one** (Guy, *For. Med.*, p. 56, quoted from Parent-Duchatelet).—Two young women, of genteel appearance, were attacked in the public streets by some young men, who called them opprobrious names, and

[1] Woodman and Tidy, *For. Med.*, p. 684.

told the passers-by that they were no better than common prostitutes. Some good-natured persons resented this conduct and took the girls' part, and a complaint was lodged on their behalf against their defamers, who were summoned before a magistrate The defendants pleaded a justification, while the females, on the contrary, stoutly insisted on their purity, and even offered to submit to inspection by a medical examiner, which the opposite party dared them to do. A sworn inspector, clever and conscientious, was appointed by the magistrate, and reported that it was totally out of his power to say anything certain as to one of the females; she might or might not be a virgin; but that the other had probably had some intercourse with men, though he could not assert the fact positively. Yet it subsequently came out that these young women had actually been for some time on the registers of the Police, and had both had repeated attacks of the venereal disease.

Signs of virginity. The most reliable sign of virginity is an intact hymen. We have to consider the following questions:—

(1.) **Is the hymen always present?**—At one time it was alleged by many authorities that the hymen was frequently absent. This view has, however, been proved by later observations to be erroneous. It was found, for example, to be present in each one of 650 cases examined by Devilliers, Orfila, and Tardieu.[1] Capuron, however, records a case of congenital malformation of the genitals with absence of the hymen.[2]

(2.) **What is the natural condition of the hymen in the virgin?**—Ogston[3] gives the following description of the natural condition of the hymen: "In children this membrane lies deep, and can only be readily seen in them on the forcible separation of the thighs, when it is found to consist of two lateral and vertical folds of integument at the entrance of the vagina, which it almost closes. A very common form of the membrane, after the age of infancy especially, is that of an irregularly circular diaphragm, broken at its upper third by an opening more or less large, and placed more or less distant from the lower border of the vaginal orifice. In a third set of cases the hymen has been described in late observations as a sort of diaphragm, exactly and regularly circular, pierced by a central opening. A fourth form assumed by it, and that its most common appearance, is that of a semi-circular fold of integument stretched across the lower border of the vaginal orifice, its free border concave and notched (*échancré*), and its extremities losing themselves in the labia minora. Lastly, the hymen has been occasionally encountered in the shape of a mere narrow fringe around the entrance to the canal of the vagina; in one case as a sort of bridle across the vagina, with a passage on each

[1] Ogston, *Lect., Med. Jur.*, p. 102. [2] Tidy, *Leg. Med.*, ii, p. 97.
[3] *Lect., Med. Jur.*, p. 102.

side; in another as a complete septum, pierced by numerous minute openings; and in a third instance as a double septum, without any opening whatever into the vagina. The entrance to the vagina is thus practically closed or narrowed by the hymen, which in early life is most usually vertical, but by the natural development of the parts gradually assumes a horizontal direction. Towards puberty more firm and consistent than in early life, as menstruation becomes established it becomes more or less flaccid, presenting less resistance to their flow, and is more easily lacerated."

(3.) **What changes are produced in the hymen by sexual intercourse?**—As a general rule, when sexual intercourse takes place, the hymen is lacerated or ruptured, in the latter case giving rise to "those small pyramidal tubercles, from three to six in number, known as the carunculæ myrtiformes."[1] Tidy,[2] however, points out that two or more of the carunculæ "are vaginal and not hymeneal," and that "the vaginal carunculæ may therefore co-exist with an unruptured hymen." If, however, the aperture in the hymen be larger than usual, or the membrane itself be lax, repeated intercourse may take place without rupture, or even laceration. Many cases are recorded, in fact, where the hymen has existed all through pregnancy, and has only ruptured at the time of delivery. In very young children the hymen, owing to its deeply seated position, and to the narrowness of the parts,[3] is not usually even lacerated by intercourse.

Case CXIV.—**Hymen is present and apparently intact in prostitutes, &c.**—At Martineau's service in the Broca (then Lourcine) Hospital in Paris, I saw a girl who had come to the out-patient department for treatment of what was to all seeming an insignificant leucorrhœa. There was no obvious urethritis, nor were Skene's tubules affected, a point to which Martineau used to pay particular attention, and there was present a hymen whose orifice was barely two millimetres in diameter. But this girl was suffering from gonorrhœa, and admitted that she had infected several of her customers, she being a clandestine prostitute of the purlieus of the Sorbonne. She had been on the town for over a year, and had entertained as many as five men in a single afternoon on a *fête* day. Her hymen was elastic, and admitted of the passage of a large rectal bougie, returning to its obturator-like condition, when this was withdrawn.—W. D. Sutherland, *Ind. Med. Gaz.*, 1902, 245. See also *Case CXIII.*

The hymen may be *ruptured by* the introduction of *foreign bodies* other than the penis: *e.g.* (1) accidentally,—this, however, is extremely rare; or (2) by the introduction of instruments during an examination or surgical operation; or (3)

[1] Guy, *For. Med.*, p. 55. [2] *Leg. Med.*, ii, p. 198. [3] *Ibid*, p. 201.

in practising masturbation, especially if the body introduced is of large diameter; or (4) in endeavours to dilate the parts of young females, so as to render them aptæ viris. Casper mentions a case where the mother of a girl aged ten employed first her fingers and then a long stone for this purpose, thereby lacerating the hymen.[1] Chevers mentions the use in India for this purpose of the fruit of the plantain, and also of pieces of sola pith, the girl being made to sit in water, so that the pith may swell and dilate the parts.[2]

It has also been asserted that the hymen may be ruptured by indirect violence in a fall, or during violent exertion; this appears, however, to be very doubtful. Ogston and Tidy both regard rupture of the hymen in this way as very improbable.[3] The same may be said in regard to the possibility of rupture occurring from the action of vaginal discharges.

(4.) **How far can virginity or non-virginity be inferred from the condition of the hymen?**—Given that the **hymen is intact** (not even lacerated), the probabilities, except in the case of females below the age of puberty, are very strongly in favour of virginity; and the inference of virginity becomes almost certain, if the membrane is normal in position and structure, and its aperture is of small size and undilatable; and if accompanying this condition of the hymen the other signs of virginity (see below) are present.

Case CXV.—**Evidence of virginity in disproof of alleged adultery.** (Taylor, *Med. Jur*, ii, p 441; *Frazer* v. *Bayley*, Common Pleas, Feb. 1884.)—It was alleged by defendant that the plaintiff, a married man, had had adulterous intercourse with a young woman, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. The late Dr. Ashwell was called upon to examine the woman, and he deposed that, in his opinion, she was a virgin and had never had a child.

Case CXVI.—**A similar case.** (*Ibid*, *Delafosse Fortescue*, Exeter Lent Assizes, 1853)—In this case, which involved an action for defamation of character, the plaintiff, a married man, *æt.* 64, had been charged with committing adultery with a certain woman. Several witnesses for the defendant positively swore that they had seen these persons in carnal intercourse. This was denied by the plaintiff; and as an answer to the case, medical evidence was tendered to the effect that the woman, with whom the adulterous intercourse was alleged to have taken place, had been examined and the hymen was found intact. In cross-examination, however, this was admitted not to be a conclusive criterion of virginity, and a verdict was returned for the defendant.

On the other hand, the **absence of an intact hymen,** although strong evidence of non-virginity, cannot be taken as

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[1] Taylor, *Med. Jur.*, ii. p. 430.
[2] *Med. Jur.*, p. 689.
[3] Ogston, *Lect.*, *Med. Jur.*, p. 103; Tidy, *Leg. Med.*, ii, p. 197.

conclusive proof thereof, seeing that, as already stated, the hymen may be ruptured or lacerated by the introduction of foreign bodies other than the penis.

Other signs of Virginity.

These may be briefly stated to be (1) a narrow and rugose condition of the vagina, the clitoris unenlarged and the labia elastic and in close contact; (2) absence of signs of previous delivery, of fourchette and perinæum entire; and (3) a hemispherical plump and elastic condition of the breasts. All such signs, taken by themselves, are unreliable as evidence of virginity, but are useful as corroborating evidence of virginity derived from the condition of the hymen.

CHAPTER XII.

RAPE AND UNNATURAL SEXUAL OFFENCES.

RAPE.

Rape is a felony punishable by imprisonment up to penal servitude for life ; and formerly it was punished by castration and death. As it is usually committed in the absence of witnesses the law admits the testimony of the alleged victim, but the medical evidence is essential, as a large proportion of the accusations are false charges.

Definition of Rape.—According to the law of India,[1] (and also according to that of England,[2]) rape, subject to certain explanations, may be defined as sexual intercourse by a man with—(1) any female (including his own wife) under the age, in India, of twelve[3] (in England, it is thirteen) or (2) any female over the above-stated age, not being the man's own wife—(*a*) *against her will*, or (*b*) *without her free consent*, or (*c*) even with her consent, when this has been obtained in certain unlawful ways.

The explanations above referred to are as follows :—

(1.) "**Sexual Intercourse,**" or to "*unlawfully and carnally know,*" as is the phrase used in English law. It has been decided in England, that any introduction of the male organ within the vulva, constitutes penetration sufficient for the 'carnal knowledge' necessary to the offence. In India, the rule on this point is laid down in the explanation attached to *s.* 375 of the *Penal Code* as follows :—"Penetration is sufficient to constitute the sexual intercourse necessary to the offence of rape," and in the case of *Reg.* v. *Ferroll* (Bombay High Court Sessions, February, 1879), Green, J., directed the jury that vulval penetration only was sufficient, under the law of India, to constitute rape (see *Case CXIII*) without actual seminal emission.

Case CXVII.—**Vulval penetration sufficient to constitute rape, according to Indian law.** (*Reg.* v. *Ferrol*, Bombay High Court Sessions, February 1879.)—In this case the prisoner was charged with rape on a child, six years old. The child had not complained, and admitted on cross-examination that she had not been hurt. The medical evidence proved there was no injury to the parts. The child was found

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[1] *I. P. Code*, *s.* 375.
[2] *Criminal Law Amendment Act*, 1885 (48 & 49 Vict. ch. 69, *s.* 4).
[3] Act X of 1891, *s.* 1.

to be suffering from gonorrhœa, so was the prisoner. It was clear that the penetration (if any) had been only vulval. Green, J., directed the jury that this was sufficient to constitute rape, and the prisoner was convicted of rape.

(2.) **The male accused.**—As already pointed out, it is an irrebuttable presumption of **English law** that a boy under the age of fourteen is incapable of committing rape. In England, therefore, a boy under the age of fourteen cannot be convicted of this offence. The criminal **law of India** contains no special presumption as to the age at which a boy attains potency, and becomes capable of committing rape. It, however, contains two general exceptions bearing on the question of age in regard to criminal responsibility, and applying to rape as to other offences. These exceptions are in effect (1) that a child under the age of seven cannot be held criminally responsible for his acts, and (2) that a child between the ages of seven and twelve can only be held criminally responsible for his acts if he has attained a certain specified degree of maturity of understanding.[1] Hence, in India, if the case of a boy charged with rape does not fall within one or other of these general exceptions, the question of the capacity of the accused to commit the offence is left to the Court to decide according to the evidence produced in the case. Thus, "in the case of *Kureem Noorbae* v. *Meun Noorbae* (2 *N. A. Rep.*, p. 87), a boy of ten years was convicted for rape by the Court of Sessions, but the Nizamut Adawlut, considering it unadvisable to admit his capability, viewed the matter only as an attempt."[2]

(3.) **Age of Consent in female.**—According to the law of India, sexual intercourse with a female, of or over the age of twelve, with her valid consent, is not an offence, but see p. 33. According to the law of England, however, sexual intercourse with a female of or over the age of thirteen, but under that of sixteen,[3] with her consent, is (unless it be proved that the accused had reasonable cause to believe that the girl was of or above the age of sixteen) a misdemeanour punishable less severely than rape.[4] *Marriage is no defence* in this case, notwithstanding that the marriageable age for a female in England is twelve years of age, and the fact that the girl forgives the accused or subsequently enters into the marriage relations with him, does not relieve him technically from the crime, as the law holds that the female being under the age of consent, her consent to the sexual act constitutes no defence, though such forgiveness by her for her injury and acceptable amends usually terminates the prosecution.

(4.) **Consent of the female is invalid** under the following circumstances :—According to the **law of India**, consent

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[1] *I. P. Code*, *ss.* 82 and 83.
[2] O'Kinealy's *Penal Code*, p. 177.
[3] L. R., 1 C. C. R., p. 39 ; Tidy. *Leg. Med.*, ii, p. 194.
[4] In the United States of America the age of consent is 18.

of a female to sexual intercourse is not valid, and does not exculpate the accused, if the manner in which it has been obtained falls within (*a*) certain general exceptions of the *Penal Code* in regard to consent (see *s.* 90) ; or (*b*) certain *special* exceptions in regard to consent to sexual intercourse embodied in *s.* 375 of the *Code* namely :—

Consent of the female is invalid :—(1) If it is given under misconception of fact, and the man knows, or has reason to believe, it was so given (*s.* 90). (2) If the woman, by reason of unsoundness of mind, or intoxication, is unable to understand the nature and consequence of the act to which she consents (*ibid*). (3) If her consent has been obtained by putting her in fear of death or hurt (*s.* 375). (4) When the man knows that he is not her husband, and that her consent is given because she believes that he is another man to whom she is, or believes herself to be, lawfully married (*s.* 375). Regarding these exceptions it may be noted :—

(1.) That, as regards exception 1, a female, for her consent to be valid, must be aware that the act to which she consents is sexual intercourse. On this point the law of England agrees with that of India (see *Case CXVII*).

Case CXVIII—**Conviction for rape where consent to sexual intercourse was given under misconception of fact** From Tidy's '*Leg. Med.*,' ii, p. 244 ;*R* v. *Hattery*, L. R., 2 Q. B D., p. 410) —"The prisoner, a quack-doctor, professed to give medical and surgical advice for money. The prosecutrix, a girl of nineteen, consulted him with respect to an illness from which she was suffering. He advised that a surgical operation should be performed, and under the pretence of performing it had carnal connection with the prosecutrix. She submitted to what was done, not with any intention that he would have carnal connection with her, but under the belief that he was merely treating her medically, and performing a surgical operation, that belief being wilfully and fraudulently induced by the prisoner The Court for Crown Cases Reserved were unanimously of opinion that these facts constituted the crime of rape."

(2.) That, as regards exception 2, the law of England appears to differ somewhat from that of India, it having been decided in the case of *R.* v. *Fletcher*,[1] in which a man was charged with rape on an idiot, that "a consent resulting from a mere animal instinct would suffice to prevent the act from constituting a rape." By *s.* 5 of 48 & 49 Vict., c. 69, however, sexual intercourse with "any female idiot, or imbecile woman or girl, under circumstances which do not amount to rape, but which prove that the offender knew, at the time of the commission of the offence, that the woman or girl was an idiot or imbecile," is a misdemeanour punishable less severely than rape.

(3.) That the law of England agrees with that of India in regard to exception 3.

(4.) That, as regards exception 4, it was ruled in *R* v. *Barrow* (L. R , 1 C. C. R., p. 156), that this is not rape by English law. Since then, however, it has been enacted that a man who "induces a married woman to permit him to have connection with her by personating her

[1] (*Criminal Law Amendment Act*, 1885, *s.* 5). Imprisonment with or without hard labour not exceeding two years.

husband," is guilty of rape (*Criminal Law Amendment Act*, 48 & 49 Vict., c. 69, *s.* 4).

Cases are mentioned by foreign writers of females compelling young boys to have intercourse with them, and Chevers (p. 704) mentions cases as having occurred in India, in which there was good reason to suppose that young boys had, under compulsion, intercourse with their *ayahs* or other females. Cases of this description, however, do not come under the definition of rape laid down in the Indian penal code.

Under the penal code of France, it is an offence for a woman to attempt sexual intercourse, with or without consent, with a boy under the age of eleven.

Age.—Young children are more frequently raped than adult women as they are less capable of offering resistance, and as in India the practice of infant marriage creates a desire for intercourse with immature girls. Besides an occasional motive for the rape is the old world superstition common both to India and Europe, that intercourse with a virgin is a cure for venereal disease, and the younger the girl the greater the probability of her being a virgin.

The child-wives of India are still, to a large extent, the victims of rape at the instance of their maturer husbands, notwithstanding the British Act of 1891 which raised the nubile age from ten to twelve years. For there is reason to believe that premenstrual congress with children is still largely practised in this country under the cover of marriage.

The *age:* in 205 cases of proved rape in Bengal during the three years 1871-73 there was one 2 years old, one 2½, one 3, three 4, five 5, nine 6, nine 7, eighteen 8, twenty-one 9, twenty-six 10, nineteen 11, twenty 12, thirty between 12 and 15, and only nineteen above 15 That is to say 51 per cent. were under 10 and 89 per cent. under 15 years of age. In the year 1868 of 48 cases in Bengal in two the age was 5, in seventeen between 6 and 10, in ten between 11 and 15, in seven between 16 and 20, in three above 20, and in nine not stated, that is to say about half of the victims were under 10 years of age, and in most of the cases the children were badly hurt.

QUESTIONS IN RAPE CASES.

(1.) **Can a man unaided commit a rape on an adult female of ordinary strength, in full possession of her senses?**—It has been alleged that this is impossible. That, however, in exceptional cases, rape may be committed under the circumstances stated, is shown by *Case CXIX*, reported by Casper, who, in regard to it, remarks: "The interest of this important case cannot be mistaken, for it shows that a healthy

powerful woman was certainly completely violated by a single man."[1] Ogston, also, in reference to this question remarks, that the arguments advanced against the possibility of intercourse under the circumstances stated, "apply rather to the case of entire penetration of the vulva, than to the partial entry, which is now admitted in law as amounting to the crime of rape. That such entry may be forced in an ordinary case, I had the assurance of actual fact in at least one serious case."[2] Chevers, again, gives two cases in which rape was affected by unaided single men on adult females. Of course, the younger and weaker the female, and the stronger the man, the greater the probability of the commission of the offence being possible; *Case CXX* illustrated this. A very old woman also may be incapable of offering sufficient resistance. Chevers mentions a case in which a man committed a rape on a woman of seventy.

Case CXIX.—**Rape by one man unaided on an adult female.** (From Casper's *Handbook*, vol. iii, p. 311.)—"L persuaded F, a girl aged twenty-five, to accompany him to the Theirgarten in the dark, and after he had been baulked by her struggles in his endeavours to violate her against a tree, he seized her round the body and flung her on the ground, and being now, as she states, deprived of the power of resistance, he flung her dress over her head and violated her. Nine days subsequently I had to examine her. Her appearance was timid and maidenish, and without dissimulation she was deeply moved by what had befallen her. The entrance to the vagina was still reddened, and painful when touched and dilated; the hymen was completely torn, and bright red; carunculæ, still slightly swollen, were visible; the frænulum still existed. Without any leading question, and only in answer to general queries as to her bodily and mental condition, she declared that still a little, and several days ago much more, she could only with difficulty walk and pass urine and fæces. After carefully considering all that required to be considered in such a case, I came to the conclusion that a rape had actually been committed upon F. At the time of the trial, circumstances came out which only served to confirm this opinion. The police-officers who had hurried up at the cries of F testified that the ground upon which she had been thrown was hard frozen, and they deposed that L, when arrested, and after his lust had been satisfied, was still in a condition of actual satyriasis."

Case CXX.—**Rape by one man unaided on a married girl æt. sixteen.** (Chevers, *Med. Jur.*, p. 702.)—Fadil Gazee, of Jessore, a tall and powerful man, seeing a married girl of sixteen standing at her door, accosted her, apparently under the pretence of asking for a *soot nullee*, and wished to worm out of her if she was alone; finding that she was, he put his arms round her, forcibly drew her into the house, flung her down, and, gagging her mouth with her right hand, effected a criminal connection with her. Before her mouth was well gagged she managed to yell out for assistance, and her cries

[1] Casper, iii, p. 311. [2] *Lect., Med. Jur.*, p. 120.

brought her mother and a neighbour, who found him in the act. He then got up hastily, offered to give her a rupee if she would say nothing more of the matter, and ran off.

(2.) **Can a woman during sleep be violated without her knowledge?**—A woman can undoubtedly be violated without her knowledge while under the influence of narcotics (alcohol included), or during syncope or coma; and it has been alleged, also, but this is open to grave doubt, during mesmeric trance (see *Case CXXI*, and Taylor's remarks thereon). It is probable also that, in exceptional cases, a woman accustomed to sexual intercourse may be violated during profound natural sleep. Guy, in support of this view, mentions the case of a woman who, in illustration of a symptom which somewhat alarmed her—*viz.*, that her sleep was unnaturally heavy—told him that her husband had assured her that he had frequently had connection with her during sleep.[1] On the other hand, it is highly improbable that a virgin could, during natural sleep, be violated without her knowledge, or even that, without her knowledge, sexual intercourse sufficient to constitute rape could be effected with her. Still, however, cases are reported where it is alleged that this has occurred (see *Cases CXXI* and *CXXII*).

Case CXXI.—**Alleged violation during mesmeric trance.** (Taylor, *Med. Jur.*, ii, p. 447.)—"A girl (*æt.* eighteen) consulted a therapeutic magnetiser as to her health. She visited him daily for some days. Four and a half months afterwards she discovered that she was pregnant, and made a complaint to the authorities against the magnetiser. They directed a physician and surgeon to determine the date of her pregnancy, and whether complainant might have then been violated and rendered pregnant contrary to her will, *i.e.*, if her volition could have been completely or partially annihilated by magnetism. The medical inspectors were satisfied that the pregnancy did not extend farther back than four and a half months; and founding their opinion on M. Husson's report, made to the Academy in 1831, concluded that, as a person in magnetic sleep is insensible to every kind of torture, sexual intercourse might then take place with a young woman without the participation of her will, and without her being conscious of the act, and consequently without her being able to resist the act consummated on her. This opinion was confirmed by that of Devergie (*Gazette Médicale de Paris*, and *Edin. Month. Jour.*, December 1860, p. 566). There is another view of this case which does not seem to have occurred to the French medical experts, namely, '*Non omnes dormiunt quæ clausos habent oculos.*'"

Case CXXII.—**Alleged violation during profound natural sleep.** (Ogston, *Med. Jur., Lect.*, p. 121.)—A servant woman at an hotel in Nenagh proved pregnant, and solemnly declared that she was not conscious of having had intercourse with any man. Suspicion, however, fell upon an ostler in the establishment, who subsequently acknowledged that he believed he was the father of the child; that,

[1] *For. Med.*, 4th ed., p. 57.

having found the woman in a deep sleep from fatigue, caused by long-continued exertion and being kept out of bed two or three nights in succession, he had connection with her, and, as he believed, totally without her knowledge, as she did not evince the slightest consciousness of the act at the time, or recollection of its occurrence afterwards. The parties were married with mutual consent.

Case CXXIII.—**Another case.** (Taylor, *Med. Jur.*, ii, p. 445.)—Casper met with a solitary case in which a girl, *æt.* sixteen, accused a man of having had intercourse with her while she was sleeping in her bed, of which she was not conscious until he was in the act of withdrawing from her. On her own statement she was *virgo intacta* up to the date of this occurrence. Upon the facts of the case Casper came to the conclusion that, if her statement was true, the man could not have had intercourse with her without causing pain and rousing her to a consciousness of her position. The hymen was not destroyed, but presented lacerations in two places. This and other facts showed that there had been intercourse, but did not prove that this had taken place without the consciousness of the woman.

(3.) **May pregnancy follow rape?**—It was formerly alleged that pregnancy never followed rape, and that hence if a woman charged a man with committing a rape upon her, and became pregnant as a result thereof, the charge must be untrue, and the woman must have consented to the intercourse. Impregnation is, however, independent of volition on the part of the female, and hence pregnancy, as is proved by more than one recorded case, may undoubtedly follow rape.

(4.) **May rape cause death?**—The introduction of the mature male organ into the vagina of an immature female, may produce local injury sufficient to cause death from *hæmorrhage*, *shock*, or *subsequent inflammation*, such as peritonitis or gangrene by violent laceration of vagina or perinæum. Such a cause of death was not uncommon amongst the child-wives in Bengal up till at least 1890 when a notorious case (*Case CXXIV*) attracted medical notice and led to the act raising the nubile age from ten to twelve. Even now cases of this kind doubtless happen not unfrequently and are concealed, the death being attributed to other causes. Chevers mentions 14 cases of death from this cause; and Harvey[1] records that in Bengal, in the three years ending 1873, out of the 205 cases of rape which were proved, in 24 of these laceration of the vagina, generally of the posterior wall, was found; and in 14 the perinæum was torn, the rent varying from one-fifth of an inch, to one inch in length. Five of the cases terminated fatally (see *Case CXXV*). Injury to the genitals of a young female may, however, be caused in order to support a false charge (see *Case CXXVII*). Violent sexual intercourse in a young female

[1] *Beng. Med. Leg. Rep.*, 1870-72, p. 179, *et seq.*

at or near the age of puberty, may cause constitutional disturbance, leading to fatal hæmorrhage into the brain, peritoneal cavity, &c. On the question whether death may result from nervous exhaustion, the result of repeated intercourse, Chevers cites the case of certain Marquesan women, who boasted, apparently with truth, of having had intercourse with one hundred men in one night. The intercourse, however, was voluntary; had it been otherwise, no doubt the exhaustion would have been greater.

Case CXXIV.—**Total rupture of uterus in girl-wife by sexual intercourse.**—In 1890 at the Calcutta High Court a fully developed Bengali, aged 35, was charged with causing the death as above of his child-wife, a girl aged 11 years and 3½ months. Medical evidence testified that the girl, although well developed for her age, was immature, had not attained puberty, and was wholly unfit for sexual intercourse. The injury inflicted was a rent of the vaginal wall on the right side of the *os uteri*, measuring 1¾ inch in length and 1 inch in breadth. Copious hæmorrhage took place immediately after intercourse. The girl died of exhaustion 13½ hours after the act. The vagina was found to be distended with a clot measuring 3 inches in length by 1½ inches in breadth, and there was a globular hæmatoma in the right broad ligament, measuring 3 inches in diameter. The mucous surfaces and internal organs were exsanguine; the uterus was infantile, and ovaries showed no sign of active ovulation. There was no sign of injury of the labia or vulva, and no trace of hymen. These circumstances were held to indicate that *sexual intercourse, more or less complete, had taken place on previous occasions.* The wall of the vagina was thin and showed no *rugæ*. The evidence in this case clearly established the fact that the fatal injury was caused by the sexual intercourse of this mature male with an immature female, his wife. The court held that when a girl is a wife and above the age of consent (which at that time was only ten years), although it is therefore not rape, still the husband has not the absolute right to enjoy the person of his wife without regard to her safety. Found that the prisoner caused the death of the girl by a rash and negligent act. *Queen-Empress* v. *Hurry Mohun Mythee*, I. L. R., 18 Cal., 49; J. Wilson, July 1890.

Case CXXV.—**Death following rape.** (*Ind. Med. Gaz.*, Nov. 1875.)—Rape on a female *æt.* nine. Death from hæmorrhage from a wound on the genitals ascribed to the introduction of the male organ. The left wall of the vagina was ruptured from the orifice upwards for 2½ inches, and the rent was an inch wide.

On the other hand it has been held to be physically impossible that a girl of tender age should be killed by any violence in rape, and not show external signs of violence (*Queen* v. *Banee M. Mookerjee*, 1 W. R., 29 Nov., 22, 1864).

Rape on the Dead.—In cases of young children it is probable that rape was first committed and murder afterwards. In older females it is probable that they were murdered first and violated afterwards.

Case CXXVI.—Rape on a child of seven years, with murder. A lad of Benares, who stated himself to be eighteen, but who

appeared to be fourteen or fifteen years old, confessed at the *thannah* and magistrate's court that he had carnal knowledge of a child of seven, had caused her death in so doing, and had stolen her ornaments. The body was found concealed in a room, much decomposed, with a stone on the chest, and a cloth wrapped round the neck. Dr. Leckie, on removing the cloth, found that the whole of the soft parts of the neck had been destroyed, from which he inferred that it had been compressed, and that strangulation was the probable cause of the death.—(*Niz. Ad. Reports, N. W. P., June,* 1853.)

EXAMINATION IN RAPE CASES.

As no one, either a magistrate or anyone else, can compel either the complainant or accused to submit to being examined, without being guilty of and running the risk of a charge for indecent assault, you must invariably, and in the presence of witnesses, obtain the *consent* of the person in question to make your examination, and at the same time caution him or her that the results of the examination may be used as evidence against them. Where the victim is under age, the consent of the nearest guardian should be asked. If a woman refuses to be examined it is probable that no rape has been committed.

The examination will comprise, (1) examination of the victim or complainant, (2) the accused, and (3) stained linen worn by the parties at the time, and (4) the spot where alleged crime was committed

EXAMINATION OF THE VICTIM.

Having obtained her consent, and in the presence of a third person in order to avoid false charges being brought against you commence, in a good light, to make your examination ; after note down in writing the following points:[1]—

Preliminary Examination :—

1. *Date and exact hour* at which she visits you.
2. Her walk and mental state.
3. Who accompanies her, and their attitude towards accused.
4. Her statements.
   (1). Age.
   (2). Date, time and place of alleged offence.
   (3). Exact position of parties, sitting, standing, &c.

1. With reference to lapse of time since alleged rape. If long delayed, why ? as traces may disappear in 3 or 4 days.
2. Referring to pain, emotional state, alcohol, &c.
3. Referring to concocted tales.

[1] Modified after F. T. Smith, *Med. Jur.*, 192.

(4). Did she cry out or struggle.
(5). Was she sensible the whole time.
(6). Menstruating or not.

4. Screaming out does not necessarily imply want of consent when it is done only when discovered by a third party in a compromising position.

Examination of her clothes.—Then have her completely undressed, by some other person, and note **stains of blood, semen, mud, &c., on her clothes.** The clothes may be found torn or stained with blood, and marks of **blood** may be found on the person. Of course, in such a case, the question will arise whether the blood is menstrual or not. As already pointed out (p. 102), stains of menstrual blood cannot be distinguished from stains of other blood; by inquiry, however, it will have been ascertained whether or not the female was menstruating at the time of the alleged commission of the offence. If the female is seen soon after the alleged rape, the discharge from the vagina, if a discharge exists, or the vaginal mucus, should be examined for the presence of **spermatozoa** (see p. 104). Spermatozoa may even be found in the vaginal mucus, ten to fourteen days after rape. Stains containing spermatozoa may be found on the clothes; but it must always be recollected that the non-discovery of spermatozoa, does not prove the absence of semen.[1]

Examination of her person.—Note her physical development with reference to power of struggling, &c., and any bruises or scratches with reference to possibility of self-infliction.

Scratches, finger-marks, bruises, or wounds, may be found on parts of the body other than the genitals, and the more the resistance offered the more likely are such marks to be found. Hence, therefore, such marks are likely to be more numerous if the subject is an adult female, and less numerous if a child. Even, however, in the case of an adult female, a rape may have been committed, and no such marks may be found. This may happen if the offence was committed while the female was insensible, or if several persons combined in the assault, some holding the female; or even where one man only has been concerned in committing the offence, when the woman has been nearly suffocated by her clothes being thrown over her head. Marks of violence employed to prevent the female crying out, may be found on the mouth or throat.

Sometimes violence employed for this purpose, results in death from suffocation. Thus Chevers mentions a case where the husband of a young girl, in order to stifle her cries during first connection, bound a cloth over her mouth, and after intercourse found her to be dead.[2] In a case which came before the Bombay Chemical Analyser's office, it was reported that "deceased had been violated before death, and that

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[1] Tidy, *Leg. Med.* ii, p. 303.

[2] *Med. Jur.*, p. 695.

the cause of death was suffocation, produced by the forcible introduction of earth into the mouth and windpipe."[1]

Then examine the *genitalia* signs of loss of virginity and other injury or disease; noticing first the *hairs* on pubes, whether matted or stained, cutting off a portion of any such for microscopic examination; also whether any bruising of the *vulva*.

(1.) **Signs of loss of virginity.**—These are obviously only available as evidence of rape in cases where the female was *virgo intacta* previous to the commission of the offence.[2] The *hymen:* as this is the most reliable sign of virginity, so rupture or laceration of this membrane is the chief sign of defloration available as evidence of rape, the various other signs of virginity being, as a rule, not lost as a consequence of one intercourse. Recent lacerations of the hymen are "sharp-edged, fresh-looking, and tender"[3]; and when rupture of the hymen has recently occurred, the carunculæ myrtiformes are found swollen and tender;[4] also in recent defloration, especially if due to rape, a hot and tender condition of the genitals, accompanied by pain in walking, and pain and difficulty in passing urine and fæces, perhaps lasting some days (see *Case CXIX*) may be present. There may or may not be laceration of the fourchette.

Laceration or rupture of the hymen may, however, occur independently of sexual intercourse, *viz.*, from the introduction of foreign bodies other than the penis. Rape, again, even in females over the age of puberty, may be unaccompanied by injury to the hymen; and, as already pointed out, in very young children the hymen is not usually even lacerated by sexual intercourse. On the whole, therefore, the presence of signs of recent injury to the hymen, is to a certain extent evidence, but by no means conclusive evidence, in support of a charge of rape. The evidence, however, in favour of rape becomes stronger in proportion as the signs of local and other injury are greater. On the other hand, especially in young children, the absence of injury to the hymen cannot be taken as negativing the supposition that rape has been committed.

(2.) **Other injury to the genitals.**—Rape by an adult on an immature female usually causes a considerable amount of

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[1] Tidy, *Leg. Med.*, ii, p. 200.
[2] Loss of signs of Virginity, see p. 240.
[3] Tidy, *Leg. Med*, p. 200.
[4] For Signs of Virginity, see p. 240.

local injury. The injury may amount simply to bruising, but frequently laceration of the parts results, and these lacerations may be extensive and severe enough to cause death. Severe injuries may be followed by inflammation and sloughing of the parts ; but see *Case CXXVIII.* Again, injuries to the genitals of immature females resembling those resulting from rape, have been caused by the introduction of foreign bodies other than the penis with the object of rendering them *aptæ viris*, or in order to support false charges (see *Case CXXVII*).

Case CXXVII.—**Injury to the genitals of a young girl for purpose of supporting a false accusation.** (Chevers, *Med. Jur.*, p. 701, from the *Med. Times and Gaz.*, May 21st, 1859.)—A procuress brought a girl into the officers' barrack, Fort William, Calcutta, but the person to whom she was presented objected to the girl on account of her youth. The bawd, having been disappointed of her fee, injured the child so as to cause very considerable hæmorrhage from the genital organs. The girl was seen by an assistant-surgeon in the Fort, and the circumstances of the case having been reported to the police, it was discovered to be a conspiracy against the officer to obtain money. The child recovered.

In females who have reached puberty, laceration of the genitals may be found, if the disproportion between the size of the organs of the parties is great, or if much violence has been used. In adult females accustomed to sexual intercourse, lacerations are not likely to result from rape alone. Cases, however, are reported, where fatal laceration of the genitals has been produced in adult females after violation, by forcing foreign bodies such as sticks into the vagina. Bruises, scratches, and marks of violence, other than those caused by the introduction of the penis, may be found on the genitals, especially in adult females, but may be absent.

On the whole, the presence of marks of local injury to the genitals is, to a certain extent, evidence in support of the supposition that rape has been committed. On the other hand —except when the subject is an adult female accustomed to sexual intercourse—the absence of such marks is strong, but not conclusive evidence against the same supposition.

Case CXXVIII.—**Post-mortem appearances of noma pudendi in a girl aged five.** (Taylor, *Med. Jur.*, ii. p. 432)—"The genital organs externally, and the skin around and beyond the anus, were intensely inflamed, swollen and ulcerated, and in an approaching state of gangrene or sloughing. The hymen was destroyed posteriorly, and the lining membrane of the vagina and uterus was much inflamed, of a dark purple colour, with softening and disorganisation of substance. The upper inguinal glands were enlarged on both sides. The child was in a neglected and dirty state."

(3.) **Signs of infection with disease.**—Many cases of rape by adults on young children owe their origin to a popular belief that sexual connection with a virgin is a cure for venereal disease ; and there is no doubt that in this way female children are infected with gonorrhœa, a disease readily communicable to them. Ogston[1] mentions the case of a man who, while affected with gonorrhœa, had connection with four female children, communicating the disease to three of them. Female children, however, may become infected with gonorrhœa without intercourse. A case is recorded in which two girls, *æt.* respectively one and four years, became infected with the disease from using a sponge which had been used by a female suffering from it.[2] It is, however, not easy to distinguish non-syphilitic from syphilitic sores ; or a gonorrhœal discharge from a muco-purulent discharge, arising from *worms*, *&c.*, in dirty or delicate children, but it can be so distinguished (see *cases* pp. 257-258).

Adult females are liable to leucorrhœa, which, although usually a mucous discharge, may become, like gonorrhœa, muco-purulent owing to ulceration of the vagina. In adult females, also, it most be noted that the existence of syphilitic sores or of gonorrhœa only proves impure connection, not rape.

The period of incubation of syphilis, or of gonorrhœa, may have an important bearing in a case of alleged rape. This in gonorrhœa varies from some hours to three or four to twelve days, and in syphilis from fourteen to forty-five or more days. Hence, if a female is seen within a few hours after an alleged rape has been committed, and is found to be suffering from a profuse discharge ; or is seen within a few days, and is found to be suffering from syphilis ; the presumption is strongly against the disease having been communicated during the intercourse represented as rape. It should further be noted that infected individuals do not necessarily by intercourse communicate either gonorrhœa or syphilis.

Dr. Powell cites a case[3] where he knew four men to have connection with a woman suffering from a copious gonorrhœal discharge and only one was infected, and in another case out of seven troopers only two of them were infected. Mr. Hutchinson estimates that probably not once in a hundred acts of coition with a syphilitic partner is a chancre contracted.

In the case of rape on young children, however, there is greater likelihood of inoculation on the freshly torn surface.

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[1] *Lect., Med. Jur.*, p. 96. [2] *Med. Gaz.*, vol. 47, p. 144.
[3] *Ind. Med. Gaz.*, 1902, p. 232.

The discharge should be examined **microscopically** with the requisite stains for the detection of the *gonococcus* of Neisser.[1]

If the accused be suffering from gonorrhœa, the vagina of the complainant should certainly be searched for spermatozoa and gonorrhœal pus as soon as possible. Here, as recommended by Dr. A. Powell, a douche should be given, and a second examination for pus and gonococci made an hour or two later. If gonococci be now abundant, on the day of the alleged rape, they cannot be due to that act. A third examination should be made at the end of a week. If gonococci or the soft sore be now present and had existed on the prisoner at the time of the rape, the evidence will be of value.

Case CXXIX.—**Gonorrhœal infection by accused detected by microscope:** Dr. A. Powell relates:[2]—In a case of sodomy I examined the catamite, a boy eight years of age, about an hour after the occurrence. There was a slight recent tear near the anus, which was surrounded by pus. The boy had no ulcer, abscess or dysentery to account for the pus, which contained gonococci and a remarkably large proportion of eosinophile leucocytes. The accused had gonorrhœa, in the discharge of which there were gonococci and a similarly unusual proportion of eosinophiles. The next day the boy had no discharge from the anus. A little clear exudation from the tear, showed no unusual character in the leucocytes.

When examining for gonococci it is well to take two slides. One is stained with methyl blue, the other with aniline violet and examine in xylol under a cover-glass. The position of some diplococci is then noted and marked with a finder, Gram's process is then completed. If the cocci be gonococci they will be decolorised. The civil surgeon in India is not likely to have serum culture material at hand, but he may inoculate agar tubes. Should diplococci develop, they cannot be gonococci. In the intertrigo of children due to dirt the staphylococci, albus and aureus, are most commonly found. In discharges from the vagina bacilli of the colon type are common.[3]

To recapitulate—To distinguish between a gonorrhœal discharge and a muco-purulent discharge, note (1) profusion of discharge; (2) presence or absence of gonococci, or B. coli communis, thread-worms or their ova; (3) duration; (4) response

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[1] Doubts have been expressed as to the pathognomic value of the *gonococcus*. Thus, Morrow (Genito-Urinary Diseases) adduces the cases of six raped girls in which a pseudo gonococcus or diplococcus was found, which was morphologically and bacteriologically identical with the gonococcus of Neisser, but none of them suffered from gonorrhœa.

[2] *Ind. Med. Gaz.*, 1902, p. 232.

[3] *Id.*

to cleanliness and treatment—prompt in 'dirt' cases, slow in gonorrhœa ; (5) locality—urethra often inflamed in gonorrhœa, seldom in other ; (6) co-existence of eczema, often in 'dirt' cases.

(4.) The age of the victim of alleged forcible intercourse may have to be determined, especially as nearly nine-tenths of the cases of rapes in India are in children, and the question arises whether or not she is under *twelve* years of age, so as to be capable of giving consent to the act, or is she under sixteen with reference to abduction of a minor for immoral purposes. In England the question of age would be (*a*) is she under thirteen or (*b*) under sixteen ?

The following recent case well illustrates how the examination of an alleged victim of rape should be conducted and reported :—

Case CXXX.—**False charge of Rape and Venereal infection.** In 1901 a girl aged 10 and her mother charged a wealthy old man with the rape of the former and with infecting her with gonorrhœa. She was brought by the police for examination, by Dr. A. Powell, three days after the alleged rape. The child is in a poor condition and very dirty. There are no signs of bruising or injury. There is slight muco-purulent discharge from the vulva and vagina. The hymen is slightly swollen, of normal colour, circular with a mesial oval opening. There is no tear or abrasion. The opening will not admit a $\frac{1}{3}$ inch glass rod without tearing or duly stretching. There is a slight eczema intertrigo in the labio-femoral folds. The thighs are stained with green aniline dye. A pair of drawers, dyed a similar colour, are marked by three stains of a brownish red colour, which are pointed out as blood stains due to tearing in the act of intercourse. The stains do not give the reactions of blood. Though dry they are not stiff. Under the microscope they are seen to contain starch cells, spiral vessels and other vegetable structures, as well as numerous ova of the thread-worm. The discharge from the vagina contains no spermatozoa ; pus cells are numerous ; there are no gonococci, many short bacilli of a colon type, a few staphylococci which all retain the stain after Gram's process. **Opinion.**—The child has what are usually considered the signs of virginity. I consider it impossible that a body as large as accused's penis could penetrate the hymen without tearing it. The child has a discharge from the private parts, but I am of opinion that it is not venereal in origin, as the germs usually found in gonorrhœa are absent. Similar discharges are said to frequently arise from the irritation of dirt or worms. There is evidence of the presence of numerous eggs of worms. The child is dirty, and has an eruption such as would be caused by dirty or an irritating chemical such as was found on her thighs and drawers. The stains alleged to be of blood are not blood : they are human fæces. The discharge from the skin and the private parts is a chronic one and must have existed for some time. The accused was released.

Examination of THE ACCUSED.

This should ascertain :—(1) His age and capacity for committing the offence. (2) Whether his clothes or person

exhibit signs of recent sexual intercourse or a struggle. (3) Whether he is suffering from venereal disease.

Age and potency.—This is ascertained as already described. As regards age whether he is under seven, or under twelve (p. 33), and as regards impotency see p. 232, also his muscular development.

Signs of recent intercourse.—Glans. If this be covered by uniform layer of *smegma*, it negatives the possibility of recent complete penetration. If not, any abrasions should be noted, especially on frænum.

Stains on clothes or person.—The presence of *semen* on the clothes or person of accused is only evidence of recent emission and may have an innocent explanation, or have been in connection with another woman. The presence of **blood** is more important, but the stains may have been removed by washing before your examination. It is of the utmost importance in rape cases that the police should not allow the accused person to retire to a water-closet on any pretext before the surgeon has made his examination.

Case CXXXI.—Dr. A. Powell relates[1]:—A menstruating woman accused a neighbour of rape. He was arrested in her room, but allowed by the police to wash himself. On examining him I found no trace of blood on his private parts. He quite frankly admitted intercourse, but with consent. He stated the woman only cried out when some friends attempted to enter the room. He added that his penis and hand were covered with blood when arrested, and it was for this reason he went to the latrine and washed.

Stains of **mud**, &c., derived from the spot where offence is alleged to be committed should be looked for. Any **scratches** or bruises on his body should be noted with reference to a struggle.

(3.) **Signs of Venereal Disease.**—If the accused is suffering from venereal disease his discharge should be at once examined, and the character of the pus and any organisms therein compared with any found then or subsequently on the victim, see *case*, p. 257, and at the same time the presence or absence of spermatozoa can be ascertained in it.

Examination of THE SPOT.

The **spot** where the offence is alleged to have been committed, may show signs of a struggle having taken place, or there may be blood marks on it, or an impress of the body of the female on the ground.

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[1] *Ind. Med. Gaz.*, 1902, 231.

UNNATURAL SEXUAL OFFENCES.

The desire for unnatural sexual intercourse, so repugnant to the normal mind, may be acquired, or it may be due to perverted sexual instincts in which a man may be psychically a woman and *vice versâ*. Even in the acquired sodomy which is so prevalent in the East, it is probable that there may often be some slight abnormality of sexual passion present, since many men who have given themselves up to the most unbridled debauchery never develop any tendency to unnatural intercourse.

An unnatural offence is defined by *s.* 377 of the *I. P. Code* to be "carnal intercourse against the order of nature with any man, woman or animal," and, like in rape, "penetration is sufficient to constitute the carnal intercourse necessary to the offence."

The law of England on this subject is as follows:—"Whosoever shall be convicted of the abominable crime of buggery, committed either with mankind or with any animal, shall be liable," &c., &c. (24 & 25 Vict., c. 100, *s.* 61). Further, from a decision in England, it would appear that to constitute the crime of "buggery with mankind" the penetration must be anal; introduction into the mouth was held not to constitute the offence. Whether introduction in the anus is necessary to constitute the "carnal intercourse with any man or woman," contemplated by *s.* 377 of the *I. P. Code*, does not appear to have as yet been decided.

Three forms of unnatural sexual intercourse are usually described, namely, (1) **Sodomy** or sexual intercourse between two human beings usually of the male sex (the converse form, **Tribadism** or sexual congress between two human beings of the female sex is not publicly known), (2) **Pæderastia** or that form of sodomy in which the passive agent is a boy, a "*catamite*," and (3) **Bestiality**, or sexual intercourse of mankind with the lower animals.

SODOMY.

This offence is largely practised in many countries, and is very extensively practised in India. Indeed, Chevers mentions a case where two men, convicted of this crime on their own confession, defended themselves by putting forward the plea that "it was their occupation."[1] The offence is not uncommon in prisons, and it is a well-known prison rule that where more than one prisoner is confined in one cell, the number should never be less than three.

Sometimes the offence is practised between two men, either taking alternately the part of active and passive agent. In other forms of

[1] *Med. Jur.*, p. 708.

the offence, the passive agent is a boy, and the others, again, a eunuch. In the course of a trial at Mainpuri in 1852, it came out that a great number of eunuchs regularly practising the offence exist in India; these go by the name of "*hijrahs*,"[1] dress as women, and profess to obtain their living by dancing and singing at births and marriages. They recruit their ranks by castrating boys;[2] as a rule, making a clean[3] sweep of the whole of the genital organs (see also *Injuries of the Male Genitals*, p. 150).

In European countries false charges of sodomy are sometimes made for purposes of extortion.

Where the act has been done with consent the law regards the active and passive agent as equally guilty. In England, however, if one of the two is over and the other under fourteen, the one over fourteen alone is charged. In India, the question of age in relation to responsibility for this offence is governed by the general exceptions of the Penal Code (*ss.* 82 and 83). As in the case of rape, the question of alleged capacity of the active agent may form part of the inquiry, or whether feeble minded.

SIGNS OF SODOMY.

(1.) **Habitual practice** of the offence.—Male adults, who habitually practise sodomy, often affect effeminate manners, dress like women, &c.; and, as already pointed out, the passive agents in India are frequently eunuchs. It has been alleged that the habitual practice of the offence as an *active* agent gives rise to certain changes in the genital organs, *e.g.*, elongation and constriction of the penis, and twisting of the urethra. On the whole, however, examination of an individual is not likely to afford any trustworthy indication as to whether or no he habitually practises sodomy as an active agent.

Where the individual has been habitually practising the offence as a *passive* agent, the skin around the anus may be found to have assumed a smooth appearance, instead of showing the usual series of folds extending "concentrically towards the anal aperture."[4] This, Casper considers to be "the most certain of all the uncertain signs of passive pæderastia."[5] There also may be a "funnel-like" or "trumpet-shaped" depression of the nates leading to the anus and the triangular sodomitic wound. But the absence of these signs does not necessarily establish the innocence of an accused.

Case CXXXII.—A Brahman, aged about 40, sought treatment for a boil on the perinæum. On examining the "boil," I found it to

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[1] They are to be distinguished from the similarly mutilated eunuchs, *khwajas*, who guard the harems in palaces and are relatively more respectable in their habits.

[2] *Ibid*, p. 707.

[3] *Ibid*, p. 497.

[4] Casper, iii, p. 333.

[5] *Ibid*, p. 334.

be a typical Hunterian chancre, situated one inch in front of the anus, and on being questioned, the patient admitted that he might have contracted it from one of his friends. He volunteered the statement that he had been a pathic for at least twenty years, so I examined him for the classical signs of his aberration, and found none of these. The genitals were well formed, there was no deformation of the anal region, no infundibulum or loss of rugæ and the tone of the sphincter was normal. (Sutherland, *Ind. Med. Gaz.*, 1902, 246.)

The presence of a chancre about the anus, or of a gonorrhœal discharge from the rectum, is, of course, strong evidence that the individual has been the passive agent in the offence, and may be corroborative evidence of his having acted in that capacity.

(2.) **Recent commission** of the offence.—If it is alleged that the offence has been recently committed without consent, both parties should be examined for marks of violence indicative of a struggle, as in a case of alleged rape ; and whether the act has been done with consent or not, the alleged active agent should be examined in the same way as the accused in a rape case. Examination of the passive agent may show stains of blood, or seminal fluid or characteristic gonorrhœal discharge (see *Case CCLVII*) on his clothes, or person in the neighbourhood of the part ; or if the individual is a young boy or a person unaccustomed to the offence, there may be found about the anus bruising or excoriations of the mucous membrane, or, perhaps, slight laceration of the sphincter.[1] Obviously also, the question of the age of the parties must be considered, seeing that this bears on the question of their criminal responsibility.

BESTIALITY.

The forms of this offence in which a human male is the active agent is tolerably frequently met with in India. Cases

[1] Dr. J. W. Johnstone, with reference to the physical evidences of sodomy, states : "Penetration seldom reaches beyond an inch, and the force expends itself on the semi-lunar folds which in the empty gut droop on either side. One arc of the lower anal mucous fold occupies the superior and upper left, a second the inferior lower and right angle of the rectum, and hangs down in a central crescent ; the foreign agent impinges against this loose centre, stretches its point of attachment at one or other of the angles, and in every case of clear penetrative contact (provided the gut has not been distended by polypi, as is not infrequent in children, or by systematic sodomy, when the mucous membrane loses its rugæ and the sphincters their contractile power) rupture will be found cutting horizontally outwards at the left superior or right inferior angle. . . . The shape of the wound is characteristic, and it cannot be produced by any hard substance. A true sodomy wound is *triangular ;* the base external, with the sides of the triangle retreating into the fundament." He (Dr. Johnstone) "has never observed any other portion of the mucous membrane ruptured by a specific act of sodomy." *Ind. Med. Gaz.*, 1868, 213.

occur every year in which the offence is alleged to have been committed with a goat, a mare, an ass, a cow, and even a hen.

In these cases, matters removed from the vagina of the animal with which the offence has been committed, or adhering to the surrounding hairs, may have to be examined for the presence of spermatozoa. Detached hairs also may be found adherent to the person or clothes of the accused, and may have to be examined as to the identity or otherwise of their appearance, with the hairs of the animal employed as the passive agent.

CHAPTER XIII.

PREGNANCY IN RELATION TO CRIME AND LEGITIMACY.

The circumstances under which the law may require you to ascertain whether or not pregnancy does exist are chiefly :—

(*a*) *Respite of a condemned pregnant woman.*

When pregnancy is pleaded in bar of an execution in India, owing to the wording of *s.* 382 of the *Cr. P. Code*, the question to be decided is simply, Is the woman pregnant or not? In England, however, owing to the terms of the charge to the jury of matrons, a medical man called into their assistance may have to examine into the further question, Is the woman "with child (pregnant) of a quick child"?

(*b*) *The birth of a posthumous heir by a widow.*

Where a widow is suspected of feigning pregnancy in order to ultimately produce a supposititious heir to an estate of which her husband died possessed.—In such a case, according to the law of England, the heir-presumptive to the estate, *i.e.*, the person who would succeed thereto, supposing the woman not to be pregnant, may apply to the Court to order an inquiry to be made into the alleged pregnancy. The Court, if it grants the application, does so by issuing what is technically called a writ "de ventre inspiciendo."

(*c*) *Negatively to disprove libels in charges of adultery, &c.*

The woman alleged to be pregnant may be a married woman living apart from her husband, and the allegation may be put forward in support of a suit for divorce. Or she may be an unmarried female or a widow, who has been defamed and seeks to avoid disgrace.

(*d*) *To increase damages in seduction cases.*

(*e*) *Cases of alleged abortion.*

An attempt to cause miscarriage is an offence, irrespective of whether the woman be or be not pregnant. Further, according to the law of India (but not according to that of England), to cause, or attempt to cause, a woman "quick with child" to miscarry, is a graver offence than if she be not quick with child.[1] Hence, in India, in these cases the question may arise, whether or no a certain female was "quick with child" at a particular time (see *Causing Miscarriage*).

(*f*) *As motive in suicide and murder.*

Case CXXXIII.—**Pregnancy a motive for murder or suicide** (*a*) (From *Bombay Chemical Analyser's Report* for 1884, reported by the District Magistrate of Bassim, Hyderabad Assigned Districts)—

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[1] *I. P. Code*, *s.* 312.

A widow seven months gone with child died rather suddenly; an inquest was held by the police, and a verdict returned of death from dysentery. Suspicion, however, being excited, a *post-mortem* examination was ordered, the result of which was the discovery of the pregnant condition of the woman (which had been concealed in the inquest report furnished by the police), and of the fact that the cause of death was arsenical poisoning. The District Magistrate remarks, in reference to this case, that there is every reason to believe that all engaged in the inquest tried to conceal the true cause of death.

(*b*) **Another case** (*Ibid*).—In this case, which occurred in the Surat District, as in *Case CXXXIII*, the cause of death was arsenical poisoning, and the deceased was a widow far gone in pregnancy. The brother and sister of the deceased confessed to having given her eight annas' worth of opium in order to procure abortion or cause death, so as to avoid the disgrace arising out of her condition. No opium, however, could be discovered in the viscera of the deceased.

Case CXXXIV.—**Pregnancy a motive for Murder** (*a*) (Chevers, *Med. Jur.*, p. 733).—Allabux, of Purneah, was convicted of murdering his brother's widow. He confessed that, having administered drugs to her in order to cause her to abort, and having failed, he and others took her to a river bank, put a cloth into her mouth, held her down, and murdered her by cutting her throat.

(*b*) **Another case** (*Bombay Chemical Analyser's Report*, 1876-77, p. 18).—Case of poisoning by arsenic reported by medical officer, Tatta, Sind. "Deceased was promised in marriage to a man of her caste (Mussulman), but before marriage she cohabited with him and became pregnant, and was advanced to above the fourth or fifth month, when her parents, to avoid disgrace, it is said, tried very much to procure abortion, but failed (much against her intended husband's will); so having failed to procure abortion, her parents, to save their reputation, it is suspected, gave her poison in her food."

SIGNS of Pregnancy.

These may be divided into:—(1) The statement of the woman herself as to her condition. (2) Signs not directly referable to the fœtus. (3) Signs directly referable to the fœtus and its appendages.

(1.) **Woman's own statement of her condition.**—*Quickening, &c.* This obviously cannot be relied on for forensic purposes. Apart, however, from any wilful endeavour to deceive, a woman may be mistaken as to her condition. She may mistake, for example, symptoms of organic disease for symptoms of pregnancy. Cases also are recorded where, no organic disease being present, symptoms closely simulating those of pregnancy (spurious pregnancy), and, in exceptional cases, of labour also, have appeared. Again, a pregnant woman attributing her symptoms to disease, may be unaware of her condition, and remain so, even up to the time of her delivery. Further, as impregnation is independent of volition on the part of the female, conception may occur as the result

of intercourse effected with her while in an insensible condition, and in such a case a woman may be unconscious of the fact that she is pregnant, and, it is possible, remain so up to the time of her delivery.

(2.) **Signs not directly referable to the Fœtus.**

1. **Cessation of menstruation.**—This sign is open to several fallacies. Menstruation may cease owing to causes other than pregnancy. A discharge of blood simulating menstruation may occur during pregnancy. Again, a woman may feign or deny menstruation in order to conceal her condition.

2. **Constitutional disturbance.**—**Morning sickness is** a common symptom, but it may, however, arise from causes other than pregnancy.

3. **Changes in mammæ.**—The breasts enlarge, become firmer, and secrete milk. A dark circle (areola), varying in width from half an inch to three inches, studded with glandular follicles, develops around the nipple. These appearances may, however, arise from causes other than pregnancy, or may continue after delivery. Hence they may be present in a non-pregnant female. Again they may be absent in pregnancy.

4. **Kyestin or gravidine in the urine.**

This appears in urine, after it has stood for some time, as a fatty pellicle on its surface. Its formation is usually, but not invariably, observed in the urine of pregnant females after the first month. It has, however, been seen in the urine of men, and in the urine of non-pregnant females. But little weight can be attached to its presence or absence.

5. **Changes in uterus.**

The cervix becomes full, round, soft, and elastic, and the os loses its transverse shape, and becomes circular, and its edges become soft and indistinct. Up to the end of the third month, the uterus not having risen out of the pelvis, the cervix is low down in the vagina and easily reached, and no enlargement of the abdomen is perceptible. After this the uterus begins to rise, and the cervix to shorten, recede, and become indistinct. About the end of the fourth month the enlarged uterus begins to be perceptible above the pubes, and rises to—between the pubes and umbilicus during the fifth month ; the umbilicus during the sixth mouth ; half-way between the umbilicus and the lower end of the sternum during the seventh month ; and to the ensiform cartilage during the eighth mouth. As similar changes may take place owing to enlargement of the uterus from causes other than pregnancy, more reliance is to be placed on their absence as a negative sign, than on their presence as a positive sign of pregnancy.

(3.) **Signs directly referable to Fœtus and its appendages.**

1. **Active movements of fœtus.**—If the hand, especially after immersion in cold water, be placed on the abdomen over

the uterus, the movements of a living fœtus within its cavity may be felt, in some cases as early as during the fourth month, in others not until the fifth month, or later. This sign is, of course, only available if the fœtus be living. It is open to several fallacies:

Thus, the movements may not be detected until after several examinations have been made; or, in exceptional cases, may not be detected at all during pregnancy. Again, movement of flatus in the intestines, or contractions of the uterus, or of the abdominal muscles, may be mistaken for the movements of a fœtus.

2. **Passive movement of fœtus** (*Ballotement*).—This sign is not available until the end of the fourth month. It consists in the detection of a solid body floating (in the liquor amnii) in the uterus.

To obtain it, the woman—her bladder and rectum having been previously emptied—should be placed in the upright position; or recumbent, with the shoulders much raised. One or two fingers of one hand are then to be introduced into the vagina, and applied to the point of the cervix. The other hand is steadily pressed on the abdomen over the uterus. A jerk upwards is then given with the fingers in the vagina, when a hard body will be felt to recede from, and in three or four seconds fall back on, the fingers. After the end of the sixth month this sign is rarely available, the fœtus, from its bulk, not floating freely enough in the liquor amnii. Care must be taken to keep the fingers in contact with the cervix, otherwise a movement of the uterus itself may be mistaken for the movement of the fœtus within it.

3. **Sounds of fœtal heart.**—This, the most certain of the signs of pregnancy, is described as resembling the ticking of a watch heard through a pillow. The pulsations vary from one hundred and twenty to one hundred and sixty a minute, and are **not synchronous with the mother's pulse.** A double sound is heard at each pulsation.

The sounds are generally, but not always, in normal presentations heard about midway between the umbilicus and one or other of the anterior superior spines of the ilium; they seldom can be heard earlier than the end of the fifth month and in every case should be heard after the seventh month. If detected, the existence of pregnancy is certain, but pregnancy may exist and the sounds not be detected (*a*) owing to the examination being made at too early a stage; (*b*) owing to the death of the fœtus; or (*c*) owing to want of skill on the part of the auscultator. Ogston records a case where owing to ascites the sounds could not be detected by a skilled auscultator.

4. **Uterine murmur.**—This, generally attributed to the flow of blood through the placenta, is described by Guy and Ogston as a low cooing sound, such as is made by blowing gently over the lip of a wide-mouthed phial. It is **synchronous**

with the mother's pulse, and is first distinctly heard about the end of the fourth month.

This sound is liable to intermission, and, according to some writers, may not be heard at all in pregnancy, if the placenta is attached to the posterior wall of the uterus. Other sounds also may be mistaken for it, *e.g.*, the muscular susurrus of the uterus, the bruit of a vascular sarcoma of the uterus, or a bruit resulting from pressure on the abdominal aorta.

When any doubt exists it is always better to give the individual the benefit of the doubt. After death, the discovery of an ovum or fœtus in the uterus is, of course, an unequivocal sign of the existence of pregnancy. For the characters of the ovum or fœtus at various stages of gestation, see *Appendix VI.* The presence also of a corpus luteum in the ovary, may afford corroborative evidence.

QUICKENING.

The term "**quickening**" is applied to certain peculiar sensations experienced by the mother at a certain stage of pregnancy. These sensations are often accompanied by constitutional disturbance, and are popularly ascribed to the first perception by the mother of the movements of the fœtus. They are most probably due to this cause, perception of the movements probably first occurring when the uterus comes into contact with the abdominal wall. These sensations may be felt as early as the twelfth week, are generally first felt between the fourteenth and twenty-fourth week, but in some cases are not felt at all during pregnancy. A woman who has felt these sensations is said to have quickened. These two terms, "quickening" and "quickened," are derived from the word "quick," used in its old signification, *viz.*, living. Their use with reference to these sensations, arises from the old popular belief that their occurrence denoted the first accession of life to the fœtus. As, however, a fœtus is actually alive from the moment of conception, two interpretations may be assigned to the word "quick" when applied to a fœtus in utero : (1) The more extended interpretation, namely, that the fœtus is alive ; or (2) The more restricted interpretation, namely, that the mother has experienced the sensation known as quickening.

As regards the first of the two phrases in question, *viz.*, "with child of a quick child," there appears to be no doubt but that this has always been used in law as if the more restricted meaning attached to the word "quick." Some doubt, however, has been thrown on the interpretation accepted by English legal authorities of the second phrase, *viz.*, "quick with child," owing to the remarks made by Baron

Gurney in the case of *R.* v. *Wycherley* (8 C. & P., 262). In this case pregnancy having been pleaded in bar of execution, the jury of matrons were directed to try whether the prisoner was "quick with child or not." Subsequently Baron Gurney addressed a medical witness called to the assistance of the jury of matrons as follows: "Quick with child is having conceived; with quick child is when the child has quickened. Do you understand the distinction?" Baron Gurney, therefore, in this case directed the medical witness to take the expression "quick with child" as if the more extended meaning attached to the word "quick." This, however, is contrary to the law as stated by Blackstone, who says: "If they (the jury of matrons) bring in their verdict quick with child—for barely with child, unless it be alive in the womb, is not sufficient—execution shall be staid." . . . "But if she (the prisoner) once hath had the benefit of this reprieve, and been delivered, and afterwards become pregnant again, she shall not be entitled to the benefit of a further respite for that cause. For she may now be executed before the child is quick in the womb." In the *I. P. Code* also, the expression "quick with child" is clearly used as if the more restricted meaning attached to the word "quick." S. 312, for example, makes causing miscarriage, if the woman be "quick with child," a graver offence than simply causing miscarriage, thus implying that the condition "quick with child" is one which arises at a period subsequent to conception.

When, therefore, the question arises, is a certain woman "with child of a quick child" (or "quick with child"), what has to be determined is whether or not the woman has quickened. Quickening, however, is a sensation only felt by the mother. Still, if a medical man has, on examination, felt the actual movements of the fœtus, he is justified in assuming that the mother has also felt them, and that therefore she has quickened.

Should he be unable to detect the active movements of the fœtus, he can only, in answer to the question, Has this woman quickened? state his opinion as to whether or no (1) The woman is pregnant; (2) The child is alive; and (3) The pregnancy has advanced to, or beyond, the stage at which the sensation of quickening is usually experienced; leaving it for the Court to decide whether his answers do or do not amount to an affirmative answer to the question, Has this woman quickened?

In giving an opinion on the last of the three above-mentioned points, a medical witness should bear in mind that quickening does not occur at any fixed period; it may occur at any time between the twelfth and twenty-fourth week. Further, it may be noted, that of the two cases in which the question of quickening arises, namely, the English case of pregnancy pleaded in bar of execution, and the Indian case of causing miscarriage; in the first the prisoner is benefited by being found "quick with child," while in the second a similar answer has the reverse effect.

CHAPTER XIV.

BIRTH IN RELATION TO CIVIL LAW—LEGITIMACY AND INHERITANCE.

In cases where the right to inherit property or a title is in dispute, medico-legal questions may arise. Thus when the succession is fixed in the male line to the exclusion of the female line, the question may arise, Of what sex is a certain individual? (See *Sex*, p. 27.) Again, as by law, children born "*without the shape of mankind*" cannot inherit, the question may arise, Has this child "the shape of mankind"? More commonly are the cases where the right to inherit is disputed, on one or other of the following grounds:—

1. That the claimant is not a legitimate child; and with the medico-legal questions which arise in such a case, we may consider those which arise in affiliation cases.
2. That, as in tenancy by courtesy cases, a certain child was not born alive.
3. That the claimant is a supposititious child.

LEGITIMACY.

Children are either legitimate or illegitimate also called "*bastards.*" Only legitimate children are regarded by law as the children of their father. These, therefore, possess certain rights which illegitimate children do not possess. According to the law of most countries, only such children are held to be legitimate, as are either born or begotten during the existence of a valid marriage (lawful wedlock) between their parents. By the law of Scotland, however, children born before marriage, become legitimate on the subsequent marriage of their parents. Further, according to the **law of England**, any child born or begotten during lawful wedlock, is presumed to be legitimate until the contrary is shown; (*a*) by proof of the impotence of the alleged father of the child; or (*b*) by proof that the parties to the marriage had no **access** to each other at any time when the child could have been begotten. The presumption, as to legitimacy, of the **law of India** is embodied in *s.* 112 of the Indian Evidence Act, and is as follows: "The fact that any person was born during the continuance of

a valid marriage between his mother and any man, or within two hundred and eighty days after its dissolution, the mother remaining unmarried, shall be conclusive proof that he is the legitimate son of that man, unless it can be shown that the parties to the marriage had no access to each other at any time when he could have been begotten."

ACCESS IN LEGITIMACY CASES.

The English law on this subject is to be found in the answers given by the judges to questions put to them by the House of Lords in the *Banbury Peerage Case*, 1 S. & S., 155, A.D. 1811. The law, as then stated, was recognised in a subsequent case, in the House of Lords, in 1837 (*Morris* v. *Davis*, 5 Cl. & F., p. 163), and is as follows :—(1st) That when the husband and wife have opportunities of access, the presumption of legitimacy may be rebutted by circumstances inducing a contrary presumption. (2nd) That non-access or non-generating access may be proved by means of such legal evidence as is admissible in every other case in which it is necessary to prove a physical fact. (3rd) That after proof of sexual intercourse evidence will not be admitted, except to disprove the fact. (4th) That sexual intercourse is presumed, unless met by such evidence as satisfies those who are to decide that it did not take place.

By **"access"** is meant sexual intercourse, and not such intercourse as is understood by being in the same place or in the same house (*Banbury Peerage Case; Morris* v. *Davis*). Although possibility of such access may be proved, yet, if the court is satisfied, from legal evidence, that no sexual intercourse did take place, the presumption of legitimacy is rebutted. In the case of *Aylesford* v. *Aylesford*, reported in the *Times* of July 3rd, 1885, the husband and wife were both living in London during the period, or some portions of the period, when the child whose legitimacy was in question could have been begotten. The circumstances of the case negatived the probability of intercourse between the husband and wife, although it was possible. The child was found, by the House of Lords, to be illegitimate. In the case of *In re Westhead's Trusts* (*Times*, July 29th, 1885), there was no evidence where the husband was during the critical period during which the child could have been begotten. He, however, had at that time taken divorce proceedings against his wife. The Court of Appeal held that the circumstances of the case negatived any probability of intercourse between the husband and wife, and, being satisfied it had not taken place, held the child to be illegitimate.

In the case of *Rex* v. *Inhabitants of Mansfield*, 1 Q. B., 444, the Court of Queen's Bench determined that the non-access of the husband might be proved by circumstances, "one of which," it was said, "certainly is adulterous intercourse between the husband or wife and another party." In that case the whole proof consisted only of that single fact, and it was held not sufficient to rebut the presumption. The parties, however, were in a low class of life, the wife being a pauper, circumstances which Kay, J., in *Hawes* v. *Draegen*, 23 Ch. Div., p. 173, said must be taken into consideration in determining whether the presumption is rebutted.

The courts in India would no doubt construe the 112th sect. of the Evidence Act in accordance with the English decisions. It will be

noticed that the 112th sect. does not in terms refer to the presumption being rebutted if the husband be impotent, but proof of such impotency would negative the fact of "access" in the sense in which it is submitted the word is used in the above section.

Hence, the **legitimacy** of a child **may be disputed** on either of two grounds, namely (1), that the alleged father of the child is **impotent**; or (2) that the parties to the marriage had **no access** to each other at any time when the child could have been begotten. The following examples show the medico-legal questions which may arise when legitimacy is disputed on the second of these two grounds.

(1) A husband on a certain date ceases to have access to his wife; after a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the interval between the last access of the husband and the birth of the child, was greater than the utmost period to which gestation can be prolonged.

(2) The parties to a marriage are proved, after a long period of separation, to have resumed access to each other on a certain date. After the lapse of a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the period intervening between the date of resumption of access and the date of the child's birth was so short, that the child must have been begotten before access was resumed. If in such a case the appearance of the child at birth indicates it to be a mature child, the question arises, What is the shortest natural period of gestation? or if the child is an immature child, what, judging from its appearance, was its uterine age at the time of its birth? Again, in such a case it may be alleged that the mere fact that the child was born alive and capable of being reared, proves that its uterine age at birth was greater than the interval which elapsed between resumption of access and birth, thus raising the question, What is the earliest period of gestation at which a "**viable**" child can be born, *i.e.*, one capable of living and being reared? Moreover, as a portion of the evidence bearing on the question of early viability, is derived from cases where a viable child has been born a short time after a previous delivery, and as such cases may be accounted for by "**superfœtation**" (*i.e.*, conception of a second ovum during gestation of a first), the further question arises, Is superfœtation possible?

It may be here remarked that, as his wife's adultery is a ground on which a husband may claim a divorce, questions similar to those arising in cases of contested legitimacy, may arise in suits for divorce. The question as to the degree of maturity of a child, may also arise in cases

where a child is born soon after marriage, and where it is alleged that the parents must in consequence have had sexual intercourse before marriage, and are therefore of immoral character (see following *Case*).

Case CXXXV.—**A viable child born one hundred and seventy-four days after marriage** (The Jardine Case: Guy, *For. Med.*, p. 127)—The Rev. Mr. Jardine was married on the 3rd of March 1835, and on the 24th of August following his wife was delivered of a girl, who, supposing her to have been the fruit of sexual intercourse on the day of the marriage, was only one hundred and seventy-four days, or five calendar months and twenty-one days old. The infant, which was undoubtedly immature, though to what degree could not be determined, died on the 20th of March 1836, having survived about seven months. On this Mr. Jardine's parishioners brought a charge of incontinency against him before the General Assembly of the Church of Scotland, alleging that he must have had intercourse with his wife before marriage. The main question in the case was:—Was it possible that a child not more than one hundred and seventy-four days old at birth, could be maintained alive for seven months? The Court found the charge "not proven."

Affiliation cases.—Although illegitimate children are regarded by law as the sons of nobody, their father is bound to contribute towards their support until they have attained a certain age. Hence, a woman having been delivered of an illegitimate child, may appear before a Court and claim that a certain individual, who she alleges is the father of her child, may be compelled to so contribute. Such cases are called "affiliation cases," and in them questions may arise, similar to those arising in cases of contested legitimacy. In affiliation cases, also, the further question may arise, Can any opinion as to the paternity of the child be formed from its resemblance or non-resemblance to its alleged father?

Tenancy by the courtesy of England.—By the common law of England, if a man survived his wife, and he had issue by her born alive, that might by possibility inherit the estate as her heir, the husband so surviving became entitled to an estate for the residue of his life in such lands and tenements of his wife as she was solely seised of in fee simple, or fee tail in possession. The husband, while in enjoyment of this estate, is called a tenant by the courtesy of England, or, more shortly, tenant by courtesy.[1]

To establish this tenancy by courtesy, the child must be born during the existence of the marriage, and hence, although the right accrues to the husband if the child is extracted by Cæsarean section during the mother's life, it does not accrue if the child is so extracted after her death, for in that case the marriage has ceased to exist before

[1] Williams on *Real Property*, p. 274.

the birth of the child. Further, the child must have been completely born, and must, after complete birth, have manifested some sign of life; the slightest sign of life, however, a mere tremulous motion of the lips for example (see *Case CXXXVI*), has been held by the English Courts sufficient to establish the fact of live birth in these cases.[1] Much stronger evidence of live birth is, however, required in cases of infanticide (see *Infanticide*). As in a case of disputed right to tenancy by courtesy, it may be alleged in opposition to the claim, that the child when born was so immature, that it could not possibly have manifested any sign of life after birth; the question may arise in these cases, what is the earliest period of gestation at which a child can be born, capable after birth of manifesting signs of life?

Case CXXXVI.—**Proof of live birth in a tenancy by courtesy case** (*Fish* v. *Palmer:* Taylor, *Med. Jur.*, ii, p. 207).—The wife of the plaintiff, who was possessed of an estate in her own right, died after having given birth to a child. The child was supposed to have been born dead, and the estate was surrendered to the defendant, her heir. Ten years afterwards facts came to the knowledge of the plaintiff which led him to believe that the child was born alive, and that he had therefore wrongfully surrendered the estate. The evidence of live birth was as follows: it was proved that the accoucheur in attendance (who had died before the trial) had, an hour before the child was born, declared it to be alive, and ordered a warm bath to be prepared for it. Further, two women, who after the child was born placed it in the bath, swore that they twice saw a twitching or tremulous motion of the lips of the child. This motion of the lips was the only sign of life observed, but it was held sufficient to establish the fact of live birth.

It is possible that a claim to be tenant by the courtesy might arise in India, as there are estates held in India subject to the English Law of Inheritance (see remarks of Mr. Justice Pontifex in *Case* below). No such claim, however, could be made by any one whose marriage had taken place since the 31st of December 1865, as *s.* 4 of the Indian Succession Act, 1865, enacts that no person shall by marriage acquire any interest in the property of the person whom he or she marries. That section by *s.* 331, is not applicable to marriages contracted before the 1st of January 1866.

Case CXXXVII.—**Tenancy by courtesy in India** (*Sarkies* v. *Prosonomoyee Dossee*, I. L. R., 6 Calc., p. 794).—In this case the widow of an Armenian, married before the Dower Act 29 of 1839, was held to be entitled to dower out of her husband's lands. In the course of the argument, Pontifex, J., remarked: "It would take away from the mutuality of contract between husband and wife to hold that the widow is not entitled to dower as against a purchaser from her husband. The husband is entitled to an estate by the courtesy in his wife's lands."

Supposititious children.—By a supposititious child is meant a child produced by a woman who avers it to be hers when it is not. In these cases the motive is generally to further

[1] The Scotch Courts require, in order to establish the fact of live birth in civil cases, proof of commencement of respiration (Ogston, *Lect* on *Med. Jur.*, p. 182). For crying as a proof of birth, see *Infanticide*, p. 302.

an attempt, either to extort money, or to divert succession to property. A supposititious child may be one (1) produced by a woman who has never been delivered of a viable child ; or (2), produced by a woman in substitution for a child of her own. In case (1), besides questions similar to those occurring in legitimacy cases, the following additional questions may arise : (*a*) Is this woman sterile ? and (*b*) does this woman show signs of having been recently or previously delivered of a viable child ? In case (2), it is very seldom that medical evidence can afford any assistance. In both cases, as in affiliation cases, the question of how far the paternity of a child can be inferred from its resemblance or non-resemblance to its alleged parents may also arise.

INHERITANCE.

Hence the following are the principal medico-legal questions which may arise in cases of disputed right to inherit :—

(I) Is a certain individual impotent or sterile ? This question has already been considered (see *Impotence and Sterility*).

(II) What is the natural period of human gestation ?

(III) How far may this period be prolonged ?

(IV) Is superfœtation possible ?

(V) What is the earliest viable age ?

(VI) What are the characters of children born at various periods of gestation ?

(VII) How far may the paternity of a child be inferred from its resemblance or non-resemblance to its alleged parents ?

(VIII) Has this woman ever been delivered of a viable child ?

II. What is the natural period of human gestation ?

The two most reliable methods of estimating the duration of gestation are : (1) By observation of the period intervening between cessation of menstruation and delivery ; and (2) by observation of the period intervening between a single coitus and delivery. Of these two methods the first cannot be relied on to give precise results, because—

(*a*) Menstruation may cease from causes other than pregnancy, or may continue after pregnancy has commenced ; and

(*b*) Impregnation may occur at any period during the menstrual interval.

The second method, although more precise than the first, also cannot be relied on to give accurate results, because impregnation is not necessarily coincident with coitus, but may occur as long thereafter as the spermatozoa retain their vitality, which they may do for several days after emission.

Even, however, when the second and more accurate of these two methods is employed, results varying considerably are obtained, from which it appears that the duration of natural gestation is **not a fixed period,** but one subject to variation within certain limits. Guy, for example, states that of fourteen authentic cases in the human subject, in which the duration was ascertained by reckoning from a single coitus, the minimum duration was 270, the maximum 293, and the average 284 days.[1] Again, Wharton and Stillé give a table of all the authentic cases of this kind in the human subject they have been able to collect.[2] Their table includes fifty-six cases, and shows a range of duration of from 260 to 296 days, with an average of 276 days.

The view that the **duration of pregnancy is not a fixed period** is **supported** by the results of **observations on the lower animals.** Thus from three series of observations on cows, the minimum period in these appears to be 241 days, and the average period 280 to 285 days : but in one series[3] (160 animals) a period of 308 days was observed ; in the second series[4] (764 animals) a period of 313 days was noted ; and in the third[5] (1,105 animals) in four delivery took place in the forty-eighth week, equal to a duration of over 329 days ; and in one in the fifty-first week, equal to a duration of over 350 days. Again, a series of 102 observations on mares[6] gave a range of 311 to 394 days, with an average of about 340 days ; and another on 177 sheep,[7] a duration of 145 to 171 days, with an average of 150 days.

III. How long may human gestation be prolonged ?

The chief considerations bearing on this question are as follows :—

1. Of the fifty-six authentic cases collected by Wharton and Stillé, in which the duration of gestation was fixed from a single coitus, in nineteen the duration was over 280 days, and in two of these it was 291, and in three others 296 days.

2. In exceptional cases, where the commencement of pregnancy has been fixed by the death or absence of the husband or male, a longer period than 296 days has been recorded. Thus Guy, on the authority of Hewitt, quotes a case in which the duration of pregnancy, as fixed by the sudden death of the husband, was 308 days ; and in two less satisfactory American affiliation cases, in which the commencement of pregnancy was fixed by date of last intercourse, the alleged duration

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[1] *For. Med.*, p. 123.
[2] Tessier's, Guy, *For. Med.*, p. 124.
[3] *Med. Jur.* (1884), iii, p. 41.
[4] Earl Spencer's, *ibid.*
[5] Krahmer's, Wharton and Stillé, iii, p. 44.
[6] Tessier's, Guy, *For. Med.*, p. 124.
[7] Krahmer's, Wharton and Stillé, iii, p. 43.

was respectively 313 and 317 days. In both these cases the Court decided in favour of the plaintiff, thus admitting the possibility of prolongation of pregnancy to the periods stated.

3. In a very large number of cases recorded by various authorities, in which the duration of pregnancy was estimated from the last day of menstruation, the longest period recorded was 325 or 326 days. As, however, conception may occur at almost any period during a menstrual interval, these cases cannot be relied on as showing anything more than that pregnancy may be prolonged for 325 or 326, less (say) 23 days. This would give 303 days, or a shorter period than in Hewitt's case. In four less certain cases of the same kind, the estimated period of gestation was 309 and 313 days (Simpson), and 314 and 324 days (Murphy).

4. In the lower animals, it has been observed that the duration of pregnancy, as estimated from a single coitus, may be greatly protracted beyond the usual period.

On the whole, therefore, as regards the question, What is the longest period which in natural human gestation may intervene between coitus and delivery?—the form which the question under consideration assumes for forensic purposes,—it may be stated that—

1. It may be regarded as proved that this may be 296 days.

2. Most authorities agree in considering that the interval may be as long as 44 weeks, or 308 days. Indeed, in the Gardner Peerage case, several eminent obstetricians gave it as their opinion that the interval might extend to, at any rate, 311 days.[1]

3. Some authorities consider that the interval may extend to the forty-sixth week, 315 to 322 days.[2]

IV. Superfœtation.

It may be stated (1) that two closely following acts of intercourse in the same female may each prove fruitful (see *Case* below; and (2) that it cannot be doubted but that conception may occur during pregnancy in cases where the uterus is double or bipartite, a rare condition in the human female, but still one of which several instances are recorded.

Case CXXXVIII.—**Two closely following acts of intercourse in the same female; both prove fruitful** (Guy's *For. Med.*, p. 132, one of several similar cases quoted by Beck).—"A female at Charleston, in South Carolina, was delivered in 1714 of twins within a very short time of each other. One was black and the other white. She confessed that on a particular day, immediately after her husband had left his bed, a negro entered her room, and by threatening to murder her had connection with her."

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[1] In this case the question at issue was as to the legitimacy of an individual, born 311 days after the last access of the husband (see Guy, *For. Med.*, p. 125.)

[2] See Ogston's *Lect. For. Med.*, p. 189.

Excluding these two classes of cases, and limiting the question to whether the organs of the female being of normal formation, it is possible for conception of a second embryo to occur during gestation, we find that authorities are divided in opinion on the subject. The arguments for and against the possibility of conception occurring under the conditions stated are founded on (1) physiological considerations, and (2) recorded cases.

(1.) **Physiological considerations.**—Those who deny the possibility of the occurrence, allege that the plugging of the os uteri and Fallopian tubes, and the formation of the decidua, events which occur at a very early stage of pregnancy, offer an impassable barrier to the passage of the seminal fluid. On the other hand, those who affirm the possibility of superfœtation, deny that these conditions invariably offer an impassable barrier to the seminal fluid (especially previous to the end of the third month),[1] and point out that, as in exceptional cases menstrual blood finds its way out of the uterus during pregnancy, it is by inference also possible that seminal fluid may find its way in.

(2.) **Recorded Cases.**—The cases brought forward in support of the view that superfœtation is possible, may be divided into two classes, *viz.* :—

(*a*) Cases in which a woman is delivered at or about the same time, of a more or less mature child, and a less developed dead fœtus : *e.g.*, as in a reported case, of a mature child ; and a dead fœtus of apparently five months. Many cases are, however, reported showing that a dead fœtus may be retained in the uterus until the full term of pregnancy has expired, or even for a considerable period beyond. Hence cases of this class can be explained on the supposition, that conception of the two children occurred at the same time, but that one died and was retained in utero until the delivery of the other. Obviously, therefore, such cases do not support the view that superfœtation is possible.

(*b*) Cases in which a woman is delivered of two more or less mature children ; a considerable interval, but still an interval shorter than the usual period of gestation, separating the two births. Cases of this kind where the interval between the births is comparatively short, *e.g.*, in one reported case a month, are easily explained on the supposition, that conception of the two children occurred at the same time, but that the delivery of one was delayed. Other cases of this description again, in which the interval between the two births is comparatively long, can be explained by supposing that conception of the second child occurred, after delivery of that first born. It should, however, be noted, as bearing on this possibility, that it is highly improbable that conception can occur until a week after delivery ; probably a fortnight must intervene.[2] A few cases, however, are on record in which the interval separating the births of two viable children has been four to five months ; *e.g.*, *Case CXL*, and a case referred to by Taylor, in which the interval was 127 days (see also *Case CXXXIX*, in which the interval was 167 days, but in which no sexual intercourse took place until twenty days after the first delivery.)

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[1] It is not until the end of the third month that the decidua reflexa, or portion of the decidua surrounding the ovum, comes into contact with the decidua vera or portion of the decidua lining the uterus.

[2] Bonnar, *Edin. Med. Jour.*, vol. x, p. 582.

Case CXXXIX.—**Supposed superfœtation** (*Ibid*, p. 133).—The wife of Raymond Villard, of Lyons, eight months after a previous abortion at the seventh month, was delivered of a living female child. "This delivery was not followed by the usual symptoms, no milk appeared, the lochia were wanting, and the abdomen did not diminish in size. Three weeks after her delivery she again felt the motions of a fœtus, the abdomen increased in size, and five months and sixteen days after delivery she was again delivered of a living daughter." Both children were alive two years after the birth of the first child. "Dr. Desgranges, who attended the case, adds to his report that the second child could not have been conceived after delivery of the first, inasmuch as no sexual intercourse took place between the husband and wife until twenty days after the first delivery," or four months and twenty-seven days before the birth of the second child.

Case CXL.—**Superfœtation?** (Tidy, *Leg. Med.*, ii, p. 149, quoted from Naphey, 'Physical Life of Women,' p. 156).—"Marie Anne Bigaud, *æt.* thirty-seven, gave birth on April 30th, 1748, to a full term mature boy, which survived its birth two and a half months, and to a second mature child (girl) on September 16th, 1748, which lived one year. The interval between the two births was thus four and a half months (= one hundred and thirty-nine days). The mother, after her death, was proved not to have had a double uterus."

Cases such as these involve the acceptance of one of three propositions, *viz.*, either :

(1) That superfœtation is possible, even, as in *Case CXXXIX* when the uterus is not double ; or

(2) Supposing conception of the second child to have taken place after the birth of the first ; that a viable child may be born at a very early uterine age; *e.g.*, in Taylor's case at 127, or more probably 120 days ; or

(3) As suggested by Wharton and Stillé ; that in cases of twin pregnancy the pressure of one child on the other, instead of, as is sometimes the case, causing the death of one of the two, may in exceptional cases simply retard its development ; the result being that one child is born mature at the full period, and after its birth, development of the second child continues, until it also reaches maturity, when its birth takes place.

V. What is the earliest Viable Age?

What is the earliest period of gestation at which a child may be born, capable of living and being reared?—Here it may first be remarked (1) that there is no doubt but that a child born at or after the 210th day of uterine life may be reared ; and (2) that the evidence afforded by recorded cases so strongly supports the view that children born as early as the **180th day may be reared,** that the possibility of this cannot be denied. As regards the question of **viability before the 180th day,** it should be noted that the validity of the evidence afforded by cases cited to prove early viability mainly depends on the accuracy with which the date of conception is determined ; for although the characters of a child at birth afford indications of its age, they cannot be relied

on, except as corroborative evidence. **In some** of the **cases** cited as evidence of early viability, the **date of conception is fixed from a previous delivery**; *e.g.*, the case mentioned by Taylor (see *Superfœtation*), in which a viable child was born 127 days after a previous delivery, and another similar case referred to by the same author, in which the interval between the births was 174 days.[1] If we assume that in these cases conception of the second child did not take place until after the birth of the first, we must admit viability to be possible at respectively the 120th and 167th day of intra-uterine age. Obviously, however, the acceptance of cases such as these, as valid evidence of early viability, rests on the assumption that it is impossible for either superfœtation, or retardation of development as suggested by Wharton and Stillé, to occur.

Of the cases in which the **date of conception is fixed independently of a previous delivery,** there is one, Dr. Outrepont's case (see *Case CXLI*), in which a viable child was born twenty-five weeks (175 days) after the last menstruation of the mother. Guy, in reference to this case, says—"It is very valuable, for it is the only quite unequivocal instance on record of the rearing of a six months' child."[2] The Jardine case (*Case CXXXV*) is also a fairly authentic case of the rearing of a 174-day child. There are also a few less reliable cases of the rearing of children born at a period **earlier than the 174th day.**[3] Among these, the earliest viable age recorded is 133 days (Dr. Rodman's case).[4] The evidence afforded by these cases, in favour of viability at a period earlier than the 174th day, is further supported by certain recorded cases, in which children born at an earlier age than this, lived for some days after birth.[5]

Case CXLI.—**Viability of a one hundred and seventy-five days' child** (Dr. Outrepont's case, Guy, *For. Med.*, p. 131).—In this case "the mother, a young woman who had always been perfectly regular, menstruated as usual ten days after her marriage, and was subsequently repeatedly connected with her husband. About a fortnight after this menstruation she became changed in appearance, and

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[1] Taylor, *Med. Jur*, ii, p. 229.

[2] Guy's *For. Med.* (4th ed.), p. 136.

[3] *E.g.*, Dr. Barker's case, 158 days (*Med. Times*, 1850, vol. ii, pp. 249, 392), and Capuron's doubtful case of Fortunio Liceti, 135 days (Guy's *For. Med.*, p. 129).

[4] Guy's *For. Med.*, p. 129.

[5] *Eg*, Fleischmann's case of a child of 168 days living for eight days (Guy, *For. Med.*, p. 134), and Dr. Routh's case of a child born between the fifth and sixth month living for eighteen days after its birth (*Obstet. Trans.*, 1871, p. 182).

for the first time in her life had frequent attacks of vomiting and fainting. These symptoms continued, but the catamenia did not return, and about twenty weeks after their last appearance she felt the first movements of the child. Five weeks after this (*i.e.*, twenty-five weeks, or one hundred and seventy-five days from the last appearance of the catamenia), she was seized with labour pains and hæmorrhage, and Dr. Outrepont having ascertained that this proceeded from the placenta being attached to the os uteri, encouraged the labour and brought it to a prosperous conclusion." The appearance of the child, a boy, at birth corresponded to those of a fœtus not more than twenty-five weeks old. He was known to be alive eleven years after the date of his birth.

As regards the further question, What is the earliest age at which a child may be born, capable after its birth of showing signs of life? it may be stated, that there is more than one reliable case on record, showing that a child born between the fourth and fifth month of uterine life may after birth manifest signs of life. Among these may be mentioned Dr. Barrow's case of a child born at 144 days, which after birth breathed convulsively at intervals, for forty minutes.[1]

VI. What are the Characters of Children Born at Various Periods of Gestation?

Previous to the end of the fourth month, the characters of the embryo are as follows :—

Embryo of three to four weeks.—Length, about $\frac{1}{3}$ inch. Weight, about twenty grains. Size, that of a large ant or barleycorn. Form, that of a serpent, the head indicated by a swelling, the caudal extremity slender, and ending in the umbilical cord ; the mouth indicated by a cleft, the eyes by two black points, the members appearing as nipple-like protuberances. The villosities of the chorion uniformly spread over the surface.—(Guy.)

Embryo of six weeks.—Length, from $\frac{1}{2}$ inch to less than 1 inch. Weight, from forty to seventy-five grains. The head distinct from the chest, and the face from the cranium, apertures of the nose, mouth, eyes, and ears perceptible ; the hands and forearms in the middle of the length, and the fingers distinct ; the legs and feet situated near the anus ; a distinct umbilicus for the attachment of the cord, which consists of the omphalo-mesenteric vessels, of part of the urachus, of the intestinal tube, and of filaments which represent the umbilical vessels. The placenta forming ; the chorion and amnion still separate : the umbilical vesicle very large. Points of ossification in the clavicle and maxillary bone.—(Guy.)

Embryo of two months.—Length variously stated at from $1\frac{1}{2}$ to 4 inches (Tidy gives the length as 16 to 19 lines). Weight, 120 to 300 grains. Rudiments of nose, lips, and eyelids ; organs of generation visible ; arms and legs detached from the trunk, anus marked by a dark spot. Rudiments of lungs, spleen, and supra-renal capsules, cæcum behind the umbilicus, digestive canal withdrawn into the abdomen ; urachus visible ; chorion beginning to touch the amnion, at the point

[1] Wharton and Stillé, vol. iii. p. 51.

opposite to the insertion of the placenta which begins to assume its regular form ; umbilical vessels becoming twisted. Points of ossification in frontal bone and ribs ; also in the shafts of the long bones of the extremities, in the shafts of the metacarpal and metatarsal bones and phalanges, and in the scapula and ilium—(Tidy).

Embryo of three months.—Length variously stated at 2 to 6 inches (2 to 2½ inches, Tidy). Weight, one to three ounces (480 to 720 grains, Tidy). The head voluminous ; the eyelids and lips in contact ; membrana pupillaris visible ; fingers separated ; lower extremities longer than rudimentary tail (clitoris or penis very long, Tidy). Thymus and supra-renal capsules present ; the ventricle of the heart distinct. The decidua uterina and reflexa in contact. The funis containing umbilical vessels and a little gelatinous matter ; placenta completely isolated ; the umbilical vesicle, allantois, and omphalo-mesenteric vessels have disappeared (points of ossification for the occipital, sphenoid, os unguis, nasal bones, squamous portion of temporal and ischium—(Tidy).

After the fourth month the uterine age of the fœtus is indicated by the following characters. (A) **During** life : (1) Its length and weight ; (2) changes about the eyes ; (3) the appearance of the skin, nails, and scalp hair ; and (4) the position of the middle point of the body. (B) **After death** the following additional characters become available :—(1) The progress of ossification ; (2) the condition of the intestines ; (3) the condition of the gall-bladder ; (4) the position of the testicles ; and (5) miscellaneous characters. According to Guy, Tidy, and others, these characters are as follows :—

(1.) **The length and weight.**—The following table gives the average length in inches, and average weight in pounds and ounces, at the end of each month :—

Month.	Length.		Weight.	
	From	To	From	To
			lbs. oz.	lbs. oz.
4	4½	8½	0 3	0 7
5	6½	10½	0 5	1 1
6	8	13½	1 0	2 2
7	11	16	2 0	4 5
8	14	18	3 4	5 7
9	16	20	4 5	7 0

Exceptional cases are recorded of children at birth being unusually large and heavy. The greatest length and weight recorded appears to be 32 inches, and 18lbs. 2oz. ; next to this comes a case where the length was 24 inches, and the weight 17lbs. 12oz.[1]

[1] Taylor, *Med. Jur.*, ii, p. 314.

(2.) **Changes about the eyes.**—The eyelids are adherent, and the membrana pupillaris vascular and distinctly visible up to the end of the sixth month. At the end of the sixth month, the eyebrows and eyelashes are beginning to form. At the end of the seventh month, the eyelids are non-adherent, and the membrana pupillaris is beginning to lose its vascularity, and by the end of the eighth month, it is so thin and transparent as to be only with difficulty discernible.

(3.) **Appearance of the skin, nails, and scalphair.**—Up to the end of the fifth month, **the skin** is destitute of fibrous structure and sebaceous covering. At the end of the sixth month, it begins to show a fibrous structure, and papillæ begin to appear; at this period it is covered with down, and sebaceous matter begins to be visible on its surface. At the end of the seventh month, it is dusky red, thick, and fibrous, and covered with sebaceous matter. By the end of the eighth month, it is covered with fine short hairs, and the sebaceous envelope is well marked. At the end of the ninth month, the down has disappeared from the surface of the body except the shoulders. **The nails** begin to appear at the end of the fourth month, are very distinct at the end of the fifth month, and gradually increase in length, reaching the ends of the fingers at the end of the eighth month. **Hair on the scalp** begins to appear at the end of the fifth month, is about quarter of an inch long at the end of the seventh month, and at the end of the ninth month has attained a length of about an inch.

(4.) **The position of the middle part of the body.**—This up to the end of the fifth month lies on the body of the sternum; gradually descending, it reaches the lower end of the sternum at the end of the sixth month, is nearer the umbilicus than the sternum at the end of the eighth month, and at the end of the ninth month is generally about three-quarters of an inch above the umbilicus.

Further Signs Available after Death.

(1.) **The progress of ossification.**—At the end of the fourth month the ossicles of the ear are found ossified, and points of ossification have just appeared in the upper part of the sacrum (for points of ossification appearing before the end of the third month, see tables on pp. 285 and 286). By the end of the fifth month, points of ossification have appeared, in the pubis, os calsis, axis, and odontoid process; at the end of the sixth month, in the four divisions of the sternum; at the end of the seventh month, in the astragalus; at the end of the eighth month, in the last sacral vertebra; and at the end of the ninth month, in the **lower epiphysis of the femur.** This last point of ossification is not present at the end of the eighth month, and great weight is attached to it by Casper and others, **as a sign of maturity.** According to Casper, its diameter in mature children is three-quarters of a line to four lines, and Tidy adds that if it is more than three lines in width, the child has probably survived its birth. "This nucleus appears to the naked eye as a more or less circular blood spot in the midst of milk-white cartilage."[1]

(2.) **The condition of the intestines.**—At the end of the fourth month, the duodenum contains meconium, the cæcum is placed near the right kidney, and the cæcal valve is visible. At the end

[1] Tidy, *Leg. Med.*, ii, p. 59 (1 line = $\frac{1}{12}$th of an inch.)

of the fifth month meconium of a yellowish green tint is present at the commencement of the large intestines. At the end of the sixth month in the large intestine sacculi begin to appear, and meconium is present in the upper part. At the end of the seventh month the cæcum lies in the right iliac fossa, the valvulæ conniventes begin to appear, and meconium is present nearly throughout the whole length of the large intestine. At the end of the ninth month the meconium has reached the rectum.

(3) **The condition of the gall-bladder.**—The gall-bladder begins to appear at the end of the fourth month, is distinct at the end of the fifth, contains insipid serous fluid at the end of the sixth, and bile at the end of the seventh month.

(4.) **The position of the testicles.**—At the end of the sixth month these lie close to the kidneys, and at the end of the seventh have begun to descend towards the internal ring, which they reach at the end of the eighth month. At the end of the ninth month they have, as a rule, passed through the canal and are often found in the scrotum.

(5.) **Miscellaneous characters.**—At the end of the fifth month the germs of the permanent teeth are visible; at the end of the sixth month the cerebral hemispheres cover the cerebellum. At the end of the seventh or eight month the cerebral convolutions are apparent.

VII. Paternity.

May Paternity of a child be inferred from its Resemblance or non-resemblance to its alleged Parents?—Undoubtedly peculiarities of the parents are frequently transmitted to their offspring, *e.g.*, the general characters of the features, the colour of the skin, certain deformities, tendency to disease, tricks of manner, character of the voice, colour of the hair, &c., &c. Peculiarities in the parents are, however, not necessarily transmitted to their children, and, as before pointed out, a peculiarity may be subject to atavism, and miss one generation, appearing in the next. Further, the children of a woman by a second husband may resemble the first husband, not the second. More weight, therefore, is to be attached to the presence of hereditary peculiarities as affirmative evidence, than to their absence as negative evidence, of paternity. Other things being equal, the more close the resemblance, the stronger the evidence of paternity.

VIII. Recent Delivery.

Has this woman ever been delivered of a viable child?—The signs of recent delivery may be present and supply an affirmative answer—these signs will be discussed under Infanticide (see p. 322). On the other hand, the signs of virginity may be present—the presence of these, especially of an intact hymen, is a strongly negative indication. An intact hymen may be taken as positive proof that the woman has never been delivered of a

EXTERNAL CHARACTERS of the FŒTUS at the END of EACH MONTH of UTERINE LIFE.

Month . . .	4	5	6	7	8	9
Average length in inches . . .	6½	8½	14	15	17	19½
Mean weight (Guy)	5 oz.	11 oz.	2 lbs. 2 oz.	3 lbs. 8 oz.	4 lbs. 5 oz.	6 lbs. 8 oz.
Skin	No sebaceous covering or fibrous structure apparent.		Fibrous structure, papillæ and sebaceous matter beginning to appear, covered with down.	Dusky red; thick and fibrous, and covered with sebaceous matter.	Covered with fine short hairs and sebaceous matter.	Down almost all disappeared; covered with sebaceous matter.
Nails	Appearing.	Very distinct.	Growing.	Do not quite reach to end of fingers.	Reach to end of fingers.	
Hair on scalp . .	None.	Appearing.	Distinct.	About a quarter of an inch long.	Over a quarter of an inch long.	About one inch long.
Eyes, &c. . . .	Lids adherent; membrana pupillaris distinct.		Lids adherent: membrana pupillaris distinct. eyebrows and eyelashes beginning.	Lids non-adherent: membrana pupillaris getting indistinct.	Membrana pupillaris hardly visible.	
Position of middle point of body.	On sternum.	On sternum.	At lower end of sternum.	Below lower end of sternum.	Nearer umbilicus than sternum.	Just above the umbilicus.

INTERNAL CHARACTERS of FŒTUS at END of EACH MONTH of UTERINE LIFE.

Month	4	5	6	7	8	9
Ossification apparent in.	Ossicles of ear* and upper parts of sacrum.	Pubis and os calcis.	Four divisions of sternum.	Astragalus.	Last sacral vertebra.	Lower epiphysis of femur.
Intestines. . . .	Cæcum near right kidney, valve visible.	.....	Sacculi appearing in large intestine.	Cæcum in right iliac fossa, valvulæ conniventes appearing.		
Meconium . . .	In duodenum . .	At commencement of large intestine.	In upper part of large intestine.	Present nearly throughout large intestine.	.....	Has reached the rectum.
Gall-bladder . .	Appearing.	Distinct.	Contains serous fluid.	Contains bile.		
Position of testicles	.....	.....	Close to kidneys.	Between kidneys and internal ring.	At or in the internal ring.	Generally external.
Miscellaneous . .	.....	Germs of permanent teeth apparent.	Cerebral hemispheres cover cerebellum.	Cerebral convolutions becoming apparent.		

For points of ossification appearing before the 4th month, see Table of Characters of Embryo anterior to the 4th Month (p. 281)

mature or nearly mature child. Obviously, however, no conclusions can be drawn from the absence of the signs of virginity.

If the signs of recent delivery and of virginity are both absent, the other chief signs to be looked for are :—

(1.) **Presence or absence of the lineæ albicantes and condition of the breasts.**—The presence of the lineæ albicantes may, however, be accounted for by causes other than delivery, *e.g.*, ovarian tumours, or ascites ; and they may be absent in women who have been more than once delivered.[1] Enlargement of the breasts also may be the result of causes other than pregnancy.

(2.) **The condition of the posterior commissure.**—This, if ruptured, strongly indicates a previous delivery. If intact, the indication is strong that the woman has never been delivered of a child, and still more strong that she has never been delivered of a mature child.[2]

(3.) **The condition of the uterus.**—After delivery, the uterus does not wholly return to its original condition. The chief changes observable are as follows :—

(*a*) Its cavity becomes larger. According to Dr. Barnes,[3] the vertical diameter of the cavity is, in virgins 1·80, in women 2·20, and in mothers 2·44 inches ; and the transverse diameter of the cavity, in virgins ·60, in women 1·08, and in mothers 1·24 inches.

(*b*) Its walls become thicker and its weight greater. According to Dr. Barnes its weight, in girls at the age of puberty, is 360 to 1000 grains, whilst in women who have borne children its weight ranges from 1200 to 1800 grains. In advanced life, however (and in exceptional cases, in adult life after delivery), the uterus undergoes atrophy, and in old women its weight may become reduced to 100 to 200 grains.

On the whole, although the conditions of the uterus may afford strong indication of a previous delivery, no absolutely certain conclusion can be drawn from its state.

It may further be remarked that the question, "Has this woman ever been delivered of a child?" may also arise in defamation cases and in cases of disputed identity. In a recent trial for murder (*R.* v. *Wainwright*, *Case CXLII*) this question arose with reference to the identity of the remains discovered and alleged to be those of a certain female who was missing. From the opinion expressed by Dr. Meadows in this case, it would appear that, in the absence both of the signs of recent delivery, and of those of virginity, no certain answer can be given to this question.[4]

Case CXLII.—**Signs of previous delivery in exhumed corpse** (*R.* v. *Wainwright:* Taylor's '*Manual*,' p. 495).—The prisoner was tried for the murder of a woman with whom he had cohabited, and who had two children by him, the last being born about nine months previous to the time of her supposed murder. A year after her disappearance the mutilated remains of a female were discovered buried in premises

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[1] Taylor, *Med. Jur.*, ii, p. 162.
[2] *Dis. of Women*, p. 32.
[3] Tidy, *Leg. Med.*, ii, p. 138.
[4] Taylor's *Manual*, p. 496.

belonging to the prisoner. Examination of these showed the uterus to be enlarged and flaccid; its walls were unusually thin. There were one or two white lines in the skin of the lower part of the abdomen, and other marks of a darker colour in the inguinal region. Two medical men who had examined the remains, were of opinion that they were those of a woman who had borne a child. Dr. Alfred Meadows, called for the defence, was of the contrary opinion, but stated that he believed it to be impossible to decide this question in any case with certainty.

CHAPTER XV.

FŒTICIDE OR CRIMINAL ABORTION OR MISCARRIAGE.

CRIMINAL abortion is undoubtedly very prevalent in India, though only a relatively small proportion of the cases come into the law courts, usually those cases only where the results have proved fatal to the mother, as prosecutions are beset by obvious difficulties and convictions are extremely rare. Amongst Europeans in India cases often occur in medical practice, where hæmorrhage, paralysis and other symptoms are obviously due to the clandestine use of abortifacients.

On the frequency of this dangerous and immoral practice an experienced Anglo-Indian physician writes :—"I am afraid that in India inducements to procuring abortion criminally are frequent and strong, and I have known instances in which solicitations in that direction have caused medical men to swerve from the path of rectitude ; but apart from considerations of personal reputation and professional honour, the blunt truth should never be forgotten that fœticide is murder, and, if fatal to the unfortunate mother, double murder."

Criminal abortion or 'causing miscarriage' is unlawful expulsion of the fœtus. The term "miscarriage," as used in law, includes both abortion and premature labour. Medical writers, however, restrict the term "premature labour" to denote premature expulsion of a child that has attained viability, and use the terms "abortion" or "miscarriage" to signify expulsion of an ovum or fœtus at any earlier period.

Miscarriage may be—(1) *Accidental*, i.e., the result of natural or accidental causes ; (2) *Justifiable*, i.e., the result of a lawful act ; or (3) *Criminal*, i.e., the result of an unlawful act.

ACCIDENTAL Miscarriage.

This frequently occurs, and is more common in the earlier than in the later stages of pregnancy. Whitehead, from observation of 2,000 pregnancies, estimates that one in seven end in abortion. Dr. Robert Barnes divides the causes of accidental or natural miscarriage into (1) Maternal and (2) Fœtal causes, and classifies them thus :—

(1) Maternal Causes.

(1.) **Poisons circulating in the mother's blood :** (*a*) Introduced from without, as fevers, syphilis, various gases, lead, copper, &c.

(*b*) Products of morbid action, as jaundice, albuminuria, carbonic acid from asphyxia, and in the moribund.

(2.) **Diseases degrading the mother's blood:** Anæmia, obstinate vomiting, over-lactation.

(3.) **Diseases disturbing the circulation dynamically** (mechanically), as liver, heart, and lung disease.

(4.) **Causes acting through the nervous system:** (*a*) certain nervous diseases, as chorea, &c.; (*b*) mental shock; (*c*) diversion or exhaustion of nerve force, as from obstinate vomiting.

(5.) **Local diseases:** (*a*) Uterine diseases, as fibroid tumours, inflammation, hypertrophy, &c., of the uterine mucous membrane; (*b*) mechanical anomalies, as retroversion, pressure of tumours external to uterus, &c.

(6.) **Climacteric abortion.**

(7.) **Abortion artificially induced.**

(2) Fœtal Causes.

(1.) **Diseases of the membranes of the ovum.**—As fatty degeneration, hydatidiform degeneration, inflammation, congestion, apoplexy, and fibrous deposits.

(2.) **Diseases of the embryo itself.**—Malformation, inflammation of serous membranes, diseases of nervous system, diseases of kidneys, liver, &c., and mechanical, as from torsion of the cord.

Common Causes of accidental miscarriage are syphilis, mental shock, and accidental **violence.** In some women miscarriage results from the slightest exciting cause. Others having once miscarried, miscarry in subsequent pregnancies apparently without any exciting cause. Others, again, seem "proof against the most severe physical injuries and suffering" (see the two following cases "and the most violent mental excitement.")[1]

Case CXLIII.—**Failure of external violence to cause miscarriage** (Woodman and Tidy, *For. Med.*, p. 754, from Tardieu).—In the Assize Court of the Loire-Inférieure it was proved that a peasant who had seduced his servant and wished to make her abort, mounted on a strong horse, and put the girl on the same horse, then galloped wildly hither and thither, throwing her down on the ground whilst in full gallop, and this repeatedly. Having tried this twice without success, he applied to her stomach bread just taken from a very hot oven. This means failed like the former, and the poor victim gave birth to a living and well-formed child at term.

Case CXLIV.—**Failure of violence to cause miscarriage** (Guy, *For. Med*, p. 87, quoting Dr. Wagner, of Berlin).—A young woman seven months with child had employed savin and other drugs to produce miscarriage. As these failed, her paramour bound a strong leather strap tightly round her body. This, too, availing nothing, he

[1] Tidy, *Leg. Med.* ii. p. 166.

(by his own confession) knelt upon her with all his weight, and trampled on her while she lay on her back. As this also failed, he took a sharp-pointed pair of scissors and proceeded to perforate the uterus through the vagina. Much pain and hæmorrhage ensued, but did not last long. The woman's health did not suffer in the least, and pretty much about the regular time a living child was brought into the world, without any marks of external injury upon it.

JUSTIFIABLE Miscarriage.

In defining the offence of causing miscarriage *s.* 312 of the *I. P. Code* excepts as not criminal miscarriage caused "in good faith and for the purpose of saving the life of the woman." The law of England does not formally define under what circumstances it is lawful to cause miscarriage. Usually justifiable miscarriage takes the form of "artificial induction of premature labour," *i.e.*, the operation is deferred until the child has attained viability, so that, if possible, its life as well as that of the mother may be saved. So long, however, as the operation is undertaken for the purpose of saving the life of the mother, miscarriage may be legally caused at any period of pregnancy. For the purpose of saving the mother's life it may be necessary to cause premature expulsion of the contents of the pregnant uterus :—

(1.) **In cases where from pelvic distortion** the antero-posterior diameter of the pelvis (normally $4\frac{1}{4}$ inches at the brim and $4\frac{3}{8}$ inches in the cavity) is reduced below, or to, $3\frac{1}{4}$ inches.

(2.) **In cases of obstruction** caused by the presence of tumours or contractions of the soft parts arising from cicatrices, of such a nature as to prevent the passage of a mature child.

(3.) **In cases where during gestation the mother's life is endangered** by obstinate vomiting, hæmorrhage from placenta prævia, convulsions, or serious cardiac, or pulmonary, or other disease.

Dr. Meadows and others advise the artificial induction of premature labour in "cases in which there is evidence that on several previous occasions the death of the fœtus occurred at a given time suddenly. "Here," writes Meadows, "the operation would be resorted to prior to the period in question with the view of preventing its recurrence."[1] To cause miscarriage under these circumstances is by the law of India not justifiable, unless there is reason to believe that the child's death will endanger the life of the mother.

CRIMINAL Miscarriage.

Criminal abortion, or miscarriage, common in many countries, is especially common in India. It is resorted to by both single and married women in order to get rid of the product of illicit intercourse or to avoid inconvenient additions to their families. In India the custom of preventing the re-marriage

[1] '*Man. of Midwifery*,' p. 234.

of widows tends directly to increase the prevalence of the offence. In India, in fact, in by far the great majority of cases of this offence, the female who has miscarried is a Hindu widow (see *Cases CXXXII* and *CXXXIII*) who resorts to this practice to avoid disgrace. This, however, is not invariably the case (see *Case CXXXIV*). This crime is also not uncommonly practised by European women in India, as already noted.

The sections of the *I. P. Code* concerning the offence of causing miscarriage are as follows :—

312. "Whoever voluntarily causes a woman with child to miscarry, shall, if such miscarriage be not caused in good faith for the purpose of saving the life of the woman, be punished with imprisonment of either description for a term which may extend to three years, or with fine, or with both ; and if the woman be quick with child, shall be punished with imprisonment of either description for a term which may extend to seven years, and shall also be liable to fine."

"*Explanation.*—A woman who causes herself to miscarry is within the meaning of this section."

313. "Whoever commits the offence defined in the last preceding section without the consent of the woman, whether the woman is quick with child or not, shall be punished with transportation for life, or with imprisonment of either description which may extend to ten years, and shall also be liable to fine."

314. "Whoever with intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine ; and if the act is done without the consent of the woman, shall be punished either with transportation for life, or with the punishment abovementioned."

"*Explanation.*—It is not essential to this offence that the offender should know that the act is likely to cause death."

[Unlike in English law the question here arises of the consent of the woman.]

Two other sections of the code refer to results which may arise to the child from the doing of certain acts before its birth, namely, *s.* 315 ; and

316. "Whoever does any act under such circumstances that, if he thereby caused death, he would be guilty of culpable homicide, and does by such act cause the death of a quick unborn child, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine."

Attempts to cause miscarriage may be dealt with either by the application of the provisions of *s.* 511 of the Penal Code to *ss.* 312 or 313 ; or if the attempt has been made by the administration of an "unwholesome drug or other thing" the case may be dealt with under *s.* 328. Hence by the law of India to voluntarily cause or attempt to cause "miscarriage," except in good faith for the purpose of saving the life of the woman, is an offence, proof

of pregnancy which is required to convict for causing miscarriage is not required for an 'attempt.'

Further, supposing it to be proved that such an offence has been committed, the following **additional questions** are, owing to the wording of the above-quoted sections, liable to arise :—(1) **Was the woman pregnant?** Proof of pregnancy is required to secure a conviction for causing miscarriage, but not to secure conviction for an attempt. (2) Was the woman **quick with child?** (3) **Was the miscarriage caused,** or the attempt to cause it made, **without the consent** of the woman? (4) **Did the woman's death result** from the miscarriage or the attempt to cause it? And (5) In certain cases (see *ss.* 315 and 316) **did the death of the child result** from an act done before its birth?

In England, causing miscarriage is punishable by death or imprisonment under *ss.* 58 & 59 of 24 & 25 Vict., c. 100, as amended by 27 & 28 Vict., c. 47.

S. 58. "Every woman being with child who, with intent to procure her own miscarriage, shall unlawfully administer to herself any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever with like intent, and whosoever, with intent to procure the miscarriage of any woman, whether she be or be not with child, shall unlawfully administer, &c., shall be guilty of felony."

S. 59. "Whosoever shall unlawfully supply or procure any poison or other noxious thing, or any instrument or thing whatsoever, knowing that the same is intended to be unlawfully used or employed with intent to procure the miscarriage of any woman, whether she be or be not with child, shall be guilty of misdemeanour, and being convicted thereof, shall be liable, at the discretion of the Court, to be kept in penal servitude for the term of three years, or to be imprisoned for any term not exceeding two years." 24 & 25 Vict., c. 100.

N.B.—By 27 & 28 Vict., c. 47, *s.* 2, the minimum term of penal servitude awardable is increased to five years.

It may be noted that under these sections (1) the question of pregnancy only arises when a woman is accused of doing an act with intent to procure her own miscarriage ; (2) that the question of quickening does not arise at all ; and (3) that these sections do not, like those of the Indian Code, expressly provide that the absence of the woman's consent aggravates the offence. Further, in England, if the death of the woman results, the ordinary law of homicide applies, the felony is considered to be murder.

PROOFS of an Abortion.

In investigating a case of alleged criminal miscarriage examination should be made of—

(I) **The means** alleged to have been used ;
(II) **The substances** alleged to have been expelled ; and
(III) **The woman** alleged to have miscarried.

I. MEANS ALLEGED TO HAVE BEEN USED.

The **methods** of the criminal abortionist are usually of the crudest kind. Miscarriage may have been caused, or an attempt to cause it made, by (1) General violence ; (2) Local violence ; or (3) Administration of drugs.

(1.) General Violence.

Blood-letting has, in some countries, a popular repute as a means of causing miscarriage. Bleeding from the foot, application of leeches to the anus or to the vulva, have all been resorted to. Blood-letting, however, usually fails, and the same may be said of the use of very hot or very cold baths. **Violent exercise,** such as hard riding ; severe jolting, as driving over a rough road ; **violent shocks,** as from blows or falls ; and tight **compression** of the abdomen, may all cause abortion. Often severe general mechanical violence altogether fails (see *Cases CXLIII* and *CXLIV*). Sometimes mechanical violence is ombined with the administration of drugs (see *Case CXLV*).

Case CXLV.—**Miscarriage caused by drugs combined with mechanical violence.** (*Bombay Chem. Analyser's Report* for 1884).—In a case from Dohad (Panch Mahals) a quantity of orpiment and ruskapoora—impure calomel—were discovered among matters found in the house of some persons charged with procuring abortion. In this case a woman was heard screaming in a house ; the police entered, and found that the screams proceeded from a woman who had aborted, and who on examination told the following story. She said she had been forced against her will to take some medicine brought by the man in whose house she was found. After taking it she suffered from vomiting, and, in about two hours, from pain in the abdomen. As soon as the pain became severe, the man who gave her the medicine seized hold of her hands and feet, and his wife pressed on her abdomen, with the result that abortion was effected.

(2.) Local Violence (including Local Application).

Rupturing or separating the membranes, with or without dilation of the os ; the insertion of a foreign body into the uterus ; or the use of the vaginal douche ; are the means of inducing premature labour commonly employed by medical practitioners. Similar means are often resorted to by unskilled persons in criminal attempts, and often fatal injury to the mother is the result.

In India a common method employed is the introduction into the vagina or uterus, of either a twig of some irritant plant, or a thin piece of stick armed with some irritant or reputed abortifacient preparation. The plants, twigs of which are most commonly used, are **Plumbago rosea** and **zeylanica** (**Lal** or **Chitra**), and less frequently **Nerium odorum** (olean-

der), **Cerbera thevetia** (yellow oleander), and **Euphorbium tirucalli** (milk-bush). The twigs of these plants, previous to introduction, are often smeared with asafœtida (*Hing.*) When a piece of stick armed with an irritant or other preparation is employed, the stick is commonly wrapped round at one end or for the greater portion of its length with cotton, and to this the preparation is applied. More or less common ingredients of the preparations employed for arming such sticks are, besides matters derived from the plants just named, the juice of **Jequirity** (*'rati'* *abrus precatorius*), **Calotropis procera** or (*madar*), the milky juice of various other **Euphorbias,** bruised **marking-nuts** (*semi-carpis anacardium* **arsenious oxide, orpiment,** and **red lead.** This last (red lead), very commonly in Bombay, forms one of the ingredients of the composition employed.[1]

Sometimes a mass of irritant paste is simply thrust into the upper part of the vagina.[2] Not infrequently the twig or stick employed passes wholly into the uterus, causing fatal inflammation, and after death is found lying wholly or partly within the cavity of the emptied or unemptied uterus, perhaps transfixing its walls. **Perforation of the uterine was** by such sticks or twigs may occur from force used in introducing them, or from subsequent contraction of the uterus upon them. Dr. Lyon was present in Bombay at a *post-mortem* examination on an abortion case, in which two thin pieces of stick were found lying side by side in the uterus across the fundus, both transfixing the uterine wall on either side. From their position, these sticks must have been (*a*) retained by the uterus after expulsion of its contents, and (*b*) forced through the uterine wall by the contractions of the uterus. Introduction of irritant twigs, or of sticks armed as described above, appears to be the method usually resorted to in India by practised abortionists, and very often proves successful. It should be noted that irritant substances are sometimes introduced into the vagina as a mode of torture. Dr. W. Gray met with a case in which a man placed three marking-nuts in his wife's vagina, as a punishment for infidelity.[3]

SUBSTANCES ALLEGED TO HAVE BEEN EXPELLED FROM THE UTERUS.

(*a*) **These may contain no ovum or embryo**; *e.g.*, they may be blood clots, a fibroid tumour, a dysmenorrhœal false membrane, a mole, or hydatids. In India, in such a case, the accused can only be convicted of an attempt to cause miscarriage.

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[1] See Lead *Chapter XXIII* on Poisons. [2] See p. 294.
[3] *Bom. Chem. Analyser's Rep.*, 1874-75.

In England, except the accused be the female alleged to have miscarried, the nature of the substances expelled from the uterus is immaterial.

(*b*) **They may contain an ovum, embryo, or immature fœtus.**—As by the law of India causing miscarriage is punishable with greater severity if the woman be quick with child, it is important to determine the uterine age of an immature fœtus found in the matters expelled. For the characters of the fœtus at various periods of gestation, see pp. 281 and 285. In criminal miscarriage, it may be noted, the usual period selected is during the fifth or sixth month.

Chevers, however, points out that women in India "not infrequently induce premature confinement when they have nearly advanced to their full period."[1] In giving, from examination of the fœtus, an opinion as to whether quickening has occurred, it must be borne in mind that quickening does not take place at any fixed period. After ascertaining the probable uterine age of the fœtus, the question of the cause and time of its death must next be considered. By the law of England, the fact that the death of the child resulted from criminal causing of miscarriage, only affects the gravity of the offence committed in one case, namely, where the child survives its complete birth. In such a case the offence committed is murder according to English law. This is not so in India. In India, however, in certain cases (see *Penal Code, ss.* 315 and 316, pp. 353 and 374) the fact that the death of the child resulted renders the offender liable to enhanced punishment.

(*c*) **What has been expelled may be a mature child.**—In such a case it is of course possible that miscarriage has not occurred at all. When this is suspected, signs indicative of maturity should be carefully looked for. One of the most important of these, only available however if the child be dead, is the presence in the lower epiphysis of the femur, of a point of ossification more than three-quarters of a line in width (see p. 348). Of course, in all cases where the degree of maturity of the child indicates that it might possibly have been born alive, the questions whether or no it survived its birth, and what was the cause of its death, must be inquired into, as in a case of alleged infanticide.

(3.) Administration of Drugs.

The substances popularly believed to possess abortifacient properties, may conveniently be arranged in five classes, namely (*a*) Ecbolics ; (*b*) Reputed Emmenagogues ; (*c*) Purgatives ; (*d*) Irritants, and (*e*) Other substances. The clandestine use of such abortives by married women, both native and European, may be the cause of apparent menorrhagia, dysentery, paralysis, &c.

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[1] *Med. Jur.*, p. 735.

(*a*) **Ecbolics,** *i.e.*, substances which stimulate the contraction of the muscular fibres of the uterus. The only undoubtedly ecbolic drug known is **Ergot.** Administration of this, after the uterus has begun to contract, nearly always increases the force and frequency of its contractions. When, however, contractions of the uterus have not commenced, administration of ergot may or may not excite their commencement. Apparently, the less advanced the pregnancy, the more likely is it to fail. Hence, when given with criminal intent, as is frequently the case in England, it often fails to cause abortion. Ergot has been stated to act injuriously on the child. Dr. U. West,[1] however, records that out of one hundred and seventy-two labours in which he gave ergot, only five still-births resulted, or considerably less than the usual percentage of still to live births.[2] **Borax** (*Sohaga*, *Tankanakhara*) has been stated to possess ecbolic action, but this is extremely doubtful. **Cotton root bark** is said to act on the uterus like ergot, and has been used as a substitute for it.[3]

(*b*) **Reputed Emmenagogues**—*i.e.*, substances believed to promote the menstrual flow. The principal substance of this class used criminally as an abortifacient, is **Savin** (*Juniperus sabina*). This is frequently employed in England, both in the form of the powdered leaves (or a decoction made from them), and in the form of oil of savin. It often occasions abortion, but often fails. When given in large doses for the purpose of procuring abortion, it acts as a powerful irritant poison, and has in several cases caused death.

The following reputed emmenagogue poisonous plants have also been criminally employed in Europe :—**Rue** (*Ruta graveolens*), **Yew** (*Taxus baccata*), **Tansy** (*Tanacetum vulgare*) and, in India, **Oleander** (*Nerium odorum* and *Cerbera thevetia*). All these are powerful poisons : the first two have caused abortion, the others are not known to have any effect on the uterus. **Belladonna** applied locally as a suppository, or used as a vaginal injection, is stated to have caused abortion. Single cases of abortion following internal administration of **Actea racemosa** (black snake root, or cohosh), and **Digitalis,** the latter resulting fatally to the mother, have also been reported.

Less active or non-poisonous drugs of this class are :—**Pennyroyal** (*Mentha pulegium*) This has been used in England for the purpose of procuring abortion. Most authorities consider it to be without action on the uterus, and many do not even consider it to be a noxious substance.[4] Tidy, however, doubts its absolute innocence.[5]

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[1] Taylor, *Med. Jur.*, ii, p. 192.
[2] 5¼ per cent. (see p. 362.)
[3] Lauder Brunton's *Pharmacology*, p. 788.
[4] Taylor, *Med. Jur.*, ii, p. 185.
[5] Tidy, *Leg. Med.*, ii, p. 169.

Papaya seeds (*Carica papaya*) and **carrot seeds** (*Daucus carota*), *vern.* Gájir-bij), are both popularly believed in India to be powerfully abortifacient. In regard to the first, Dymock[1] states that the general belief among all classes of women in Southern and Western India is, that if a pregnant woman partakes of them even in moderate quantity, abortion will be the probable result. As regards the second, numerous cases are recorded where carrot seeds have been given internally, their administration being followed by abortion. More precise information is much wanted as to the alleged abortifacient power of both these drugs.

(*c*) **Purgatives**, especially such as cause much straining, or act powerfully on the rectum, may, if given in large doses, bring on abortion. This effect is more likely to result in the advanced than in the earlier stages of pregnancy.

In India, various **Cucurbitaceous tubers**, namely, **Cucumis trigonus** (*Karit*), **Momordica Charantia** (*Kerala*), and **Momordica Cymbalaria** (*Kadavanchi*) have been used, it is alleged, with success.

Aloes, in the form of **Hierapicra** (a mixture of powdered aloes and powdered canella bark), and **Pilacotia** (a mixture of aloes and colocynth) has frequently been used in England as an abortifacient. **Sulphate of potash** is said to be much employed for the same purpose in France.

Again, Taylor gives an English case where one hundred and twenty grains of **Colocynth** taken with intent to excite abortion, caused death.[2] **Elaterium, Croton oil,** and **Gamboge** may also be classed as purgatives, likely, under certain circumstances, to cause abortion.

(*d*) **Irritants**.—Powerful irritants may, like purgatives, cause abortion owing to the uterus participating in the irritant action set up in the system. Obviously, if given to an extent which renders abortion probable, the death of the mother is likely to result. Among the **mineral irritants** which have been used, may be mentioned :—

(1) **Arsenic** ; this is sometimes employed in India ; it has, in more than one case, caused death without producing abortion (See *Case CXXXIII*, p. 265). (2) **Iron** ; the sulphate, and the tincture of the perchloride, have been used in England : neither of these preparations appear to possess any specific abortifacient power. (3) **Mercury** ; this has been used in England in the metallic form, and as calomel, but without success. Chevers mentions an Indian case where mercuric sulphide formed one of the ingredients of a powder given with intent to cause abortion. (4) **Copper** ; in another Indian case mentioned by Chevers, sulphate of copper formed one of the constituents of a similar powder. (5) **Quicklime** ; this is also mentioned by Chevers as used for the

[1] *Mat. Med. of W. India*, p. 295. [2] *On Poisons*, p 522.

purpose of procuring abortion. (6) **Iodide of potassium and Nitrate of potassium.** In one case each, the administration of these salts was followed by abortion; iodide of potassium is, however, frequently in the course of medical treatment, given to pregnant females, without ill effect.

Organic Irritants: Plumbago (*rosea* and *zeylanica*), the juice of various **Euphorbias,** and the juice of the **Calotropis procera**, are all in more or less common use in India for internal administration as abortifacients. Chevers also mentions as similarly used—**Black Pepper,** unripe **Pine-apple,** the bark of **Moringa pterygosperma** (horse-radish tree), and **blistering flies**; and Gray,[1] in a case of abortion followed by death from irritant poisoning, identified the drug used as the leaves of **Lasiosiphon speciosus** (N. O. *Thymelaceæ*, *vern. Rametha*, see *Chap. XXIV*). **Cantharides,** Tidy states, has in some cases caused abortion, and in others failed, even in doses of one drachm of the powder.

(*e*) **Other substances.**—Numerous other substances, none of which so far as known, possess any specific abortifacient power, are mentioned by various writers as enjoying more or less popular repute as ecbolics.

In India, the juice of **Bamboo leaves**; the fruit of **Randia dumetorum** (*Main-phal* or *Gela-phal*), an emetic recommended as a substitute for ipecacuanha in dysentery; a decoction of **Cuscuta reflexa** (*Akasweli*, *Ghagar bel*); the seeds of **Celastrus paniculata** (*Malkangni*); and the seeds of **Anethum graveolens** or Sowa (Indian dill), have all been used. See also, under 'Poisons,' *Dolichandrone falcata* and *Plumieria acutifolia*. In Europe, squills, hellebore, and laburnum have all three been employed as abortifacients. So also have the following: sarsaparilla, guinea pepper (grains of paradise), saffron, guaiacum, horehound, camomile, wormwood, mugwort and juniper.

III. EXAMINATION OF THE WOMAN.

During life, traces left by the means employed may be found on the person of the female: *e.g.*, bruises on the abdomen, marks of injury on the genitals, or foreign bodies in the vagina. If miscarriage has actually been caused, the signs of recent delivery may be present. These obviously are less marked, the earlier the period of gestation at which the miscarriage has taken place, and the longer the interval which has elapsed since it occurred. In a case no signs of an alleged abortion at three months were present seven days after the event; on the other hand, the same compiler (Harvey) mentions a case where relaxation of the genitals was found six or seven days after abortion at two to two and a quarter months, and another, where in a woman *æt.* twenty-two, eight days after abortion at four months, the following signs were found: vagina slightly dilated, puer-

[1] Bombay *Analyser's Report*, 1874-75.

peral smell distinct, the uterus could be felt through the abdominal wall, and a little milk could be squeezed from the breasts. In other cases signs sufficient to indicate abortion, were reported to be present a fortnight to a month after the occurrence.[1]

After Death.—Further traces left by the means employed may be found, *e.g.*, extravasation of blood underlying bruises, internal wounds, signs of irritation on the mucous membrane of the alimentary canal, presence of poisons, &c. In addition to the signs of recent delivery present during life, others become available, derived from examination of (1) the uterus, and (2) the ovaries.

(1.) **The Uterus.**—This may be found enlarged, the enlargement being greater, the more advanced the period of gestation at which delivery took place, and the less the time which has elapsed since the event. Montgomery gives its dimensions a day or two after delivery at the full term, as 7 to 8 inches by 4 inches, and its weight as 1½ lbs Fourteen days after delivery at the full term, it does not exceed 5 inches in length, and weighs about ¾ lb. If delivery has taken place at five months, the uterus, according to the same authority, will be found immediately afterwards to measure 5⅝ by 3¾ inches; and fourteen days afterwards, 4½ by 2¾ inches. On internal examination within a few hours of delivery at the full term, coagula, or fluid tinged with blood, will be found in the cavity. At the seat of attachment of the placenta, the substance of the organ will be found exposed, showing large valvular openings. The inner surface is extremely dark, almost black in colour, and portions of the decidua, intermixed with flakes of lymph, adhere to it. These appearances also are less marked the earlier the period of gestation, and the longer the time which has elapsed since expulsion of the uterine contents. As already pointed out, twigs of irritant plants, or pieces of stick, may, in abortion cases, be found in the cavity of the uterus, or transfixing its walls.

(2.) **The Ovaries.**—Ordinarily at each menstruation an ovum escapes from the ovary, leaving behind it a cicatrix called a **corpus luteum.** As a rule, this cicatrix undergoes a peculiar development during pregnancy; but does not undergo such development, if the escape of the ovum is not followed by pregnancy. Hence corpora lutea are distinguished as true and false, meaning by a "**true corpus luteum,**" the corpus luteum of pregnancy, and by a "**false corpus luteum,**" the corpus luteum of the unimpregnated female. In some exceptional cases, the development of the cicatrix and its conversion into a body not distinguishable from a true corpus luteum, has been found to occur in the unimpregnated female; and *vice versâ*, in other exceptional cases, no such developed cicatrix has been found in a pregnant female According to Tidy and others, true and false corpora lutea, three weeks after the escape of the ovum, present the same characters, *viz.*, cavities three-quarters of an inch in diameter, containing a reddish-coloured central clot, and having a pale convoluted wall. About one month after the escape of the ovum, the convoluted wall in both becomes bright

[1] Bengal *Med. Leg. Rep.*, 1870-72, p. 297.

yellow, but the false corpus luteum has diminished, while the true corpus luteum has increased in size. In the false corpus luteum, the diminution in size goes on rapidly: at two months it has become "an insignificant cicatrix," and at six months it has entirely disappeared. On the other hand, the true corpus luteum, at two months is seven-eighths of an inch in diameter, its convoluted wall still retains its bright yellow colour, but "the central clot is perfectly decolorised." At six months it is still of the same size; the convoluted wall, although paler, is still yellow; and the central clot "appears fibrinous." At nine months, its diameter has become reduced to half an inch, the yellow colour of the convoluted wall has disappeared, and the central clot "is converted into a radiating cicatrix."[1] Hence, then, the presence in one of the ovaries, of a body possessing distinctly the characters of a true corpus luteum, is strong, but not conclusive, evidence of pregnancy or delivery. The absence of such a body is similarly strong, but not conclusive, evidence to the contrary.

Post-mortem delivery.

In examining the dead body of a female alleged to have miscarried, the possibility of the occurrence of this accident must not be forgotten. *Post-mortem* delivery, owing to the pressure of gases evolved during putrefaction, may occur after death at any period of gestation. It may or may not be accompanied by inversion of the uterus. Inversion even of the non-gravid uterus may occur from the same cause. In the Bengal *Medico-legal Reports* for the three years ending 1872, nine or ten cases of *post-mortem* delivery are cited and several of *post-mortem* inversion of the non-gravid uterus, were reported during this period. For a typical case of *post-mortem* delivery, see the following:

Case CXLVI.—**Post-mortem delivery** (Dr. Wright, Civil Surgeon, Jaunpur, *Ind. Med. Gaz.*, 1887, p. 296).—A Mussulmani, aged about twenty-seven, at about the full term of pregnancy, committed suicide by drowning. Three days after she was missed, her body was found in a well much decomposed, but presenting no signs of delivery. It was left all day lying on the ground in the sun (in June), a woman, a relative, watching it from a little distance. No one touched the body during the day, and the watcher observed no sound or movement in it. In the evening, however, when the corpse was being lifted on to a charpoy (sleeping cot), something was noticed hanging between its legs. At the *post-mortem* examination it was found that "the uterus, with all its contents, had emerged from the vagina, and was turned inside out. The contents were a full-grown male fœtus, with the remains of the membranes, funis, and placenta, all continuous with each other, but detached from the uterus." No attempt to cause abortion had been made, and no signs indicating that any such attempt had been made, were to be seen.

[1] Tidy, *Leg. Med.* ii, p. 124.

CHAPTER XVI.

INFANTICIDE.

"**Infanticide**" is a term popularly used to denote the murder or homicide of a newly-born infant. The law, however, draws no such distinction; infanticide is homicide in law, and the provisions of the law which apply to homicide apply equally to infanticide. But although the law draws no distinction between infanticide and homicide, the subject of infanticide requires special consideration on account of (1) **The frequency of the crime,** and (2) **The special questions which arise.**

(1) CAUSE AND FREQUENCY.

Infanticide is common in almost all countries, the motive being generally to get rid of an illegitimate child, or less commonly, to get rid of a child the parents are too poor to support. In India **two forms** of infanticide may be said to exist, namely, (1) **Infanticide irrespective of the sex** of the child, and (2) **Infanticide of female children.**

As regards the first of these forms of infanticide, the motives leading to it in India are similar to those which lead to it in other countries. Its frequency in India is, however, specially affected by certain social customs; *viz.* (*a*) **Early marriage,** which tends to diminish the frequency of the crime; and (*b*) **Prohibition,** especially among higher caste Hindus, of **widow remarriage,** which tends to increase its frequency. As a consequence, therefore, while in European countries the accused is most frequently an unmarried female, in India the accused is very frequently a Hindu widow.

The second form of infanticide may be said to be special to the East. In India the motives leading to it are: (*a*) Family pride among certain divisions of the warrior caste (Kshatri) notably the Rajputs and Thakurs, and consequent fear that a husband of suitable rank and position may not be found for the girl; (*b*) the extravagant expenditure entailed by custom on the parents at the marriage of a daughter, and (*c*) the disgrace which by social custom is attached to the father of a girl who attains puberty unmarried. Notwithstanding the fact that in India, owing to the exertions of the British Government, this second form of infanticide had been rendered much less prevalent, it was considered necessary in 1870 to pass a special Act for its repression,[1] and even now the crime is far from rare. Some idea of the

[1] Act VIII of 1870. The chief provisions of this Act are as follows:—Power is given to the Local Governments to apply the Act to any district or class, and thereafter (subject to confirmation by the Government of India)

extent to which it was practised may be formed from the facts which came out in the course of an inquiry ordered by Government previous to the passing of the Act. It was found, for example, that in many villages of the Benares district, there were no girls at all. In Mainpuri again, out of thirty villages, in eleven there were no girls ; and in the whole thirty, only 37 girls to 329 boys. Again in the United Provinces, in seven villages inhabited by Rajputs, there were 104 boys to one girl, and in nine other villages 71 boys to seven girls.[1] In Kathiawar and Kutch also the practice largely prevailed ; in the latter province in 1840 "there were only 335 females to 4,912 males of pure Jadeja (Rajput) blood."[2] Further it was shown that where measures for the repression of the crime had been adopted, the result was to greatly increase the number of female children. In Mainpuri, for example, the number of Rajput girls rose in thirteen years from nil to 250, and in the Agra district the number of girls was doubled in a few years.

(2) SPECIAL QUESTIONS IN INFANTICIDE.

It has already been stated that the legal term "homicide" means the destroying of a human being. **According to the criminal law of England,** an infant is not considered a human being until the moment it is completely born ; *i.e.*, completely and wholly external to the mother, irrespective of whether or no it be still attached to the mother by the umbilical cord. Hence, according to English law, the destruction of an infant before its complete birth has taken place, is not homicide.

According to the law of India, however, so far as homicide is concerned, a child is "in being" from the moment "any part of that child has been brought forth, though the child may not have breathed or been completely born."[3] Hence, according to Indian law, killing an infant before any part of it is born is not homicide.

Further, if the result of an act is to cause a child to die after its complete birth, the doing of the act is not punishable as culpable homicide.

Section 315 of the Indian Penal Code states : "Whoever before the birth of any child does any act with the intention of thereby preventing that child from being born alive, or causing it to die after its birth, and does by such act prevent

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to make rules applicable to such district or class : (1) for the registration of births, marriages, and deaths ; (2) for the regulation and limitation of marriage expenses ; and (3) for the establishment of punitive police posts.

[1] Chevers, *Med. Jur.*, p. 755.

[2] These figures in 1873 had risen to 4,272 females to 8,371 males (Cooke on the 'Repression of Female Infanticide in Bombay,' 1875).

[3] "The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child if any part of that child has been brought forth, though the child may not have breathed or been completely born" (*I. P. Code*, *s.* 299, expl. 3.)

that child from being born alive, or causes it to die after its birth, shall, if such act be not caused in good faith for the purpose of saving the life of the mother, be punished with imprisonment of either description for a term which may extend to ten years, or with fine, or with both." This is not so in England: By English law, the doing, before the birth of a child, of a felonious act, the result of which is to cause the child to die after its complete birth, is murder.

INVESTIGATION.

Hence the chief medico-legal questions which arise in cases of alleged infanticide, are: (I) Did this child live after its birth? This question, for the purposes of English criminal law, must be read as if the latter part of it stood, "after its complete birth," while for the purposes of Indian criminal law it must be read as if the latter part of it stood "after any part of it was born." (II) What was the cause of the child's death? and (III) Does this woman exhibit signs of having been delivered (or recently delivered) of a child? These imply examination of the child and of the mother:

EXAMINATION OF THE CHILD.

Did this child live after its birth?

In cases of alleged infanticide, it has always been the practice of the English Courts to require, in order to establish the fact of live birth, much stronger evidence than they will accept as proof of the same fact in civil cases. Moreover in an infanticide case, it is possible that the fact that the child lived after its birth, may be capable of being established by the evidence of ordinary witnesses, *e.g.*, of individuals who saw the child move, or heard it cry. In regard to crying as a proof of live birth, it must be noted that it is possible that a child may be heard to cry before birth, and while its head is still in the uterus (*vagitus uterinus*), or in the vagina (*vagitus vaginalis*). Several authentic cases of vagitus uterinus (Dr. Ogston has collected nine[1]) have been recorded (see *Case* the following), and several others of vagitus vaginalis.

Case CXLVII.—**Vagitus uterinus** (Ogston, *Med. Jur. Lect.*, p. 247).—"In 1834 Dr. Joubert was called to assist in the delivery of a woman with a deformed pelvis, who had had two abortions previously. After strong pains the membranes had ruptured forty-eight hours before his visit. On examining the woman he found the head of the child above the brim of the pelvis, the occiput and face towards the right and left iliac fossæ. The parietal bones had alone entered the

[1] *Lect. Med. Jur.*, p. 247, *et seq.*

brim of the pelvis. The os uteri was dilated to about 2 inches. As the narrowness of the antero-posterior diameter of the pelvis proved an obstacle to the descent of the head, the forceps was applied to it, when, at the moment the operator commenced his attempts at extraction, the fœtus, during some seconds, uttered repeated and distinct cries which were heard by all in the room. After this, while considering whether it would be advisable to bring down the feet, from the little effect produced by the forceps, the cries were renewed as distinctly as before, as from the effect of repeated inspirations. Finally, when introducing his hand in order to lay hold of the feet, the moment it passed over the left shoulder, the fœtus for the third time uttered cries less prolonged than before, yet sufficiently loud to be heard by all present."

In all the authentic cases of vagitus uterinus or vagitus vaginalis, which have been reported, a passage by which air could reach the mouth of the child was provided, by the introduction of the hand or instruments, into the uterus or vagina. Although therefore it must be admitted that a child may be heard to cry before any part of it has been born, there is no doubt but that such cases are extremely rare, and have only been known to occur under the special circumstances stated above. Obviously, also, a child may be heard to cry after the birth of the head and before complete birth; the question, however, whether or no the crying took place after partial, but before complete birth, would not be material in a case of alleged infanticide in India, although it might be so in an English case.

As a rule, however, in cases of alleged infanticide, the only evidence of live birth available, is the opinion of an expert founded on *post-mortem* examination of the body of the infant. In giving such an opinion, the following points must be considered: 1. What is the degree of maturity of the child? 2. Does it show signs of having breathed? 3. Does it show any signs of live birth other than such as are directly due to the establishment of respiration? 4. Does it show signs of having been born dead?

The degree of Maturity of the Child.

In order to establish the fact that infanticide has been committed, the law both of England and of India) requires it to be proved that the child was born alive; not that it was born "viable" or capable of living and being reared. The degree of maturity of the child, however, is a factor which must be taken into account in framing an answer to the question: Did this child live after its birth? because the less the degree of maturity, the less the probability of live birth. Indeed in the case of a child born before the 120th day of intra-uterine life the possibility of live birth may be altogether excluded. (For the characters whereby the degree of maturity can be ascertained, see pages 281 to 286.)

Does this child show signs of having breathed;

When respiration has been fully established **certain changes** will be found to have taken place **in the lungs,** viz. : (1) They alter in appearance and feel ; (2) they increase in weight, and (3) their specific gravity is lowered.

(1.) **Alteration in appearance, &c., of lungs.**—The following table shows the changes produced :—

Before Respiration.	**After** Respiration.
Dark red in colour.	**Bright red** or pink.
Collapsed, occupy only the upper part of the chest, leaving the pericardium exposed. (See Figure 8.)	**Expanded** and nearly cover the pericardium. (See Figure 9.)
Do not crepitate when handled or cut, and exude little blood on section.	**Crepitate** when handled or cut, and exude frothy blood freely on section.
No inflated air vesicles visible, but possibly bubbles of gas due to **putrefaction** present on surface of the lung. These are :—	**Inflated air vesicles** visible on surface of lung. These are :—
(1) **Large and not uniform** in size.	(1) **Small and nearly uniform** in size.
(2) **Not arranged in groups.**	(2) **Arranged in groups.**
(3) **Project considerably** from the surface of the lung, and	(3) **Project only slightly,** or not at all ; and
(4) The gas in them **can be pushed** readily **from place to place.**	(4) **Cannot be pushed** from place to place.

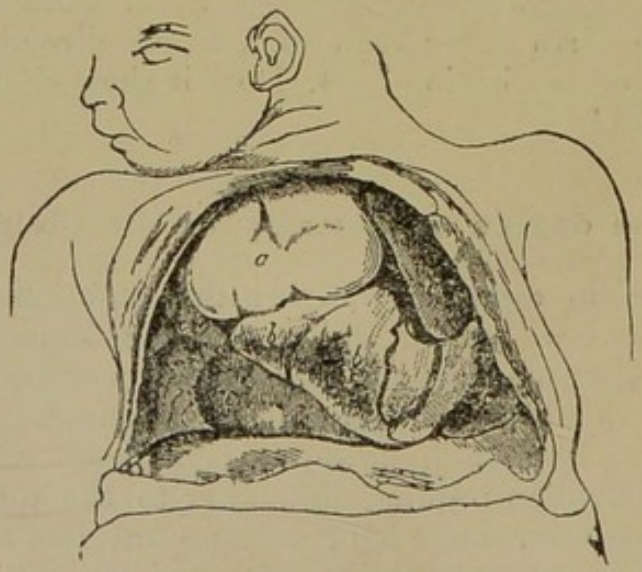

Fig. 8.—Infantile lungs *before* breathing.[1]

(2.) **Increase in weight of lungs,** owing to the increased amount of blood they contain. Hence two tests for establish-

[1] After Guy and Ferrier, p. 118.

ment of respiration have been proposed : (*a*) **The absolute weight of the lungs** (Schmidt's test), and (*b*) **The ratio borne by the weight** of the lungs to weight of body (Ploucquet's test).

As regards the first of these tests Guy (from over 400 cases) gives the following as the average weight of the lungs in mature children : Before respiration, 874 grains ; after respiration, 1072 grains. Individual cases, however, depart so greatly from these averages as to make this test most untrustworthy. Thus, in nine of Guy's cases, the weight of the lungs of children that had breathed was below 874 grains (the average in stillborn children), and in four of the nine below 600 grains. Again, Ogston gives a case where after respiration the lungs weighed only 420 grains. Further, in three of Guy's cases, the weights of the lungs of stillborn children were as follows : 1054, 1480, and 1950 grains, and in two of Ogston's cases, 1180 and 1315 grains. As regards the second test : Ploucquet (from three cases only) asserted that the ratio of the weight of the lungs to the body in mature children was, before respiration, 1 to 70, and after respiration 1 to 35. Extended observations have, however, shown the average ratios before and after respiration to be much closer to one another than this. Thus, Guy (from over 400 cases) found them to be respectively 1 to 57 and 1 to 38 ; Casper (from about eighty cases) 1 to 61 and 1 to 59 ; and Ogston (from sixty-six cases) 1 to 56·4, and 1 to 53·6. Here also individual cases depart so greatly from the average as to make the test untrustworthy.

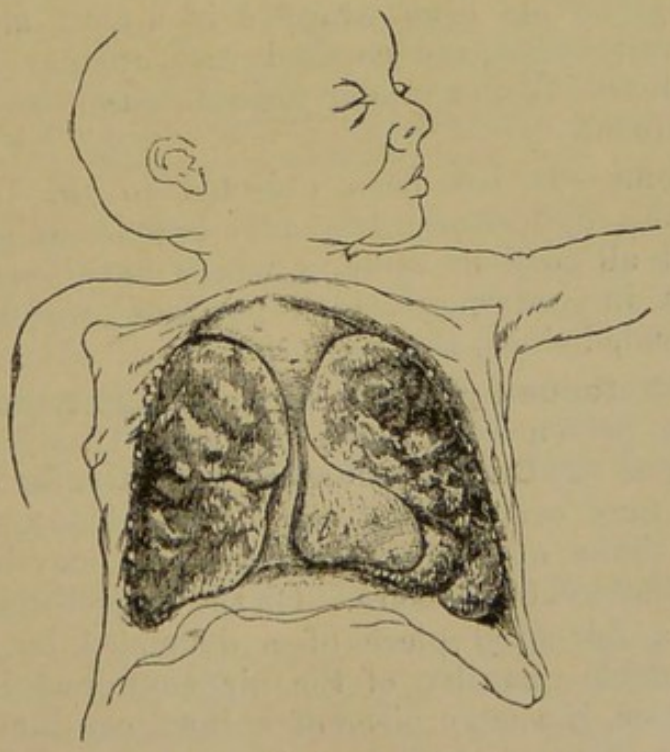

Fig. 9.—Infantile lungs *after* breathing.[1]

Thus, in individual cases, the ratio in stillborn children has been found 1 to 21, 1 to 24, and 1 to 37, and, in seven out of sixty-three cases of children born alive, Casper found the ratio to be between 1 to 74 and 1 to 99.

[1] After Guy and Ferrier.

(3.) **Their specific gravity is lowered.**—In the fœtal condition and before distension with air, the lungs are heavier than water. After distension with air they become lighter than water.[1] Hence if a portion of an undistended lung be thrown into water it sinks, while a portion of a distended lung floats. On this is founded the Hydrostatic test.

The Hydrostatic Test.

Procedure.—The test should be conducted as follows. The water employed should be of a specific gravity, as near 1,000 as possible, *e.g.*, rain-water, or nearly pure water at 60° Fahrenheit.[2] With this a vessel, at least twelve inches deep and eight inches in diameter, should be nearly filled. The lungs with the heart attached having been removed from the body, are to be placed in the vessel, and it is to be noted whether they float or sink. Next each lung detached from the heart, is to be separately and similarly tried ; then each lung is to be cut into about twelve pieces and each piece also tried. Lastly, it is to be noted whether the pieces, if they float, continue to float, after firm but moderate pressure has been applied to them. The pressure may be applied as follows : the pieces of lung having been wrapped in a cloth are placed on a hard floor or a board, and covered with another board. On this upper board the examiner should stand, avoiding any jerking movement.

Objections.—It has been objected to the presumption upon which this hydrostatic test may be said to be founded, (namely, that all portions of lung which have been distended with air float in water, while all portions which have not been so distended sink,) that :—

(1) **Undistended portions of lung may float in water,** owing to the presence in the intercellular tissue of (1) **Air-emphysema,** or (2) **Gases generated by putrefaction.** This undoubtedly may occur. But air or gases present in the intercellular tissue of a portion of a lung, may be expelled therefrom by moderate pressure. On the other hand, moderate pressure on a fair-sized piece of a distended lung, fails to expel any notable quantity of the air contained in its air-vesicles. Hence, if such a piece of a lung continues to float

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[1] Taylor found the sp. gr. of undistended lungs to be 1·04 to 1·05, and the sp. gr. of the lungs of an infant that had breathed to be ·94

[2] Rise of temperature lowers the sp. gr of water ; dissolved solid matters raise it. If the water is nearly pure, and its temperature is about 80° Fahr., about three ounces of common salt dissolved in five gallons of the water will restore its sp. gr to about 1,000. For water at 90° Fahr. the quantity required is about five ounces of salt to five gallons of water.

after moderate pressure has been applied to it, we may infer that the floatation is due to distension of its air-vesicles, and not to emphysema or putrefaction.

When, however, the lungs are in an advanced state of putrefaction, it is possible that moderate pressure may not expel the whole of the gases present in the intercellular tissue ; or may break up the lung tissue and cause expulsion of air from its air-vesicles. Hence it is advisable to refrain from drawing any inference from the floating or sinking of portions of the lungs, when these are in a highly putrid condition. *In situ*, however, the lungs putrefy comparatively slowly, and hence, unless general putrefaction of the body is far advanced, their condition is not likely to be such as to make it unsafe to draw decided inferences from the results of the hydrostatic test.

(2.) **Distended portions of the lungs may sink in water owing to disease,** *e.g.*, congenital tumours, œdema, congestion, hepatization, &c. This is also true. Hence, therefore, if *post-mortem* examination shows the existence of very extensive disease of the lungs, we ought logically to refrain from drawing the inference that no portion of either lung has been distended with air, because all portions sink in water.

Practically, however, as (1) cases of such very extensive disease of the lungs are extremely rare in newly-born infants, and (2) no harm results in criminal cases if the inference drawn is, that the lungs have not been distended ; the objection that distended portions of the lungs may sink owing to disease, may be disregarded.

Inferences.—Given, then, that the following conditions are complied with : (*a*) That the lungs are **not in an advanced state of putrefaction** ; (*b*) That **each lung is cut into** say twelve tolerably equal sized **pieces,** and (*c*) That **firm but moderate pressure** has been applied to each piece ; we may safely conclude that each piece that **sinks has not been distended** with air, and that each piece that **floats has been distended** with air.

Hydrostatic Test as Evidence of Respiration.

Suppose now, conducting the test as directed, we come to the conclusion (each piece sinking), **that no portion of either lung has been distended** with air, we may practically conclude that **respiration has not taken place** because : (1) Although infants have been known to live for several hours after birth without any portion of their lungs having become distended with air, such cases are extremely rare : and (2) In criminal cases, no harm results from drawing the inference that respiration has not taken place.

Suppose, however, conducting the test as directed, we come to the conclusion **that some or all portions of the lungs have been distended with air,** what inference may we then draw as regards respiration? Here it must be pointed out that distension with air may be due either to (*a*) **artificial inflation,** or (*b*) **natural respiration,** and that it is only when the first of these two causes of distension has been excluded, that we may with safety draw the conclusion that the distension observed is the result of natural respiration.

Artificial inflation is, however, **contra-indicated**: (*a'*) **If every portion of either lung is distended,** because it is extremely difficult even by skilled manipulation to effect complete distension of both lungs *in situ*; so difficult, in fact, that Ogston and others entirely deny the possibility of effecting it. (*b'*) **If the lungs on section exude much frothy blood,** and (*c'*) (but this is less reliable) **if the stomach and intestines are free from air.**

Of course, also, **the circumstances of the case may be, and in infanticide cases generally are,** such as to **exclude artificial inflation,** or at any rate skilled artificial inflation; and without skilled artificial inflation, it is extremely unlikely that any extensive distension of the lungs can be produced.

Hence, then, if attending to the precautions specified, we come to the conclusion (every piece floating), that **every portion** of the lungs has been **distended** with air, we practically, in cases of infanticide, may safely infer that **respiration has taken place.**

If, however, we come to the conclusion (some pieces floating and others sinking), that **portions** of the lungs **only** have been **distended** with air; the inference is, that **either artificial inflation** has been effected, or **natural respiration** has taken place. The question to which of these causes the distension is due, cannot be decided by the hydrostatic test alone, and in many cases also cannot be decided without taking into account the circumstances of the case.

The existence in the otherwise distended lungs, of portions in an undistended condition, has been noticed in children in whom natural respiration has been established, and has been described under the name of *atelectasis pulmonum*.

Other evidences of respiration.—If the changes in the lungs indicate that respiration has taken place, confirmatory evidence of this indication may be afforded by the condition of the anterior chest-wall, and condition of the diaphragm. After respiration has been established, the former becomes more arched, and the upper surface of the latter becomes less convex and lies lower. Finding the upper surface of the diaphragm at a level corresponding to between the fifth and sixth ribs, may

be regarded as confirmatory evidence of the establishment of respiration.[1]

Respiration as Evidence of Live birth.

It must be pointed out that **the two questions,** Did this child **breathe?** and Did this child **live after its birth?** are not strictly concurrent, and that a negative or affirmative answer to the first, does not necessarily involve a similar answer to the second, because :—

(*a*) **A child may live after its birth without respiring,** or may respire so imperfectly that it may be impossible by *post-mortem* examination, to obtain satisfactory proof that respiration has taken place.

(*b*) **A child may respire before any part of it has been born.** That this is possible is shown by the fact that cases of vagitus uterinus and vagitus vaginalis have been recorded. Respiration before birth is, however, (1) only likely to occur in a case of face presentation, or under conditions similar to those present in the recorded cases of vagitus uterinus or vaginalis ; (2) extremely rare ; and (3) not likely to be anything more than imperfect, and not likely, therefore, to cause full distension of every part of the lungs.

These two cases excepted, it is obvious that in a criminal case in India, proof that respiration has taken place *de facto*, amounts to proof of live birth, and *vice versâ*.

In criminal cases **in England a third** possibility must be excepted, *viz.:*

(*c*) **A child may respire after partial and before complete birth.** The possibility of the occurrence of this is beyond doubt. Whether, however, this has or has not occurred, cannot possibly be decided by *post-mortem* examination.

Does this child show signs of live birth, other than those directly due to the establishment of respiration?

The most important signs of live birth coming under the above description are :—

(*a*) **Presence of food, e.g., milk, or of drugs in the stomach.** This affords conclusive evidence of live birth.

(*b*) **Complete absence of meconium from the intestines.** In exceptional cases, the meconium is completely expelled before birth ; but, as a rule, its complete expulsion is not effected until some hours after birth. Hence complete absence of the meconium from the intestines, affords strong but not conclusive evidence of live birth.

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[1] The position of the diaphragm should be ascertained from below *before* the thorax is opened.

(*c*) **Exfoliation of the scarf-skin.**—This generally commences about the first day after birth, but sometimes not till later, and may not be completed for a month or more. It is difficult, however, sometimes to distinguish this vital change from peeling of the cuticle resulting from intra-uterine maceration.

(*d*) **Changes in and about the umbilical cord.**—These are: (1) Obliteration of its vessels (the arteries first), commencing about twenty-four hours after birth, and, according to Billard, taking place by concentric thickening. (2) Formation (generally about the third day) of a ring of inflammatory redness round the insertion of the cord, accompanied by thickening, and often by a slight purulent discharge. This ring of inflammatory redness must not be confounded with a narrower red line round the insertion of the cord, often present at birth. (3) Falling off of the cord occurring about the fifth day (in exceptional cases, as early as the second, or as late as the tenth); and cicatrization of the umbilicus, generally complete about the tenth to the twelfth day. Shrinking and withering of the cord commences soon after birth, but not being a vital change, is not a sign of live birth.

(*e*) **Closure of the special channels of fœtal circulation.**—(1) The internal portions of the umbilical arteries (hypogastric arteries); the internal portion of the umbilical vein, and its continuation the ductus venosus. The concentric thickening of these commencing at the umbilicus (see above) continues; at the end of two days, the arteries are contracted for the greater portion of their length, and by the end of the third day the contraction has nearly reached their termination in the iliacs. The vein and ductus venosus contract more slowly, showing only slight contraction for the first three days, which becomes more marked on the fourth day, and is, with few exceptions, complete on the fifth (Guy). (2) The ductus arteriosus. This begins to contract (at the aortic end first) as soon as respiration is established. The contraction extends throughout the whole length usually during the first day. In a week, the channel becomes narrowed to the size of a crow-quill, and it is usually completely closed by the tenth day. (3) The foramen ovale usually closes between the second and the tenth day. **In exceptional cases,** closure before birth has been recorded in the case of the foramen ovale; and within, at any rate, ten minutes of birth, in the case of the ductus arteriosus. No case of closure before birth of the ductus venosus is on record. The foramen ovale sometimes does not close till the end of the second year. Sometimes the foramen ovale, or the ductus arteriosus, remains patent throughout life, giving rise to cyanosis.

(*f*.) **Other signs of live birth** which have been advanced are: (1) Emptiness of the urinary bladder; this is wholly unreliable, and (2) presence of air in the cavity of the tympanum, replacing the gelatinous matter with which this cavity before birth is filled. This indicates that respiration has taken place. As, however, the replacement may not occur for five weeks (Tidy), absence of air from the cavity of the tympanum is wholly unreliable as a sign of still-birth, or of death soon after birth.

Certain of the foregoing signs of live birth may be utilized for the purpose of determining how long a child has survived its birth (see following *tables*).

PROPORTION of CASES in which the FORAMEN OVALE and DUCTUS ARTERIOSUS HAVE BEEN FOUND OPEN at VARIOUS PERIODS AFTER BIRTH.

The third column shows (calculated from Tardieu as quoted by Tidy) the proportion of cases in which separation of the cord was found to have taken place (Guy).

Day.	Foramen Ovale open in cases, per cent.	Ductus Arteriosus open in cases, per cent.	Cord separated in cases, per cent.
1	74	68	...
2	68	59	3
3	64	68	17
4	63	63	40
5	45	52	70
6	...	...	90
7	...	...	95
8	25	15	97

CHANGES WHICH OCCUR DURING the FIRST FEW DAYS AFTER BIRTH (Tidy).

Period after birth.	Conditions observed.
A few minutes to some hours	The stomach contains a frothy fluid, and clots will be found in the vessels of the umbilical cord.
After 24 hours ...	Concentric thickening of the umbilical arteries near umbilicus.
After 2nd day ...	Contraction throughout the greater part of the umbilical arteries. Epidermis beginning to exfoliate.
After 3rd day ...	Umbilical arteries contracted throughout. Slight contraction of the umbilical veins. Formation of inflamed ring round cord.
After 4th day ...	Cord separated.
After 5th day ...	Contraction of umbilical veins complete.
After 7th day ...	Ductus arteriosus contracted to size of a crow-quill.
8th to 10th day ...	Fœtal circulatory openings obliterated.
10th to 12th day ...	Osseous centre of lower femoral epiphysis larger in diameter than $\frac{1}{4}$th or $\frac{1}{3}$th of an inch. Cicatrization of umbilicus. (If the umbilicus be healed, it indicates life for about 21 days.)

Does this child show signs of having been born dead?

The body may show signs of intra-uterine maceration.

This is readily distinguished from ordinary putrefaction. In intra-uterine maceration (1) The odour exhaled by the body differs markedly from the odour of ordinary putrefaction. (2) The skin is coppery red, or flesh-coloured, not green. (3) The bones are more or less separated, and the body is flaccid; the head, thorax, and abdomen flattening out when the body is placed on a level surface. It must be recollected, however, (*a*) That when death has occurred shortly before delivery, signs indicating intra-uterine maceration will be absent; and

(*b*) that after delivery, ordinary putrefaction may supervene and mask the appearances resulting from intra-uterine maceration. Hence, therefore, while the presence of distinct signs of intra-uterine maceration amounts to positive proof of still-birth, no inference can be drawn from the absence of such signs.

What was the cause of the child's death ?

Was the child's death due to (*a*) natural causes, (*b*) violence, or (*c*) neglect or omission.

(*a*) DEATH FROM NATURAL CAUSES.

Children are frequently born dead from natural causes. **Still birth is more frequent** (*a*) in first than in subsequent pregnancies, (*b*) in male than in female children, and (*c*) among illegitimate than among legitimate children.

Statistics show the proportion of still to live births to be about 5½ per cent. of the total number of births, and to be (*a*) about 9 per cent. in first as compared with about 3·2 per cent. in other pregnancies; (*b*) about 5·8 per cent. in male as compared with about 4·7 per cent. in female children; (*c*) about twice as great among illegitimate as among legitimate children.

Death from natural causes may be due to :—

(1.) **Immaturity and consequent debility.**—When a child is born alive, and dies after its birth, solely in consequence of debility arising from its want of maturity, the question arises, Was the premature delivery, as a result of which the child was born immature, criminally induced or not ? If criminally induced, an offence has obviously been committed. By the law of India, however, this offence is not punishable as culpable homicide.[1]

On the other hand, according to the law of England, provided, of course, the child lived after its complete birth, the offence which has been committed is murder.[2]

(2.) **Debility not due to immaturity.**—A mature infant free from disease, may die from debility, and consequent inability to continue breathing. In such a case the lungs will most probably be found, at any rate in parts, imperfectly distended and portions may be found in a condition of atelectasis (see p. 310).

(3.) **Disease.**—This may be **general disease**, *e.g.*, small-pox, syphilis, or cancer; or **local disease**. If the latter, the seat of the disease may be the lungs, brain, or heart.

1. **Congenital disease of the lungs.**—This, according to Guy, may be (*a*) hepatization—red or grey—from pneumonia before birth;

[1] See *Penal Code*, sect. 315, p. 353.
[2] See case of *R.* v. *West*, Taylor, *Med. Jur.*, ii, p. 313.

(*b*) pulmonary apoplexy ; (*c*) tubercle ; (*d*) œdema ; or (*e*) Devergie's œdema lardaciforme.

2. **Congenital disease of the brain** and cord may be (*a*) morbid softening, "but it must be borne in mind that the brain of the fœtus is naturally soft and vascular ;"[1] (*b*) effusion of blood (apoplexy) into the substance, cavities, or on to the surface of the brain ; or (*d*) effusion of other fluids, *e.g.*, serum or pus.

3. **Congenital disease of the heart** or large vessels is rare in infancy. Tidy also mentions uric acid infarction, *i.e.*, blocking of the kidney tubes with uric acid or urates, as a cause of infant mortality.

Obviously *post-mortem* evidence of the existence of disease does not necessarily prove death therefrom : much must depend on the extent of the diseased condition.

(4.) **Malformation.**—Death may be due to a congenital malformation, *e.g.*, of the heart or large vessels ; or of the alimentary canal, such as an imperforate gullet or anus. No amount of malformation or monstrosity justifies the destruction of the infant.

(5.) **Hæmorrhage from apertures of the body** may cause death, *e.g.*, from the genitals of a female infant, or from the rectum. Two cases of death from the last-mentioned cause are recorded by Casper.

(6.) **Protracted or complex labour** frequently results in the death of the infant. The immediate cause of death may be—

1. **Accidental violence** to the body of the child (see p. 316).

2. **Exhaustion from protracted labour.**—Death from this cause is frequently accompanied by marks of violence on the body of the child, especially on the head, but may not be so accompanied. Protracted labour is more common in first than in subsequent deliveries ; and the greater the disproportion between the size of the child and that of the mother's pelvis, the more likely is labour to be protracted. Male children are generally larger than female children ; hence more male than female children die during delivery.

3. **Fœtal asphyxia.**—Asphyxia may occur before birth owing to premature separation of the placenta, or be due to (*a*) **the death of the mother**, or (*b*) **obstruction to the flow of blood through the cord**. With reference to (*a*), Tidy remarks that there is more chance of saving the child when the mother has died suddenly, than when her death has occurred slowly. Garezky concludes that in most cases infants are more or less asphyxiated after the first minute, but that they may be extracted alive in a more or less asphyxiated condition, up to twenty-six minutes after the death of the mother. Harris considers that a child may live still longer (one to two hours). From Tidy's summary of 379 cases of *post-mortem* Cæsarean section, it appears that in 81·3 per cent. of the cases the children were dead when extracted,

[1] Guy, *For. Med.*, p. 114.

and in 9 per cent. distinctly alive, but of these only one-seventh lived for any length of time. **As regards** (*b*), **the obstruction** to the flow of blood may be due to **pressure on the cord** from abnormal presentation, *e.g.*, foot or breech, or from prolapse of the cord. Scanzoni gives nearly 55 per cent. as the mortality in cases of prolapse of the cord. Again, the obstruction may be due to the **accidental formation of a tightly drawn knot** on the cord: two knots even have been found; and lastly, the obstruction may arise from spontaneous rupture of the cord during delivery.

(*b*) DEATH FROM VIOLENCE.

Death from violence may be the result of **accident**, or the violence may have been inflicted **intentionally**; if the latter, under Indian law, it will be a material question whether or no death resulted from an act done before the birth of the child (see p. 353). Again, death from violence may be due to **mechanical violence, or to poison**; in the former case, the mode of death may be **asphyxia**, from suffocation, drowning, or strangulation; or **coma**, from head injury: or **syncope**.

(1.) **Asphyxia from suffocation.—Accidental suffocation** may occur in many ways, *e.g.*, from the head being born enveloped in the membranes; from pressure of the child's face against soft bedding; from the child being overlaid by some one in the same bed; from some spasmodic retraction of the tongue; or from accidental entry of particles of food into the air-passages: **Intentional suffocation** is a frequent mode of infanticide. The following are the more commonly adopted methods:

(1) drawing the membranes tightly over the child's head; (2) closure of the mouth and nostrils by the hand or a cloth; (3) stuffing mud or rags into the mouth, or plugging the fauces with a piece of cotton-wool, sometimes, in India, smeared with mustard oil; (4) rolling the tongue back into the throat; (5) burying the child's face in bran, or in mud, cow-dung, or other matters. Any matters found in the throat of the infant, should be carefully examined and preserved.

(2.) **Asphyxia from drowning.—Accidental drowning** (or suffocation) may occur from the infant falling into a privy or cesspool, owing to the mother being suddenly delivered while in the act of defæcation: this may occur even in primiparæ. Finding the cord torn across,[1] not cut, supports the supposition of the occurrence of such an accident. Accidental drowning may also occur from the infant, at the time of delivery falling face downwards into the mother's discharges. **Intentional drowning** is sometimes resorted to. In some parts of

[1] Usually about two inches from the navel (Guy).

India, immersion of the child's face in milk is a common method of infanticide.

(3.) **Asphyxia from strangulation.—Accidental strangulation** may occur from the funis becoming tightly coiled round the neck of the child, or, in rare cases, by the spasmodic contraction of the os round the neck of the child. **Intentional strangulation,** by the fingers, funis, or other ligature, is a frequent form of infanticide. As before mentioned (see *Hanging and Strangulation*), if the ligature employed is a soft one, *e.g.*, the funis, no mark may be left on the neck. Casper points out that natural folds on the skin of the neck, especially of fat infants, somewhat resemble marks caused by a ligature. Close examination and dissection of such marks, however, will show no extravasation and no condensation of tissue.

If the **post-mortem appearances** show that death has been due to **asphyxia,** much will depend on the absence or presence of **marks indicating** that the asphyxia has been **due to violence. If all such marks are absent,** death may have been the result either of accident or intention ; it is not possible from the *post-mortem* examination to say which. **If such marks are present,** much will depend on what they are. Some of themselves strongly indicate intention, *e.g.*, finger-marks on the throat, or rags, &c., firmly impacted in the fauces. Others are consistent with either accident or intention, the probabilities being more in favour of intention than accident, if the amount of violence has been great. A torn cord supports the supposition of accident.

(4.) **Coma.—Death from coma, due to head injury,** may occur before labour, during labour, or after delivery.

1. **Before labour.**—In very exceptional cases fracture of the skull of the fœtus in utero has been caused by violence applied to the body of the mother. Thus, Ogston (p. 269) mentions a case where a fracture of the right parietal bone, one inch in length, resulted from the mother, during a fit of hysteria, falling out of bed four weeks before delivery (see also *Case CXLVIII*). Great violence may, however, be applied to the body of the mother without injury to the fœtus.

Case CXLVIII.—**Fractures of the skull of a fœtus in utero caused by a fall** (quoted by Casper, iii, p. 115, on the authority of Maschka.—A woman towards the end of the eighth month of her pregnancy leaped down from the second story, broke both her thigh bones, and died in six hours. On the fœtus in utero there were several fractures of both parietal bones, with extravasation of blood and coagula both on the external surface and within the cranial cavity.

2. **During labour.**—Pressure on the head from expulsive efforts during delivery may cause death from coma, either without or with fracture of the skull. The first, and much the most common case (without fracture), is the most frequent cause of death during delivery. In such

cases, inside the cranium will be found congestion of the brain and its membranes, and in rare cases extravasation of blood. Outside the cranium a serosanguinolent tumour (*caput succedaneum* or *cephalhæmatoma*) frequently forms. Extravasations of blood under the scalp, due to pressure on the head, are, it should be noted, larger in size and more irregular in outline than the punctiform ecchymoses which occur under the scalp in cases of suffocation (see *ante*, page 89). Cases of fracture of the skull by expulsive efforts during labour are recorded, but such fractures are rarely more than mere fissures, generally of the parietal, less frequently of the frontal, bone. Defective ossification of the cranial bones, obviously favours the production of such fractures. **Injury to the head may be the result of efforts to effect delivery.**—If the result of the mother's own efforts, the skull is not likely to be more than slightly fractured. Extensive injury may obviously be produced by the use of instruments; and considerable injury may be produced without the use of instruments, by ignorant efforts to aid delivery (see *Case CXLIX*).

Case CXLIX.—**Fracture of an infant's skull from attempts to aid delivery** (Taylor, *Medl. Jur.*, ii., p. 404).—Dr. Hicks was called by a midwife to aid the delivery of a woman. On examination he observed that the skull was fractured through the parietal bone of one side, and there was a slight fracture of the edge of the occipital bone, with a scalp tumour. The head of the child was at the brim of the pelvis, and the fractures had been produced by the midwife in her attempts to push the head back into the cavity.

3. **After delivery.**—If a woman is delivered in an erect position, and the child falls on a hard floor, fatal injury to the head, with or without fracture to the skull, may occur. The possibility of this is shown (*a*) by the fact that several cases of this accident have been recorded (see Taylor, ii., 399); and (*b*) by Casper's experiments on the bodies of infants, which conclusively prove that a fall from a height of 30 inches suffices to cause fracture of the skull. In every one of Casper's experiments, twenty-four in number, fracture was actually produced; confined, however, to the temporal bones in twenty-two out of the twenty-four cases. As before noted, sudden delivery, leading possibly to such an accident, may occur even in primiparæ (see *Case CL*).

Case CL.—**Sudden delivery in a primipara** (Taylor, *Med. Jur.*, ii., p. 399, from *Lancet*, i. 1854, p 1854, p. 637).—M. C., *æt.* twenty-three, single, was suddenly delivered of a full-grown male child at 5-30 A.M. She stated that between 4 and 5 A.M. she felt griping pains. She suspected that her labour was coming on, and walked to a friend's house 600 yards distant to be confined. When she had proceeded half-way, she was suddenly delivered while in the erect position, and her child fell upon the pavement. The navel-string was ruptured transversely 4 inches from the navel, and the placenta was expelled. She walked to the place where she intended to be confined carrying the child, which she had wrapped in a petticoat. *This was her first child;* it was well nourished and healthy-looking. The only injury it had sustained by the fall was on the left parietal bone at the junction with the coronal suture; there was here a soft tumour between 2 and 3 inches in its transverse diameter, which was slightly ecchymosed. Both mother and child did well, and the tumour entirely disappeared at the end of three weeks. The cord was tied after the woman's arrival at the house.

Finding the cord torn across (see p. 369) supports the supposition that such an accident has occurred. The length of the cord is important in such cases, and should, if possible, be ascertained, fracture being more likely to occur if the cord be short. The average length of the cord is eighteen to twenty inches ; it, however, has been found as short as four to six, and as long as fifty-four inches. **Intentional violence** to the head is a common mode of infanticide. In homicidal cases the amount of violence employed is usually very great.

On the whole, therefore, if death has resulted from injury to the head, and there is **no fracture or punctured wound** of the skull, it is almost certain that death was due to **accident. Slight fractures** of the skull bones are also perfectly consistent with **accident. Extensive injury** to the head is strongly in favour of **homicide**, especially if accompanied by a cut cord, and unaccompanied by severe injury to the mother.

(5.) **Syncope or shock.**—This may occur from (1) hæmorrhage from the divided cord ; (2) external wounds ; (3) fractures or other internal injuries.

1. **Hæmorrhage from the divided cord** is more likely to occur (*a*) when it has been cut across with a sharp instrument, than when it has been divided with a blunt one or torn asunder ; (*b*) when it has been divided close to the umbilicus ; (*c*) when it has been divided almost immediately after birth ; and (*d*) when it is thick and gelatinous. **Fatal hæmorrhage from the cord** may possibly but not necessarily occur. (*a*) **If the cord has not been tied**, and may occur even if the cord has been torn and not cut. Spontaneous rupture of the cord may occur during delivery ; the usual mode of death from this accident is, however, asphyxia, not syncope. (*b*) **From the ligature not being tied sufficiently tight**, or from its slipping ; or (*c*) **From the navel after separation** of the cord (secondary hæmorrhage).

Obviously, **when the cause of death is primary hæmorrhage** from the divided cord, it is important to note (*a*) whether or not the free end of the cord appears to have been cut, and (*b*) whether or not a mark of a ligature is present.

2. **External wounds.**—Death from syncope or shock, the result of external wounds, is usually homicidal. Fatal external wounds may, however, be the result of accident, *e.g.*, from broken utensils, or the result of an obstetric operation. The nature of the injury may show whether it is the result of accident or design. Fatal injury, it may be noted, may be caused by wounds which leave hardly any external mark, *e.g.*, the thrusting of a needle through the fontanelles, the temples, under the upper eyelid and through the orbital plate of the frontal bone or through the back of the neck into the spinal cord or brain, or the thrusting of a sharp instrument down the throat or up the rectum. Cases have occurred of the employment of each of these methods. Such injuries obviously strongly indicate homicide ; but Ogston,[1] it should be mentioned, records a case of death from accidental thrusting of a small pin through the anterior fontanelle.

[1] Lect. on *Med. Jurisp.*, p. 268.

3. **Fractures or other internal injuries.**—Just as fracture of the skull may occur before, during, or after delivery; so fractures of other bones, or dislocations of joints, may similarly occur. Cases even are recorded of women, who have met with no accident during pregnancy, being after an easy labour, delivered of an infant with more than one of its long bones fractured or dislocated. Fractures or dislocations are not likely to prove immediately fatal, unless the neck be the seat of the injury. Twisting the neck is a frequently employed method of infanticide. Very great force is required to effect this, and hence death from this cause strongly indicates homicide. In one case a woman in her unaided efforts to effect her own delivery, the case being one of breech presentation, employed so great an amount of force, apparently without homicidal intent, as to tear the body of the child completely away from its head.[1]

(6.) **Infanticide by poison.**—In India poisoning by **opium** is said to be a commonly employed method of infanticide; and it is alleged that in some cases a peculiar mode of administration is adopted, *viz.*, smearing the mother's nipples with the drug. Opium is largely used (in India as crude opium, and in Europe in the form of syrups containing opium) by women of the lower classes and by nurses (*ayahs*) to keep young children quiet. Hence accidental cases of the poisoning of young children by opium are of common occurrence. Other poisons said to be used in India for the purposes of infanticide are arsenic tobacco and '*madar*' (*Calotropis sp.*), which see.

Taylor mentions cases of intentional poisoning of young children by arsenic, sulphuric acid, and phosphorous scraped from the heads of lucifer matches. Accidental poisoning of young children by arsenic has been known to occur, as, for example, in a recent case in England,[2] where a number were poisoned by the external application of arsenious oxide, introduced as an adulterant into "violet powder." It must not be forgotten that in new-born infants, *post-mortem* appearances simulating those of irritant poisoning, are sometimes met with as the result of disease, *e.g.*, injection of the mucous membrane of the œsophagus, and ulceration of that of the stomach and intestines. Such appearances have been met with in the bodies of plump and fat children.[3]

(*c.*) DEATH FROM NEGLECT OR OMISSION.

Omission or neglect may be culpable.—*S.* 32 of the Indian Penal Code states: "In every part of this code, except where a contrary intention appears from the context, words which refer to acts done extend also to illegal omissions." Death from neglect or omission may be accidental or intentional, and causing death by an intentional and illegal omission may

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[1] *Beng. Med. Leg. Rep.*, 1870–7. p. 314. [2] See *Arsenic*, Chap. XXIII.
[3] Ogston's *Lect., Med. Jur.*, p. 272.

or may not amount to murder. **The principal forms of neglect or omission** likely to cause death are—

1. **Omission to provide assistance during labour.**—This may result in the death of the infant from suffocation, head injury from a fall, hæmorrhage from a ruptured cord, &c., &c. (See *Death from Violence*). Two questions which may arise in such cases are: (1) Is it possible for a pregnant woman to remain ignorant of her state up to the time of her delivery? That this, in exceptional cases, is possible, has already been pointed out (see *Pregnancy*, p. 268); and (2) Would a newly-delivered woman be capable of the exertion necessary to save the life of her child? As regards this second question, it may be remarked (*a*) that in rare cases women have been delivered during profound natural sleep (see *Case CLI*); and (*b*), that in some cases women have been known to go through a considerable amount of exertion immediately after delivery (*see* following case). As a rule, however, a newly-delivered woman is capable of but little exertion.

Case CLI.—**Unconscious delivery during sleep in a primipara** (Chevers, *Med. Jur.*, p. 767).—Dr. W. Case, of Chicago, attended a primipara whose delivery took place during profound sleep. During the day on which delivery took place she had been feeling unwell, but attributed this to over-fatigue on the previous day. Delivery took place rapidly, and the woman after it was complete, woke up in a fright, having dreamt that something was the matter with her.

Case CLII.—**Exertion after delivery** (Chevers, *ibid*, p. 745).—A Brahman widow, after walking two miles, was delivered of a mature male child, and leaving it in the dry bed of a stream, walked back to the house from which she had started. She was tried for exposing her infant, and the Judge held that the facts of the case were inconsistent with her defence, *viz.*, that she was in bad health at the time, and from bewilderment and pain was unaware of what she was doing.

2. **Omission to tie the cord after dividing it.**—If a woman has been delivered without assistance, proof that the cord has been cut, not torn, indicates that ability existed after delivery for a certain amount of exertion. This, taken with the other circumstances of the case, might support the supposition that the omission to tie was intentional. Previous to examining the cut end of the cord, this, if dry, should be softened in warm water. A clean smooth edge indicates that the cord has been cut; a ragged edge may be the result of division with a blunt instrument or rupture.

Chevers gives the following description of the manner in which the umbilical cord is divided and dressed by native women in this country. In many parts the cord is not divided until after the placenta, or after-birth, has come away. It is only tied with one ligature, near

the child, and, before tying, the blood is either pressed towards the child or towards the placenta, according as the child seems lively or otherwise. The cord is generally divided by a piece of bamboo, and a fact of the cord being found with jagged edges is therefore no proof of neglect. In order to induce the mother to bring forth the after-birth, it is usual to put some hair into her mouth. This causes her to try and vomit, and the effort brings away the placenta. It is also usual to observe certain religious ceremonies before cutting the cord. A case is quoted (Niz. Ad. Report, N.-W. P., Feb. 1853), in which a female mendicant, of weak intellect, at Jaunpore, gave birth to a female infant, which she left in some straw where she had slept and went begging. The civil surgeon examined the body, and could find no apparent cause of death. He considered it was probably caused by neglect, as the navel string had not been severed, the after-birth being still attached. The child had breathed, but death probably took place very shortly after its birth.

3. **Omission to supply the infant with food or to protect its body against cold** may cause its death. In the first case, absence of all signs of the presence of food in the alimentary canal may, it is possible, indicate the cause of death. In the second case, there may be no distinctive *post-mortem* appearances present. Sometimes this omission takes the form of "abandonment" of the infant. This is an offence, even if death does not result, for by *s.* 317 of the *Indian Penal Code*, "Whoever being the father or mother of a child under the age of twelve years, or having the care of such child, shall expose or leave such child in any place with the intention of wholly abandoning such child, shall be punished with imprisonment of either description for a term which may extend to seven years, or with fine, or with both." For a curious legal point arising under this section (see *Case CLIII*, *R.* v. *Bejoo*).

Case CLIII.—**Alleged abandonment of an infant** (*R.* v. *Beejoo*, 1st Mad. Sess. 1869, Mayne's '*Penal Code*,' p. 275).—In this case the following facts arose: A, the mother of a newly-born child, being herself too ill to move, sent B to expose it. It was held by Scotland, C. J., that A could not be convicted under this section (*s.* 317) as she had not actually exposed the child, nor B as she was not the mother. Also, that neither A nor B could be indicted for abetting the other, since as neither could have committed the offence there could be no abetment by the other. Of course, a person who has the custody of a child merely for the purpose of exposing it, cannot be indicted as a person "having the care of such child."

Lastly, by *s.* 318 of the *Indian Penal Code*, it is an offence "by secretly burying or otherwise disposing of the dead body of a child, whether such child die before, or after, or during its birth," to intentionally endeavour to conceal "the birth of such child." Women are frequently convicted under this section when the evidence fails to support a graver charge.

EXAMINATION OF THE ALLEGED MOTHER—Signs of Delivery.

The signs of previous delivery, in cases where the signs of recent delivery are absent, have already been discussed (*see* p. 287). The question may, therefore, now be limited to recent delivery. Does this woman exhibit signs of having been recently delivered of a child? **On examination during life** of a woman who has recently been delivered of a mature, or nearly mature, child, **the following signs will usually be found:**—

(1.) **A general appearance of indisposition.**—This, however, may be present in women, who have not been recently delivered as the result of any severe illness. Again, this sign may be absent in women who have been recently delivered. Some women, especially those accustomed to labour, appear to be constitutionally but little affected by delivery, and are capable immediately afterwards of resuming their work or undergoing severe exertion. Chevers,[1] on the authority of Ward, states that poor women in the northern parts of Bengal are known to attend to the business of their families the day after delivery; and that sometimes a mother is delivered while at work in a field, carries home the child, and returns there to work the next day. For an instance of very considerable exertion directly after delivery (see *Case CLII* above).

(2.) **Organs of generation swollen, contused, or even lacerated.**—A laceration of the fourchette is usually found after delivery in primiparæ. The os uteri also may be found lacerated, and is dilated and soft. The uterus is enlarged; and, Ogston[2] remarks, may for the first two or three days be found to undergo alternate contraction and relaxation under pressure of the hand applied to the abdomen. **The abdominal parietes** are relaxed, the lineæ albicantes apparent, and a dark line is seen extending from the pubes to the navel.

(3.) **Breasts**, as in advanced pregnancy, are full and prominent, and the nipples surrounded by well-marked areolæ. Milk will be found exuding from the nipples.

(4.) **Lochial discharge.**—The presence of this discharge is the most characteristic sign of recent delivery. It is at first coloured with blood, afterwards becomes brown or green, and has a peculiar odour. The discharge may become almost wholly suppressed about the third or fourth day under the influence of the milk fever, returning when this has subsided. It usually lasts a week to a fortnight, but may continue longer. Ogston[3] states

[1] *Med. Jur.*, p. 744. [2] *Lect. Med. Jur.*, p. 155. [3] *Ibid*, p. 158.

that in some instances the lochia have been known not to appear at all.

Many of these signs may be present as the result, not of delivery, but of uterine or ovarian **disease**. No conclusion can, therefore, be safely drawn, unless all, or nearly all, the signs of recent delivery be present. As a rule, the signs of recent delivery cease to be distinguishable after the eighth to the tenth day ; and the stronger the woman, and the less severe the labour, the more likely are they to disappear rapidly. The earlier the period of gestation also, at which delivery has taken place, the less marked will be these signs and the more quickly will they disappear. For further signs of recent delivery, ascertainable on *post-mortem* examination (see *Causing Miscarriage*, p. 300).

CHAPTER XVII.

MEDICAL RESPONSIBILITY AND MALPRAXIS.

In a case of criminal wounding the position of the surgeon in charge of the case is one of great responsibility, for if the wounded person dies, the surgeon may be blamed for his treatment. It may be alleged by the defence, on the one hand, that any operation the surgeon may have done contributed to or caused the fatal result, or, on the other hand, that the death would not have occurred if a certain operation had been performed. A similar question may also arise with reference to medical treatment and nursing. What the law requires of a medical man in the treatment of a case is only that he will exhibit "reasonable skill and care." An operation in criminal wound-case, or for producing justifiable abortion (*see* p. 291), should never be undertaken except with the object of saving life; and before performing it another surgeon should, if possible, be consulted so as to share your responsibility. Where this latter course is not possible, as in isolated country towns, the surgeon should use his utmost skill, and this is all that the law requires of him.

Deaths under chloroform, or other anæsthetic administered for the purpose of performing an operation would be judged of in the same way, namely, "was the anæsthetic necessary" and "was it administered with reasonable skill and care?"

In every case where an operation is performed, the consent of the patient, or of his guardian if a minor or unconscious, must first be obtained.

'**Malpraxis**' is the want of reasonable skill and care on the part of the medical attendant whereby the person under treatment sustains damage to health or life or limb. The 'skill' demanded by the law is not of a high or specially expert kind; but such ordinary skill as is expected from a duly qualified practitioner:—

Case CLIV.—**Ordinary not eminent skill to be expected** (*Gibbs v. Tunaley*).—It was ruled that the jury were not to expect the same amount of eminent skill in a country practitioner as is to be met with in large towns; but they had a right to expect from him the usual and ordinary amount of skill, care, and attention, which, it was only reasonable to suppose, he would possess; and if, in the discharge of his

duty, he applied his professional skill and knowledge to the best of his ability, then, however unfortunate the termination of the case, he was not to be held responsible. The case was one for damages, but this ruling would probably apply to the treatment of a wound; and if death followed, even if the treatment could be shown to be not as good as might have been obtained elsewhere, the person who caused the wound, and not the medical man, would be held responsible for the death.—*Norfolk Lent Assizes*, 1846.

In fractures and dislocations, it is well to use the **X-rays** to prove that fixation and reduction have been accomplished, or if not, the surgeon should have written proof that he suggested its employment to the patient and was refused its aid. The skiagraph, however, can never form the basis upon which the amount of damages is assessed. That will depend, as formerly, upon the functional disability and loss which the patient has sustained. Whenever a skiagraph is introduced as evidence, the defendant should demand the privilege of having a similar examination made and should employ expert testimony to fully explain its meaning to the jury.[1]

The treatment followed should be of the recognised or established kind, and no new form of treatment of the nature of an experiment should be practised without the consent of the patient or guardian.

The 'care' should be of such an actively attentive kind as never to give reasonable excuse for a charge of neglect or carelessness. Cases have occurred of syphilis and puerperal fever having been conveyed by a surgeon through carelessness.

Continuance of Attendance.—Even in ordinary civil practice it is necessary for the practitioner at times to protect himself against possible charges of neglect made by an unreasonable patient or his friends, when the surgeon has been called in casually to see the case and has not been definitely asked to continue to attend it. It is well, therefore, in such instances, to take the precaution of getting such people to record definitely in writing whether they desire him to attend the case or not. Once he undertakes to attend the case, he is bound to continue his visits as long and as frequently as the requirements of the case may demand, and he is held to determine when his visits may safely be discontinued, though he is always at liberty to discontinue his attendance at any time by giving reasonable notice of his intention to do so.

An **Assault** has sometimes been alleged against the surgeon for his examining, at the instance of the police or others, a female alleged to be pregnant or the victim of rape. In such cases

[1] Dr. Leonard in *Medical News*, February 23, 1901.

therefore the consent of the party should invariably be first obtained, and the examination be made in presence of a third party. Moreover, the surgeon should not himself undress the female.

If a medical man unnecessarily strip a female patient naked under the plea that he cannot otherwise judge of her illness, it is an assault if he himself takes off her clothes (*R.* v. *Rosinski*, 1 Mood, C.C., 12).

The obligation **of Secrecy** in regard to the privileged communications of patients has already been referred to (p. 13). The State obliges medical men to notify certain **contagious diseases** and sudden deaths under suspicious circumstances. As regards the obligation of a surgeon called to a patient who has attempted to commit **Suicide**, he would, of course, attend to the patient as long as he remains under his care, but no legal obligation rests upon the practitioner to report to the authorities, as the attempt to commit suicide is by statute declared to be a misdemeanour, and not a felony. If, however, the patient dies, he should acquaint the coroner, or request the friends to do so.

CHAPTER XVIII.

Insanity or Lunacy.

The general tendency of all mental disorders being to disturb the balance of social environment, it frequently expresses itself in the form of crime. To guard against this, the law places persons of unsound mind under restraint, and the medical jurist is chiefly concerned with the diagnosis and certifying of the fact of insanity.

An insane person is not held responsible for any crime he may commit, and insanity may be accepted as a reason for divorce or for contesting a will. The plea of insanity is sometimes set up dishonestly by the defence in criminal cases to try to escape from the prescribed punishment which would otherwise be imposed by law as a deterrent to sane persons of criminal tendencies—for the safety and security of society is the true object of all legal punishment. While there is thus a danger in too readily acknowledging the presence of insanity as an excuse for crime, the plea of insanity might perhaps in the interests of society be set up oftener, as the most serious criminal, the congenital or instinctive criminal is morally insane, and the community would be better protected against an insane criminal by his permanent incarceration in an asylum than by his being sentenced to a term of imprisonment, after which he is set at large again.

According to modern socialogists all crime is due to a latent or active neurosis or physical defect or degeneration of the brain. Criminals are divided by Lombroso and the Italian School into (1) the **political** criminal, who may be, as Lombroso calls him, "the true precursor of the progressive movement of humanity," and may be the hero, martyr, or even saint of another land or age; (2) the **criminal by passion**; usually distinguished by a previous honest life and genuine remorse, he never becomes a recidivist—his crime is usually a solitary event in his life; careful examination, as a rule, fails to show any striking evidence of abnormality, degeneration, or hereditary taint in the political criminal or criminal by passion; (3) the **occasional** criminal, who has an element of innate criminality which leads him to commit crime when an opportunity offers—bad heredity is common in this class; (4) the **habitual** or professional criminal, who deliberately adopts a career of crime, and commits it either helplessly, the degenerate class, or with great intelligence, the aristocracy of criminality; (5) **instinctive** or **congenital** criminals (*criminel-né* of the French,

delinquente-nato of the Italian). Lombroso identifies the instinctive criminal with the moral insane. Criminals of this class form only a small percentage of the prison population, but they are the most serious proportion. They frequently present well-marked physical and psychical signs of abnormality, degeneration, or disease. They reveal criminality in its most pronounced shape, and they are related on one side to the occasional criminal, and, on the other, pass gradually into (6) the **insane** criminal, without any clear line of demarcation, between them.

Prevalence.—Insanity is relatively much less common in India thus in Europe, as regards both natives and resident Europeans. The census of 1891 revealed a proportion of only five insane persons for every 10,000 of the population, as against 33 for the corresponding population in England. Many cases are doubtless concealed especially in women, as the reported cases are almost entirely in males. The majority of the Indian lunatics are detained and cared for at home. As a rule, only those who are homeless or endanger the public safety and cause peril to life and property attract the attention of the police and are segregated. The voluntary consignment of troublesome lunatics to public asylums (there are no private asylums in India) is of rare occurrence. There are thus probably not more than about 5,000 confined lunatics in the whole of India. Of these so confined a large proportion are suffering from Indian hemp intoxication and soon recover ; the total recovery rate is 10 to 15 per cent. Thus the Indian asylums are small with a small number of inmates largely criminal, the latter forming over 50 per cent. of the inmates usually.

In the province of Lower Bengal, with a population of over 71 millions, there are only five public asylums containing 902 lunatics, of whom about 50 per cent. are criminals and about 20 per cent. females. One or more large central asylums are now being established in each presidency.

During the year 1900 only 831 lunatics were admitted into the asylums of the Panjab, Bombay, Bengal and Madras :

	Total admitted.	Mania.	Melancholia.	Dementia.	Idiocy.	Delusional Insanity.	Other Forms.
Bombay ...	285	130	83	34	18	17	3
Bengal ...	234	160	32	12	2	5	2
Madras ...	161	116	20	15	1	...	9
Panjab ...	151	86	40	9	7	6	...
Total ...	831	492	175	70	28	28	14

In Lower Bengal in 1901 there were 1,192 lunatics under treatment in asylums, of whom 249 were admitted during the year, 60 being cultivators, 17 labourers, 16 beggars, 12 shopkeepers, 843 of no occupation, 151 were Hindus, 65 Muhammadans, 19 Christians and 14 other castes.

Causes.—The relative infrequency of insanity in India as compared with Europe is doubtless owing in great measure to the lessened stress of the higher civilization, that rush and worry and severe mental strain which characterizes modern civilization in the west, which is fast increasing neurotic affections and the spread of insanity.

The causes of insanity may be broadly classed as *physical* and *moral*.

PHYSICAL.—In many cases of insanity there is an obvious defect in the nerve centres of the brain to account for that impairment or derangement of the mind which we call insanity. But in others, the defect, if present, is not apparent to the pathologist.

The chief physical causes are :—

1. **Congenital effects in constitution.**—This may show itself as arrest of development, occurring before or soon after birth, giving rise to **amentia** (p. 332). In such cases there may or may not be visible head deformity. The arrest of development may be due to changes interfering with the growth of the skull bones, as in **cretinism** (p. 335). *Hereditary* insanity may also come under this head (see *Life Assurances*, p. 383).

2. **Injury or disease.**—Epilepsy, sunstroke, injury to the head, may all give rise to insanity. Bucknill and Tuke calculate that epilepsy is the cause of about 6 per cent. of the admissions for insanity into asylums. In Bengal out of 1,192 insanes in 1901, 36 were epileptic blood-wasting diseases, affections of the uterus and its appendages, *e.g.*, disordered menstruation, and diseases and displacements of the uterus sometimes give rise to insanity. Pregnancy is sometimes accompanied by insanity, the patient recovering after delivery. Insanity has also been traced to puberty changes, to lactation, and to the "change of life" (climacteric insanity), and has arisen from intestinal irritation ; these are probably toxic.

3. **Intoxications** by the use of drugs, such as Indian Hemp and Alcohol. **Indian Hemp** intoxication, especially in the form of smoking, is the most common cause of insanity in India. In the Bombay Presidency in 1900 82 cases or about 40 per cent. of the admissions into asylums were due to **ganja** smoking, of which ten were violent criminal lunatics ; **bhang** produced 18 and **charas** smoking six of the cases of lunacy. In Bengal, of the 555 lunatics under treatment in 1901, of whom the cause was known, 152 were victims of **ganja** smoking, and about 38 per cent. of the admissions into Bengal asylums are traceable to the hemp habit. **Alcohol** such a common cause of insanity in England (accounting for about 12 per cent. of admissions) is not so in India, where spirit-drinking is not very common. In Bengal in 1901, of the 555 insanes of whom the cause was known, the disease was

in 44 cases ascribed to alcoholic intemperance. **Opium** is seldom ascribed as a cause of insanity.

MORAL :—

Excessive functional activity, such as excessive trouble or **grief** (Bucknill and Tuke assign 14 per cent. of cases to domestic troubles or grief) ; religious anxiety or excitement ; excessive sexual indulgence or self-abuse ; and mental overwork. Less common causes are sudden joy, fear, fright, &c. The inmates of asylum in India are chiefly males. In Bengal, in 1901 of the 555 insanes in which the cause was known in 168 it was of a 'moral' kind.

General Signs—Delusions.—The disordered mind in insanity is usually the subject of a **delusion** or **hallucination.** A '**delusion**' is a perversion of the judgment whereby the individual accepts as real an erroneous perception or conception which has no real existence ; hence a delusion, if not removeable by the presentation of facts and powers of reason, is evidence of a disordered intellect. The delusions of an insane person concern his own personality.

'**Illusion,**' on the other hand, is merely a false perception by the senses of an external impulse. It is objective with no disorder of the reasoning faculty ; for the affected individual on closer inspection perceives that he has been the subject of a false impression. Illusions are mostly visual, but may affect other senses, such as hearing and smell. A common instance is when in a dimly lit room a person supposes he sees the figure of a man, but on closer inspection finds it is only a suspended coat. The spectacular display of "Pepper's ghost" is an illusion.

Hallucination is differentiated from a delusion, in that it is an erroneous perception without an external impulse. It may affect more than one of the senses. If it be rejected by the reasoning faculties there is no insanity ; but if accepted by them, a delusion results. Hallucinations of hearing are the most common in insanity, the person hears voices speaking to him when there is absolute silence. In *delirium tremens* there are hallucinations of sight.

FORMS OF INSANITY.

That group of disorders of the brain which is called 'insanity' comprises such varied conditions with overlapping symptoms that various classifications of an arbitrary kind have been proposed. For medico-legal purposes we may classify the various types of insanity as follows :—

I.—Amentia or congenital insanity due to the arrest of development of the nerve-centres.

II.—*Dementia* or acquired imbecility due to degeneration or failure of the nerve-centres.

III.—*Mania* or active insanity from disorder of nerve-centres. The chief forms within these types may be tabulated thus :—

CLASSIFICATION OF FORMS OF INSANITY.

- I. AMENTIA (congenital)
  - Complete or *Idiocy*.
  - Partial or *Imbecility*.
  - Endemic or *Cretinism*.
- II. DEMENTIA (acquired)
  - Primary from masturbation, &c.
  - Secondary, *apoplectic* and *epileptic*, syphilis, sunstroke, &c.
  - *Senile*.
  - Paralytic, *general paralysis of insane*.
- III. MANIA
  - INTELLECTUAL (delusional)
    - General
      - Toxic usually temporary.
        - *Delirium* of fever
        - alcohol, hemp, &c.
      - *Epileptic*.
        - *Puerperal*.
        - Gout ?
    - Partial
      - *Monomania* & hypochondria.
      - *Melancholia*.
      - *Somnambulism*—(and hypnotism)
  - MORAL
    - General (unbridled depravity).
    - Partial
      - *Homicidal*.
      - *Suicidal*.
      - *Kleptomania*.
      - *Incendiary*.
      - *Erotomania*.
      - *Dipsomania*.

      → *Impulsive* insanity.

I.—AMENTIA.

In this form of insanity the individual is of unsound mind from birth. Hence amentia corresponds to what legal writers call "**dementia naturalis**" or "**the fool natural.**" Two forms of amentia are recognised by medical writers, namely, (1) Complete amentia, or **idiocy**; and (2) Partial amentia, or **imbecility**; and 'Cretinism' may be added as a third form.

(1.) **Complete amentia, or Idiocy.**—In this form of amentia the arrest of development not only affects the higher or intellectual nerve-centres, but appears also to affect the centres of sensorial perception. Hence, in the fully developed form of complete amentia, the individual carries on a mere vegetable existence, not having the sense even to eat or drink. In the more common and less developed form there is a certain amount of intelligence ; the individual recognises his friends, is capable with extreme difficulty of acquiring a certain amount of education, and is able to make his wants known by signs, or imperfectly articulated words. In almost all there is visible bodily deformity, the cranium is small, its vertex depressed, and the forehead retreating. The palate is narrow and unduly arched, the face seems to occupy the whole of the front part of the head,

the expression is vacant, there is often a squint, or deafness, and sometimes hare-lip. Their habits are often disgusting, they have no proper sense of taste or smell ; they eat or drink everything, filthy or not, and pass their evacuations insensibly. There are no delusions.

(2.) **Partial amentia, or Imbecility.**—It is difficult to draw any precise line of demarcation between partial and complete amentia. In imbecility, however, there is not that marked want of development of the centres of sensorial perception which is present in idiocy. Guy and others regard possession of the faculty of speech as the character distinguishing imbecility from idiocy. Two forms of imbecility have been described, namely, (1) **intellectual imbecility,** and (2) **moral imbecility.**

Of the two, intellectual imbecility is the form which most closely approaches to idiocy in its characters, the affected individuals in well-marked cases only differing from those suffering from complete amentia in its less pronounced forms, in possessing the power of speech. Intellectual imbeciles, although markedly deficient in general intellectual power, are capable of acquiring an amount of education sufficient to fit them for carrying on duties requiring no great mental effort (see *Cases CLV* and *CLVI*). In moral imbecility the defective development appears to affect chiefly the higher functions of the brain, the affected individual, although fairly intelligent and shrewd, being seemingly deficient in moral sense and in power of self-control (see *Cases CLVII* and *CLVIII*), his mental condition in some cases closely approaching to that present in moral mania. It may further be noted that in some cases of imbecility the individuals are greatly "under the dominion of childish fancies" approaching in character to delusions (see *Case CLIX*).

Case CLV.—**Intellectual imbecility** (*a*) (Guy, *For. Med.*, p. 164).—"A man of forty, of weak intellect from birth, but capable of such education as fitted him to be a copying clerk. He fell into bad company, committed theft, and was tried and acquitted on the ground of insanity. In general he is quiet, inoffensive, and taciturn, but answers simple questions rationally. He is subject to frequent attacks of excitement, preceded by shuffling of the feet. In these attacks, which last several days, he talks incoherently, is restless and will strike and kick those about him. When he was about thirty years old he shut the door of his room, placed a long form close to the fire, laid himself on the form, and his head on the grate. He was found insensible, but, on being removed to an open window, had copious bleeding from the nose, and soon came to his senses. His head was burnt to the bone."

(*b*) (Guy's '*Factors of the Unsound Mind*,' p. 173).—John Barclay was tried and executed at Glasgow, in 1883, for the murder of one Samuel Neilson. Barclay had shown some affection for his victim, but killed him that he might possess himself of three one-pound notes and a watch, which he took from him. After the murder, Barclay hovered about almost without disguise, and while going to spend part of the money with the first person he met, dropped first one and then another note at his feet. When questioned, he could see no difference between killing a man and killing an ox, except that he "would never hear him fiddle again," and he looked on the watch

as an animal, and when it stopped, thought it had died of cold from the glass being broken. In his parish he was known as "daft Jock Barclay," and the clergyman, who knew him well, "always regarded him as imbecile, and had never been able to give him any religious instruction, and did not consider him a responsible being."

Case CLVI.—**Moral imbecility** (Browne's '*Med. Jur. of Insanity*,' p. 71).—Cuthbert Carr gave himself up to the police, confessing to the murder of a female child, aged six. By his own voluntary and detailed confession he choked the child while he was having connection with her, to prevent her informing against him. He had been attacked with venereal disease, and his object in having connection with the child was to cure himself. After the murder he showed great shrewdness in the measures he adopted to avert suspicion. In his confession he stated that he knew doctors could not, or would not, cure the disease ; that they did their best to protract a disease, and, when they could not protract it any longer, killed their patients ; that they poisoned the wells in cholera time, &c., &c. Dr. Browne reported that he found him to be labouring under mental weakness or defect, probably congenital, and that his general appearance and manners were such as are usually associated with partial mental defect or eccentricity. That otherwise he was of fully average intelligence, expressing himself with accuracy and facility, that his powers of calculation and memory were unusually acute, and that he was perfectly capable of distinguishing between right and wrong. He was acquitted on the ground of insanity.

Case CLVII.—**The Windham Case** (Browne, *ib.*, p. 67).—In this case W. F. Windham was alleged to be of unsound mind and incapable of managing his affairs. It was proved that he had been sent to Eton, but that he had profited very little by the means of education which were placed in his power. He was wholly unlike other boys, and when he came of age, in 1861, his conduct was such as to lead to a belief in the minds of those who were acquainted with his position, that he was insane. It was further proved that he was utterly deficient in business capacity ; that he was extravagant in purchasing articles which he did not require at exorbitant prices and in unnecessary quantities : that in consequence of such acts he incurred enormous debts, without having any reasonable prospect of being able to meet the demands when they became due ; that he was guilty of gross indecency of language and conduct in public places, and that even the presence of ladies was not a restraint ; that his appetite was voracious ; that he associated constantly with people of the most indifferent character ; that three weeks after he came of age he married a woman of disreputable character and life ; that he married her knowing that up to the night previous to the marriage she had lived with one of his friends as his mistress ; that having married her, he infected her with the venereal disease, and subsequently presented her with jewellery of the value of from £12,000 to £14,000, and settled £800 a year on her for life ; that his income, at the time he did this, was not not more than £1,500 per annum. The evidence went further to show that although his wife, subsequent to her marriage, cohabited with another man, Mr. Windham condoned this act by residing with her even after her adultery ; that he was in the habit of acting as a railway guard, was careless as to personal cleanliness, and on occasion displayed an utter want of feeling. There was great conflict of medical testimony in this case, but the result was that the jury, by a majority, returned a verdict that

Mr. Windham was of sound mind, and capable of taking care of himself and his affairs.

Case CLVIII.—**An imbecile greatly under the dominion of a childish fancy** (Guy's *For. Med.*, p. 166).—"A young gentleman, aged twenty, was the slave of a childish fancy for windmills, with an aversion equally strong to water-mills. Having been placed under control in a place where there were no windmills, he cut the calves of a child's legs through to the bone, and stated that he would have taken away its life, that he might be tried for his act and removed from a place where there were no windmills. He had always been violent when thwarted in his fancy, had threatened his keepers and members of his family, and had more than once made preparations for committing murder."

To these may be added as a third form :—

(3.) **Cretinism.**—This is the name given to a form of endemic idiocy prevalent in certain hill or sub-montane districts, and apparently the result of local conditions. It is met with in the Sub-Himalayas in India, and probably depends on developmental changes interfering with the growth of the skull bones. It is usually associated with goitre or enlargement of the thyroid gland, either in the individual or in his parents. The skin is usually darkly pigmented.

Case CLIX.—**Deficient sensibility to pain in general intellectual mania** (Taylor, *Med. Jur.*, ii, p. 475).—A maniac, during violent exertion, met with a severe compound fracture of the leg. The fracture was put up by the medical attendants, the maniac watching the whole proceeding attentively. In a day or two symptoms of great constitutional disturbance showed themselves, although apparently the injured limb was progressing satisfactorily. Accordingly the surgeons proposed removing the splints, and were preparing to do so, when the maniac suddenly drew the fractured leg out of a hole in the mattress, in which he had concealed it, and held it up before them. It was then discovered that the patient, soon after the fracture had been put up, had removed the splints from the injured limb, and applied them, with great nicety, to the sound one. Although the injured leg was inflamed, the bones displaced, and the wound filled with feathers, the patient had not expressed any feeling of pain.

Case CLX.—**Death of a lunatic from injuries received in a struggle with his attendants** (Taylor, *Med. Jur.*, ii, p. 475. *Reg.* v. *Slater and Vivian*, C. C. C., September 1860).—The prisoners were attendants in an asylum, and were tried for the manslaughter of a patient. The evidence showed that the deceased died rather suddenly three days after a serious struggle with one of his attendants. On *post-mortem* examination eleven ribs were found fractured; there was, however, no displacement. Slight lacerations of the left lobe of the liver were also present. Two insane patients alleged that deceased had been greatly maltreated by the prisoners shortly before death. The question therefore arose when were the injuries inflicted. On the one hand, it was represented that if the injuries had been inflicted during the struggle three days before death, marked symptoms would have been present during the interval between the receipt of the injuries and death, and that, as no such symptoms were present, the story told by the

two lunatics was probably true. On the other hand, the medical officers of the asylum considered it possible that the injuries which caused death were inflicted in the struggle three days previously, and that the absence of symptoms was accounted for by insensibility to pain especially as there was incipient general paralysis. The accused were acquitted.

II.—DEMENTIA.

Legal writers use this term as synonymous with insanity, grouping all cases of mental alienation under the two heads of (1) *Dementia naturalis*, or 'the fool natural,' *i.e.*, individuals insane from birth; and (2) *Dementia adventitia*, or *accidentalis*, *i.e.*, an acquired imbecility—individuals who become insane after birth.[1]

In *medicine* the term *dementia* is employed to denote that form of insanity in which the mental powers, having attained maturity, subsequently fail; the individual falling into a condition more or less resembling amentia, but distinguished from amentia, by being the result of failure of power previously present, and not the result of original want of power. Dementia may be **acute**, that is, come on suddenly; or **chronic**, *i.e.*, come on slowly; and may be **secondary**, *i.e.*, follow on a previous attack of mental or other disease; or **primary**, *i.e.*, come on unpreceded by any such attack. In comparatively rare cases, dementia is both acute and primary.[2] In others is acute but secondary to a serious attack of brain or other disease; *e.g.*, epilepsy, apoplexy, typhus or typhoid fever, acute rheumatism, &c. Recovery frequently takes place from acute dementia.

Usually dementia is chronic, and may then either be primary, coming on as a result of drunkenness, masturbation, or excessive sexual indulgence; or be secondary to a previous attack of mania; or supervene as the result of old age (senile dementia). When dementia comes on slowly, often the first symptom noticed is failure of memory. This is followed by general dulness of all the mental faculties. The bodily health is usually good. In very advanced cases the functions of the centres of sensorial perception become impaired—indeed, insensibility to pain is often noticed in the early stages—and the animal instincts even are lost. Recovery rarely, if ever, takes place from chronic dementia. Dementia may be accompanied by occasional attacks of maniacal excitement.

General Paralysis of the Insane.—This is the name given to a form of dementia, in which the failure of the power

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[1] Guy, *For. Med.*, p. 166.

[2] In India acute primary dementia, always rare, is when met with generally a result of sunstroke.

of the higher or intellectual nerve-centres is accompanied by failure of power of the motor centres. G. P. I. is rare in women. It most commonly attacks men of education and position. Its causation has like tabes been ascribed to syphilis, but as has been truly remarked, both general paralysis and tabes are rare amongst uncivilised or half-civilised races notwithstanding the frequency of syphilis. In the majority of cases of general paralysis, the failure of memory and of the intellectual powers generally—usual in dementia—is accompanied by delusions of possession of exalted power and boundless wealth. Along with these symptoms indicative of affection of the higher nerve-centres, impairment of power—first noticeable in the tongue and muscles of articulation—is observed, indicating affection of the motor centres. The pupils become irregular; the power of precise co-ordination of movement necessary for the performance of what may be called acquired automatic acts, such as walking, is lost; and general impairment of motor power supervenes. Apparently the centres of sensorial perception, as a rule, do not become markedly affected until near the end of the case, but, as in chronic dementia, deficient sensibility to pain may be an early symptom (see *Case CLX*). This deficient sensibility to pain is sometimes of medico-legal importance (see *General Intellectual Mania*).

The offences of a G. P. I. may be classed under three heads:[1] (1) Violence of a peculiarly brutish and irrational character. (2) Sexual impropriety, doubtless partly from lack of judgment and partly from the sexual irritability common in earlier stages. (3) Theft.

III.—MANIA OR RAVING MADNESS.

Under this head may be classed all forms of insanity characterised by disturbance or disorder (as distinguished from want of development, or failure) of the functions of the higher nerve-centres.[2] Unlike amentia and dementia, **mania is seldom continuous,** there being usually remissions, more or less complete. If complete, a remission constitutes what is termed a **lucid interval** (see p. 406). Mania may come on suddenly or slowly; if slowly, certain **premonitory symptoms** are usually first noticed. The chief of these are indigestion,

[1] D. C. Norman, *Dub. J. Med. Sc.*, Dec., 1900.

[2] Some writers on Insanity limit the application of the term "mania" to one particular form of mental disorder, *viz.*, to that in which there is general disorder of all the intellectual powers coupled with excitement—what, in fact, when the term "mania" is used in the wider sense above stated may be called the non-melancholic form of general intellectual mania.

constipation, and sleeplessness ; altered or perverted sensations, sometimes amounting to illusions ; great irritability, alterations of temper, disposition, and habits, and inability to concentrate the attention on any train of thought. According to Dr. Radcliffe, the leading mental characteristics in incipient insanity are :—1. Self-conceit, the individual fancying himself wiser, richer, or stronger than he really is. 2. Misanthropy, or general dislike to others without cause ; and 3. Suspicion, often leading to **delusions** of the existence of conspiracies to injure or poison the sufferer.[1]

Using the term "mania" in the extended sense stated above, various forms of it are recognised ; these are usually classed according as to whether—(*a*) **Delusions** are present. If present, the affection is classed as intellectual or ideational[2] mania ; if absent, as moral or affective mania. (*b*) The mental functions affected are **disordered generally, or in one particular** only. If the former, the affection is classed as general ; if the latter, as partial. This method of classification **(Ray's)** gives, therefore, four chief forms of mania, viz., 1. General intellectual ; 2. Partial intellectual ; 3. General moral ; and 4. Partial moral. A further subdivision of some, at least, of these four forms is possible, according as to whether (*c*) **Depression or excitement** is present. If the former, the affection is classed as melancholic ; if the latter, as non-melancholic.

It should, however, be remarked, that although many cases of mania are so distinct in type as to be readily classable under one or other of the above-mentioned forms, in many such distinction of type is absent.

1. General Intellectual or Ideational Mania.

In this form of mania there appears to be general disorder of the functions of the higher nerve-centres. It is divisible into a non-melancholic form and a melancholic form, according as to whether excitement or depression is present. Some writers on insanity limit the application of the term "mania" to the non-melancholic variety of this form of insanity, and apply the term general melancholia or lypemania, to the melancholic variety. Sometimes the two forms blend, excitement and depression alternating with one another in the same case.

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[1] Taylor, *Med. Jur.*, ii, p. 467.

[2] The term "ideation" has been used to denote a function of the higher nerve-centres, of the nature of sensorial perception, but higher in character. Disorder of ideation, using the term in this sense, results in delusions : hence the term "ideational mania."

The principal symptoms of general intellectual mania are: Rapid flow of ideas, expressed with confusion and incoherence; the attention is constantly wandering, and delusions rapidly succeed one another. In one form the individual fears everybody and everything (panophobia); in another he imagines himself pursued by horrible demons (demonomania) the toxic mania of delirium tremens. There may be furious excitement; or, in the melancholic form, great apparent suffering and depression. The muscular power is often much increased, and the patient is often violent and very destructive, rendering great caution necessary in visiting him. The expression is altered, he sleeps but little, and there is often (especially if the case is tending towards general paralysis) deficient sensibility to pain (see *Cases CLIX* and *CLX*). The fact that in this form of insanity there is often diminished sensibility to pain, may be of importance in cases where injuries received by insane persons form the subject of an inquiry: *a'*, from its indirectly tending to increase the amount of injury likely to be inflicted during a struggle; and, *b'*, as bearing (as in *Case CLX*) on the question of the time of infliction of an injury.

2. Partial Intellectual or Ideational Mania, or Monomania.

Some writers confine the use of the term "monomania" to the non-melancholic form of this variety of insanity, and call the melancholic form partial melancholia or lypemania. The leading character of this form of insanity, may be stated to be the affection of ideation as regards one particular only. Hence there is either only one delusion, or, in more developed cases, a series of delusions, connected together by one morbid idea (see *Case CLXI*). The delusion may be of the most ridiculous character; the individual may believe himself to be made of glass, or to be dead, or to be some celebrated character. In the melancholic form of monomania the delusion, or delusions, are frequently of a religious character (religious monomania), or, as in *Case CLXI*, delusions of persecution (monomania of persecution). Such delusions may lead to the commission of homicide (see *Cases CLXII* and *CLXIII*), or to suicide.[1] In markedly distinct cases of monomania, the individual appears to be perfectly sane on all points unconnected with his delusion or delusions, and only betray excitement or depression when these are touched upon. In

[1] Monomaniacs, in fact, may, under the influence of their delusions, exhibit propensities similar to those exhibited, without delusion, in the various forms of partial moral mania.

such cases (especially in non-melancholic cases), the individual may appear to reason correctly and accurately on matters unconnected with his delusions, and even in matters connected with them his reasoning may be accurate, although his conclusions, being founded on false premises, are erroneous. Sometimes in these cases, particularly if the individual has any powerful motive for concealing his delusion, there may be great difficulty in detecting its existence (see *Cases CLXIV* and *CLXV*). In other cases, especially advanced cases, the reasoning powers appear generally affected, so that it becomes difficult to decide whether the case is one of partial, or one of general ideational insanity. Monomaniacs are often readily imposed upon and controlled by a person affecting to believe in their delusions (see *Cases CLXV* and *CLXVI*).

Case CLXI.—**Monomania of persecution; multiple delusions connected with one morbid idea** (Bucknill and Tuke, p. 219).—A female patient was "perfectly convinced of the existence of a persecuting fellow in a room above her own, who vented all his malignity upon her by means of certain machinery and wires . . . He 'brays' her in the night with three of these wires, so that she is stiff in the morning, and covered with marks as if she had been switched . . . At other times he will thrust three wires into her mouth, which leave 'a very bitter verdigris *taste*' therein. She protests that she can see a 'hole like the cut of knife' in one corner of the ceiling, through which he introduces the wires . . . She has stopped her clock and covered it up, because he used to employ his wires to make it strike some twenty times in the night, in order to disturb her." He also, she believes, delights in sending her to sleep with chloroform, which she feels dropping from the ceiling upon her cap.

Case CLXII.—**Religious monomania. Homicide** (*Reg.* v. *Wilson*, Lincoln Sum. Ass., 1864; Taylor, Med. Jur., ii, p. 554).—"A woman consulted a medical man as to pains in her head, loss of appetite, and low spirits after her delivery; she was also suffering from religious despondency. While in this state, she got up in the night and drowned four of her children in a cistern. She gave this account of the act:—She washed the children, put them to bed, and retired herself about 10 o'clock, but could not sleep; and between 12 and 1 o'clock it was suggested to her mind, as she says, by a black shadowy figure, that if they were in heaven they would be out of danger and better done to than she could do for them. It was still further suggested to her mind in the same way, that she could easily put them into the cistern, and she at once proceeded to do so; it was better for them to die young than to grow up wicked.

Case CLXIII.—**Monomania of persecution. Homicide.** (Maudsley's '*Phys. and Path. of Mind*,' p. 371).—"A young man, who had previously had a few epileptic fits, became extremely melancholic. Being possessed with the idea that he was to be murdered in his father's house, he made frequent attempts to escape from it . . . His father was a butcher; and the young man becoming calmer after a time, and being thought trustworthy, was permitted at his own request to be present at the slaughter of an ox, but when all was finished, he did not

wish to return home. His friends, however, pressed him, and two of them taking him by the arm in a friendly manner, accompanied him towards his home; but just as he approached the door of his house he suddenly drew out a butcher's knife, which he had concealed, and stabbed to the heart one of them, fleeing immediately to the forest, where he passed the night. Next morning he went to the house of a relative who lived some distance off, and said that he had run away from home, as they wished to kill him there."

Case CLXIV.—**Monomania of persecution detected with difficulty** (Carpenter's '*Mental Physiology*,' p. 669).—"Dr. A. T. Thomson was requested to see a gentleman, whose friends were desirous of placing him under restraint, being well assured of his insanity from the supervention of uncontrollable outbreaks of temper, to which he had never previously given way, though they could find no ostensible ground in his conversation or actions which would legally justify the use of coercive measures. Several medical men had been consulted, all of whom had failed to obtain any such justification . . . Dr. Thomson, struck with the evidence of violent passion, afforded by the damages done to the furniture of this gentleman's apartments, 'felt convinced that there was some perversion of feelings or intellect which it was his business to discover.' For two hours he conversed with his patient on a variety of topics, and never enjoyed a more agreeable or instructive conversation, his patient being evidently a man of great attainments. Dr. Thomson was beginning to despair of finding out the mystery of his disorder, when it chanced that animal magnetism was adverted to, on which the patient began to speak of an influence which some of his relatives had acquired over him by this agency, described in the most vehement language the suffering he endured through these means, and vowed vengeance against his persecutors with such terrible excitement, that it was obviously necessary, alike for their security and his own welfare, that he should be placed under restraint."

Case CLXV.—**Monomania; the delusion only discoverable with difficulty** (Case related by Erskine during his defence of Hadfield, Browne, **Med. Jurisp. of Insanity,** p 290.)—"A person, who had been confined in a lunatic asylum, prosecuted his brother and the keeper of the asylum for false imprisonment and duress. Erskine was informed that the man was undoubtedly insane, but was not told the particular form which the malady assumed. The prosecutor, himself a witness in support of the indictment, was put into the witness-box and examined; and when Erskine came to cross-examine him, he found his evidence clear, distinct, collected, and rational. He tried to discover some alienation of mind; but during a cross-examination, conducted with all the skill and sagacity of which he was master, for nearly an hour he was completely foiled; the answers were perfectly rational—there was not the slightest sign of mental alienation. A gentleman, however, who had been accidentally detained, came into Court, and whispered in Erskine's ear that the witness thought he was the Saviour of mankind. On receiving the hint, Erskine made a low bow to the witness, addressed him in terms of great reverence, and respectfully begged to apologise for the unceremonious manner in which he had treated a person of his sacred character, and called him by the name of Christ. The man immediately said, 'Thou hast spoken truly; I am the Christ.'"

Case CLXVI.—**Monomania readily controlled** (Guy's '*For Med.*', p. 188).—"Henry Weber, Sir Walter Scott's private secretary

became addicted to habits of intoxication, which injured his health. One evening, Scott, after Weber's return from Edinburgh, observed Weber's eye fixed upon him with unusual solemnity of expression. On inquiring after his health, Weber rose and said, 'Mr. Scott, you have long insulted me, and I can bear it no longer. I have brought a pair of pistols with me, and must insist on your taking one instantly,' and with that he produced the weapons and laid one of them on Scott's manuscript. 'You are mistaken, I think,' said Scott, 'in your way of setting about this affair; but no matter. It can, however, be no part of your object to annoy Mrs. Scott and the children; therefore, if you please, we will put the pistols in the drawer until after dinner and then arrange to go out like gentlemen.' Weber answered with equal coolness, 'I believe that will be better,' and laid the second pistol also on the table. Scott locked them both up in his desk, and said, 'I am glad you feel the propriety of what I suggested; let me only request further that nothing may occur while we are at dinner to give my wife any suspicion of what has been passing.' Weber again assented, and Scott withdrew to his dressing room, despatched a message to one of Weber's intimate companions, and had the maniac secured and placed in confinement."

Somnambulism or 'sleep walking' is allied to epilepsy and the artificially produced state of mesmerism or hypnotism (see p. 344). In this condition the higher or intellectual nerve-centres appear to be in a state of partial activity only: or, as in the higher form of somnabulism, in a state of full activity to *one* train of impressions, but inactive as regards others. In this condition while bent in accomplishing one object very elaborate acts may be performed and dangerous ground traversed heedlessly which would disconcert the mind when wide awake. Hence the mere fact of the performance of such an act, does not of itself indicate that the higher or intellectual nerve-centres were in full activity at the time of its performance. This is obviously of much medico-legal importance, seeing that such acts, done during a condition of partial activity only, of these higher centres, may result in the death or injury of others, and form the subject of a criminal inquiry.

If somnambulism be proved, the accused is exonerated from responsibility for any criminal act; and this is also the case if the person be suddenly roused from a deep sleep.

Case CLXVII.—**Somnambulist acquitted of murder.**—"In 1878 a man named Fraser in Glasgow was tried for the murder of his child by beating it against a wall. He was acquitted on the ground of being unconscious of the nature of his act by reason of somnambulism. He was sprung from an epileptic and insane stock, his mother died in an epileptic fit, and some of his relatives were insane."—Husband's *F. M.*, p. 712.

Case CLXVIII.—**Somnambulism** (Browne's '*Med. Jur. of Insanity*,' p. 237).—"A butcher's boy, about sixteen years old, apparently in

perfect health, after dozing a few minutes in his chair, suddenly started up, and began to employ himself about his usual avocations. He had saddled and mounted his horse, and it was with the greatest difficulty that those around him could remove him from the saddle and carry him within doors. While he was held in the chair by force, he continued violently the actions of kicking, whipping, and spurring. His observations regarding orders from his master's customers, the payment at the turnpike gate, &c., were seemingly rational. The eyes, when opened, were perfectly sensible to light. It appears that flagellation even had no effect in restoring the patient to a proper sense of his condition. The pulse in this case was 130 full and hard. On the abstraction of thirty ounces of blood, it sunk to eighty, and diaphoresis ensued. After labouring under this frenzy for the space of an hour he became sensible, was astonished at what he was told had happened, and stated that he recollected nothing subsequent to his having fetched some water, and moved from one chair to another, which indeed he had done immediately before his delirium came on."

Case CLXIX.—**Stabbing performed during sleep** (Taylor's *Med. Jur.*, 2nd ed., ii, p. 600).—"Two persons who had been hunting during the day slept together at night. One of them was renewing the chase in his dream, and imagining himself present at the death of the stag, cried out, 'I'll kill him! I'll kill him!' The other, awakened by the noise, got out of bed, and by the light of the moon beheld the sleeper give several deadly stabs with a knife on that part of the bed which he had just quitted."

Case CLXX.—**A man stabbed by his brother under similar circumstances** (Browne's '*Med. Jur. of Insanity*,' p. 241).—"A Spaniard, *æt.* twenty-six, who had been a soldier, always of good conduct, and in tolerable health, was subject every spring to epistaxis, also to talking in his sleep. The spring of 1854 passed without epistaxis, and from this time, particularly during the night, he was subject to certain moral disturbance for which purging was advised. Travelling with a brother, and sleeping in the same bed, he was attacked during the night by this excitement, fancied that his bedfellow was going to kill him, and seizing a knife he plunged it into his neck. He then went out and slept on the staircase two hours. When he awoke he had some obscure consciousness of what he had done, and on seeing his dead brother, he was in despair, and wounded himself severely. The flow of blood restored his reason, and he called for help, and after some time told all the circumstances. The man was tried for the murder, but was acquitted on the medical evidence."

Case CLXXI.—**A man suddenly aroused from sleep stabs another** (*Ib.*, p. 241).—"A pedlar, who was in the habit of walking about the country armed with a swordstick, was awakened one evening, while lying asleep on the high road, by a man suddenly seizing him and shaking him by the shoulders. The man, who was walking by with some companions, had done this out of a joke. The pedlar suddenly awoke, drew his sword and stabbed the man, who soon afterwards died. He was tried for manslaughter, and, although his irresponsibility was strongly urged by his counsel, was convicted."

Case CLXXII.—**Higher form of Somnambulism** (*a*) Carpenter's '*Mental Phys.*,' p. 593).—"An eminent Scottish lawyer had been consulted about a case of great difficulty and importance, and had been studying it closely and anxiously for several days. One night his wife

saw him rise from his bed and go to a writing-desk which stood in his bedroom. He then sat down and wrote a long paper, which he carefully put by in his desk, and returned to bed. The following morning he told his wife that he had had a most interesting dream; that he had dreamt of delivering a clear luminous opinion respecting a case which had exceedingly perplexed him, and that he would give anything to recover the train of thought which had passed before him in his dream. She then directed him to his writing-desk, where he found the opinion clearly and fully written out."

(*b*) Guy's '*Factors of Unsound Mind*,' p. 71).—"A banking house once gave to a Dutch professor of mathematics (Professor Van Swinden, of Amsterdam) a question to solve which required a long and difficult calculation. He first tried it himself several times, but never without mistake; so he handed it over to ten of his pupils. One of these attacked the problem with great vigour, but more than once without success. Late in the night which preceded the day fixed for the giving in of the answers, he went to bed baffled and tired. But in the morning, most strange to relate, he finds a paper on his desk, in his own handwriting, on which the problem is solved, without a single blunder. He had calculated the problem in his sleep, and in the dark. It was singularly clear and condensed, and the professor himself declared that he had never thought of a solution so simple and concise."

Hypnotism or mesmerism is an artificially produced state which is allied to somnambulism. It is now of medico-legal interest chiefly with reference to rape or testamentary cases, see p. 249.

Before the introduction of chloroform it was largely used by Dr. J. Esdaile, I.M.S., Calcutta, as an anæsthetic for painless operations. On the 4th April 1845 he had to perform an operation on a Hindoo prisoner at Hooghly, and not having an anæsthetic in those days he tried the "mesmeric passes" he had read about, and to his delight the patient passed into a state of deep sleep. That there was "a complete suspension of sensibility to external impressions of the most painful kind" is vouched for by the collector and the judge of Hooghly who wrote separate accounts of the scene. Esdaile wrote an account of this and other cases in the now long extinct *Indian Journal of Medical and Physical Science* (May 1845). The medical press at once declared that Esdaile was duped, but when he had collected 100 cases, he reported the matter to the Government of Bengal, who appointed a Committee of four medical men to report on the matter. The Committee carefully investigated nine operations performed under this influence by Esdaile, and reported very favourably upon it, recommending that assistance should be given to Esdaile to continue his investigations. A small hospital was set apart for him in Calcutta in November 1846, and after a year's experience the medical visitors, appointed by Government, reported that "complete insensibility to pain was produced by mesmerism in

the most severe operations." The new Governor-General, the great Dalhousie, ever a friend of the medical profession in India, congratulated Esdaile and appointed him to be a Presidency Surgeon, a post, as his biographer states, "that generally leads to a fortune from private practice." In 1850 he was promoted to be Marine Surgeon. But already in 1848 the use of chloroform had begun in India, and though Esdaile continued to work with mesmerism there can be little doubt that chloroform killed off mesmerism as an anæsthetic agent. Esdaile retired from the service in June 1851, after twenty years' service. He left a record of 261 painless operations done by him under mesmerism, including many elephantiasis tumours, one weighing 105lbs., which other surgeons had declined to touch.[1]

3. General Moral Mania.

Moral or affective mania (*mania sine delirio*) is distinguished from intellectual or ideational mania by the absence of delusions, although lawyers find it hard to accept the view that insanity is possible without delusion. It may best be defined, in the words of Ogston,[2] as "consisting in a morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral dispositions, and natural impulses, without any remarkable disorder of the intellect, or knowing and reasoning faculties." In general moral mania, this morbid perversion is general, and, as a consequence, the individual exhibits several depraved propensities. He is on the borderland between habitual vice and insanity. The three undernoted cases are examples of this form of mania.

Case CLXXIII.—**General moral mania** (Browne's '*Med. Jur. of Insanity*,' p. 114).—"W. R., *æt.* 27, had been eight times in the House of Correction. His father was an epileptic, and he himself had been subject to convulsions when teething, and at intervals during his after-life. He tortured animals, picked out the eyes of a kitten with a fork. He lied and stole. He was expelled from school as too bad to be kept. He afterwards consorted with the worst characters; was drunken, debauched, dishonest. He attempted or pretended to commit suicide. He was utterly false and untrustworthy. He delighted in torturing those patients who were, like himself, confined in the lunatic asylum, and who were too weak to resent injury with violence. He was indelicate in the presence of females, and attempted a rape on his mother and on his sister. Yet with all he was intelligent, exceedingly cunning, and, while actually the victim of epileptic seizures, he was prone to feign fits, and did it with considerable ability. In spite of careful watching he repeatedly effected his escape; was exceedingly vain, and

[1] *Ind. Med. Gaz.*, 1901, p. 465. [2] *Lec., Med. Jurisp.*, p. 304.

in the presence of some persons seemed to be exceedingly devout. He was ingenious in excusing his errors, and, although exceedingly mischievous, was careful to avoid disagreeable consequences." This individual, Browne further remarks, was possessed of "an intelligence of such high order as to enable him thoroughly to understand the relation between a found-out crime and its punishment, for he invariably tried to conceal the commission of the criminal act by lies, hypocrisy and various clever explanations."

Case CLXXIV.—**General moral mania** (Maudsley's '*Phys. and Path. of Mind*,' p. 362).—"An old man, aged 69, who had been in one asylum or another for the last fifteen years of his life. He had great intellectual power, could compose well, write tolerable poetry with much fluency, and was an excellent keeper of accounts. There was no delusion of any kind, and yet he was the most hopeless and trying of mortals to deal with. Morally he was utterly depraved; he would steal and hide whatever he could, and several times made his escape from the asylum with marvellous ingenuity. He then pawned what he had stolen, begged, and lied with such plausibility that he deceived many people, until he finally got into the hands of the police, or was discovered in a most wretched state in the company of the lowest mortals in the lowest part of the town. In the earlier part of his insane career, which began when he was 48 years old, he was several times in prison for stealing. In the asylum he was a most troublesome patient; he could make excellent suggestions, and write out admirable rules for its management, and was very acute in detecting any negligence or abuse on the part of the attendants when they displeased him, but he was always on the watch to evade the regulations of the house, and when detected, he was most abusive, foul, and blasphemous in his language. He was something of an artist, and delighted to draw abominable pictures of naked men and women and to exhibit them to those patients who were addicted to self-abuse. He could not be trusted with female patients, for he would attempt to take indecent liberties with the most demented creature. In short, he had no moral sense whatever; while all the fault that could be found with his very acute intellect was that it was entirely engaged in the service of his depravity.....At long intervals, sometimes of two years, this patient became profoundly melancholic for two or three months, refused to take food, and was as plainly insane as any patient in the asylum. It was in an attack of this sort also that his disease first commenced."

Case CLXXV.—**General moral mania.**—Viciousness and Depravity. V. B., age about 22, admitted 16th August 1899, into Lahore Asylum, is an habitual criminal who has apparently never in his life maintained himself by honest labour. While in jail for a term of imprisonment for receiving stolen property, he was found so constantly troublesome and given to making unprovoked assaults on the weaker prisoners, being filthy, and utterly unamenable to reason and punishment, that he was finally certified as a lunatic and sent here. Absolutely no previous or family history is obtainable of a reliable nature.

Beyond a certain amount of irritability he showed no sign of insanity, but he was soon found to be vicious, cruel and animal, disobedient and revengeful, tearing up his bedding if checked, and destroying the materials of his work if spoken to. It was considered that his conduct denoted him at that time to be more of a criminal than a lunatic,

and he was discharged at the expiration of his sentence in December 1900, but his conduct obliging the authorities to put him under security, he was sent back to jail, and again later on was transferred here with the same history (early in 1901), and since then his conduct has never varied. He is a tall, well-built young man of most repellent aspect, being thick-lipped, with one ear cropped, and his face plentifully scarred as a result of old fights and injuries. He is clean, tidy, without any of the usual signs of insanity, that is to say, he speaks sensibly, intelligently and coherently, is without delusion or hallucinations, and works well and skilfully with application when it so pleases him. He sleeps and eats well, is not an epileptic, and is in good physical health. But he is, on the other hand, most vicious, immoral and unprincipled, a fluent liar, a thief, and though a coward, constantly found committing assaults on the weak and helpless lunatics; it is said that he assisted case IV to kick to death the man referred to; he is perpetually endeavouring to commit sodomy, always ill-treating and bullying the weak dements and idiots, and daily concerned in some quarrel or grievance which the others come to complain about, mischievous, disobedient, absolutely unreliable and uncontrollable, the perfect pest of the whole asylum, on whom no training, no kindness, persuasion or threats have the slightest permanent influence.

Now this man's actions have all the appearance of pure viciousness; he has perfect memory; he lies to excuse himself or for some other end; he does not steal from a magpie love of collection, but with a definite end and purpose; he is grossly immoral, and his acts of assault and cruelty are always on those weaker than himself and not done out of pure insane impulse or in ungovernable passion. It is doubtful how much they are due to the failure of volition, for when caught and threatened with the deprivation of some privilege or the imposition of a punishment he will remain for some days quiet and orderly, but the effect gradually wears of, and he again follows his old evil courses. In his case his general intelligence is of such a high order as to preclude the possibility of suggesting his act as due to imbecility or weak-mindedness. It may be also pointed out that being so intelligent, it is reasonable to suppose that he would exercise more self-control to escape from his present uncomfortable position, and his failure to do so is a very strong evidence of his insanity. He is certainly irresponsible and incapable of seeing things as others do, and his general conduct for ordinary public security and comfort renders it imperative that he should remain secluded either in a jail or a lunatic asylum, even though his history may always give different observers opportunities for debating as to which particular institution he more properly belongs.—G. F. W. Ewens, *Ind. Med. Gaz.*, 1902, p. 230.

4. Partial Moral Mania.

This form of mania only differs from the preceding variety in the fact that the morbid perversion is not general but limited to one or two particulars. Hence, in partial moral mania, the individual exhibits one or two, instead of several, morbid propensities. Under this form of mania may be classed the *impulsive* or *instinctive* insanity of some writers. Different varieties of partial moral mania are distinguished, according to the special propensity present, for example, *homicidal*

mania, suicidal mania, kleptomania, pyromania, &c. Medico-legally the more important kinds are the following :—

Homicidal mania.

Homicide, as has been already pointed out as in cases *CLXII* and *CLXIII*, may be the result of a *delusion*, such as the belief that the victim is persecuting the accused. Such cases according to Ray's classification of mania, belong to intellectual insanity, usually to the partial form, and may, therefore, be called cases of '*homicidal monomania.*'

Case CLXXVI.—**Homicidal mania, gradual approach** (Bucknill and Tuke, p 268).—"A young man, *æt.* 25, and of gentlemanly appearance, after giving his address, and declaring himself to be a schoolmaster in a certain well-known college (in Paris), begged that the Commissary of Police would take him in charge with a view to his confinement in the Asylum of St. Ann. He then explained that he was not mad in every respect; on the contrary, he possessed the full use of his mind, only while sleeping among the pupils confided to his charge, he was seized with the most destructive inclinations. Night after night in an agony of fear he had struggled with himself, and it was with the greatest difficulty that so far he had succeeded in restraining his intense desire to strangle one or two of the little boys. Now all his energies were exhausted. He felt that this unknown power would ultimately triumph over him, and rather than commit the crime he placed himself in the hands of the police. At this moment a boy accused of theft was brought into the room. The eyes of the schoolmaster were immediately lit with a strange light; and had it not been for the timely assistance of a brawny policeman, the boy would have been throttled before the eyes of justice."

In some cases, however, the homicide, or attempt at homicide, appears to be the result of an insane propensity or '**impulse**,' unaccompanied, at least so far as can be ascertained, by a delusion, and so would be classed as moral or affective mania, usually of the partial variety, and to these the term '**homicidal mania**' is commonly applied.

Murder may also be committed by insane **melancholics** in the belief that they are saving the person from some danger, &c., by women suffering from **puerperal** insanity (here the victim is usually their infant) or in the frenzy of an **epileptic** seizure.

In some cases the insane propensity appears to be of gradual growth (see *Case CL*); in others, previous to the commission of the act, the individual shows symptoms (perhaps only slight symptoms) of the existence of eccentricities (see *Cases CLXXIX* and *CLXXX*), mental disorder (see *Case CLXXXI*), and it has been noticed that homicidal tendencies may co-exist with a quiet exterior (see *Case CLXXXII*). In other cases, again, the homicidal act appears to be the result of a sudden and

uncontrollable impulse, occurring in an apparently sane person, the commission of the act being as it were, the only symptom of insanity exhibited as in cases of **running amok,** also see *Case CLXXXII.* Not infrequently the homicidal propensity or impulse appears to be connected with disordered menstruation, as in *Case CLXXXI,* or with parturition, puerperal or with epilepsy. Not infrequently, also, it is accompanied by suicidal tendencies. Especially in cases where the symptoms of insanity present are slight, importance attaches to the character of the act.

Running amok.—The word **amok** is a Malay word meaning litterally 'frenzied.' But it is applied to the impulsive form of reckless multiple homicide often without motive. In India it usually associated with the delirious intoxication of Indian hemp, and is most prevalent amongst Muhammadans. In the Malay Archipelago it appears to occur independently of drug intoxication. Dr. Gimlette[1] considers the Malayan form to be pathological and allied to somnambulism, the individual being rendered "subconscious by the unrestrained action of his own automatic centres," and in some respects allied to the 'pro-cursive' form of epilepsy in which the patient starts to run. There is always, he says: (1) sudden paroxymal homicide, generally in the male, with evident loss of self-control; (2) it is preceded by a period of mental depression; (3) there is a fixed idea to persist in reckless killing, due to an irresistible impulse of a purposive character; (4) there is a subsequent loss of memory. Another Malay observer[2] divided *amok* into two classes: (1) cases where the motive is revenge for a supposed or real wrong where the assailant becomes perfectly reckless; and (2) what he describes as *orang beramok*, which requires the intervention of the medical jurist to prevent irresponsible persons suffering from the penalty of the law. As the first persons injured are sometimes strangers with whom the accused is not at enemity and whom he could have no motive in killing, the mental condition of the *amok* murderer should **be subjected to prolonged medical observation with reference to the question of responsibility.**

Case CLXXVII.—**Homicidal mania by cutting.**—This man, an inmate of Lahore Asylum, has for fourteen years been constantly possessed with the desire to kill by cutting. No family history of any kind is available of a reliable nature. At the age of 32 there is a doubtful history of his having been for three months, strange and altered, given to cursing God and the Prophet, with delusions of exaltations, saying that he himself was a Prophet. Following this it was noticed that he had become more irritable and quarrelsome, but this disappeared, and he was thought to be perfectly sane and normal. He is a barber: a friend of the family used to come daily to sit in his shop, and arrived as usual on the 3rd July 1887, when quietly, without any warning or provocation, our patient came up behind him and cut his throat with his razor. Since that time up to 1900, when he was transferred here, he had been confined in jail as a criminal lunatic. He is and always has been a quiet well-behaved man, speaking calmly and sensibly

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[1] Med. Archives, Federated Malay States, 1901.
[2] Dr. Oxley in 1843 quoted by Chevers.

without the slightest of the usual signs of insanity, clean, decent, intelligent, without delusions or hallucinations, although a fluent liar and a very plausible speaker; but he is, notwithstanding, always trying to secrete knives or sharp pieces of tin, and with this make a murderous attack on some one, his own desire which he seems quite unable to combat being to kill by cutting some fellow-creature. In June, 1900, he somehow managed to get possession of a razor, and without provocation made a murderous attack on a fellow-prisoner. On 30th October 1901 he secreted a piece of iron hoop, and with this unsuccessfully attempted to cut anothor lunatic's nose off. Since then with stringent supervision he has failed to obtain means to effect his purpose, and has remained the same quiet, intelligent, well-behaved man he has always been for the last fourteen years.—G. F. W. Ewens, *Ind. Med. Gaz.*, 1902, p. 228.

The chief points usually stated to be **indicative of homicide by an insane** are :—

(*a*) **The absence of motive.**—*Case CLXXXI* is an example of this. Sometimes there is not only an entire absence of motive, but, as pointed out by Taylor, the act is done "in opposition to all human motives." A woman, for example, murders her children (see *Case CLXII*), or a man, known to be fondly attached to his wife, kills her. Caution, however, is necessary in judging from this character. In a murder by a sane person there may be an apparent absence of motive, simply because the motive has not been discovered. On the other hand, in cases of homicide by undoubtedly insane persons, a motive—often, it is true, incommensurate with the act—has existed, or has appeared to exist. Again, in cases of homicide by sane persons, especially in India, the motive leading to the crime is sometimes a very trivial one.

(*b*) **The absence of any attempt at concealment** of the act.—*Cases CLXXXI* and *CLXXVIII* afford examples of this. On the other hand, *Case CLVI* is an example of considerable effort at concealment of homicide by an insane.

Case CLXXVIII.—**Homicidal mania in an individual otherwise apparently sane.** (Guy's '**Factors Unsound Mind**,' p. 181.)—"William Brown strangled a child whom he met by accident, and then requested to be taken into custody. On the trial he said he had never seen the child before, and had no malice against it, and could assign no motive for the dreadful act. He bore an exemplary character, and had never been suspected of being insane"

(*c*) **The absence of accomplices.**—This character is often present in homicide by sane persons. The existence, however, of accomplices strongly indicates sanity.

(*d*) **Numerous murders committed at the same time.**—Little reliance can, however, be placed on this character. In homicide by insanes there is often only a single victim (see

Cases CLVI, CLXIII, and *CLXXXI*). On the other hand, in homicide by sane persons, there are sometimes numerous victims as in *Running amok* (p. 349).

(*e*) **Absence of elaborate premeditation**—*Case CLXXIX.*—**Homicidal mania with elaborate premeditation** under 'purity' hallucination—Bertha Peterson, aged 45, daughter of the rector of Biddenden, was indicted for the murder of John Whibley. The deceased, a shoemaker, had been a teacher in the Sunday school of Biddenden, and there had been rumours eighteen months before the murder of his having behaved indecently towards a little girl of eleven. The prisoner was much interested in the rumour, was a disciple of Mr. Stead, took a great interest in the Criminal Law Amendment Act, and appears to have allowed her attention to be absorbed by these subjects until she became even more crazy than the general run of the nasty-minded apostles of purity. She purchased a revolver and practised with it. She wrote to the deceased expressing her regret for the mistaken attitude she had adopted toward him, and asking him to meet her in the parish school-room in the presence of witnesses and shake hands as a token of forgiveness. The meeting took place, and then, asking deceased to take a good look at a picture on the wall, she placed a revolver to the back of his head and shot him dead. Evidence was given of various eccentricities in the previous conduct of the prisoner, and Dr. Davies, superintendent of the Kent County Asylum, and Dr. Hoare, surgeon to the Maidstone Jail, in which the prisoner had been detained pending her trial, stated that in their opinion the prisoner was under the hallucination that she was ordered to shoot the man. At this point the judge interposed and invited the jury to stop the case. The jury preferred to hear the commencement of the speech for the defence, but before its conclusion they returned a verdict of '**guilty, but insane**.'

This case shows the exaggerated effect that any emotional propaganda may have upon persons of unstable brain. The unfortunate woman's mind was obsessed by the pseudo-revelations of Mr Stead's pornography, and her crime was the result of her obsession. **The ease with which the plea of insanity was established is rather remarkable in consideration of the elaborate premeditation and contrivance exhibited.**

This case bears a striking relation to the Prendergast trial. The evidence of premeditation and adoption of means to ends shown by this unfortunate lunatic were of the same kind as those relied upon by the prosecution to prove the sanity and full responsibility of Richard Prendergast for the murder of Carter Harrison.—*Jour. Mental Sc.*, October 1899.

Case CLXXX.—**Murder of lunatic—for insurance policy.** *Regina* v. *Ansell.*—Mary Ann Ansell, aged 18, domestic servant, was indicted for the murder of her sister, Caroline Ansell, a patient in Leavesdown Asylum. The prisoner insured the life of the deceased for twenty-two pounds ten shillings. Early in the present year prisoner purchased several bottles of rat poison, saying that her mistress had sent her for it. On February 22nd, deceased received by post a parcel containing tea and sugar, but when used they were found to have a bitter taste and were thrown away. On February 24th, deceased received a letter containing the false intelligence of the death of her father and mother, and purporting to be signed by a cousin, who, however, denied having sent

it. On March 9th, deceased received by post a jam sandwich, which she shared with two other inmates. All three were taken very ill, and Caroline Ansell died. The prisoner advised her father not to allow a *post-mortem* examination to be made, and with his consent wrote a letter in his name forbidding the examination. The prisoner's mistress denied having sent her for rat poison, or having used rat poison.

The plea of insanity was raised on the ground that although the prisoner had never been insane, she had several relatives in asylums, and Dr. Forbes Winslow was the only medical man who could be found to say that the prisoner was irresponsible. The jury found the prisoner guilty. After the trial considerable agitation was raised for the reprieve of the prisoner, and pressure was even brought to bear upon the Home Secretary by means of questions in Parliament with this object. The Home Secretary did not interfere, however, and the girl was hanged. We are clearly of the opinion that the verdict, sentence, and action of the Home Secretary were right. A more deliberate and cold-blooded murder has seldom been committed for a more sordid purpose. The deed was planned with cunning and carried out with merciless cruelty. Of evidence of insanity on the part of the prisoner there was not a shred. It was said that she had several insane relatives, but this was denied by her father; and even if it were a fact, it is utterly out of the question that every person with an insane heredity should be held immune from punishment. Such a practice would be intolerable, as well as most unjust. That a medical man could be found to express an "emphatic" opinion of the prisoner's irresponsibility is much to be regretted, but it is satisfactory to find that no alienist could be found to indorse that opinion.—*Jour. Mental Sc.*, October 1899.

Case CLXXXI.—**Homicidal mania; previous symptoms of mental disorder slight only** (*R.* v. *Brixey*, Taylor, *Med. Jour.* ii, 564).—"Prisoner, a quiet, inoffensive girl, a maid-servant in a respectable family, was charged with the murder of an infant. She had laboured under disordered menstruation, and a short time before the occurrence had shown some violence of temper about trivial domestic matters" This was all the evidence of insanity exhibited previous to the act. "She procured a knife from the kitchen on some slight pretence and, while the nurse was out of the room, cut the throat of her master's infant child. She then went downstairs and told her master what she had done. She was perfectly conscious of the act she had committed; she treated it as a crime, and showed much anxiety to know whether she should be hanged or transported. There was not the slightest evidence that at the time of the act, or at any time previously, she had laboured under any delusion, or intellectual aberration. The prisoner was acquitted on the ground of insanity, probably arising from obstructed menstruation."

Case CLXXXII.—**Homicidal mania co-existing with a quiet exterior** (Taylor's *Manual*, p. 743).—A Commissioner of Lunacy deeply impressed with the conviction that a patient in the asylum which he was visiting was perfectly sane, and fit to be discharged, in defiance of the physician's warning, trusted himself alone in the lunatic's company for the purpose, as he said, of a private conversation. In less than five minutes after they were alone, and as the lunatic believed unobserved the Commissioner was throttled by his companion, and but for the timely intervention of the physician, who had been a secret spectator of the scene, would have been strangled.

2. **Suicidal mania.**—Suicide by an insane may, like homicide, result from a delusion (suicidal monomania), or may result simply from the existence of an insane propensity or uncontrollable impulse for self-destruction, unaccompanied by any discoverable delusion (suicidal mania). A tendency to suicide often coexists with homicidal tendencies. Suicide without any discoverable motive does not necessarily amount to proof of the existence of insanity, although it to a certain extent indicates it.

The verdict "suicide while in a state of temporary insanity," so frequently returned by coroners' juries in England, is most probably in many cases the result of the fact that, by the law of England, self-destruction (in a person of sound mind) is a felony (*felo-de-se*) or murder entailing forfeiture of goods and burial in unconsecrated ground, unless declared to be of unsound mind, and the average English jury shrinks from calling the suicide a criminal. The law of India, however, contains no provision making the actual commission of suicide an offence, although an attempt to commit it is so (see Wounds). Sect. 30 of the Coroners Act (IV of 1871) expressly declares that it shall no longer be the duty of coroners in India to inquire whether any person dying by his own hand was or was not *felo-de-se*, and further that a *felo-de-se* shall not forfeit his goods.

3. **Kleptomania**, or the impulse to steal, is often present in general mental disease, though it is sometimes pleaded to excuse a theft by well-to-do people otherwise sane. In some cases theft committed by an insane is distinctly traceable to the existence of a delusion, *e.g.*, the individual may believe that he is only recovering property stolen from him. This sometimes occurs as an outcome of the delusions of boundless wealth often present in incipient general paralysis. Or, again, the individual may believe that he has received a divine command to take possession of the articles he steals. In other cases, by no means common, there is no delusion ; but simply a morbid propensity, or uncontrollable impulse to steal or to acquire. Kleptomania is sometimes strikingly hereditary,[1] and it is alleged that it has often shown itself in women labouring under disordered menstruation, or far advanced in pregnancy.[2] Browne[3] goes at length into the characters which distinguish theft by kleptomaniacs from theft by sane persons. A brief summary of these is as follows :—

1. The articles stolen are such as the means of the individual would readily enable him to purchase (see *Case CLXXXIII*), or are of little value. 2. Some kleptomaniacs steal openly, others willingly avow the act,

[1] Bucknill and Tuke, *op. cit*, p. 284.
[2] Marc and others, quoted by Taylor, *Man.*, p. 757.
[3] Med. Jur. of Insanity, p 132.

or restore the goods stolen. Some, however, conceal the theft with much ingenuity. 3. Kleptomaniacs, as a rule, make no use of the articles stolen; they either throw them away or hoard them, and have no accomplices. 4 In many instances, but not invariably, the articles stolen are bright and glittering articles. *Case CLXXXI*, in which kleptomania was set up as a defence to a charge of theft, illustrates the points to be attended to in forming an opinion on cases in which it is alleged this form of insanity exists.

Case CLXXXIII.—**Kleptomania** (Browne, *op. cit.*, p. 128).—"Mr. M—— was an individual of high rank, the owner of an excellent estate, and was as wealthy as most of his neighbours in the county in which he resided. He was never suspected of being insane, and the only evidence of mental unsoundness that could have been obtained was a confession on the part of some of his servants that he was 'sometimes peculiar.' Yet this gentleman was in the habit of appropriating 'towels.' He invariably, when visiting or on a journey, packed the towels he found in his bedroom in his portmanteau And when he returned home, the stolen articles were, by his own directions, returned to their real owners."

Case CLXXXIV.—**Alleged Kleptomania** (Casper, iv, p. 308).—Frau von X—, a lady of a certain rank, committed during her pregnancy theft in three goldsmiths' shops. Apparently while committing the first theft she was surprised by the assistant in the shop, on which she became pale, asked for a glass of water, and went away hastily, scarcely drinking any. Three months afterwards, and four weeks before her confinement, she went to a second and third shops, making small purchases, and offering in payment fragments of articles stolen from the first shop. At one of these shops she accepted ten thalers (thirty shillings) in cash, in part payment for the articles she offered. She concealed her conduct from her husband until she was summoned after her delivery, when she confessed to him her thefts, accounting for them by stating that during her pregnancy she had been seized with an irresistible desire to possess herself of glittering objects. She also said that she had gone out with the intention of returning the articles she had taken, but had become convinced by the way that they were her own property, properly acquired Much evidence was given which went to show the existence of mental aberration. Casper, being referred to, gave it as his opinion that Frau von X——— was criminally responsible, that in fact in her case the propensity to acquire was not irresistible, and gave as reasons: "1. That although the accused had besought her husband not to take her to those places where shining objects were to be seen, she went to goldsmiths' shops of her own accord, and without any necessity for doing so. 2. That she had paid away silver. 3. That she broke up the object she stole in order that they might not be recognised, and in that way lead to her detection. 4. She had not gone to the same goldsmith's shop twice. 5. She had concealed her conduct from her husband; and 6 when interrogated she had made many false and contradictory statements." (Browne, Med. Jur. of Insanity, p. 138).

4. **Incendiarism.**—Cases of **pyromania**, or morbid propensity for incendiarism, sometimes occur. Young females, suffering from disordered menstruation, hysteria or epilepsy, are said to be specially liable to it.

5. **Other forms** of partial moral mania are **Erotomania** an incontrollable craving for excessive sexual intercourse, it is,

called **Nymphomania** in females and **Satyriasis** in males: it may exist in the earlier stages of general paralysis and locomotor ataxia; and **Dipsomania**, a morbid craving for intoxicants. Homicide may also be committed by an imbecile (see following case).

Case CLXXXV.—Homicidal propensity in Imbecile.—Guy's *Fact Unsound Mind,*' p. 174.)—A. H, æt. 28, was tried at Taunton Assizes, in March 1868, for the murder of a boy æt. 13. The prisoner was notoriously an imbecile from his childhood, but was considered by his father, an officer in the army, and others, to be quiet, well disposed, and harmless. He was a diligent reader of the Bible, and had expressed a wish to be a Scripture-reader. He was greatly addicted to wandering about from place to place. On the morning of the murder he walked twenty miles, armed with a big stick and a sharp knife. Early in the evening of this day, he gave himself up to the police as "having killed a human being," and crying bitterly at the thought of what he had done. He had been tempted to kill two or three persons on the road, but had abstained. At length he killed a "poor little boy in a field," afterwards washing the blood from his hands. He conducted the parish constable to the spot where his victim lay, the head beaten to a pulp and nearly severed from the trunk by a wound in the throat extending from ear to ear. He could not bear to look at the body. He stated that he had been reading of murders in the newspapers till he thought he must commit one; that the thought had been in his mind for a week; that he was compelled to do it; that he did not wish to kill the boy, but could not resist it; that he knew he was doing wrong, but had no power to resist. The prisoner was acquitted on the ground of insanity.

EXAMINATION OF ALLEGED INSANES.

To ascertain the existence or otherwise of insanity you examine:—

1. **General appearance of patient.**—Especially: (*a*) any cranial deformity (see Amentia); (*b*) the facial expression and gestures,—these are often highly indicative of insanity, especially of its advanced or more fully-developed forms; and (*c*) any peculiarities of dress, gait, or surroundings.

2. **Bodily condition.**—Note specially: (*a*) The condition of the digestive functions; these are often disordered in the early stages of insanity, the skin becoming harsh and dry; (*b*) The state of the pulse, and the presence or absence of febrile symptoms; this is important in distinguishing between insanity and the delirium of disease; and (*c*) The presence or absence of insomnia, restlessness, excitement, depression, or defect of speech or articulation. Bucknill and Tuke observe that in a great many cases of chronic mania, the hair becomes rough and bristling. A blood tumour of the ear (hæmatoma) ending in shrivelling, the so-called asylum or 'insane ear,' is often noticed in advanced cases.

3. **History.**—(1) As indicative of the **cause** of the disease. The existence or absence of (*a*) congenital defect, (*b*) hereditary taint, (*c*) habitual indulgence in intoxicants, (*d*) disorders, especially in females, of the reproductive organs, (*e*) epilepsy, or other brain affection or injury, (*f*) excessive sexual indulgence, and (*g*) mental overwork, anxiety, or sudden shock. Inquiry should also be made as to whether anything has occurred likely to induce the individual to feign insanity. It must not be forgotten, however, that as in *Case CLXXXVI*, insanity may arise from the anxiety of mind resulting from a criminal charge.

(2) As to **existence of the disease**—it should be noted whether or no (*a*) there has been any previous attack of insanity ; (*b*) there has been any marked alteration or change in the feelings, affections, and habits of the patient ; and (*c*) inquiry should be made generally as to the symptoms observed at the commencement of the alleged outbreak of insanity.

Case CLXXXVI.—**Insanity due to anxiety of mind caused by a criminal charge** (Taylor, *Med. Jur.*, ii, p. 496.).—A poor man, a shoemaker, was requested by two police-officers to assist them in conveying to prison two men committed on a charge of theft. The shoemaker took a gun with him, and on the order of the police-officers fired at one of the prisoners, who was attempting to escape, and wounded him severely. The shoemaker was committed to gaol as a criminal, and the event made "such an impression upon him that he became violently maniacal."

4. **Mental condition and capacity.**—Inference as to this may be drawn from the patient's (1) answers to questions, (2) acts, and (3) writings. As regards (1), the patient's memory may first be tested. He may be asked, for example, his name, place of birth, as to the occupation of his parents, number of brothers and sisters or children, the date, the names of well-known persons, and may be asked to count in order from one upwards, &c. Next, his judgment may be tested ; he may be asked to perform simple arithmetical operations, may be questioned as to his knowledge of the value of money, and generally as to the inferences he would draw from particular facts. While questioning him, his power of fixing his attention should be observed. Next the existence of delusions should be searched for : if these are known, the conversation should be led to them ; if not, the conversation should be led to various topics in succession (see *Case CLXIV*). Lastly, the state of the moral feelings should be inquired into by directing the conversation to the subject of the patient's friends and relatives. This testing of the mental capacity by questions, is of special

importance in cases of supposed feigned insanity. Except in complete amentia, advanced dementia, or possibly also in an actual paroxysm of maniacal excitement; in true insanes, consciousness, memory, and reasoning power, especially as regards matters unconnected with their delusions, remain, at any rate, to a certain extent, intact. *Case CLXXXIX* is an example of feigned insanity, detected by persistently silly and erroneous answers to simple questions. Care should be taken that the questions asked are not too complex, but are such as the individual under examination might reasonably, from his education and position, be expected to be able to answer.

Ogston relates a case,[1] for example, in which a medical witness put forward as evidence of mental incapacity, the fact, that an alleged imbecile could not tell how much per cent £20 interest on £1,200 amounted to, though he himself (the witness), when asked to answer the same question, was unable to do so.

During the course of the examination, it should be noted whether the individual, as is usually the case with impostors, appears to be trying to make himself out to be mad. True insanes will often argue with considerable ability that they are not mad. Others are conscious of their condition. A constant putting forward, however, of evidence of insanity, should always be looked on with suspicion.

(2) As to the evidence of mental disorder afforded by the *acts* of the patient, it should be recollected that these in a true insane are the results of his disordered mental condition. Where delusions exist, his acts and antics are connected with them, even although the connection may be apparently inexplicable (see *Case CLXXXVII*). Sometimes, as Dr. Guy remarks, 'the acts of the maniac evince the same forethought and preparation as those of the sane" (see *Case CLXXXVIII*); and lastly, true insanes are generally easily imposed upon (see *Case CLXVI*).

Case CLXXXVII.—**Acts apparently inexplicable the result of delusion** (Guy's *For. Med.*, p. 186; quotation from the Autobiography of a Religious Maniac).—"I expected to be guided to prayer, but a spirit guided me and placed me in a chair in a constrained position, with my head turned to look at the clock, the hand of which I saw proceeding to the first quarter; I understood I was to leave the position when it came to the quarter. Another delusion I laboured under was that I should keep my head and heart together, and so serve the Lord, by throwing myself with precision and decision head over heels over every style or gate I came to."

Case CLXXXVIII.—**Homicide by an insane; forethought and preparation shown** (Guy's *For. Med.*, p. 187).—"A patient

[1] Case of David Yoolow, *Lect. Med. Jur.*, p. 297.

confined in the Manchester Lunatic Asylum had been cruelly treated by a keeper, and in revenge killed him. He related particulars of the transaction to Dr. Haslam with great calmness and self-possession. He said, 'The man whom I stabbed richly deserved it. He behaved to me with great violence and cruelty.' After detailing the treatment, he went on, 'I gave him warning, for I told his wife I would have justice of him. On her communicating this to him he came to me in a furious passion, threw me down, dragged me through the courtyard, thumped me on my breast, and confined me in a dark and damp cell. Not liking this situation, I was induced to play the hypocrite. I pretended extreme sorrow for having threatened him, and by an affectation of repentance, prevailed on him to release me. For several days I paid him great attention and lent him every assistance. He seemed much pleased with the flattery, and became very friendly in his behaviour towards me. Going one day in the kitchen, where his wife was busied, I saw a knife ; this was too great a temptation to be resisted. I concealed it about my person and carried it with me. For some time afterwards the same friendly intercourse was maintained between us ; but as he was one day unlocking his garden door, I seized the opportunity and plunged the knife up to the hilt in his back."

Case CLXXXIX—**Feigned insanity—silly answers to questions** (Woodman and Tidy, *For. Med.*, p. 900, from the Berlin Medical Zeitung).—A widow, who had bought a house, and not liking it, wished to annul the contract, feigned insanity. When asked to count, she did so thus : 1, 2, 4, 6, 7, 8, 10, 11, 13, &c. Asked how many fingers she had on each hand, she said "four." Asked how many two and two made, she said "six." To some simple questions such as—How many children have you ? How long has your husband been dead ? What did he die of ? What is your daughter's name ? What have you had to eat to-day ? What is your clergyman's name ?—she in each case gave an incorrect answer. To other simple questions, such as—What year is this ? How long is it since Christmas ? Where do you live ? &c., her answer was, "I don't know." Asked what is the first commandment, she answered, "I am the Lord thy God." Asked what is the second, she gave the same answer ; said she did not know the third and fourth. Asked the fifth, she said, "Thou shalt *not* honour thy father and mother."

(3) **Writings** of the patient frequently show evidence of the existence of mental disorder by the patient. These may exhibit incoherence, or betray the existence of delusions ; but except in cases of approaching general paralysis, the legibility of the handwriting is not usually affected. Sometimes the approach of insanity is indicated, by a person beginning to omit words from his writings or spell badly.

FEIGNED INSANITY.

The chief points by which feigned insanity may be distinguished are :—

1. **Absence of characteristic facial expression.**—In insanity, especially in the fully-developed forms usually feigned by impostors, the facial expression is characteristic. In feigned

insanity, this characteristic facial expression is usually absent, or if present, is not persistent.

2. **Absence of bodily disorder.**—Bodily disorder is usually present in true, and absent in feigned insanity. The presence or absence of insomnia should specially be noted. True insanes sleep but little ; impostors, exhausted by their exertions in feigning insanity, sleep soundly. Deafness and dumbness are sometimes feigned. These in true insanes are usually congenital; in feigned insanes they come on suddenly, and after the occurrence of an event likely to induce the individual to feign insanity.

3. **Sudden attack without sufficient cause.**—In true insanity, if the attack is sudden, inquiry will, as a rule, show a sufficient cause for the attack. Feigned insanity usually appears suddenly, without sufficient cause, and is generally traceable to a desire to escape punishment (see, however, *Case CLXXXVI*).

4. **Want of uniformity in the symptoms.**—In feigned insanity, the symptoms are, as a rule, not uniform with any distinct type of the true disease. The impostor, for example, mixes general mania with excitement, with advanced dementia, &c. That variation from distinct type is often present in a case of true insanity, should, however, be borne in mind.

5. **Persistent obtrusion of the symptoms.**—Impostors nearly always try to convince you that they are mad, putting forward evidence of their insanity, especially when they think they are under observation. The fact of being under observation, makes little difference in the behaviour of a true insane.

In many cases, a satisfactory diagnosis between feigned and true insanity can only be arrived at by subjecting the patient to **prolonged observation**. It must not be forgotten also, that an expert witness, when called upon to give an opinion as to the mental capacity of an individual alleged to be insane, must be prepared, as in other cases, to state the grounds upon which his opinion is based.

LEGAL ASPECTS OF INSANITY.

In the present state of our knowledge, it does not appear to be possible to frame a thoroughly satisfactory definition of the term "insanity." One of the chief difficulties in the way of doing so lies in the fact that it is impossible to set up a standard of sanity. Any definition, for example, to the effect that insanity is mental imperfection, incapacity, or disorder, arising from certain causes, involves the setting up of such a standard. Such definitions, in fact, involve the necessity of

our laying down a standard of mental perfection, capacity, or sanity, deviation from which shall be held to constitute insanity. Nor is the difficulty diminished by substituting for the term "insanity," other terms, such as "unsoundness of mind," "mental aberration," or "mental alienation." This difficulty of defining the conditions, however, of comparatively little importance, for the reason that whenever a legal right, liability or disability, arises out of the fact that an individual is insane, it does **not arise simply out of the fact of** the individual's **insanity, but arises out of the fact** that the individual, by reason of his insanity, is—or was, at a certain specified time—**mentally incapacitated to a certain extent** or degree. The degree of mental incapacity which must be proved to exist, in order to establish that such right, liability, or disability accrues, varies with the nature of the right, liability, or disability, in question. Hence, when in the course of an inquiry for medico-legal purposes, an individual's sanity or insanity comes into question, what was to be determined is not simply, is the individual insane, or was he insane, at a certain specified time. Were it so, a definition of insanity would be necessary.

What has really to be determined is—Is this individual or was this individual at a certain specified time, by reason of insanity, mentally incapacitated to a certain extent or degree? Such questions may arise in *criminal* cases, and also in *civil* cases. Again, also, the question frequently arises, whether or not the insanity of the individual is of such a nature as to justify his being placed in an asylum or under restraint.

Criminal Responsibility and the Plea of Insanity.

Every person is by law presumed to be of mental capacity sufficient to render him responsible for his acts. In criminal cases this presumption may be rebutted by proof that, at the time the act was done, the individual, by reason of unsoundness of mind, was mentally incapacitated to a certain defined extent or degree. The burden of proving this rests with those who assert it. The plea of insanity is often advanced dishonestly to escape from the legitimate punishment for their crime or this plea is sometimes too easily accepted for sentimental reasons.

> The verdicts passed on such occasions are 'guilty' or 'not guilty because of insanity,' but a third verdict should be allowed namely, 'guilty, but insane.'—Sir W. T. Gairdner, *B. Med. Assn.*, 1898.

We have now to consider what is this **degree of mental incapacity**, which must be proved before an individual will be

held irresponsible, or entitled to an acquittal from the prescribed penalty of his crime on the ground of insanity.

The English law on this subject is to be found in the answers given in 1843, by the English judges, to certain questions propounded to them by the House of Lords.

These questions were put to the judges in consequence of the McNaughten case (see below). The object of these questions was to obtain an authoritative statement of the law for the future guidance of the Courts, and the answers of the judges thereto have ever since been held to embody the law of England on the subject.

Case CXC.—**The McNaughten case** (Maudsley, *Responsibility in Mental Disease*, p. 95).—In this case, a man, named McNaughten, was tried for the murder of a Mr. Drummond, and acquitted on the ground of insanity. McNaughten was under a delusion that Drummond was one of a number of persons whom he believed to be following him everywhere, blasting his character, and making his life wretched. Under the influence of this delusion he shot Drummond. McNaughten had transacted business a short time before the deed, and had shown no obvious symptoms of insanity in his ordinary discourse and conduct.

These answers are also embodied in *s.* 84 of the *Indian Penal Code*, which constitutes the law of India on the subject of the criminal responsibility of insanes. This section is as follows: "Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." The effect of this section may be stated to be as follows: Suppose it to be proved that an individual has done an act which, were he sane, would be an offence—say, for example, A has killed B. Suppose, also, it to be proved that A at the time of killing B was insane. A would be entitled to an acquittal if he, at the time of killing B, was by reason of insanity mentally incapacitated to one or other of the following degrees:—

1. To such a degree as to render him "incapable of knowing the nature of the act;" as, for example, if A in killing B did so under the insane delusion that he was slaying a wild beast or breaking a jar; or

2. To such a degree as to render him incapable of knowing that he was "doing what is either wrong or contrary to law;" as, for example, if A at the time of killing B was under the insane delusion that B was attacking him (A), for the purpose of killing him; for in that case A's insanity would render him incapable of knowing that he was acting contrary to law, seeing that A, were his delusion true, would be justified by law in killing B.

On the other hand, A would not be entitled to an acquittal if all that was proved in regard to his insanity was that he killed B under the insane delusion that B had blasted his character; for in that case A, even were his delusion true, would not be justified by law in killing B; and would be presumed, the contrary not being shown, to know the nature of his act, and also that he was acting contrary to law.

Another point requiring consideration is as follows:—There is a general consensus of opinion among writers on insanity, 1st, that one effect of insanity may be a weakening of the affected individual's power of self-control; 2nd, that in some cases the power of self-control is totally lost, the result being the production of an uncontrollable impulse—*i.e.*, an impulse which nothing short of mechanical restraint will control (*Case CLXXXI*)(*a*)—to do certain acts; and 3rd, that such weakening or total loss of the power of self-control may occur, both in insanity accompanied by delusions, and in insanity unaccompanied thereby. The question therefore arises:—Suppose A to have killed B., and the only thing proved about A's insanity is that, by reason of insanity, A's power of self-control was, at the time he killed B, weakened or entirely lost, what would be the legal effect?

To this question it may be answered:—

1. That any weakening short of total loss of power of self-control, would not entitle A to an acquittal, either under Indian or English law.

2. That, according to Indian law, total loss of power of self-control would not entitle A to an acquittal, except the Court consider it proved that, by reason of such total loss, A at the time of doing the act was, in the words of the section, "incapable of knowing the nature of the act, or that he was "doing what is either wrong or contrary to law."

3. As regards the law of England on this last point, Sir J. F. Stephen[1] states that it is doubtful whether or no an act is a crime if done under the following circumstances: by a person suffering from mental disease, who at the time of doing the act was by such disease totally prevented from controlling his own conduct.

Hence, in a case where the question of criminal responsibility is concerned, a medical witness should not simply direct his examination towards ascertaining whether the accused is insane or not. He should in addition endeavour to form an opinion as to whether, by reason of insanity, the accused is mentally incapacitated to the degree specified in *s.* 84 of the *Penal Code*. He must, however, recollect that the real question at issue is the mental state of the individual at the time he committed the act. Hence he must be prepared if called upon to give his opinion as to this, and, as in other cases, must also be prepared to state the grounds on which his opinion is based. It may happen that, in order to arrive at a correct opinion, he has to take into consideration not only (1) facts

[1] 'Digest of the Criminal Law,' p. 21.

which he has himself observed, but also (2) circumstances which he has heard deposed to in evidence, or of which he has been informed. It is obvious, however, that any opinion based upon circumstances not within the knowledge of the witness is worthless, unless such circumstances are admitted or proved to be true in fact; and such opinion, therefore, should be given on the hypothesis that these circumstances really exist, and should be stated to depend on such hypothesis.

Nevertheless, it should be remembered that **few insane persons are wholly irresponsible.** The insane in their routine treatment in asylums are punished for fits of temper or committing nuisances by withdrawal of privileges such as stoppages of tobacco, forbidding him the weekly dance or the infliction of pecuniary fines. The degrees and extent of immunity to be granted to an insane for his misdeeds have been thus formulated by Dr. Mercier:—

> (1) All lunatics should be partially immune for all their misdeeds; (2) every lunatic should be wholly immune for certain misdeeds; (3) Very few lunatics should be wholly immune for all misdeeds—corollary—the plea of insanity, if established did not necessarily involve the total immunity of the accused from punishment; it did necessarily involve his partial immunity; and (4) that in order to establish the plea of insanity it was necessary to prove the existence in the accused of one or more of the following mental conditions:—(*a*) exonerating delusion; (*b*) such confusion of mind that the accused was incapable of appreciating, in their true relations, the circumstances under which the act was committed or the consequences of his act; (*c*) extreme inadequacy of motive; (*d*) extreme imprudence; and (*e*) the non-concurrence in the act of the volitional self.—*Brit. Medl. Assn.*, 1898.

Those who in a fit of **intoxication** by alcohol or drugs commit crime during their temporary mental aberration are not allowed the privileges of the plea of insanity.

Validity of Consent.

In certain cases the fact that an individual has given a valid consent to suffer what has been done to him, affects the question of the criminality of the doer. But by *s.* 90 of the *Indian Penal Code* a consent is invalid if given by a person who "from **unsoundness of mind** or **intoxication,** is unable to understand the nature and consequence of that to which he gives his consent." Hence, in certain cases, the question may arise whether a consent proved, or admitted to have been given, was or was not invalidated by the fact that at the time of giving it, the giver was mentally incapacitated to the degree specified in this section.

This question may arise in **rape** cases, for the consent of a female to sexual intercourse may be invalid by reason of her insanity. By the law of India, proof of insanity to the degree above stated invalidates the consent. This is not so in England, where a female, even if she be insane to the degree specified in *s.* 90 of the *Indian Penal Code*, may yet be capable of giving a consent to sexual intercourse, sufficient to exculpate an accused from a charge of rape, and reduce the offence committed to a misdemeanour (see *Rape*).

The same question may arise in cases where **death** or **hurt** has been caused. By the law of India, if a person over the age of eighteen suffers death or harm from an act done to him with his valid consent, the fact that he so consented may have the effect of reducing the offence committed from murder to culpable homicide not amounting to murder;[1] or may even, if the act be one coming under the description of *s.* 87 of the *Code*,[2] absolve the doer of the act from all criminality.

It should also be pointed out that, by *s.* 305 of the *Indian Penal Code*, *abetment of suicide* of "any person under eighteen years of age, any insane person, any delirious person, any idiot, or any person in a state of intoxication," is punishable with death or transportation for life, while the maximum punishment awardable for abetment of suicide of a person not coming under the above description is by s. 306 ten years' imprisonment. The degree to which a person must be mentally incapacitated, to be an insane person within the meaning of s. 305, is not defined.

Capacity of an accused to make his defence.

In criminal cases the question may arise: Is, or is not, the accused "of unsound mind, and consequently incapable of making his defence?" (See *ss.* 464 and 465, *Criminal Procedure Code.*) Obviously in such cases an expert called upon to examine the accused should direct his examination, not simply to the question whether the individual is or is not insane, but to the question whether or no the individual is mentally incapacitated to the extent indicated in these sections.

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[1] S. 300, Exception 5, of the Ind. Pen. Code is as follows:—"Culpable homicide is not murder when the person whose death is caused, being above the age of eighteen years, suffers death or takes the risk of death with his own consent."

S. 87: "Nothing which is not intended to cause death or grievous hurt, and which is not known by the doer to be likely to cause death or grievous hurt, is an offence by reason of any harm which it may cause, or be intended by the doer to cause, to any person above eighteen years of age, who has given consent, whether express or implied, to suffer that harm; or by reason of any harm which it may be known by the doer to be likely to cause to any such person who has consented to take the risk of that harm.

Competency as a witness.

In civil cases, the law of India on this subject is embodied in *s.* 118 of the *Indian Evidence Act*. The "explanation" attached to this section is as follows:—

"A lunatic is not incompetent to testify unless he is prevented by his lunacy from understanding the questions put to him and giving rational answers to them."

The "competency" of a witness to testify is a matter quite distinct from the "credibility" of his evidence. Hence it may be that a lunatic who has been declared by the Court competent to testify, may give evidence which the other circumstances of the case may show, ought not to be believed. As in the case of testamentary capacity, no amount of disease of the nervous system not affecting the mind renders an individual incompetent as a witness. Thus by section 119 of the same Act: "a witness who is unable to speak may give his evidence in any other manner in which he can make it intelligible, as by writing or by signs; but such writing must be written and the signs made in open court. Evidence so given shall be deemed to be oral evidence."

Testamentary Capacity.

By 'testamentary capacity' is meant capacity to make a valid will. To invalidate a will on the ground of the insanity of the testator, it must be proved that at the time the will was made, the testator was mentally incapacitated to a certain extent or degree. This degree may be defined to be that he either (1) did not know the nature of the act he was performing, or (2) was not fully aware of its consequences; or (3) has made a disposal of his property which he would not have made had his mind been sound, under the influence of a delusion, or of a disorder of the mind, perverting his affections, or sense of right[1] (see Case *Banks* v. *Goodfellow*, and *Smee* v. *Smee* noted below).'

Case CXCI.—**Validity of will by insane.** *Banks* v. *Goodfellow*, L. R., 5 Q. B., 549: Browne, *op. cit.*, p. 191, and Maudsley, *Respons, in Mental Disease*, p. 117).—Cockburn, C. J., in delivering judgment in this case, said: "It is essential to the exercise of such a power that a testator should understand the nature of the act and its effects; shall understand the extent of the property of which he is disposing; shall be able to comprehend and appreciate the claims to which he ought to give effect; and, with a view to the latter object, that no disorder of the mind should poison his affections, pervert his sense of

[1] Undue influence exerted on a person of feeble intellect may be held to render a will invalid, although the feebleness of intellect considered *per se* be insufficient to invalidate it.

right, or prevent the exercise of the natural faculties ; that no insane delusion shall influence his will in disposing of his property, and bring about a disposal of it which, if the mind had been sound, would not have been made." . . . "But, when in the result the jury are satisfied that the delusion has not affected the general faculties of the mind, and can have had no effect upon the will, we see no sufficient reason why the testator should be held to have lost his right to make a will, or why a will made under such circumstances should not be upheld." . . . "In the case before us two delusions disturbed the mind of the testator—the one, that he was pursued by spirits ; the other, that a man, long since dead came personally to molest him. Neither of these delusions —the dead man not having been in any away connected with him—had or could have had any influence upon him in disposing of his property. Under these circumstances, then, we see no ground for holding the will to be invalid."

Case CXCII.—**Testamentary incapacity** (*Smee and Others* v. *The Corporation of Brighton*, L. R., 5 P. D., p. 84).—In this case two wills were propounded, one made in 1859 and the other in 1867. By the first the testator left nearly the whole of his property to his wife absolutely. By the second he gave it her for her life or widowhood only, after which it was to go to the Corporation of Brighton for the purpose of forming a public library in the Royal Pavilion there. It was proved that at the time the wills were made the testator laboured under various delusions, the chief of which were that he was a son of George IV, that when he was born a large sum of money was placed in his father's hands in trust for him, and that his father had robbed him of part of this and had given it to his brothers. Sir James Hannen in summing up the case to the jury, said : "You should specially bear in mind that any one who questions the validity of a will is entitled to put the person who alleges that it was made by a capable testator upon proof that he was of sound mind at the time of its execution. The burden of proof rests upon those who set up the will, and, *à fortiori*, when it has already appeared that there was in some particular undoubtedly unsoundness of mind, that burden is considerably increased. You have therefore to be satisfied, from the evidence which has been offered by those propounding the will of 1867 and the earlier will also, that the delusions under which the deceased laboured were of such a character that they could not reasonably be supposed to affect the disposition of his property.

"This is an extremely delicate and difficult investigation, and may be illustrated by reference to the physical world. There might be a little crack in some geological stratum of no importance in itself, and nothing more than a chink through which the water filters into the earth ; but it might be shown that this flaw had a direct influence upon the volume, or colour or chemical qualities of a stream that issued from the earth many miles away. So with the mind. Upon the surface all may be perfectly clear, and a man may be able to transact ordinary business or follow his professional calling, and yet there may be some idea through which, in the recesses of his mind, an influence is produced on his conduct in other matters." After pointing out that George IV had taken a great interest in the town of Brighton, and that the testator was under the delusion that his brothers by the fraud of his father had been put in possession of two-thirds of his (the testator's) property, Sir James Hannen concluded thus : "It being conceded that the testator was undoubtedly of unsound mind, are you satisfied that when he made

either of the wills he was capable of dealing with the subjects before him entirely free from the delusions under which he suffered? If the evidence does not satisfy you as to this, your verdict should be against the will." The jury found against both wills.

A person who is insane therefore may make a valid will provided, at the time of making it, he was not mentally incapacitated to the degree specified above (see *Case CXCI*). A valid will may, of course, be made by a lunatic in a lucid interval. Obviously, however, the shorter the alleged lucid interval, the greater the caution which should be exercised in accepting evidence of its having occurred.

Mere eccentricity will not invalidate a will nor will any disease of the nervous system not affecting the mind. For example, a person speechless and paralysed from apoplexy may (his mind being unaffected) make a valid will.

A medical man in examining into the testamentary capacity of an individual, might ask him to repeat the principal provisions of his will, and explain their action. Ability to do so would show that the testator understood the nature, and was aware of the consequence, of the act he was performing. The existence of delusions, &c., likely to affect the provisions of the will should, of course, also be inquired into.

CAPACITY TO MANAGE OWN AFFAIRS.

When a person is alleged to be of unsound mind and incapable of managing his affairs, an inquiry into the truth of this allegation may, on proper application, be ordered by a court so empowered. On such incapacity being proved, the individual may be deprived of the control and management of his property,[1] and a person appointed to manage it for him. The courts are also empowered to make suitable provision for the protection[2] of the individual, *e.g.*, by appointing a person to take care of him. Formerly in **England** the usual procedure in such cases was to order—under what is technically called a writ "*de lunatico inquirendo*"—an inquiry to take place before a "commission in lunacy;" lately, however, the proceedings have been much simplified.

In India the conduct of proceedings of this nature is provided for by Acts 34 & 35 of 1858.

Of these Acts, Act 34 applies to the High Courts, and Act 35 to Courts other than the High Courts. By section 10 of Act 35, "the

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[1] Placed under "interdiction" is the technical expression.

[2] Protection is distinct from restraint (see Impostion of Restraint, p. 371).

legal heir of the lunatic" is not in any case to "be appointed guardian of his person."

In all such cases the **question at issue** is not simply, whether or not the individual is insane or sane, but whether or not he is mentally incapacitated to such a degree as to render him incapable of managing his affairs. That this is so must always be borne in mind while examining alleged insanes in these cases. **No general rule can be laid down** as to what should, in these cases, be held to **constitute incapacity.** Where doubt exists, it should be given in favour of sanity, *i.e.*, in favour of the supposition, from which, if established, disability does not arise. It may however be pointed out :

1. That in cases of complete amentia, advanced dementia, and general intellectual mania, the individual is obviously incapacitated.

2. That in partial intellectual mania, an individual may be incapacitated or not, according as to whether his delusion does or does not interfere with his capacity. For example, an individual may believe himself to be made of glass, and yet be perfectly competent to manage his affairs.

3. That in moral mania, especially partial moral mania, the mental disorder may well be of such a nature as not to interfere with the individual's capacity.

The cases which present most difficulty, are usually cases of incomplete amentia, especially the less developed form (moral imbecility). In such cases very great conflict of opinion often exists among the expert witnesses as to the individual mental condition and capacity. This was so in case CLVII (the Windham case). Lastly, it may be remarked that defective memory arising from old age does not, *per se*, constitute incapacity. "A defective memory in an aged person taken alone proves nothing."[1]

VALIDITY OF CONTRACTS.

It may be sought to invalidate a contract on the ground of the insanity of one of the parties thereto. To succeed, two things must be proved, namely : (1) That the insanity existed at the time the contract was entered into, and (2) that by reason of insanity the contracting party was then mentally incapacitated to a certain extent or degree, namely, that he was incapable of "understanding it, and of forming a rational judgment as to its effect upon his interests" (*Indian Contracts Act* [IX of 1872], *s.* 12).

The law of England, however, makes certain exceptions to this general rule, namely : (1) An insane is "liable for the price of neces-

[1] Judgment *in re Toplis*, Taylor, *Med. Jur.*, ii, 524.

i.e., goods suited to his rank and position, actually ordered and enjoyed by, and *bonâ-fide* supplied to him ; "[1] and (2) an executed contract will not be invalidated, especially if the parties cannot altogether be restored to their original position, provided the contract is a fair and reasonable one, and the other party thereto had no reason to suppose the individual to be insane at the time of making it.[2]

According to the law of England, **marriage** is a contract. Hence a marriage may be declared null and void on the ground of the insanity of one of the parties thereto at the time of entering into such contract. The degree of mental incapacity which must be proved in order to, *per se*, invalidate a marriage may be stated to be incapacity "to understand the nature of the contract and of the responsibilities and duties it creates" (see *D.* v. *D.*, *Case CXCIII*). Weakness of intellect coupled with undue influence, has been held to be good ground for invalidating a marriage (see *Case CXCIV*) ; hence the suitability, or otherwise of the marriage, may be one of the points for the consideration of the court.

Case CXCIII.—**Question of insanity in regard to validity of marriage.** (*D.* v. *D.*, otherwise *M.*, *Times*, 11th March 1885).—In giving judgment in this case, Sir James Hannen said : "The question I have to determine is whether the respondent at the time of her marriage, on the 28th October 1882, was of sound mind, so as to be able to enter into the contract of matrimony. . . . I am of opinion that every case of this kind must be decided on its own facts. . . . I accept for the purposes of this case the definition (of soundness of mind) which has been substantially agreed upon by the counsel . . . namely, a capacity to understand the nature of the contract and the duties and responsibilities which it creates. It is to be observed, however, that this only conceals for a moment the difficulties of the inquiry, for we have still to determine the meaning to be attached to the word 'understand.' If I were to attempt to analyse this expression, I should encounter the same difficulties at some other stage of the investigation with reference to some other phrase, and I should still have to determine on the review of the whole facts, whether the respondent came up to the standard of sanity, which I must fix on in my own mind, though I may not be able to express it. I may say this much at the outset, that it appears to me that the contract of marriage is a very simple one, which does not require a high degree of intelligence to comprehend it. I agree with the Solicitor-General (for the plaintiff) that a mere comprehension of the meaning of the words of the promises exchanged is not sufficient. The mind of one of the parties may be capable of understanding the language used, but may yet be affected by such delusions, or other symptoms of insanity, as may satisfy the tribunal that there was not a real appreciation of the engagement entered into."

Case CXCIV.—**Undue influence on validity of marriage of an insane.** (Woodman and Tidy, *For. Med.*, p. 890, and Abercrombie, *Students' Guide to Med. Jur.*, p. 169).—"In the suit for the dissolution

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[1] Browne, *Med. Jur.* of *Insanity*, p. 7.
[2] *Ib.* ; *Molton* v. *Zamroux*, 4 Exch., 17.

of the marriage of the Earl of Portsmouth, on the ground that he was of weak, and afterwards of unsound mind, it was proved that his servants were his playfellows, and that he was of fond of driving carts loaded with dung or hay, that he was occasionally extremely cruel to his horses and domestics, &c., &c. He was, although of age, in the hands of guardians. One of these, a solicitor, persuaded him to marry his daughter, without communicating with the relations or other guardians, and the marriage was afterwards declared void on account of the undue influence used."

Aphasia in relation to Testamentary Capacity. The question whether a person suffering from aphasia is capable of making a will, will depend upon the particular case. Each case must be judged on its own merits.

It must be laid down as a general principle that no one could make a will who did not possess the power of understanding and producing language of some sort. In order to make a will it was necessary for an individual to be able to communicate to others by means of some form of language what he would like to be done after his death. It would not be held to be a will if a person simply indicated by signs before he died that he wanted such and such a thing to be done, nor would it be held to be a will if a person gave directions by word of mouth. A person must be capable of understanding language, so that he knew either what he said or what was read to him. That implied that he could hear and understand words, if he could not read or understand pantomimic language, but if he could read and understand what he read, then it was not necessary for him to hear or understand pantomimic language. Given that a person understood what was in a document, it was not necessary that he should be able to speak it. order that he might execute a testamentary deed. He might indicate what he wished by means of writing, or by pantomime or in other ways. A complete case of auditory aphasia, which implied word deafness and word blindness, would be incapable of making a will, because not being able to understand any form of language, he would, in all probability, not be able to communicate his wishes by producing any form of language. From a consideration of the whole subject he had come to the conclusion that organic disease of the brain might render a patient incapable of making a will, and that some forms of aphasia might be produced also as one of the symptoms of the organic disease ; that some forms of aphasia might render a patient incapable of will-making ; that auditory aphasia, if well marked, would incapacitate a patient from will-making ; and that some other forms of aphasia such as pictorial word blindness, pictorial motor aphasia, and graphic aphasia, might render a patient incapable of making a will, although he was not necessarily mentally incapable.—Dr. W. Eider. *Brit. Med. Assocn.*, 1898.

IMPOSITION OF RESTRAINT AND LUNACY CERTIFICATES.

When an individual by reason of unsoundness of mind is mentally incapacitated to a certain extent or degree, restraint may be lawfully imposed upon him. This restraint may be either immediate, or may be imposed (after certain conditions

have been complied with), by relegation to an asylum. Hence in regard to the imposition of restraint, we have to consider three questions: (1) What degree of mental incapacity justifies the imposition of immediate restraint? (2) What degree of mental incapacity justifies the imposition of restraint by relegation of the individual to an asylum? and (3) What are the conditions which must be complied with, before an insane person is relegated to an asylum?

DEGREE OF MENTAL INCAPACITY JUSTIFYING IMMEDIATE RESTRAINT.

By the common law of England a person of unsound mind may be lawfully restrained from inflicting physical injury on himself or others. Restraint also, imposed in good faith on a person of unsound mind, for the purpose of preventing him from injuring himself, would come within the general exceptions of the *Indian Penal Code*, relating to acts done for a person's benefit (see *ss.* 89 and 92). Probably, also these exceptions would be held to extend to such restraint as might be necessary to prevent an individual inflicting injury on others. Hence the degree of mental incapacity which, in a person of unsound mind, justifies the imposition of immediate restraint, is mental incapacity to an extent which renders him dangerous to himself or others. Immediate restraint can, however, only be lawfully imposed, either (*a*) with the consent of the person having lawful charge of the insane individual; or (*b*) without such consent if the circumstances of the case are such, that the consent cannot be obtained in time to prevent danger. Further, immediate restraint thus imposed is only lawful so long as the danger exists.

Imposition of immediate restraint is justifiable also, under similar conditions in cases of delirium from disease, *e.g.*, **delirium tremens.** In imposing immediate restraint in cases of delirium from disease, a medical man must recollect that from the nature of the case, the danger is liable to cease suddenly, and that restraint continued after danger has ceased, may be a ground of action against him.

DEGREE OF MENTAL INCAPACITY JUSTIFYING SENDING TO AN ASYLUM.

By the law of both India and England, a medical man in relegating an insane person to an asylum, must certify that the individual is insane, and that he is "a proper person to be taken charge of and detained under care and treatment."

Obviously a proper person to be detained under care in an asylum is one, who being insane,[1] is dangerous to himself or others, and medico-legal writers are agreed, that this extends also to one who by reason of insanity is likely to injure his own property, or the property of others. Taylor[2] infers that relegation to an asylum simply for the purpose of treatment is not justifiable, but from the remarks of Lord Coleridge, C. J., in the case of *Neave* v. *Hatherley* (see below), it would appear that relegation to an asylum simply for the purposes of treatment is justifiable in cases, where the circumstances are such that efficient treatment cannot be employed unless the individual is so relegated.

Case CXCV.—**Legal justification of restraint.** (*Neave* v. *Hatherley*, Q. B. D, *Times*, 3rd Aug. 1885).—In this case Lord Coleridge, C.J., said that the examination of a person previous to placing him in an asylum ought to be "a real inquiry, a real weighing and sifting of evidence, a real examination, a real serious and solemn exercise of judgment," in order to ascertain whether an individual came within the definition of the statue of " a lunatic, idiot, or person of unsound mind, and a proper person to be taken charge of and detained under treatment. He emphatically dissented from the Attorney-General (for the plaintiff) that unless every other means had first been exhausted a person ought not to be placed in an asylum. The abuse of a thing was no proof that it had not a use, and early treatment in cases of unsoundness of mind was of the very greatest importance. People living in small houses had no power of making provision for such early treatment of relations who might be unsound in mind, while relegation, at an early stage, to a well-appointed asylum was calculated to have the best results."

It may further be pointed out that when restraint by relegation to an asylum has been lawfully imposed, the responsibility for alleged unnecessary continuance of such restraint, no longer rests with the medical practitioner under whose certificate the restraint was originally imposed.

ADMISSION TO ASYLUM.

An insane person may be sent to an asylum by order of a Court, or he may be sent (in England) under the provisions of 16 & 17 Vict., cc. 96 & 97 ; or, in India, under the Lunatic Asylums Act (Act 36 of 1858).

In England, by *s.* 74, c. 97, no person (not a pauper) may be received into an asylum without (1) an order from some person according to a certain specified form ; and (2) the medical certificate also, according to a particular form, of two registered practitioners, not in partnership,

[1] Not simply suffering from delirium of disease which renders him a fit subject for a hospital, not for an asylum.

[2] Taylor, *Manual*, p. 709.

and not one an assistant to the other, "each of whom shall separately from the other have personally examined the person to whom it (the certificate) relates, not more than seven clear days previously to the reception of such person into such asylum." In cases of emergency, however, a patient may be received on one medical certificate only, provided that two other medical certificates are furnished within three days. By *s.* 12, c. 96, no medical practitioner who is interested in or attends a licensed house or hospital, or whose father, brother, son, partner, or assistant, is wholly or partly the proprietor of, or a regular professional attendant in such house or hospital, shall sign any certificate for the reception of a patient into it. By *s.* 67, c. 97, a pauper lunatic may be received on one medical certificate only, if sent by order of a Justice; or under certain circumstances, if the certificate is accompanied by an order for the reception of the lunatic, signed by an officiating clergyman of, and the relieving officer or overseer of his parish.

In India, according to the *Lunatic Asylums Act* (36 of 1858), lunatics (other than lunatics sent to asylums by order of a criminal court) may only be received into an asylum under the following conditions:—

1. If sent by a magistrate, commissioner of police, or civil court. In this case only one medical certificate is required. This certificate must be in the form shown as Form A in the schedule of the Act;[1] and must be signed by a "medical officer"[1] after examination of the lunatic (*ss.* 4 and 8). (Government medical officers are forbidden to give certificates of lunacy except when required to do so by law, except as regards Form B.)

2. In the Presidency towns, and stations of the Straits Settlements, on presentation of an order and statement filled up in the form shown as Form B in the schedule of the Act,[2] accompanied by "the medical certificate containing the particulars of Form A in the schedule to this Act (Act 36) of two persons, each of whom shall be a physician or surgeon, and one of whom shall be a Presidency surgeon, or a surgeon in the employment of the Government"[3] (*s.* 7).

Section 2 of Act 36 provides for the appointment of visitors to asylums, two or more of whom by *s.* 3 are to visit the asylum at least once in every month; and by *s.* 12, defective or incorrect orders or medical certificates may, with the sanction of two or more of the visitors, one of whom must be a medical officer, "be amended by the person or persons signing the same."

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[1] Appendix VII (*a*).
[2] Appendix VII (*b*).
[3] Bomb. G. R. Genl. Dept. No. 4, of 3rd Jan. 1883, directs that no medical officer of lower rank than an assistant-surgeon is to be called upon to examine lunatics under these sections.

The form of medical certificate prescribed in the Indian Act (like that prescribed in England), requires the person signing it, it will be observed, to give the grounds on which his opinion has been formed, in the form of (1) facts indicating insanity observed by himself, and (2) other facts (if any) indicating insanity communicated to him by others. Under head (2) must also be stated the name of the person from whom the information was received.

In examining a patient previous to filling up and signing such a certificate, a medical man is bound to exercise the greatest care. The social stigma which attaches to any person who has been detained in an asylum is a terrible infliction to a sensitive mind, and makes it necessary that no case should be sent there without due cause, and every safeguard should be taken to prevent the possibility of a sane person being incarcerated in an asylum. As remarked by Lord Coleridge (see *Case CXCV*), his examination should be "a real inquiry, a real weighing and sifting of evidence, a real serious and solemn exercise of judgment." Negligence or want of care on his part (not simply an error in judgment) renders him (see *Hall* v. *Semple*, *Case CXCVI*) liable to be cast in damages, on an action being brought against him. Obviously, a medical man, unless he has himself observed facts indicating insanity in the patient, is not justified in signing such a certificate. To rely solely on the statements of others in such a case, amounts to culpable negligence.

Case CXCVI.—**Negligence in filling up a certificate of lunacy—Heavy Damages.** (*Hall* v. *Semple*, 3 F. & F., 337).—In this case the plaintiff had been discharged from an asylum on the ground of informality in the certificate. This certificate was dated July 29th, but the visit and examination were made on June 13th. The defendant was one of the medical men who had signed a certificate of the plaintiff's insanity. The evidence, however, went to show that Hall, although a very bad-tempered man, was not really insane, and that the defendant had relied too much on the statements of the wife and other interested persons. Compton, J., in summing up the case to the jury, said: "The principal questions to which I desire to direct your attention are these; first, whether you think that he (the defendant) signed the certificate untrue in fact, negligently and improperly, and without making proper and sufficient inquiries. It will be for your consideration what degree of care is necessary, so as to make out by the absence of it culpable negligence. It is not a mere mistake or error in judgment which would amount to such negligence, but you must be satisfied that there was culpable negligence..... And, again, you are not inquiring into an error in judgment, but whether the defendant has been guilty of that culpable negligence which I have explained and described to you—negligence in not making sufficient inquiries, the examination not having been sufficient in his own judgment." The jury found that there had been culpable negligence, and awarded the plaintiff £150 damages.

Further, the facts relied on and embodied in the certificate as facts indicating insanity, must be facts which really do so. Numerous instances are quoted by Taylor[1] on the authority of Dr. Millar, of certificates filled up with facts other than "good facts," or facts really indicating insanity. Some of these consist of mere statements of the existence of peculiarities of appearance or temper, not of themselves sufficient to show the existence of insanity ; *e.g.*, Has an insane appearance, or, is violent in temper and very abusive, or refuses to take medicine. Others again are statements either to the effect, that the individual labours under delusions, without specifying precisely what these delusions are ; or statements to the effect that the individual labours under a particular belief, such as from its nature may possibly be true, unaccompanied by any definite statement to the effect that such belief has been inquired into and found to be untrue. A fact to be a good fact really indicating insanity, must either clearly show the existence of a delusion, or the existence of such conduct as cannot be accounted for on the supposition of sanity.

With the admission of the lunatic into the asylum the responsibility of the medical jurist ceases. The question as to the care and the ultimate release or otherwise of the lunatic rests with the asylum authorities.

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[1] Taylor, *Med. Jur.*, ii, p. 512.

CHAPTER XIX.

LIFE ASSURANCE.

MEDICAL men are associated with Life Insurance Companies as *medical adviser* or as *medical examiner*, in both of which capacities it is the duty of the physician to detect any unsatisfactory deviation from the normal standard of health for the applicant, and any attempt by the applicant to conceal any unsoundness, and to enable the company to appreciate the extent to which the unsoundness may shorten life.

Life assurance is a contract, for the object of making provision for a family through the premature death of the head of the house or for borrowing money for commercial purposes in which an individual enters into an agreement with a company to pay them, each year he lives, a certain fixed sum, or "**premium**," in return for which the company issue a "**Policy of Assurance**," or undertaking to pay a certain fixed sum on the death of the assured, whenever this may happen.

This is the simplest form of the agreement; variations, however, are frequently introduced. Thus the yearly premium may be made payable in monthly, quarterly, or half-yearly instalments; or the assurance may be effected for a term of years only, the liability of the company ceasing on the expiry of the stated term; or it may be arranged that the sum assured shall be paid on the assured attaining a certain age, 'Endowment assurance' or at his death, whichever may first happen.

For a given sum, payable at death or at a fixed age, the yearly premium to be paid by the assured must obviously be more or less, according to his "**expectation of life**," that is, according to the number of years he may reasonably be expected to live.

An individual's expectation of life depends (1) on his age, and (2) on his freedom or otherwise from any special influence tending to shorten his life. If no such special influence exists, the individual's expectation is said to be **normal**. Hence arises the general question, on the answer to which the ordinary scale of premium rates of assurance companies must obviously be based, namely—(1) What is the normal expectation of life at various ages? But an individual seeking

to assure, may be subject to some special influence tending to reduce his expectation of life, and hence two other questions arise, namely—(2) What are the special influences which tend to shorten life, and to what extent do they do so? and (3) How is the existence, in any given case, of influences tending to shorten life ascertained?

THE NORMAL EXPECTATION OF LIFE AT VARIOUS AGES.

The expectation of life is calculated from the general death-rate which being fairly well-fixed in a country like England gives a fairly fixed expectation of life for different ages amongst individuals subject to the same conditions as those to whom the statistics refer. The following is one of the most recently published tables showing the expectation of life for men in England.[1]

Expectation of Life for Men in England.[1]

Completed Age.	Years.	Completed Age.	Years.	Completed Age.	Years.	Completed Age.	Years.
0	39·91	32	31·42	56	15·86	80	4·93
5	49·71	33	30·74	57	15·26	81	4·66
10	47·05	34	30·07	58	14·68	82	4·41
11	46·31	35	29·40	59	14·10	83	4·17
12	45·54	36	28·73	60	13·53	84	3·95
13	44·76	37	28·06	61	12·96	85	3·73
14	43·96	38	27·39	62	12·41	86	3·53
15	43·18	39	26·72	63	11·87	87	3·34
16	42·40	40	26·06	64	11·34	88	3·16
17	41·64	41	25·39	65	10·82	89	3·00
18	40·90	42	24·73	66	10·33	90	2·84
19	40·17	43	24·07	67	9·82	91	2·69
20	39·48	44	23·41	68	9·36	92	2·55
21	38·80	45	22·76	69	8·90	93	2·41
22	38·13	46	22·11	70	8·45	94	2·29
23	37·46	47	21·46	71	8·03	95	2·17
24	36·79	48	20·82	72	7·62	86	2·06
25	36·12	49	20·17	73	7·22	97	1·95
26	35·44	50	19·54	74	6·85	98	1·85
27	34·77	51	18·90	75	6·49	99	1·76
28	34·10	52	18·28	76	6·15		
29	33·43	53	17·67	77	5·82		
30	32·76	54	17·06	78	5·51		
31	32·09	55	16·45	79	5·21		

These are actuarial facts, based on an enormous number of fixed data and worked out by mathematicians. And on such tables assurance companies base their ordinary British premium

[1] From Bowne's *Manual*—English Experience, No. 3 Males.

rates for assuring the lives of men resident in Great Britain whose expectation of life is normal. Some insurance companies allow a slightly higher estimate than in this table. Lives deviating from the normal standard of health are '**loaded**' with an extra premium, if accepted.

PURE, OR UNLOADED, 3 PER CENT. PREMIUMS, CORRESPONDING TO CERTAIN EXPECTATIONS IN ENGLAND.

The "pure or unloaded 3 per cent. premium" is the sum which, if paid yearly during the period of expectation, will at 3 per cent. interest amount at the end of that period to the sum assured. Assurance offices, of course, add to the "unloaded premium" a certain percentage to cover cost of management and profit.

Age.	Expectation of Healthy Male Lives from experience of twenty Life Offices.	Unloaded 3 per cent. premium in sterling per £100 assured.	Unloaded 3 per cent. premium stated as percentage on the sum assured.
		£ *s.* *d.*	
20	42·06	1 8 7	1·430
25	38·44	1 12 6	1·625
30	34·68	1 17 7	1·880
35	31·03	2 3 10	2·190
40	27·40	2 11 9	2·588
45	23·79	3 2 3	3·112
50	20·31	3 16 0	3·800
55	16·93	4 14 6	4·725
60	13·83	5 19 9	5·983
65	11·01	7 14 8	7·705

For **women** in Europe the expectation of life is greater than for men by about three years all through, except during the child-bearing period when it is somewhat less.

A rough rule for calculating the "Expectation of Life" is:—Between the ages of 20 and 45 use the fixed number 96. Deduct the present age of the person from this number, and half the remainder gives his expectancy. Between 20 and 30 the result is a trifle below the average: and over 40 is slightly above. For estimating the expectancy of those over 45 take 90 as the fixed number, instead of 96 as before.

Another method which gives a slightly lower expectancy is to add to the actual age of the individual two-thirds of the difference between it and 80, a limit of life which is certainly more reasonable than that of 86.

Thus: deduct present age, 42 from 80, result 38; and two-thirds of this number, 25; the net result is the probable duration of life—67 years. By your method it is 64 years.

For India no tables have yet been published showing the normal expectation of life amongst **natives of India** especially

as Indian Birth and Death statistics for native lives are still incomplete and not sufficiently trustworthy. Dr. C. H. Joubert, I.M.S., as medical adviser of a large Insurance Company in India, writes, regarding the expectancy of native lives in India, as compared with European lives :—

"For some years past I have had frequent opportunities of seeing the family life of Natives of the insuring class, having been frequently called into consultation at houses in the Native parts of Calcutta. I may state in general terms that in such houses there is an entire absence of all ordinary sanitary arrangements. In almost all houses that I have seen even of the best class, there seems to be free communication with the sewers, and the smell of sewer gas is to be found in most of them. In fact, the adoption of under-ground sewers in Calcutta has introduced a new element of danger into Native houses, and were it not for the open character of Native houses, I am convinced that sewer gas diseases would be more prevalent even than they are at present. Foul stinking drains in the lower parts of Native houses are the rule, and cholera and diphtheria are common diseases."

"Again, another well-known fact is that diabetes is a very common disease amongst middle-aged Natives who are in easy circumstances, in a ratio greatly in excess of that which obtains among Europeans. It is not so rapidly a fatal disease as in Europe, but it shortens life most assuredly." ....." The same remarks apply to the poorer classes of Eurasians and Armenians and Jews who live under bad insanitary conditions "....." I consider it my duty to express a most decided opinion that though the constitutions of healthy natives may not be much inferior to the European standard, from a medical point of view, their habits, modes of life and the insanitary conditions amidst which they live are most distinctly inferior to the European standard, and render them more liable to acute diseases, increasing the risk of assurance."[1]

The rates, however, at which one of the principal assurance companies in India assures healthy native lives, appear to correspond roughly to an expectation—between twenty and sixty—of two-fifths of the difference between ninety and the age : *e.g.*, at age thirty the expectation apparently calculated on is about twenty-four years, *i.e.*, two-fifths of the difference between thirty and ninety.

For European and Eurasian lives in India the expectation of life has been worked out in some detail, see the following table, from which the extent by which the expectation of healthy Europeans is reduced by residence in India may be arrived at approximately. The expectation shown in B, it will be observed, corresponds approximately to half the difference between the age and eighty-six (not two-thirds of the difference between the age and eighty).

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[1] *Ind. Med. Gaz.*, 1889, p. 311.

TABLES of EXPECTATION of LIFE in INDIA.

A. Table of expectation of life compiled by J. Westland, Esq., Beng. C.S., from the experience of the Bengal Uncovenanted Civil Service Family Pension Fund; European and Eurasian lives; period of observation, 1837 to 1862.

B. Table of expectation of life compiled by A. F. Cox, Esq., Mad. C.S., from the combined mortality statistics of the Bengal, Madras, and Bombay Civil Services; European lives only; periods of observation—Bengal, 1850 to 1872; Madras, 1790 to 1852; Bombay, 1790 to 1860; number of lives under observation—Bengal, 600 to 1200; Madras, 500; Bombay, 700.

Note.—Table A is based wholly on Indian experience; Table B on Indian experience only up to the age of fifty.

Age.	Expectation A.	Expectation B.	Age.	Expectation A.	Expectation B	Age.	Expectation A.	Expectation B.
20	.....	33·65	42	17·86	22·12	62	7·93	11·39
22	31·43	32·49	44	16·69	21·18	64	7·27	10·54
24	29·85	31·41	46	15·57	20·29	66	6·62	9·52
26	28·32	30·36	48	14·53	19·39	68	5·92	8·54
28	26·84	29·31	50	13·55	18·43	70	5·20	7·62
30	25·39	28·26	52	12·63	17·38	72	4·50	6·75
32	24·02	27·22	54	11·71	16·25	74	3·80	5·95
34	22·72	26·19	56	10·72	15·09	76	3·10	5·23
36	21·49	25·16	58	9·68	13·91	78	2·41	4·57
38	20·28	24·13	60	8·72	12·74	80	1·72	3·98
40	19·07	23·10						

SPECIAL INFLUENCES TENDING TO SHORTEN LIFE.

When an individual who proposes to assure, is found to be subject to a special influence tending to shorten life, an assurance company may either refuse altogether to undertake the risk, or may agree to assure the life, charging an enhanced rate of premium or 'loading' as a compensation for the individual's diminished expectation. This enhanced rate may be charged in one or other of the following ways:—

(1) According to a special table of rates fixed by the company for individuals subject to a particular influence: *e.g.*, residence in a tropical **climate.**

(2) The ordinary premium rate for an individual whose expectation of life is normal may be charged, plus a special additional rate, calculated either as a percentage on the sum assured, or on the ordinary premium. This is the method commonly adopted when the influence reducing expectation is the individual's **occupation.**

(3) By adding a certain number of years to the assured's age, and charging him, instead of the ordinary rate corresponding to his actual age, the ordinary rate for an individual so

many years older. This is the plan generally followed when the influence reducing expectation is the existence of **disease** or of a predisposition to disease. It should be noted that when this method is adopted, the number of years to be added to the age must always be greater than the number of years by which it is estimated that the individual's expectation is reduced. A little consideration will show that, where normal formula is applicable, the addition must, in round numbers, be one and a half times the reduction of expectation, *i.e.*, just so many years as will raise the assured's actual age to the age at which the reduced expectation exists.[1]

The special **influences tending to shorten life** may conveniently be considered under three heads, *viz.* :—(1) External ; (2) Hereditary ; and (3) Acquired, personal influences.

1. EXTERNAL INFLUENCES.

The chief external influences likely to reduce expectation of life are—1. Locality of residence ; and 2. Occupation.

1. Residence in an unhealthy locality.—Practically, assurance companies may be said to recognise three classes of localities, *viz.*, (1) specially unhealthy, (2) unhealthy, and (3) ordinary localities. The West Coast of equatorial Africa is considered to belong to the first class, and companies will only assure lives resident there by special agreement and at a special rate. India and tropical countries generally are looked on as belonging to the second class. During time of residence in a locality of this second class, some companies charge, in addition to the ordinary premium, an extra rate, in some cases as much as $1\frac{1}{2}$ to 2 per cent per annum on the sum assured. Many companies, however, publish a special table of rates for residence in India and the tropics. The rates shown in these tables vary considerably : approximately the amount by which they exceed the corresponding ordinary or English rates, ranges from $\frac{3}{4}$ to $2\frac{1}{4}$ per cent. per annum on the sum assured. In forming an estimate of an individual's expectation of life, it should not be forgotten that of a number of localities to which the same assurance office rate applies, some may be more unhealthy than others. Low-lying, marshy districts, for example, are more unhealthy than well-drained ones, and in England towns are, as a rule, less healthy than country districts. Thus Guy gives the expectation of life at thirty for the whole of England, as 34·1 years. The records of benefit societies in rural districts, however, show an expectation of 38·4 years at the same age ; while in Liverpool and Glasgow the expectation at thirty is respectively twenty-seven and twenty-five years.[2] In India, again, certain localities are well known to be more unhealthy than others.

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[1] For more precise calculations a table of expectation of life must be employed thus :—Find the expectation corresponding to the individual's actual age ; from this deduct the number of years by which it is estimated his expectation has become reduced ; then find in the table the age corresponding to the reduced expectation ; the difference between this and the actual age is of course the number of years to be added.

[2] Guy, quoted by Sieveking, '*Medical Adviser in Life Assurance*,' p. 119.

2. **Occupation.**—The occupation of an individual may tend to reduce his expectation of life by exposing him to risk of (1) mechanical injury, (2) absorption of poison, or (3) contraction of disease, or of a habit, tending to shorten life.

(1) **Mechanical injury.**—The chief occupations exposing to this risk are as follows:—**Military and Naval service.** In war time extra rates of five to twenty guineas per cent. have been charged to officers actually engaged. During time of peace officers of the Navy are usually charged an extra rate of half a guinea per cent. within certain limits, and a special higher rate beyond.[1] In India an extra charge of about 1½ per cent. per annum (which covers **war risk** in India) is usually made for military employ, **engine-drivers, sailors, and miners.** The usual extra charge for these occupations is 1 to 2 per cent. additional on the sum assured. Other occupations exposing to this risk, and for many of which extra rates are charged, are mining engineers and agents, makers of explosives, quarrymen and others using explosives, railway officials generally, policemen, firemen, gamekeepers, builders, plumbers, and glaziers, and all occupations involving constant contact with horses.

(2) **Absorption of poison.**—This risk attends the manufacture of chemicals generally, and specially to the manufacture of compounds of the more poisonous metals. Occupations involving constant contact with such metals or their compounds (*e.g.*, arsenic, mercury, lead, and copper) are also exposed to it. Again, occupations involving exposure to poisonous vapours: *e.g.*, phosphorus vapour, nitrous acid vapour, sewer gases, &c., involve this risk.

(3) **Contraction of disease, or of a habit tending to shorten life.**—Occupations exposing to risks of this kind are (a^1) **very dusty occupations,** as grinders, millers, masons, and coal-miners; Sieveking remarks that few of the Sheffield steel grinders attain the age of thirty-five; (b^1) **sedentary occupations** especially if carried on in badly ventilated rooms; (c^1) **occupations likely to lead to the acquirement of habits of intemperance,** *e.g.*, publicans and others engaged in the manufacture or sale of alcoholic liquors. Sieveking[2] points out that while between the ages of forty-five and fifty-five the general mortality for all England is 18 per 1,000, the rate between the same ages in the case of inn and beershop keepers is 28 per 1,000, and in butchers (probably from the same cause) 23 per 1,000. There is some reason also to suppose that much **railway travelling** injuriously affects health, and hence that occupations involving this tend to shorten life. It may also be noted that, according to Guy, the average duration of life among members of the learned professions is seventy-six years and six months, or greater than is the case in any other occupation.

2. HEREDITARY INFLUENCES.

1. **The influence of the constitution of the parent on the life of the offspring may convey hereditary disease.**—The percentage of cases in which hereditary transmission of

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[1] Sieveking, *op. cit.*, p. 121.
[2] *Op. cit.*, p. 62.

disease is traceable, is variously stated by different authorities. Much of this variation arises from difference in the fact accepted as showing hereditary transmission. Thus, if the only fact accepted as indicating this, is affection of the parents, a lower percentage of heredity will be found, than when affection of the grandparents or any of their children is accepted. The following are the chief hereditary diseases, and the main facts derived from European experience, bearing on the question under consideration. Little or no information is available as regards hereditary transmission of disease among natives of India.

(1) **Tubercle of the lung.**—The percentage of heredity of this disease is variously stated at 25 to 60 per cent. Females appear to be somewhat more liable to inherit it than males, and the disease seems to be more liable to descend from mother than from father to child. Sieveking considers that where the personal condition of the individual is good, the death from consumption of one parent, or of two of the individual's brothers or sisters, should be met by an addition of seven to ten years to the age; and that if both parents have died of the disease, the life should either be rejected altogether, or twenty to twenty-five years added to the age.

(2) **Gout.**—Percentage of heredity equals about 50. Sieveking states that the usual practice is to add three years to the age for hereditary liability to gout, but considers this addition inadequate.

(3) **Cancer.**—Percentage of heredity, 8 to 33. Twice as many females as males die from this disease; hence the addition to age for hereditary liability to cancer, should be greater in the case of females, as cancer is mainly a disease of later life.

(4) **Rheumatism.**—Percentage of heredity, about 30. Acute rheumatism, although not so likely to prove directly fatal as other hereditary disease, may damage the heart and so impair expectation.

(5) **Insanity, and brain disease generally.**—Percentage of heredity of insanity, 25 to 60. Hereditary transmission of insanity appears to be more common in the upper than in the lower classes of society, and to take place more frequently from mother to daughter, than from father to son. Other brain diseases, *e.g.*, epilepsy, exhibit a marked tendency to hereditary transmission, and frequently brain disease in one form in the parents is transmitted in another form to the children. Contrary to a notion formerly entertained, insanity undoubtedly tends to shorten life.

(6) **Syphilis and scrofula.**—Hereditary transmission of these diseases is chiefly liable to affect the expectation of life of an adult indirectly, *e.g.*, by rendering him less able to resist an attack of serious disease.

Heredity to long life.—Limited family vitality requires a substantial increase of premium.

The importance of heredity used to be exaggerated, says Sir William Gairdner, but the tendency now was too much the other way, partly in consequence of the discovery of the tubercular bacillus and the difficulty of reconciling that with the doctrine of heredity. It was the

fashion nowadays to regard heredity as a misapprehension or a superstition. After all had been done, however, it could not be denied that the simple fact of long life or short life was in many cases a hereditary fact. Looking back over three or four or five generations in families known to be long-lived, you will see if many of the members had not even approached being centenarians. The opposite peculiarity was equally notable in short-lived families. Then there are the cases of families, among the members of which tubercular disease was rampant, and not only tubercular disease but tubercular disease which killed at a particular age or within particular limits.

Indirect hereditary influences.—Great disparity of age (and, according to some, near consanguinity) between the parents, or extreme youth of the mother, may exert an indirect injurious effect on an individual's expectation of life, by interfering with his development, or power of resisting attacks of disease. Under the head of indirect hereditary influence, the influence of sex on expectation may also be considered.

The general expectation of life among **females** is slightly greater than among males. Females, however, are subject to the special risk attendant on **child-bearing.** This risk does not attach to the pregnant condition, but to parturition, and attaches specially to a first delivery. Dr. Allen's statistics, collected from various sources, give as the proportion of deaths (from puerperal causes) to deliveries, one in sixty-two for primiparæ, and one in one hundred and twenty-four for multiparæ. Females, therefore, pregnant for the first time, Sieveking advises,[1] should be charged a special rate, and it is a question whether an extra rate should not also be charged to multiparæ. The risk to life attendant on parturition is greatly increased by insanitary surroundings: hence the advisability of charging an extra rate becomes greater, if the female about and after the time of her delivery is likely to be subject to such surroundings. Such extra rates may be remitted when parturition has taken place, or the period of child-bearing has come to an end. Frequent previous **miscarriages** often indicate a syphilitic taint, and justify an extra rate being charged, no matter what may be their alleged cause.

3. ACQUIRED PERSONAL INFLUENCES.

1. **A previous attack of disease** may be deemed to have reduced expectation, if the disease is (1) serious in

[1] *Op. cit.*, p. 75, "the older the primipara the heavier should be the rate, the mortality increasing after 50 years of age, a hereditary history of cancer could be ignored in endowment assurance maturing at the age of 45 or 50, whilst it should carry extra rates for a *whole* life policy.

nature and likely to recur, *e.g.*, cancer, apoplexy, epilepsy, gout, &c.; or (2) likely to have impaired the functions of some important organ, *e.g.*, sunstroke, acute rheumatism, dysentery, &c.; or (3) one indicating serious constitutional taint, or impairment of function, *e.g.*, fistula, piles, guinea-worm,[1] &c.

In some cases the expectation may be deemed to be so greatly reduced as to render the life uninsurable. In other cases the reduction of expectation may be met by an addition to the age. No general rules can be laid down applicable to all cases as to the course which should be followed. Sieveking, however, states that a single well-marked attack of acute rheumatism, confining the individual to bed for six weeks or more, justifies an addition of seven to ten years to the age, and that the addition should be greater if there has been a recurrence of the disease. The same authority also considers the usual deduction of three years from expectation for an attack of gout too little.[2]

2. **Acquirement of a particular habit.**—The habit reducing expectation, most commonly coming under notice, is intemperance. **Intemperate habits**, according to Mr. Neison, reduce expectation so greatly as to bring it down (in the middle ages of life) to about $19\frac{1}{2}$ minus one-fifth of the age; *e.g.*, at thirty to $19\frac{1}{2}$ minus six, or $13\frac{1}{2}$ years. Abuse of narcotics other than alcohol, *e.g.*, **opium**[3] and habits other than over-indulgence in narcotics, may also reduce expectation.

3. **Existence of a morbid or abnormal condition**, such as :—

(1) **Blindness.**—Usually met by an addition of ten years to the age. (2) **Hernia.**—This, unless the individual agrees to wear a truss, renders his life uninsurable. (3) **Loss of a limb** or malformation interfering with the power of locomotion. For loss of a leg three years is usually added to the age, but Sieveking thinks this insufficient. (4) **Open ulcers.**—These must be healed before the life can be accepted. (5) **Deafness.**—No addition is usually made for this, although, like blindness, it undoubtedly exposes the individual to increased risk of accident. (6) **Loss of Teeth.**—See p. 389. (7) **Presence of disease.**—Examination of the proposed Assuree, see below.

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[1] For an attack of guinea-worm in a native of India three years before proposal and with one recurrence an English Life Assurance Company charged one per cent. extra for three years, the extra to be removed in case the guinea-worm did not recur during the subsequent three years. Death from guinea-worm is very rare and would be presumably through extensive sloughing. Captain C. L. Williams, I.M.S., gives statistics (*I. M. G.*, 1898) to show that no extra rate for native lives need be imposed for the small chance of death from this parasite in proposer who had harboured the worm previously.

[2] C. Muirhead, causes of death amongst Scottish Widows Fund, A. D. Secy. 1892.

[3] *Op. cit.*, pp. 97, 143.

Finally, it should be remembered that in the same case there may exist *a combination of influences* reducing expectation. The locality of residence, occupation, or habits of an individual may, for example, have the effect of augmenting the damage caused to his expectation of life by disease or a tendency thereto. Thus residence in a tropical climate may augment the damage to expectation resulting from certain diseases of the digestive organs. An occupation involving much exertion may augment the damage due to certain affections of the circulatory system; or one involving much anxiety of mind, the damage due to a tendency to brain disease. Intemperate habits again increase the damage due to disease generally, and especially the damage resulting from affections of the nervous and digestive organs.

For the detailed examination for these defects see p. 388, *et seq.*

EXAMINATION OF APPLICANT.

How the existence of influences tending to shorten life is ascertained?

The usual method is as follows: The individual proposing to assure is—(1) Supplied by the insurance company with a series of printed questions, to which written answers are required. (2) Required to refer to two or more persons personally acquainted with him (one being his usual medical attendant), and to these *referees* of the proposed assuree a similar series of questions are addressed. (3) Examined by a medical man acting on behalf of the company, who also is usually supplied with a series of questions to be put to the proposed assuree; and (4) required to sign a formal declaration to the effect that his statements are true, and are to be taken as forming the basis of his contract with the assurance company.

1. Printed Questions.—The object of the questions put to the proposed assuree is, of course, to ascertain whether or not he is subject to any hereditary or other influence tending to shorten life, and being put in a categorical and formal way, delicate question such as to previous syphilis, can be asked as a matter of course. In answering them and generally the assuree is bound to exercise the utmost good faith in the representations he makes to the assurers; failure in this respect on his part will, as a general rule, render the policy void. Further, save in very exceptional cases, misrepresentation or concealment of material facts will render the policy void. Hence arises a fourth question in regard to life assurance, which presently must be considered, namely: Has there been misrepresentation or concealment of material facts?

2. **Referees.**—Any person the assuree nominates as one of his "referees" may refuse to act in such capacity ; but if he undertakes the duty, he is bound, like the assuree, to exercise the utmost good faith in discharging it, at the risk, should he fail in doing so, of rendering himself liable to an action should loss ensue. Hence "the usual medical attendant" of the proposed assuree, if he accepts the duty of a referee, is bound to answer truly all questions put to him, and to disclose every material fact known to him ; or, should he have no knowledge as to any particular fact, in regard to which information is required from him, to state so distinctly.

3. **Medical Examination.**—The examination of the proposed assuree should be thorough, and, in order that nothing may be omitted, should be conducted in regular order, somewhat as follows :

Medical Examination of the proposed Assuree.

General external examination.—This may (*a*) directly or (*b*) indirectly disclose the existence of a condition tending to shorten life. The chief conditions coming under head (*a*) are blindness, hernia, loss of a limb, or malformation interfering with the power of locomotion, open ulcers, and deafness (see p. 388).

(1) **Gait, manner, and general appearance.**—This may indicate actual disease of the nerve centres or of a tendency thereto ; or premature decay, the individual looking older than his age ; or existence of a habit tending to shorten life, *e.g.*, *intemperance*. (2) **Skin disease** : a disease of this class may indicate a constitutional taint or intemperate habits. (3) **Weight** : this should be in fair correspondence with the height. From the table on p. 38, it will be seen that roughly a male European, 5 feet 7 inches in height, should weigh about 150 lbs., and 5 lbs. more or less for every inch above or below this height. The proportion borne by the weight to the height appears, in the case of natives of India, to be as a rule lower than among Europeans. Very low or very high weight in proportion to the height, or marked recent gain or loss in weight, should be looked on with suspicion. A variation in weight of more than 20 per cent. from the standard, is regarded by most authorities as incompatible with normal health. (4) **Vaccination.**—The unvaccinated or the unprotected by a previous attack of smallpox are considered unsound and are not accepted at all by several offices, or, if accepted, death from smallpox and its sequelæ are excluded from the contract, or an extra premium exacted.

In England the percentage of deaths from diseases of the chief systems to total deaths, is about as follows :—Respiratory, 30 (one-third of these from phthisis) ; nervous, 13 ; circulatory, nearly 7 ; digestive, about 51 ; and genito-urinary, about 2 per cent

In India a very large proportion of the total deaths (in the Bombay Presidency about 65 per cent.) are attributed to "fever." In ordinary years, "bowel-complaints" come next, being credited with (in Bombay) about 8½ per cent of the total deaths In exceptional years, the deaths from cholera exceed those from bowel-complaints Thus, in 1877 (the famine year), in Madras,[1] 22 per cent., and, in Bombay, 9 per cent. of the total deaths were reported as from cholera.

The various systems of the body should next be examined.

Respiratory system.—Respiration should be quiet and easy ; its ratio to the pulse 1 to 4 or 5, and not quicker than 20 per minute. The chest should expand in all directions, and there should—especially below the clavicles—be no flattening. Deep inspiration should cause no distress. There should be no lividity of the lips, or tips of the ears or fingers ; and the individual ought to be able to count aloud rather slowly 1 to 20 or 30, without taking fresh breath The circumference of the chest should be in fair correspondence with the height, and in suspicious cases the "vital capacity" (*i.e.*, the volume of air expelled after the deepest possible inspiration by the deepest possible (expiration) should be ascertained [1] The chest should be examined by percussion and auscultation, and special inquiry made as to previous hæmoptysis, cough, loss of weight. A single occurrence of hæmoptysis, Sieveking thinks, should be met by an addition of fifteen years to the age, and the life should be altogether rejected if examination shows decided evidence of the existence of tubercular deposit. Out of 524 deaths from phthisis in the Scottish Widows Assurance Society Dr. Muirhead found that certainly not more than 35% exhibited any family predisposition, and this percentage corresponds closely with the 34% of Dr. Williams and with the 36% of Dr. Cotton. His investigations tend to show that a family history of phthisis is just as common amongst non-consumptives, and he formulates the statement that "15% at least of proposers to the Society for assurance, and of those accepted by the Society, will show a record of death by consumption among their parents." [2]

Nervous system.—The principal symptoms indicating existence of actual disease of this system are paralysis, want of co-ordinating power, hyperæsthesia, anæsthesia, and certain affections of the special senses. A tendency to disease of this system, again, may be indicated by repeated attacks of giddiness or headache, or by a general appearance of plethora, accompanied by shortness of the neck. Disease of the spinal cord, a previous attack of apoplexy, or confirmed epilepsy, render the life uninsurable. Previous attacks of other diseases, *e.g.*, sunstroke, impair expectation in proportion to the amount of persisting damage. Woodman and Tidy note that sexual incapacity in males is an early symptom of many neuroses.

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[1] The total death-rate in Madras in 1877 was 53·2 per 1,000.
[2] *Op. cit.*

Circulatory system.—The pulse should be regular between (in adults sitting) 70 to 85 per minute, soft, but not too compressible. Change of posture should not make a difference of more than 10 beats per minute. The heart sounds should be normal, and the apex-beat in the fifth intercostal space about 1½ inches below, and the same distance to the right of, the left nipple. If a murmur exists, and there is reason to suppose it to be not due to organic disease, postponement of the assurance should be advised. If due to valvular disease, its intensity affords no indication of the amount of danger. Certain forms of valvular disease damage expectation more than others. Aortic regurgitation is the most serious from liability to sudden death, whilst aortic stenosis and mitral disease, especially if regurgitant in character, is much less serious. Fatty degeneration of the heart obviously greatly impairs expectation. In the rheumatic class prognosis depends largely or in considerable degree on good compensation and absence of recurrence of attacks of rheumatism. Age is also important as acute rheumatism is more a disease of early life—occupation quiet and habits regular. Aortic regurgitation should be rejected, and also double mitral disease. Generally cardiac diseases should be accepted only on careful consideration and in certain selected cases, otherwise a heavy addition should be made in the case of a would-be insurer exhibiting *functional disorder of the heart*, produced by excessive tea or coffee drinking or tobacco smoking, and especially in regard to tea intoxication. He had known of several cases of this. The consequent cardiac irregularity might be so great, in fact, that any medical examiner must reject the candidate, if afforded only one opportunity of examination. A second examination should be obtained in two or three years' time. *Tea* acted on the acceleration of the heart without clouding the higher cerebral functions, but in very varying degrees in different individuals. The chief symptoms of excessive tea-drinking were found in the heart's action. The cardiac symptoms were (1) increased rapidity; (2) intermittency and irregularity, amounting in extreme cases to delirium cordis; (3) pulse very irregular also, and altered in volume and force; and (4) no pericardial rub, though sounds might be quite arhythmic. These symptoms were due to tea alone, and would disappear in two or three weeks if the tea-drinking were discontinued. The irregularity was of purely nervous origin, it did not end in organic disease of valves, or affect the heart except possibly in the direction of dilation of the cavities. The tea or coffee habit could be easily given up by most persons. In the case of the *tobacco* habit, the heart became irregular and irritable, but the cardiac complications were removable by stoppage in this case also. There were no interstitial depreciations of the heart as in the case of chronic alcoholism; the effects were transient, and called only for the relinquishing of the habit, and in regard to application for insurance for the postponement of the medical examination.

Digestive system.—Under this head the appearance should be noted of the tongue, lining membrane of the mouth, skin, and conjunctiva. **Teeth**.—Loss of teeth renders the individual unsound, by leading to dyspepsia and dysentery, through want of proper mastication. In such cases the proposer should be made to get and use a set of artificial teeth before he can be considered sound. Inquiry should be made as to the state of the appetite and action of the bowels, and as to present or previous existence of piles, jaundice, hæmatemesis, chronic vomiting, and symptoms of dyspepsia generally. Inquiry should also

be made as to previous attacks of malarious disease, and an endeavour made to ascertain the condition of the spleen. Enlargement of the liver (except when due to simple congestion) renders complete rejection of the life advisable. If due to simple congestion, the examination should be postponed until the liver has recovered its normal dimensions.[1]

Genito-urinary system.—Œdema or puffiness, especially of the eyelids, hands, feet, or scrotum, should be looked for, and inquiry made as to the existence of lumbar pains or dysuria. Inquiry should also be made as to the existence or otherwise, in males, of sexual incapacity and urethral stricture; and in females of symptoms indicating ovarian or uterine disease. The urine passed during twenty-four hours should be examined; its quantity should be forty to sixty ounces, specific gravity 1015 to 1025, and it should be free from blood, sugar, and albumen. Persistent presence of any of these renders the life uninsurable. The urine should also be examined for the presence of bile pigments, pus, tube casts, and crystalline deposits.

Colour blindness.—Special examination should be made for this in the case of sailors, railway guards, locomotive engine drivers, or others whose occupations are such as to expose them to danger should they mistake the colour of a signal. The form of the affection may be inability to distinguish red, or green, or violet, constituting, as the case may be, red blindness, green blindness, or violet blindness. Of these three forms the first is most and the last least common. Or the inability to distinguish these colours may be incomplete, constituting incomplete colour blindness, the most common form of all. Examination for colour blindness is best conducted by Holmgren's method. This consists in placing before the individual a number of skeins of wool of various shades of colour, and making him sort them in order according to their colour and shade.

Other questions connected with Life Assurance are—Has there been misrepresentation or concealment of material facts? Has the death of the assured taken place? Did the assured kill himself? What was the cause of the assured's death?

Has there been misrepresentation or concealment of material facts?

This question arises when liability to pay the sum assured is disputed on the ground that the policy is void, owing to such misrepresentation or concealment. In regard to it, it may first be stated that, in general terms, a material fact is anything the assurers have a right to be informed of, which may influence the rate of premium, irrespective of whether the party from whom the information is required, does or does not know it may have this influence, and irrespective of whether the fact is or is not a condition of things which has actually shortened the life of the assured.

The question whether a given fact is material or not may be one on which expert evidence is not required, *e.g.*, previous

[1] Sieveking, *op. cit.*, p. 169.

rejection of the life by another assurance office. Frequently, however, the fact alleged to be material is the existence at the time of effecting the assurance of a particular habit or disease, or previous attack of disease. Here the question whether the fact is material or not may depend on whether or no such habit or disease is one which usually tends to shorten life, and when this is the case the opinion of a medical expert may be required in order to enable the Court to decide the question at issue. **The existence of disease, or of a previous attack of disease, may or may not be a material fact.**—It is a material fact if information regarding its existence has been specifically required by the assurers. Information regarding the existence of the disease in question may not, however, have been specifically required, in which case the question whether the fact of its existence is material or not may turn on whether or no it is one coming within the description of a "disease tending to shorten life."[1] On this point it has been decided[2] that when the question is one of material concealment in life assurance, only such diseases come within this description as are of a serious nature, and the usual course of which is to shorten the duration of life. **The existence of a habit such as usually tends to shorten the duration of life is obviously a material fact.** Commonly there is no difficulty in answering the general question whether or no a particular habit comes within this description. In one important case, however,[3] the expert witnesses called at the trial differed greatly in opinion on the question whether or no opium-eating was a habit tending to shorten life. The same question has arisen in regard to vegetarianism, and it is possible that it might also arise in regard to tobacco smoking. Where, however, the habit is one which, like the two last mentioned, is not usually held to shorten life, the question whether its existence is a material fact or not, has been held to depend on whether or no specific inquiry as to its existence has been made by the assurers. Considerable difficulty is sometimes met with in coming to a conclusion as to whether or no a particular habit existed at the time the assurance was effected. In the case, for example, of alleged intemperate habits, it is difficult to draw a line between moderate use and abuse of alcohol; and often difficult, therefore, to come to a conclusion as to whether what existed at the time of effecting the assurance, was the latter or the former. When, however, this is the question at issue, the decision in the case usually rests on the ordinary evidence produced, not on the expert evidence.

To establish that there has been misrepresentation or concealment, the existence at the time of effecting the assurance, of the fact alleged to have been misrepresented or concealed must be proved. This, in many cases, is a matter of ordinary, not expert, evidence. In other cases proof of the existence of the fact concealed rests in whole or in part on expert evidence; *e.g.*, the assured may have endeavoured to conceal a previous attack of disease, by concealing the name of his usual medical attendant. Such cases usually present no

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[1] The questions regarding the present or previous existence of disease, put by assurance offices to an individual proposing to assure his life, after specifically mentioning various diseases, usually conclude with the words "or any other disease or disorder tending to shorten life."

[2] *Watson* v. *Mainwaring*; see Taylor, *Med. Jur.*, ii. p. 598.

[3] The suit regarding payment of sums assured on the Earl of Mar's life (1831). The assured was an opium-eater, but this had not been made known to the assurance company (see Christison on *Poisons*, p. 716).

difficulty. Cases more difficult to deal with are (1) cases where the only evidence available of the existence of a disease tending to shorten life, is evidence of the existence of certain symptoms which may or may not have been due to the disease in question; and (2) cases where the inference, that a particular disease tending to shorten life existed at the time of effecting the assurance, rests on the rapidly fatal termination of the case from such disease. No general rules can be laid down for guidance in cases of this kind. In each case a medical witness must be guided by his knowledge of the symptoms and usual course of the disease alleged to have existed.

Has the death of the Assured Really Happened?

This question may in effect be one of identity, *namely*, Is this body that of the assured? or, in cases where no direct proof of death is obtainable, one of presumption of death. These two subjects have already been considered (*see* p. 60). This question also arises occasionally in cases where, with the view of defrauding an insurance company, an assured disappears, having first fabricated evidence of his own death.

Did the Assured kill himself?

Assurance policies almost always contain a clause exempting the company from liability should the assured "**die by his own hands**" or "**commit suicide.**" In giving evidence at an inquest, therefore, it should be kept in mind that an opinion as to the cause of death, given at such inquest, may afterwards be called in question in an action to recover assurance money. In such a case, omission to make a thorough examination of the body, may place the witness in a very awkward position. Again, a question, which has more than once arisen in the course of actions of this kind, is this: The assured kills himself during an attack of insanity; is this "death by his own hands" or "suicide," as the case may be, according to the phrase used in the policy? On this question the English judges have expressed different opinions. It has, however, been decided by a majority of the judges, that these phrases, as used in assurance policies, include all cases of intentional self-killing, no matter whether the individual be or be not insane at the time.

What was the cause of the Assured's death?

Obviously, when it is alleged that the assured killed himself, this question directly arises. So, also, this question may arise indirectly, in a case where it is alleged that there has been material concealment, seeing that the cause of death may afford corroborative evidence of the fact that there was

such concealment. Further, the question, What was the cause of the assured's death? may arise in the following cases.

ACCIDENT ASSURANCE.

In cases where the life is **assured against accident only.** Here the question takes the form: Was death due to accident or to natural causes? the assurers being liable in the former case, but not in the latter. When the cause of death has been definitely ascertained, there is usually no difficulty in coming to a conclusion on this point; and it may here be mentioned that it has been decided, that death from sunstroke does not come within the meaning of death from accident, as used in such policies. So, also, there is usually no difficulty when death occurs within a short time after the alleged accident. Where, however, a considerable interval of time has elapsed between the accident and death, difficulty may be experienced in coming to a decision on the question. In such a case points for consideration are: (1) Were the symptoms and *post-mortem* appearances present in the case, such as indicate the presence of disease? (2) Could such disease have arisen from the accident? (3) What influence would the accident be likely to exert on such disease? &c., &c.

Part III.—POISONING OR TOXICOLOGY.

CHAPTER XX.

Poisons in Their General Aspects.

Poisoning, with its secret treachery, has from early times been especially ascribed to the East as the favourite mode of removing objectionable persons and taking life; and certainly at the present day poisoning is very much more common in India and the East than in Europe.

Poisons must early have been discovered by primitive man, who by experience or accident must early have learned to avoid them himself and to use them against his enemies or game; for nearly all savage tribes use poisoned arrows. Indeed the classic term 'Toxicology' is derived from the Greek word for 'an arrow or missile for the bow,' which would indicate that the earlier use of poison in Eastern Europe was to smear over arrows for slaying. The modern word 'poison' comes from the Latin *poto*, to drink, as signifying the more modern mode of administering a poison, namely, as a 'potion' or draught. The Indian term *Bish* is from the Sanskrit root 'to permeate or pervade,' and denotes the intruding, alien and diffusive nature of poison. The ancient Indian scriptures contain references to the poisoning of kings, the doings of professional poisoners and of widespread organised poisoning in almost prehistoric times. In one of the *Shastras* translated by Dr. Wise[1] it is written: "It is necessary for the practitioner to have a knowledge of the symptoms of the different poisons and their antidotes as the enemies of the king, bad women and ungrateful servants mix poison with food." Susruta, the Indian Hypocrates, describes the several modes of poisoning in ancient India, how the poisons are mixed with food or drink, honey, medicine, bathing water, anointing oils, perfumes, eyelash pigments, snuff; or sprinkled over clothes, beds, couches, shoes, garlands and jewellery, saddles of horses, &c.; how poisonous

[1] Medicine of the Hindus.

draughts are prescribed as love-charms, also the secret poisoning of wells and other drinking water to destroy enemies.

The Mahābhārat, which is usually ascribed to the 5th or 6th century B. C., mentions that Bhim Sen, the Hindu Samson, was poisoned by his cousin Durjodhan in revenge for being defeated by him in a duel. In a semi-historical legend of mid-India[1] it is related that the grandfather of Asoka, Chandra Gupta, a contemporary of Alexander-the-Great, sent to the latter monarch in the guise of a present, a fascinating girl who was a 'poison-maiden' fed on poison until she was so saturated with venom that her embrace would prove fatal to an ordinary mortal—the mere conception of the idea of such a Borgia-like siren would imply considerable familiarity with poisoning.

Strabo relates that the custom of burning Hindu widows alive on the death of their husbands (*sati*) was introduced as a check against the prevailing custom of Hindu wives poisoning their husbands, so that the wives would thus have an interest in not being privy to the premature death of their lords.

In Muhammadan times, poisoning was a recognized form of capital punishment and was unusually rife in harem intrigues and against political foes and prisoners.

Tavernier, in describing his visit to Gwalior then used as a great state prison of the Muhammadans, writes :—"When Aurungzebe sends any great lord to this place, at the end of nine or ten days he orders him to be poisoned ; and this he does that the people may not exclaim against him for a bloody prince." And this practice was imitated pretty generally throughout India.

For magical and mystic purposes without intent to actually kill a good deal of what may be called 'accidental' poisoning goes on in the country districts, *see* pp. 19 to 21.

It is mostly practised here as everywhere else by jealous women or desperate lovers of either sex for the purpose of captivating affection or of infatuating and enthralling the object of desire. But it is also used for baneful purposes to cause disease, death, or some strange aberration ; and whether employed by love or by hate it has certainly always been intimately connected with some real knowledge of medicine and has veiled a great deal of downright poisoning.[2]

Definition.—It is not easy to define the term 'poison.' It is not enough to define it as 'any substance which on being absorbed into the body injures health or destroys life. Because (1) certain substances *harmless in small doses* are capable of causing death when absorbed into the system in large doses

[1] *Mudra-rakshasa* in Wilson's Hindu Theatre.
[2] Chevers, *M.*, p. 105.

although not usually considered poisons, *e.g.*, common salt and sulphate of potash in sufficiently large quantities ; (2) the *toxins of disease*, though capable of causing death, are not considered 'poisons' in the ordinary sense of the word ; (3) certain substances may cause injury or death by local action without absorption into the system, *e.g.*, *corrosive acids* and *mechanical irritants*. The definition therefore should include in addition to "any substance absorbed into the body also, and substances which by chemical action on the tissues injures health or destroys life."

For legal purposes in India, however, the exact definition of a 'poison' is not essential because the law usually paraphrases in explanatory form its references to 'poison.'

Thus in the causing of 'hurt' and 'grievous hurt' by poison, *ss.* 324 and 326, *I. P. C.*, states : "**Any poison or any corrosive substance,**" or "**any substance which it is deleterious to the human body to inhale, to swallow, or to take into the blood.**" Hence, for conviction under these sections, it is not necessary to establish that the substance by means of which the hurt or grievous hurt was caused is a poison ; it is sufficient if it be proved that it is a substance which comes under the above-stated description.

Again *s* 299 declares : "Whoever causes death by doing an act with **the intention** of causing death, or with the intention of causing such bodily injury as is likely to cause death or with the knowledge that he is likely by such act to cause death, commits the offence of **culpable homicide**." Hence, if A administers a substance to *B*, with such intent or knowledge, and thereby causes B's death, A may be convicted under this section of the offence of committing culpable homicide, irrespective of whether the substance administered may or may not strictly be called a poison. For it is the *intent* which suffices to constitute a crime, irrespective of the dose or even the nature of the substance.

In *s.* 328 it is ruled that : "Whoever administers to, or causes to be taken by, any person, any **poison or any stupefying, intoxicating, or unwholesome drug or other thing,** with intent to cause hurt to such person, or with intent to commit, or to facilitate the commission of an offence, or knowing it to be likely that he will thereby cause hurt, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine" Here, again, it will be observed that the addition of the words "any stupefying, intoxicating, or unwholesome drug or other thing," render the exact definition of the term "a poison" unnecessary for the purposes of this section.

It should, however, be noted that the words "or other thing" must be read "other unwholesome thing." "Hence, administering a substance as to whose nature no evidence was given, which was intended to act as a charm, was held to be no offence (*R.* v. *Jotee Ghoraee*, 1 Suth. Cr., 7)."[1]

The question of a definition of the exact meaning of "poisonous substance" might arise in the case of a person charged under *s.* 284 of

[1] Mayne's *Penal Code*, 282.

the *Penal Code* with the offence of "knowingly or negligently" omitting "to take such order with any **poisonous substance** in his possession as is sufficient to guard against probable danger to human life from such poisonous substance."

Restriction on sale of poisons.—In India, with the exception of Bombay presidency there is practically no restriction on the sale of poisons, other than a partial one on white arsenic; and this accounts doubtless in considerable degree for the excessive prevalence of poisoning in India. There was no restriction whatever on the sale of poisons, except in Bombay, notwithstanding the repeated representations by myself and other chemical examiners, up till 1899 when the White-Arsenic Act (of 1899) was passed,[1] but regulations as to the possession and sale of the white arsenic is limited to such local areas as local Governments may direct, the result being that arsenic may still be readily obtained in large quantities in ordinary **bannia's** shop in most bazaars, with practically no restrictions.

On poisons other than arsenic, there is no restriction whatever except in Bombay, which in its **Sale of Poisons Act** incorporates the provisions of the English **Arsenic Act** (14 Vict., cap. 13).

The Sale of Poisons Act (Bombay Act VIII of 1866). The chief provisions of this Act are that certain poisons named in Schedule A of the Act—(1) May only be sold by licensed vendors (*s.* 3). (2) (Except when dispensed as medicine on the order or prescription of a practitioner of medicine) may only be retailed to persons known to the vendor, or in presence of a witness known to the vendor, and to whom the purchaser is also known; and each sale must be entered with the purchaser's name and address in a book kept for the purpose (*ss.* 13, 14 and 19); and (3) **Pounded white arsenic** (except in special cases) **may only be sold mixed with soot** in the proportion of one ounce to each pound of arsenic, **or with indigo of Prussian blue** in the proportion of half an ounce to each pound of arsenic (*s.* 17).

Schedule A of the Act enumerates the poisons it applies to, with their vernacular names, as follows:—"1. **Vegetable poisons.**—Aconite (*botchnag*), cocculus indicus (*kakmari*, *kakphul*), datura (*datura*), henbane (*khorasanu ajwan*), nux vomica (*kuchila and kajra*), Saint Ignatius' bean (*papita*), and Calabar bean. 2. **Mineral poisons.**—White arsenic (*phutkya somul*, *somul*), red arsenic or realgar (*mansil*). yellow arsenic or orpiment (*hurtal*), Scheele's green or arsenite of copper, and Schweinfurth green or aceto-arsenite of copper (*hirwa*), and corrosive sublimate (*ruskapur*)."

For Bengal provision has been made to guard against ignorant the compounding of European drugs by unqualified druggists (Beng. Mun. Act,

[1] The draft bill recommended to the Medical Congress, Calcutta, in 1894, by Drs. Evans and Chuni L. Bose doubtless contributed to hasten this measure.

s. 252) ; but no restriction is placed on the indiscriminate sale of indigenous poisons in the bazaar which is much the greater evil what is needed is a bill for all India somewhat similar to the poison Schedule of the English *Pharmacy Act*, 31 & 32 Vict., Cap. 21.) As is in force in the Bombay Presidency. *In Government Dispensaries*, the rules for the custody and dispensing of poisonous drugs prescribe that the labels of poisons be printed on yellow paper with the word 'poison' in English and vernacular affixed to all bottles, and that a copy of the rules pasted on paper or board is to be suspended in every apartment where poisons are dispensed.

The need for legal restrictions even in the large cities is shown by the following recent case. In 1901 a Mr. Hicks at Calcutta was taken ill with dysentery, and was advised to take a vegetable compound known as **"Supari-ka-phul."** This drug was obtained from the grocery of Ram Nath Dass, but with it was a large quantity of aconite, which is a deadly poison. This was administered unwittingly to Mr. Hicks, who succumbed to the effects. It was impossible to tell from the contents of the stomach what quantity of **aconite** was actually administered ; anyhow, the accused was ordered to be prosecuted on a charge of doing a rash act by omitting to take due care in the sale of a poisonous drug. The accused raised the plea that the sale was actually effected by his assistant, and that he was not responsible for the acts of his servant. The Court held a contrary view ; moreover, the accused was found guilty of gross neglect by not exercising due and proper control of the aconite. The accused was convicted under *s.* 298, *I. P. C.*, and sentenced to three months' rigorous imprisonment.

It is not yet possible to get any precise estimate of the prevalence of poisoning in India as a whole, for no systematic attempt is made to record this information in official statistics. An estimate is only to be formed approximately by piecing together the figures in the various provincial police and sanitary return with those of the chemical examiners. The police returns only refer to reported cases of criminal poisoning, and the sanitary only to reported fatal cases ; and the chemical examiners' return is simply the record of the results of analyses in the small proportion of cases, in which viscera and vomit and other suspected matters are sent for analysis.

For Bengal, the statistics, such as they are, have been collated by Drs. J. F. Evans and C. L. Bose,[1] for comparative purposes, for the two quinquennial period 1876 to 1880 and 1889 to 1893, with the following results :—

Murder by poison.—During the five years 1876 to 1880, 94 cases of murder by poison in Bengal were reported by the police, and during the five years 1889 to 1893, 81 cases, or an average of ·31 and ·23 per million of the population respectively as compared with an average of 12 cases in England ·07 per million of the population for the years 1876 to 1880, which shows that in Bengal **murder by poison is more than four,** and **over three** times respectively **the rate for England.** In these cases the evidence of murder was usually if not in all established by the chemical analysis.

[1] *Trans. Ind. Medl. Congress*, 1894

Suicide by poison.—During the five years 1876 to 1880, 11,662 suicides or 38·8 per million of the population, were reported by the Sanitary Commissioner for Bengal, and during 1889 to 1893, 15,743 or 45·8 per million. As the number of suicides in all England and Wales in the year gives 65·2 per million, the reported suicides in India are less relatively, but there is every reason to believe that a large number are never reported. No returns for Bengal, however, show what proportion of these suicides is due to poisoning. For Calcutta city, however, the statistics are more complete, and these give for the years 1876—80, 126 cases and for the years 1889-93, 236 cases, or an average of 36·42 and 68·84 per million respectively (registration is more accurate of late and years) as against an average of **only 3·55** per million in England for the years 1876-80. And of the total cases of suicide in Calcutta 55·8 per cent. were due to poison as against 12·25 in England, showing that **suicide by poison is about 19 times more prevalent in Calcutta than amongst the general population of England.** The conditions of life in a city are likely to make suicide more prevalent than in rural areas.

Accidental fatal poisoning.—There are no statistics available for the province, but for the town of Calcutta there were respectively 14 and 11 such deaths reported during these two periods, or a rate of 6·5 and 3·6 per million excluding snake-bite, as compared with 5·15 per million per annum for England during 1876-80. A very large number of such deaths are believed to pass unreported, especially in the practice of ignorant quack native medical practitioners.

Non-fatal cases of poisoning.—There are no provincial statistics for these except for the reported criminal cases by the police. These are mostly cases in which *datura* or other stupefying drugs are given for the purposes of theft. There were 161 such cases in 1889-93 reported, or ·46 per million of the population. The Calcutta hospitals in 1893 treated 127 non-fatal cases.

The special poisons, usually selected for homicide and suicide in India are very few in number, consisting chiefly of arsenic, opium and a few indigenous substances (alkaloids and European poisons are only used in a few cases in cities) ; and each poison has, by long-established custom, come to be used for a particular class of crime. Thus :—

For **Homicide** ...	Arsenic is chiefly used in about half of the cases. Aconite comes next. Nux vomica Mercury, copper, antimony. (Opium for murder of children and drunken persons.)
For **Suicide** ...	Opium chiefly—about three-fifths of total cases in Bengal. Arsenic about one-fifth of the cases.
For **stupefying** for robbery or fatuity (not necessarily with intent to murder).	*Datura*. Indian hemp.

For **abortion** ... { *Plumbago rosea.* / Oleander. / *Calotropis sp.* / Colocynth.

Accidental ... { Snake poison, aconite, mercury, arsenic, } in quack medicines.

The relative frequency with which particular poisons are used **in fatal cases** may, to some extent, be estimated from the reports of the chemical examiners on the results of their analysis of human viscera in poisoning cases. *See* Appendix VIII for details for the various provinces.

The two poisons most frequently used in India to take human life are **Arsenic** and **Opium**. Arsenic is especially used for homicide (and also cattle poison), whilst opium is the special favourite for suicide ; occasionally it is used for homicide, in case of young children or drunken persons.

The next most frequent poison is **datura** used for stupefying people to facilitate robbery. Other less frequently used are :—

Mineral poisons.—(*a*) **Copper.** Cases of poisoning by compounds of this metal frequently arise accidentally from contamination of food by the copper cooking-vessels largely employed in India ; occasionally, however, cases of attempt at homicide by the administration of sulphate of copper, are met with (*b*) **Lead.** Chronic poisoning by lead, common in England, is rare in India. Red lead, however, is tolerably frequently met with in India as an ingredient of local applications employed to procure abortion. (*c*) **Mercury.** Cases of chronic mercurial poisoning arising from malpraxis, although not met with so often now as formerly, are still occasionally seen. Occasionally also ruskapoor, or calomel containing a variable percentage of corrosive sublimate, is criminally employed. (*d*) **Pounded glass.** This is popularly believed in India to be a powerful poison, and is occasionally mixed with food with homicidal intent.

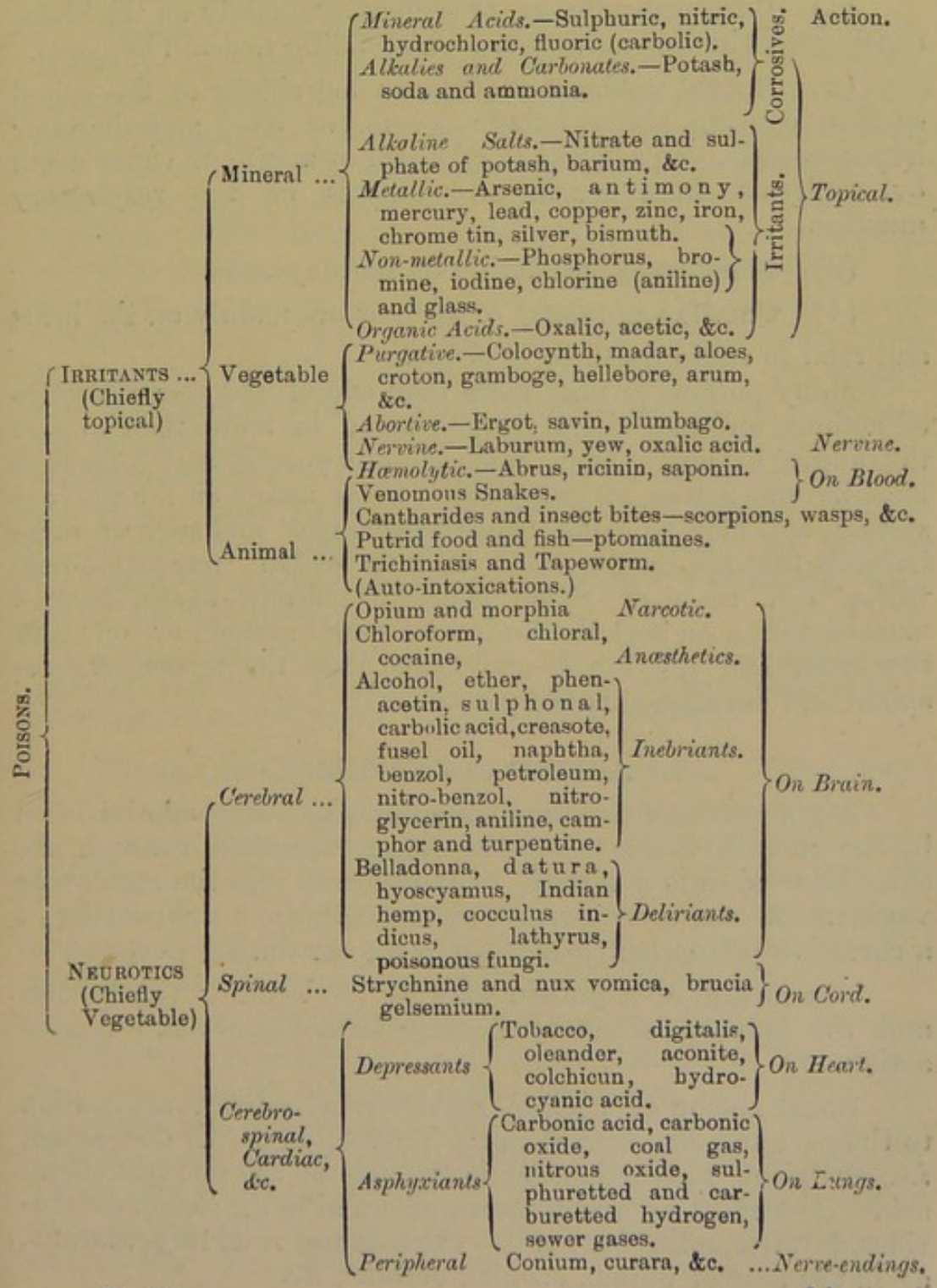
Vegetable poisons.—Next to **opium** and datura, the vegetable poisons most frequently used for homicidal and suicidal purposes are **aconite,** nerium odorum or **oleander** (and cerbera thevetia), **nux-vomica** (and its alkaloid strychnia) and various **euphorbias.** Of these, aconite and strychnia have also given rise occasionally to accidental cases, notably in the case of the first, from its use as a fortifying agent for alcoholic liquor, and in the case of the second from its use as a dog-poison. The seeds of cerbera thevetia, it may be mentioned, are sometimes used as a cattle-poison, and the milky juice of the milk bush, and other euphorbias, as an ingredient in irritant preparations employed as local applications, for the purpose of procuring abortion. Another vegetable poison often used for this last purpose is **plumbago rosea,** and occasionally various **cucurbitaceous tubers** are internally administered with the same object. Lastly, it may be mentioned that **mudar** (calotropis procera) and **tobacco** are said to be used for purposes of infanticide, and that in some parts of India a paste made

from the seeds of **abrus precatorius** is used, by subcutaneous insertion, for the purpose of destroying cattle.

CLASSIFICATION OF POISONS.

Poisons may be classified according to their action as follows :—

Classification of Poisons.



1. **Irritant poisons**, or such as possess a marked local irritant action, exciting irritation and inflammation ; and when swallowed cause vomiting, and, as a rule, also purging. A few of these, when concentrated, act as '**corrosives**,' *i.e.*, cause chemical destruction of the tissues.

2. **Neurotic** are poisons such as have a specific action on the **human** system, brain or spinal cord.

(1) **Cerebral poisons**, or such as act mainly on the brain, causing delirium or narcotism ; and tending to death by coma.

(2) **Spinal poisons**, or such as act chiefly on the spinal system, causing either tetanic spasm, or local anæsthesia or hyperæsthesia, or paralysis ; and tend, as a rule, to cause death by asphyxia, from spasm or paralysis of the respiratory muscles.

(3) **Cerebro-spinal** acting on both systems.

(4) **Cardiac poisons**, or such as act mainly on the heart and tend to cause death by syncope.

Many poisons possess more than one of the above described actions, and may therefore be classed in more than one of the above groups. Thus, some poisons possess both a marked local irritant action, and a specific remote action on the nervous system, and may be called '**neuro-irritants**' and such of these irritants that act on the brain may be called '**narcotico-irritants**,' *e.g.*, aconite. Some neurotic poisons, again, have a marked action on both the brain and spinal system, or on both the brain and the heart, and hence arise the terms cerebro-spinal and **cerebro-cardiac** poisons.

ACTION OF POISONS.

A poison may produce its effects by being administered by the mouth, inhaled into the lungs, absorbed through the skin, injected into a wound, or introduced into the rectum, or vagina. A case even is recorded of death from the pouring of a corrosive poison (nitric acid) into the ear during sleep.

The action of a poison may be (1) local, or (2) remote, and the same poison may possess both a local and a remote action.

Local action of a poison results from its direct application to the part and may consist in the production of (*a*) **Corrosion**, *i.e.*, chemical destruction, as in the case of the strong mineral acids; (*b*) **Irritation and inflammation**, as in the case of cantharides, tartar emetic, &c. ; or (*c*) **Certain nervous impressions**, as in the case of opium, aconite, cocaine, &c.

Remote action of a poison may be of a non-specific or specific character.

Non-specific.—Poisons which possess a violent local action sometimes exert a remote non-specific action on the system, producing thereby an effect similar to that which often results from severe mechanical injury. Extensive corrosion produced by a corrosive acid, may, for example, be followed by shock, as a remote non-specific action.

Specific.—This may consist in the production of tetanic spasm, as in poisoning by strychnia; syncope, as in poisoning by tobacco; nephritis, as in poisoning by cantharides; gastritis, as in poisoning by arsenic, &c., &c. The remote specific action of a poison **results from** the **absorption** of the poison into the system through the blood. Absorption takes place with extreme rapidity. Blake, from his experiments, inferred that a poison might be diffused through the whole body in nine seconds; and Erichsen, in a case of extroversion of the bladder, found potassium ferrocyanide in the urine one minute after it had been given by the mouth on an empty stomach. As **poisons are absorbed** into the system **through the blood**, it indicates the advisability, in the case of poisoned wounds, of applying a ligature above the wounded part, and endeavouring to remove the poison from the wound by excision and suction. Again, it indicates that after death, absorbed poisons will probably be found, in greatest quantity, in organs containing much blood, *e.g.*, the liver.

In some cases the remote action may be the result of "**sympathy**," that is, of impression conveyed to the nerve-centres by the nerves, as where hydrocyanic acid kills in two seconds.

Causes modifying the action of a poison. These are:—

1. **Quantity administered.**—The administration of a large dose of some poisons is sometimes followed by symptoms differing greatly in character from those which follow a moderate dose; *e.g.*, moderate doses of arsenic produce irritant symptoms, very large doses sometimes cause death by shock without irritant symptoms, See *Case CCXII*, p. 435.

2. **Form.**—(1) **Physical difference.** Poisons act most rapidly when gaseous; next, when liquid; next, if in fine powder; and least rapidly when in solid masses (see *Case CCXVII*). (2) **Chemical difference.** This may have the effect—(*a*) **If the poison acts chemically** only, of rendering an active poison inert, *e.g.*, corrosive acids may be rendered inert by combination with alkalies; or (*b*) **If the poison does not act chemically** only, chemical difference in form may, by rendering

the poison more soluble, increase the rapidity with which it acts, or, by rendering it less soluble, diminish the rapidity of its action.

3. **Mechanical mixture** with inert substances, *e.g.*, dillution, or mixture with inert powders.—In some cases this **alters the character of the symptoms** produced ; for example, corrosive acids, when diluted, act as irritants only. In other cases, mechanical mixture with an inert substance, by protecting the poison from absorption, may **delay its action** ; hence poisons, as a rule, act less rapidly when given on a **full stomach.** Again, **animal charcoal,** by taking up a poisonons alkaloid and rendering it **insoluble by adhesion,** may delay or prevent its action.

4. **Mode of application.**—This, by affecting rapidity of absorption, affects the rapidity of action of poisons. Modes of introduction enumerated in order of rapidity of action, the most rapid first, are (1) injection into a vein ; (2) application to a wound ; (3) application to a serous surface ; (4) application to the broncho-tracheal mucous membrane ; (5) introduction into the stomach ; (6) injection into the rectum, and (7) application to the unbroken skin.

5. **Condition of body** :—

(1) **Habit.**—This, in the case of many poisons, *e.g.*, opium, alcohol, and tobacco, tends to confer on the system a resisting power to the action of the poison to the use of which the individual is habituated.

(2) **Idiosyncrasy.**—This may show itself either in abnormal sensitiveness (or the reverse) to the action of a particular poison,—*e.g.*, mercury ; or the individual may be exceptionally affected by a drug, *e.g.*, purged by opium, or by an article of food (see *fish poisoning*).

(3) **Disease.**—This, if the symptoms of the disease resemble those produced by the poison, tends to confer increased sensitiveness to the action of the poison : *e.g.*, narcotics in advanced renal disease. If, on the other hand, the symptoms of the disease are opposed in character to those produced by the poison, diminished sensitiveness to the action of the poison may be the result : *e.g.*, narcotics in tetanus.

(4) **Sleep and Intoxication.**—These may delay the action of a poison (see *Cases CCXIV a*, *b*, and *d*).

(5) **Accumulation.**—Small doses of a poison, each insufficient to cause any serious effect, if given one after the other at short intervals, may accumulate in the system and

produce serious effects. Accumulation obviously tends to occur, when the rate of elimination of the poison is slower than the rate of its administration. Hence poisons which are only slowly eliminated from the body,—*e.g.*, lead and mercury, and metallic poisons generally,—are specially prone to act as cumulative poisons. Organic poisons are, as a rule, quickly eliminated. In some, however,—*e.g.*, strychnia—the rate of elimination is comparatively slow, and accumulation tends to occur.

TREATMENT OF POISONING.

The indications of treatment in cases of poisoning are :—(1) Elimination ; (2) Prevention of action ; and (3) Counter-action and removal of effects.

1. **Elimination.**—The measures to be adopted for the purpose of procuring elimination of a poison, vary with the mode in which the poison has been administered. Thus, if the poison has been injected into a wound, **excision** of the wounded part and **suction** are indicated. If the poison has been inhaled into the lungs, the patient must be made to **inhale pure air,** so that the poison may thereby be chased out of the lungs.

If the poison has been taken into the stomach, (1) the **stomach-pump** should be used, except in cases of corrosive poisoning, care being taken to inject warm water before proceeding to exhaust, and always remove a little less than the quantity injected ; the stomach-pump should always be used without delay in serious cases ; (2) in milder cases and especially in children, **vomiting should be promoted** by the administration of warm water, or set up by tickling the fauces, or by the administration of **emetics** ; *e.g.*, mustard and water, or 20 to 30 grain doses of sulphate of zinc, or powdered ipecacuanha, or subcutaneous injection of one-tenth to one-fifth of a grain of apomorphine. Or **special treatment** may be necessary for the elimination of absorbed poisons, *e.g.*, the administration of potassium iodide, in cases of poisoning by lead.

2. **Prevention of action or absorption.**—The nature of the measures by which this indication is carried out, vary with the poison, thus :—

(1) **When the poison is not corrosive or mechanical** in action, the measures indicate, for adoption are measures calculated to **prevent absorption.**

(*a*) **By the administration of substances to render the poison insoluble by chemical antidotes** (See list in *Appendix IX*), *e.g.*, albumen in cases of poisoning by corrosive sublimate ; freshly

prepared hydrated ferric oxide in cases of poisoning by arsenic; sulphates in cases of poisoning by lead, &c., &c.: or **to destroy** the poison, *e.g.*, cauterization of poisoned wounds; or (*b*) **by mechanical means**, *e.g.*, the application of a ligature above the wounded part, in cases of poisoned wounds.

(2) **Where the main danger** is **corrosion or destruction** of the tissues with which it comes in contact, this second indication of treatment is carried out, by the administration of substances calculated to prevent the action of the poison, by entering into chemical combination with it; *e.g.*, the administration of alkalies in cases of poisoning by the corrosive acids.

(3) **Where the substance acts mechanically** only, it is in some cases possible to prevent its action, by the administration of matters which will mechanically protect the tissues from the action of the substance swallowed: *e.g.*, the administration of bulky food, in cases where pounded glass has been taken.

3. **Counteraction and removal of effects.**—In some cases of poisoning this indication may be carried out by the administration of **physiological antidotes** or substances which exert an action on the system, opposed to that of the poison; *e.g.*, atropia in poisoning by opium see list of Antidotes in *Appendix IX.* In other cases this indication is carried out, by various measures calculated to counteract or remove the effects of the poison; *e.g.*, the use of **cold affusion** and **galvanism** in narcotic poisoning; of **warmth** to the surface, **stimulants**, and the recumbent posture, in cardiac poisoning; of **artificial respiration** in cases where the poison taken is one which, like opium and conium, tends to cause death by paralysing the respiratory movements (Sylvester's or other system [p. 203] should be kept up for several hours); of *demulcents* in irritant poisoning, &c., &c. Special measures adopted for the purpose of promoting the elimination of absorbed poison, already referred to under Elimination, may also be included under the head of measures directed to the removal of the effects of the poison.

EVIDENCE OF POISONING.

The medico-legal evidence pointing to the administration of poison may be derived from: (1) The Symptoms; (2) The *Post-mortem* appearances; (3) Chemical analysis; and (4) Experiments on animals.

1. THE SYMPTOMS.

GENERAL CHARACTERS.

1. **Sudden onset.**—This character, however, may be absent in a case of poisoning, *e.g.*, in chronic poisoning by

lead, mercury, phosphorus, &c.; and may be present in cases not due to poisoning, *e.g.*, apoplexy, cholera, &c.

2. **Increase in severity.**—This character, like the last, is often present in disease. Again in some cases of poisoning, this character is absent, *e.g.*, in the remittent form of opium poisoning (see *Case CXCVII*); and in cases where small doses of a poison are administered at short intervals.

Case CXCVII.—**Remittent form of opium poisoning** (Taylor, *Poisons*, p. 552, case of the Hon. Mrs. Anson).—"This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit for half an hour, and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of laudanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours, the patient revived, her face became natural, the pulse steady, the power of swallowing returned, she was able to recognise her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes; the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."

3. **Uniform character**, *i.e.*, with the known effects of a particular poison; hence gastritis followed by salivation, as in acute mercurial poisoning, or by paralysis as in arsenical poisoning, do not form exceptions to this rule.

4. **Begin soon after taking food, drink, or medicine.**—This character may be absent owing to the symptoms of poisoning being delayed in their appearance by sleep, or by intoxication (see *Cases CCXIV*, *a*, *b* and *d*); or by the counteractive effects of another poison simultaneously administered. Or again this character may be absent, owing to the nature of the poison swallowed; for example, sparingly soluble lead salts only give rise to acute symptoms after an interval of several hours, and a similar interval is often noticed in cases of fish poisoning. This character also may be present in cases not due to poison, *e.g.*, cholera, apoplexy, &c., may come on soon after a meal, or rupture of the stomach may occur; and symptoms closely resembling those of poisoning, have appeared from swallowing, after exertion, a quantity of cold fluid (see two following cases.)

Case CXCVIII.—**Sudden death from swallowing, while heated, a quantity of cold fluid** (Christison, *Poisons*, p. 120).—"A young man having just sat down panting, and bathed in sweat, after a severe match at tennis, drank greedily from a pitcher of water fresh drawn from a neighbouring pump. Suddenly he laid his hand on his stomach, bent forward, became pale, breathed laboriously, and in a few minutes expired."

Cases CXCIX.—**Another case; death on the fifth day** (*ib.* p. 121).—A soldier, after a hurried journey on a hot day, swallowed a quantity of iced beer. Six hours afterwards, shivering set in, followed by vomiting, anxiety, thirst, and frequency of the pulse. This was followed by great prostration, hiccough, and lividity of face. Death took place on the fifth day. On *post-mortem* examination, the mucous membrane of the stomach was found much reddened, and spots of extravasation were present. The stomach contained blackish matter, similar to what had been vomitted during life.

5. **Other individuals are affected who partook of the same food, &c.** This is a very striking character; it may however be present in disease, *e.g.*, where as sometimes happens, several persons after partaking of a meal together, are nearly simultaneously attacked by cholera. This character may be apparently absent in a case of poisoning, *e.g.*, where (as in *Case CC*), of several persons present at a meal, only one partakes of a particular dish. Poisoning also may be indicated by the fact that several persons have suffered from suspicious symptoms, after partaking of articles of food, &c., which have passed through the hands of one and the same individual; although the attacks occurred at different places, and at different times (see *Case CCI*).

Cases CC.—**One only of a number present at a feast killed by poison** (Bombay Chemical Analyser's Report, 1880-81).—In a case which occurred in Poona, a man was reported to have died six or seven hours after partaking of food at a feast with about one hundred and twenty-five other persons. No complaint was made by his relations, and the body was buried. Some days afterwards, an anonymous writing was found outside the Magistrate's Court, stating that deceased had been poisoned, and an inquiry was ordered. It then turned out that deceased being of a different caste to the other persons present at the feast, was served with food separately from the rest, by a separate person, and that before death he suffered from symptoms of irritant poisoning. The body was then (eleven days after death) exhumed, and the viscera forwarded for analysis, when about twenty grains of arsenious oxide was found in the contents of deceased's stomach.

Cases CCI.—**Homicidal poisoning by colchicum** (*R.* v. *Catherine Wilson.* Taylor, *Poisons*, p. 512).—The prisoner was tried and convicted of the murder of a Mrs. Soames, who six years previously had died suddenly while being nursed by her. It was proved that, besides Mrs. Soames, three other persons had died suddenly after the administration to them by the prisoner of food or medicine. In all four cases the symptoms were similar in character, *viz.*, burning pain in the throat and stomach, intense thirst, violent vomiting and purging, collapse, and death from exhaustion without convulsions or loss of consciousness. In each of the four cases, also, the symptoms came on suddenly while the affected individuals were in a state of health, and in each case the death of the individual affected enabled the prisoner to acquire money or property. In each case the body of the deceased individual was exhumed, in one case within two months, in another about one and a half years

and in the other two six years, after death, but in all four cases no poison could be detected on analysis of the viscera.

6. **Appear in persons previously in good health.**—This character may obviously be absent in cases of poisoning, or present in cases of disease.

7. **Prove rapidly fatal.**—This character, like the last, is one which may be absent in poisoning and present in disease.

Obviously the greater the number of the above characters present in the same case, the stronger is the suspicion of poisoning; and *vice versâ*, the smaller the number, the weaker the indication of poisoning.

Special Symptoms of poisoning vary with the class to which the poison belongs.

1. **Irritant poisons**, see p. 433.—Certain diseases are accompanied by symptoms more or less resembling in special character those of poisoning, *e.g.*: The chief affections simulating the effects of poisons of this class, are:

(*a*) **Cholera.**—This is specially liable to be mistaken for arsenical poisoning, and *vice versâ* (see *Arsenic*, p. 436).

(*b*) **Gastritis**, following the imbibition of a large quantity of cold fluid, whilst the body is cooling after violent exertion (see *Case CXCIX*). Or, under such circumstances, death may occur from shock (see *Case CXCVIII*), and the case resemble one of rapidly fatal narcotic poisoning, *e.g.*, by hydrocyanic acid. Idiopathic gastritis is very rare, and is not accompanied by the violent purging usually present in irritant poisoning.

(*c*) **Rupture of the stomach**, complete or partial, especially when due to over-distension (see *Case CCII*), may closely simulate irritant poisoning. So also may perforation of the stomach from disease, rupture or perforation of the intestines and rupture of the biliary ducts, uterus, or uterine appendages. In cases such as these the *post-mortem* appearances will indicate to what the symptoms have been due.

Case CCII.—**Partial rupture of the stomach; symptoms similar to those of irritant poisoning** (*ib.*, p. 118).—A boy aged fourteen after eating and drinking heartily at a feast, was attacked with violent vomiting and purging. Next morning he was unable to swallow, his pulse became irregular, and pressure on the heart or stomach caused excruciating agony. These symptoms continued, and on the following day, after having vomited at intervals altogether about two pounds of blood, the boy died. On *post-mortem* examination, the inner coat of the stomach was found torn in many places, and that of the duodenum lacerated almost completely round.

(*d*) **Colic.**—There may be some difficulty in diagnosing this from acute irritant poisoning, especially by lead salts. Pressure, however, in acute irritant poisoning augments the pain, while in colic it often relieves it.

(*e*) **Enteritis, Peritonitis, and Intussusception.**—These affections, like acute poisoning by lead salts, are accompanied by

constipation. Unlike irritant poisoning, in the later stages of these affections, vomiting, if present, becomes stercoraceous.

2. **Cerebral poisons** (see Chap. XXVIII).—The chief affections simulating the effects of these are :—

(*a*) **Apoplexy and uræmic coma.**—These may more or less resemble poisoning by opium, or narcotics similar in action thereto (see *Opium*).

(*b*) **Epilepsy.**—A fatal attack of this affection might possibly be mistaken for hydrocyanic acid poisoning. Death, however, seldom results from a first attack of epilepsy, and a history of previous attacks would indicate the nature of the case.

(*c*) **Sudden death from heart disease.**—This may be mistaken for hydrocyanic acid poisoning, or for one of those cases which sometimes occur, of death by syncope from a single over-dose of chloral. The presence of *post-mortem* appearances of advanced heart disease, would of course tend to indicate death from disease. In some cases of sudden death from heart affection, however, no marked appearances of the heart are discoverable after death.

3. **Spinal poisons** (see Chap. XXVII).—The effects of poisons of this class may be more or less simulated by—

(*a*) **Tetanus.**—This closely resembles strychnia poisoning (which see) .

(*b*) **Cerebro-spinal meningitis.**—This affection is accompanied by tetanic spasms, more or less resembling those of strychnia poisoning. Unlike strychnia poisoning, headache, fever, hyperæsthesia, and delirium precede the tetanic symptoms.

(*c*) **Convulsions** in young children proving (as sometimes happens) rapidly fatal, may simulate poisoning, the more so as opium poisoning in children is often accompanied by convulsions. In some cases the attack may be traced to dentition, indigestion, worms, or other source of irritation, but sometimes no cause for the attack is discoverable.

4. **Cardiac poisons** (see Chap. XXVIII).—The effects of a poison of this class may be simulated by heart disease (see above), or by sudden death from embolism, especially of the pulmonary artery. In this last case, the discovery of a plug obstructing the affected vessel would indicate the cause of death.

Post-mortem Appearances.

Many poisons leave no characteristic *post-mortem* appearances, but irritant poisons usually leave well-marked signs of their action. Such signs may consist in the presence of—

1. **Redness of the mucous membrane of the stomach** and other portions of the alimentary canal, due to inflammatory action. Such redness may be the result of disease, but is usually

the result of the administration of an irritant poison. When due to poisoning, the redness may vary in degree from unusual vascularity to a deep red velvety appearance. The mucous membrane is softened and opaque, and may show dark patches, due to underlying extravasated blood. Often its surface is covered with a glairy tenacious mucus, in which particles of the poison may be found entangled. Usually, in irritant poisoning, these appearances are chiefly met with in the stomach. They may, however, extend to the duodenum, or beyond. Redness due to inflammatory action may be more or less simulated by—

(*a*) **Staining with red dyes.**—Chemical tests will usually distinguish this, most vegetable reds being turned either blue or green by alkalies, or yellow by acids. Examination under the microscope also will, in such cases, show that the redness is not due to distension of the blood vessels.

(*b*) **Congestion not due to irritation.**—In some cases of sudden death, especially from congestion of the brain, or from apnœa, the mucous membrane of the stomach is found congested, and patches even of extravasated blood have been found beneath it. In such cases, as a rule, the redness is only a diffused blush, not stellated or punctated as in irritant poisoning. On dissection, also, the mucous membrane is found to be tough and transparent, and not as in irritant poisoning, softened and opaque from inflammation.

2. **Discolorations other than redness** of the parts with which the poison has come into contact.

In some cases such discolorations are met with in the alimentary canal. Thus, in arsenical poisoning, yellow patches, due to conversion of arsenious oxide into sulphide, are often found on the mucous membrane; and in cases of copper poisoning a blue or green coloration may be found. In cases of corrosive poisoning also, discolorations varying according to the poison may be found, not only on the mucous membrane of the alimentary canal, but also on other parts, *e.g.*, the skin.

3. **Ulceration of the mucous membrane of the stomach.**—Ulceration from disease must not be mistaken for this.

Generally, but not always, in disease, the ulcer is only just surrounded by redness, the symptoms are slight, and, unless due to malignant disease, the individuals affected are generally young women—from eighteen to twenty-three years of age. In irritant poisoning the redness, as a rule, is diffused over the whole stomach, particles of the poison may be found adhering to the ulcer, the ulceration may extend into the duodenum, and the symptoms are severe.

4. **Corrosion or chemical destruction of the tissues, and perforation of the stomach.**—In cases of corrosive poisoning marks of corrosion may be found on the skin, or in the mouth, throat or œsophagus, or on the mucous membrane of

the stomach. Perforation of the stomach may be found ; this however, is comparatively rare in poisoning.

Post-mortem softening of the stomach, with or without perforation, due to the action of the gastric juice, is sometimes met with, and must not be mistaken for corrosion. In such *post-mortem* softening, dependent parts of the stomach, and sometimes neighbouring organs, are affected. There is no inflammatory redness, and the mucous membrane is gelatinous and transparent. The extent of the softening, also, is likely to be greater the longer the period which has elapsed since death.

5. *Post-mortem* appearances of **irritation** may also be found **in** the **air passages,** in cases of poisoning by volatile or gaseous irritant, *e.g.*, ammonia and hydrochloric acid ; and in the case of certain irritant poisons, *e.g.*, cantharides, in the kidneys or **urinary passages.** A **yellow tinge of the skin** is a common *post-mortem* appearance in acute poisoning by copper and phosphorus, and in the latter, fatty degeneration of the liver is almost always present.

In the case of some non-irritant poisons, *e.g.*, hydrocyanic acid, the presence, on opening the body, of a particular **odour** may indicate the nature of the case. In others, during the *post-mortem* examination, **portions of the poison** used, *e.g.*, dhatura seeds, may possibly be found and identified. In the great majority, however, the *post-mortem* appearances present, if any, are merely such as indicate the " mode " of death (coma, asphyxia, &c.), and are therefore consistent with death from causes other than by poisoning.

DIRECTION FOR MAKING A POST-MORTEM EXAMINATION IN A CASE OF SUSPECTED POISONING.

The chief points requiring special attention are :—

1. **Surface and Orifices of the body, especially the mouth and throat, should be examined for marks of Corrosion.**—This is most important. It frequently happens that in corrosive poisoning, chemical analysis can do no more than prove the existence in the viscera of a salt, *e.g.*, a sulphate or an oxalate, which may have been derived from the poison swallowed, or may have been introduced into the body as a constituent of an article of food or medicine. In such a case failure to examine the mouth and throat for marks of corrosion, may make it impossible to prove that death was due to poison.

2. **Stomach, mucous membrane and alimentary canal should be examined** at the time the *post-mortem* inspection is made. Appearances indicative of the action of a poison are liable (from decomposition, or from the action of preservative

ds) to disappear from the mucous membrane. Hence, after noval of the stomach and intestines, these should be cut en, and their internal appearance noted. Suspicious particles nd adhering to the mucous membrane of the stomach should picked off, and preserved separately. (See rules in *pendix X.*)

3. **Preservation of matters for analysis.**—In addi- to the stomach, its contents, and the contents of the estines, one kidney, and a portion of the liver, at least 1 lb. weight, should always be preserved in the manner detailed *Appendix X.* Failure to preserve a portion, or a sufficient tion, of the solid viscera, may result in entire failure the chemical analysis (see p. 414). Obviously therefore roughly clean vessels alone should be used. For the purpose preventing decomposition, spirit should be added to the tters preserved (except, of course, to fluid matters, in cases suspected alcoholic poisoning) or a saturated solution of mmon salt may be used in certain cases. It is desirable retain a sample of the spirit or salt-solution used, in case question should arise in regard to its purity. The vessels taining the matters preserved for analysis should be sealed, care taken to prevent their being tampered with.

4. **Transmission of articles for analysis.**—To secure ntity, the containing vessels should be properly labelled, an impression of the seal used in closing them (which, of rse, should be a private seal), enclosed in the letter advising ir despatch. The box containing the vessels should be nked. A summary of the case should always be forwarded he analyst. It must be recollected that the quantity of ter available for analysis is limited, and that the quantity of son present is frequently very small. Sub-division, there- , of the matters under examination is to be avoided as much possible, and this cannot be the case if the analyst is given guide to the class of poison to be searched for, and as a rule cannot begin his analysis until the full report is received him.

5. **General examination of the body.**—This should er be neglected. It should be remembered that even in es where the suspicion of poisoning is strong, death may e been due to causes other than the administration of poison. o that *post-mortem* appearances, indicative of disease or ry, may be found co-existing with appearances indicating th from poison; and that in such cases the fact of the existence he disease or injury may, even when death has been clearly

due to poison, be important as bearing on the question of suicide or homicide. In the case of **female bodies**, care should always be taken to examine the vagina. Poisonous matters, or traces left by their action, are frequently found in the vagina, in cases where death has been the result of an attempt to procure abortion. Even also in other cases poison may be found in the vagina (see *opium poisoning*).

The precautions to be attended to, &c., when examining the bodies of cattle, in cases of suspected **cattle-poisoning**, will be found in Appendix XI.

3. CHEMICAL ANALYSIS.

This is usually performed by an expert chemist, as the ordinary medical man has not the requisite technical skill or appliances for the delicate processes necessary.

The object of chemical analysis is to ascertain (1) the presence and character of the poison, (2) if possible, the quantity of poison taken, and (3) how the poison was administered, &c.

The detection of poison in the body is the most important proof of poisoning, it is improbable to have been introduced after death—if found deposited in the solid organs could not have been so. When poison is found there is the question whether it was the cause of death, for death may be the result of other injury, &c. On the other hand, poison may disappear from the body by vomiting, purging, or by the urine or be decomposed.

Poisons, after absorption, tend to undergo elimination by natural effort, *e.g.*, by the lungs, skin, or kidneys. Hence, during life, in cases of poisoning, poisons may be detected by analysis in the urine, and, if in a case of poisoning, life is prolonged for some time, no poison may, after death, be discoverable in the body. The longer life is prolonged, and the more soluable or volatile the poison, the more likely is this to occur. Complete elimination has been known to take place. in a case of arsenical poisoning, in a fortnight (see *Case CCXXXIa*); and, in a case of antimonial poisoning, in a week; and may occur very rapidly in the case of very volatile poisons, like hydrocyanic acid and chloroform.

Poison may be detected by analysis :—(*a*) **Before death**, in the (1) vomit, (2) urine or in other evacuations ; (3) or in food, or other suspected articles. (*b*) **After death**, in the contents of the stomach or intestines ; or owing to absorption, in the liver, kidneys, or other parts of the body.

The longer the duration of the case, the less likely is it that any of the poison will be found after death in the contents of the stomach ;

and the more likely is it that if poison is detected at all in the body, it will only be found in some solid viscera. Hence the importance of submitting portions of these to analysis.

When a poison is found, it does not necessarily imply poisoning. Poison may be introduced into an article of food, in order to support a false charge. Again, poison may be introduced into evacuations, or even into viscera, with a similar object ; or these may have become accidentally contaminated with poison from impurities in the containing vessel. Hence the importance of (1) if possible, securing for analysis vomit, &c., ejected in presence of the medical attendant ; (2) using only thoroughly clean vessels for holding matters to be analysed, and (3) preserving such matters under seal, &c., so as to prevent their being tampered with. Suppose, however, that poison is found, and that such poison has not been introduced in one of the ways indicated above, the case may still not be one of poisoning, because the poison discovered—

(*a*) **May be a natural constituent of articles of food,** *e.g.*, oxalic acid in combination is found in certain vegetables ; or,

(*b*) **May have been given in the course of medical treatment,** *e.g.*, arsenic or mercury (see these poisons).

In two other cases also, a poison, or substance resembling a poison, may be found in the viscera of an individual, and the case yet be not one of death from poison, *viz.* :—

(*c*) **When death has been due to some other cause,** *e.g.*, drowning or hanging, operating before the poison has fully exerted its action on the system ; or,

(*d*) **When the substance found is a "Ptomaine,"** or alkaloid resulting from decomposition (see *Ptomaines*).

The total quantity of poison found in the viscera of an individual may be **less than a minimum poisonous dose,** and the case yet be one of death from poison. Frequently a large proportion of the poison swallowed is got rid of by evacuation. In this way, the whole alimentary tract may be freed from the poison, and only that portion which has been absorbed remain in the body. This absorbed portion again is distributed more or less throughout the whole body. Obviously, however, only a fractional part of the body can be examined, and the quantity of poison found in this, therefore, is only a fraction of the quantity the body contains. Again, by elimination through the emunctories during life, a portion, or even the whole of the absorbed poison may be removed from the body, and yet death occur from the effects of the poison. In such a case, the whole body may not contain such a quantity of the poison, as amounts to a minimum fatal dose.

On the whole, therefore, the quantity of poison found in the body is, in the great majority of cases, of little importance. In a few cases, however, it may be important, *e.g.*, when the quantity found is small and the poison is one sometimes present as a natural constituent of food, or sometimes given as a medicine. Hence, where possible, the quantity present should always be determined.

When no poison is found, the case may yet be one of poisoning:—

(*a*) **From the poison having disappeared** by evaporation or by evacuation or elimination. This, as already pointed out, is specially likely to occur in the case of very volatile, *e.g.*, gaseous poisons; or in the case of very soluble poisons, *e.g.*, in poisoning by the corrosive acids; or in cases where an individual has lived for some time after swallowing the poison.

(*b*) **From neglect to submit certain matters** (or a sufficient quantity thereof) **to analysis**, *e.g.*, in cases where the individual has lived for some time after administration of the poison, and no portion, or only very small portions, of the solid viscera, are submitted to the analyst. Again, of several articles of food, one alone may contain poison, and this may not have been submitted.

(*c*) **From the poison having undergone chemical destruction** by oxidation or putrefaction. This may occur in the case of organic, but not in the case of inorganic poisons. It is possible that some organic poisons may undergo destruction, by oxidation in the body during life. Organic poisons, again, may be destroyed by putrefaction after death; some, however, *e.g.*, strychnia and opium, have been found to resist putrefaction for long periods.

(*d*) **From there being no reliable means of extracting the poison** from substances containing it, or no satisfactory tests for its identification.

(*e*) **From want of care or skill** on the part of the analyst.

Case CCI (*R.* v. *Catherine Wilson*) is an example of a conviction for murder by poison, notwithstanding the fact that no poison was discovered in the viscera of the persons poisoned.

Should a poison be found, a portion of it should, if possible, be preserved for production before the Court. (*Ind. Evid. Act*, *s.* 60.)

4. EXPERIMENTS ON LOWER ANIMALS.

The evidence from experiments on animals, the "physiological test," with the contents of the stomach and vomited matter or extracts from these may take the form of—

1. **Administration of suspected substances**, such as portions of:—

(*a*) **Food.**—This is often employed as a rough preliminary test for the presence of poison.

(*b*) **Vomited matter.**—An experiment of this kind is sometimes the result of accident, and is open to the fallacy that morbid secretions, *e.g.*, bile, may, when swallowed by animals, cause symptoms of poisoning.

(*c*) **Eliminated poison.**—This is specially useful in the case of organic poisons for which there are no distinctive chemical tests, *e.g.*, aconitia and daturia (see, however, remarks on Ptomaines).

This is the ordinary physiological test for aconite and datura—the extract by *Stas'* or other process for extracting alkaloids is put into the eye of a cat, or administered internally to a cat by the stomach-pump.

2. **Comparison experiments.**—In a case of suspected poisoning by a substance, the action of which is not well known, it may prove useful to administer to an animal a dose of the poison supposed to have been employed, so that the symptoms present in the case may be compared with those which arise in the animal experimented on. Experiments of this kind are open to two objections.

(*a*) Some animals are apparently unaffected by poisons, which act violently on man, and herbivora are as a class less affected than carnivora, *e.g.*, pigeons appear to be unaffected by opium, some varieties of monkeys appear to be unaffected by strychnia, and rabbits appear to be unaffected by belladonna and fowls by strychnia. It should be noted, however, that poisoning in the human subject may arise from eating the flesh of animals that have fed on plants not poisonous to the animal, but poisonous to man.

(*b*) The symptoms produced in the animal experimented on may be different from those of the case, although the same poison was used in both; either from the action of the poison on the animal being different to its action on man, or from failure to properly proportion the dose to the size of the animal.

The weight of the animal used in the experiment should always be recorded with the weight or quantity of suspected poison administered.

In every case a '*control*' experiment should be made on a second animal of the same species, and as far as possible of the same size and weight.

CHAPTER XXI.

IRRITANT AND CORROSIVE MINERAL POISONS.

GENERAL SYMPTOMS

Of Irritant-Poisoning.

These are divisible into (*a*) Throat symptoms ; (*b*) Abdominal; and (*c*) Later symptoms.

(*a*) **Throat symptoms.**—These are pain, difficulty in swallowing, and feeling of constriction ; and (in corrosives) marks of corrosion in the mouth and throat.

(*b*) **Abdominal symptoms.**—These are epigastric pain, thirst, nausea, vomiting, purging, tenesmus, and dysuria. The stools and vomited matters often contain blood.

(*c*) **Later symptoms.**—These are acute inflammation of parts, pain and inflammatory fever ; or collapse accompanied by a quick feeble pulse, and cold sweats ; sometimes the anus becomes excoriated. Various symptoms due to the specific remote action of the poison, may also be present, and in cases which survive, stricture of the gullet may result.

The order in which the symptoms appear varies according as to whether the case is one of corrosive, or of non-corrosive irritant poisoning. In corrosive poisoning, the throat symptoms appear first, and come on immediately, or almost immediately, and often the glottis and trachea are affected, causing dyspnœa. In non-corrosive irritant poisoning, the abdominal symptoms appear first, and are followed by throat symptoms. In non-corrosive irritants, the interval between swallowing the poison and first appearance of the symptoms varies ; it may be very short in the case of the more soluble irritants, or may be half an hour or more in the case of less soluble ones.

Death may occur—(*a*) Rapidly from **shock**, as in some cases of arsenical poisoning ; or from **suffocation** as in some cases of corrosive poisoning. (*b*) Less rapidly from **syncope** due to absorption and secondary action, as in some cases of oxalic acid poisoning. (*c*) Still less rapidly from **exhaustion** due to protracted irritation ; or, (*d*) In corrosive poisoning,

after a considerable period, from **starvation** or **suffocation,** the result of local injury.

Post-mortem appearances of irritant-poisoning are signs of irritation or corrosion of the mucous membrane of the alimentary canal. In some cases, similar signs may be present in other situations.

Treatment.—In cases of irritant-poisoning, the following indications should be followed :—

1. **Elimination.**—Usually there is free vomiting, which should be encouraged by copious draughts of warm water. In some cases, emetics or the stomach-pump may be required ; the latter, however, should never be used in corrosive-poisoning.

2. **Prevention of action.**—The means whereby this indication may be carried out have already been sufficiently indicated (see *ante*, p. 118). Here it may be noted that, in the case of vegetable and animal irritants, antidotes are, as a rule, not available.

3. **Counteraction and removal of effects.**—Under this head the employment of measures calculated to allay irritation—among them administration of demulcents—is indicated. Oily demulcents must not be given in poisoning by phosphorus, or by cantharides, these poisons being soluble in oil. Stimulants may be given to counteract depression. In cases of corrosive-poisoning, laryngotomy may be required.

Irritant poisons may be conveniently classified as:—(1) Corrosive poisons including mineral acids and alkaloids ; (2) Non-metallic irritants and organic acids ; (3) Metallic irritants ; (4) Vegetable irritants ; (5) Animal irritants ; and (6) Mechanical irritants.

CORROSIVE MINERAL ACIDS.

The chief of these are :—

Sulphuric acid, or **oil of vitriol.**

Hydrochloric or **muriatic acid,** or **spirit of salt.**

Nitric acid, or **aqua fortis.**

Action, and Origin of Cases.—These three acids are very similar in action, and are powerful corrosives, except when much diluted, when they act as simple irritants. Cases of poisoning by them are rare in India,[1] but tolerably frequent in Europe. Owing to their marked properties, these acids are

[1] Only one case (suicide by nitric acid) occurred in the Bombay Presidency in twenty years.

seldom used homicidally; a few cases, however, of homicidal poisoning of children by sulphuric acid, are recorded. **Accidental cases,** except among children, also are rare. Most commonly adult cases of poisoning by these acids are **suicidal,** and in England form about one-twelfth of the total suicides by poison. Sulphuric acid has been injected by mistake into the rectum as an enema, and has been thrown up into the vagina, for the purpose of procuring abortion. Not infrequently in England, and in rare cases also in India, sulphuric acid is thrown over the person in order to cause injury (**'vitriol throwing'**). Sometimes nitric acid is used in the same way. A few accidental fatal cases from inhalation of the vapours given off by nitric acid (see *Nitrous Acid*), have occurred; and a case of homicide by pouring nitric acid into the ear during sleep, is on record.

General Symptoms.—Swallowed in a tolerably concentrated condition, these acids cause: Immediate burning pain in the mouth and throat, followed by pain in the abdomen. Vomiting of brown or black matter containing blood, mucus, and shreds of mucous membrane. The vomited matters, especially those first ejected, may effervesce on coming into contact with the ground (owing to the acid acting on carbonates). There is tenesmus but no purging; difficulty and pain in micturating, in swallowing, and often also in breathing. The lips and interior of the mouth, unless the poison has been conveyed to the back of the throat by a spoon or some such means, are discoloured, or shrivelled and blistered. The discoloration, at first white, afterwards becomes ash grey or brown, or, if nitric acid has been employed, turns yellow. Marks of the action of the acid may be found on the skin or clothes; these are yellow if from nitric acid, and brown—or, if on coloured cloth, dull red—when due to sulphuric acid. Hydrochloric acid does not stain the skin, but stains coloured cloth very much like sulphuric acid.

Special Symptoms:—

(1) **Sulphuric acid.**—Salivation coming on about the second or third day, has been observed in several cases. In exceptional suicidal cases there has been considerable delay in the appearance of serious symptoms (see two undernoted cases), and in one case vomiting ceased in four hours, and did not return, though the patient lived thirty-one hours. In a few cases sulphate of indigo—a solution of indigo in strong sulphuric acid, used in dyeing—has been taken, giving rise to symptoms exactly like those of sulphuric acid poisoning;

except that the mouth and vomited matters, and in some cases the urine also, are tinged blue.

Case CCIII.—**Suicidal poisoning by sulphuric acid; appearance of urgent symptoms delayed** (Taylor, *Poisons*, p. 183).—A man, æt. fifty-six, swallowed by mistake a dessert-spoonful of oil of vitriol. On admission into hospital, he was able to walk upstairs. He vomited slightly at first, did not appear very ill, had one brown fluid motion. The lining membrane of the mouth was brown. There were no urgent symptoms, but the patient died suddenly on the fourth day.

Case CCIV.—**Another case.** A girl, having swallowed a quantity of concentrated sulphuric acid, sat quietly down to tea with some friends although the quantity of acid taken was sufficient to cause death in a few hours.—*Ib.*

(2) **Hydrochloric acid.**—In one case of poisoning by this acid salivation came on rapidly, in another convulsions preceded death, and in a third delirium came on on the second day, followed by paralysis of the limbs. The vapour of hydrochloric acid if inhaled acts as a poison, causing great irritation of the air passages.

Case CCV.—**Hydrochloric acid poisoning.** In 1897 a man in Calcutta was advised to purchase half an ounce of hydrochloric acid from a baniah's shop and to take it with some water for the cure of some disease from which he was suffering. He drank the strong undiluted acid and died from its effects after exhibiting all the symptoms of corrosive poisoning. The mucous membrane of the stomach was superficially charred at several places, and yellow patches were found in mucous membrane of the throat and gullet. No free acid was found in the stomach, as he was treated with alkaline medicines in the hospital. Sulphates were detected in the viscera, but abundance of hydrocloric acid, in combination with alkaline metals, was found in them as well as in the washings of the stomach received with the viscera. No nitric acid was detected.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

(3) **Nitric acid.**—In one case of poisoning by this acid lock-jaw was present, and in another insensibility. A case is recorded of poisoning by a mixture of nitric and sulphuric acids. **Nitro-muriatic acid** is used in the arts for dissolving gold and other purposes, but does not seem to have given rise to any cases of poisoning.

Mode and time of death.—Death may occur rapidly from shock or suffocation. Children poisoned by sulphuric acid often die from the latter cause, the poison never reaching the stomach. Hydrochloric acid poisoning also, is apt to end in death by suffocation. Death may take place less rapidly from exhaustion; or, after months, from starvation, due to stricture of the œsophagus. In the case before referred to, where nitric acid was poured into the ear, death took place in

thirteen weeks, from necrosis and inflammation spreading to the brain. In cases of recovery from the first effects, severe dyspepsia is often observed, and may continue throughout life. Death usually takes place within twenty-four hours, but has occurred (in nitric acid poisoning) in an infant in five minutes, and in an adult in one hour and three-quarters. The longest fatal periods recorded are, in sulphuric acid poisoning forty-five weeks, and in nitric acid poisoning two years, both from starvation.

Fatal dose.—The more concentrated the form in which these acids are swallowed the more likely is a given quantity to cause death. A very few drops of any of the three acids may cause death from suffocation ; and the more empty the stomach, the more likely is serious injury to it to result. Hence the least quantity required to destroy life cannot be precisely stated. The smallest doses which are recorded to have proved fatal are sulphuric acid, 1 drachm ; nitric acid (in a child of thirteen), 2 drachms ; and hydrochloric acid, about ½ ounce. The largest non-fatal dose of sulphuric acid recorded is 3 ounces ; and several instances of recovery after swallowing an ounce of hydrochloric acid are reported.

Post-mortem appearances.—These are usually : marks of the acid, as before described, on the clothes, skin and lips, and in the mouth. Signs of inflammation and corrosion in the œsophagus, and sometimes in the larynx. Stomach in the majority of cases discoloured (yellow from nitric acid, brown or black from the other two acids), inflamed, corroded, and sometimes perforated. Marks of the action of the acid may be absent from the mouth, if the acid has been poured down the throat with a spoon ; absent, or nearly absent, from the œsophagus, even although the poison has reached the stomach ; and even in fatal cases, altogether absent from the stomach. **Perforation of the stomach** has been found in about one-third of the fatal cases of sulphuric acid poisoning, is rare in nitric acid, and still rarer in hydrochloric acid poisoning.

Treatment.—The stomach-pump must **not** be used. Give calcined magnesia, carbonate of magnesia, chalk, or carbonate of soda, followed by mucilaginous drinks. If death from suffocation threatens, laryngotomy must be performed. In the after treatment leeches and other antiphlogistic remedies may be required. Excoriations should be washed with lime water, and treated as burns. Distress due to inhalation of hydrochloric acid vapour, may be relieved by inhalation of weak ammonia.

Detection.—In fatal cases of poisoning by these acids, especially if life has been prolonged for two or three days, no trace of the poison may be discoverable in the viscera. Should the presence of one of these acids be detected, it is important —salts of these acids being common constituents of food and medicine—to ascertain whether any of it is present in the free

condition. If no free acid be found, the quantity of **combined** acid present becomes of importance. The quantity of **free** acid present is specially important in hydrochloric acid poisoning, as this acid (in loose combination with pepsin), is contained uncombined with bases, in the gastric juice, to the extent of about ·2 per cent. or more.

Sulphuric acid and solutions of sulphates give a white precipitate with barium nitrate, which is (1) insoluble in dilute nitric acid, (2) insoluble in water, and (3) when collected, dried, and heated with powdered charcoal before the blowpipe, converted into barium sulphide, soluble in hydrochloric acid with escape of hydrogen sulphide, recognised by its odour, and by its blackening paper wetted with lead acetate solution. **Free sulphuric acid** chars organic matter. It may be separated from soluble sulphates by concentration on a water bath and treatment with quinine ; separating the quinine sulphate formed, after thorough drying, by strong alcohol, in which quinine sulphate is soluble, but alkaline and metallic sulphates are insoluble. The alcoholic solution is then to be evaporated to dryness, the residue dissolved in boiling water, decomposed by ammonia, filtered, and the sulphuric acid estimated in the filtrate by precipitation as barium sulphate.

Hydrochloric acid and solutions of chlorides give (1) a white flocculent precipitate with silver nitrate solution, soluble in ammonia, but insoluble in boiling nitric acid, and (2) when boiled with H_2SO_4 and manganese dioxide, evolve chlorine, recognisable by its colour, odour, and bleaching action on moistened litmus paper. **Free hydrochloric acid** evolves chlorine when boiled with manganese dioxide only, and (2) when mixed with HNO_3 dissolves gold. Organic mixtures to be tested for the free acid should be distilled, and the distillate tested for HCl ; or if this, as sometimes happens, fails, resort may be had to either (1) the quinine process as for sulphuric acid described above, estimating the chlorine in the decomposed filtrate volumetrically with silver nitrate solution ; or (2) the organic mixture may be divided into two equal portions, and one of these neutralised by sodic carbonate ; both are then evaporated to dryness, the residues incinerated, and the chlorine in each separately estimated. The excess of chlorine in the neutralised portion, corresponds to the free acid present in the original fluid.

Nitric acid and solutions of nitrates (1) heated with H_2SO_4 and fragments of copper dissolve the copper with escape of lower oxides of nitrogen, known by their red colour and their liberating iodine from potassium iodide ; (2) boiled with H_2SO_4 and a drop or two of indigo solution, decolorise the indigo (this test by itself is not conclusive evidence of the presence of HNO_3) ; and (3) if to a portion of the solution under test, ferrous sulphate solution and then a little H_2SO_4 be cautiously added, a brown ring appears at the point of contact of the H_2SO_4 with the other fluids.

Free nitric acid gives the above reactions without the addition of H_2SO_4, and if mixed with HCl dissolves gold. It may be separated from organic mixtures by the quinine process described above for sulphuric and hydrochloric acids.

Stains on Cloth, &c.—The yellow stains of nitric acid on the tissues or on cloth, treated with weak caustic potash solution, acquire

an orange colour, while iodine stains disappear, and bile stains remain unaltered. Stains of sulphuric or hydrochloric acid on dark-coloured cloth, are usually reddish, the red tint disappearing on addition of ammonia. Sulphuric acid stains are more moist, and show more evidence of corrosion, than hydrochloric acid stains. Stains on cloth, &c., should be macerated in water which will acquire an acid reaction if free acid is present in the stain. The watery solution may then be tested for the suspected acid. A comparison experiment should at the same time be made with an unstained portion of the cloth. Burns must not be mistaken for marks of corrosion by sulphuric acid. Blyth, on the authority of Maschka, mentions a case, where free sulphuric acid found in a charred mark on an infant's bed, was ascertained to be due to the sudden quenching with water of a live coal which had fallen thereon.

The detection of these acids may be required in criminal cases other than cases of poisoning or causing actual bodily hurt as in a case where a bottle of this liquid, loosely stoppered and leaking, was sent by post, and a prosecution under the Post Office Act thereupon instituted against the sender. A mixture of HNO_3 and H_2SO_4 is used in making nitro-glycerine and other explosives; the identification of these acids, therefore, might be required in support of a charge of illicitly manufacturing such substances. Nitric acid is used in India for the purpose of "sweating" silver coin; the method employed being apparently to steep the coins for a short time in this acid, and then, by adding metallic copper, precipitate and recover the silver. Hydrochloric acid has been used in forgery, to remove marks of writing ink from paper. Hydrochloric acid gas acts injuriously on vegetation, and by law in England alkali manufacturers—making carbonate of soda by the salt cake process—render themselves liable to penalties if they fail to condense to a stated extent, the hydrochloric acid evolved in the manufacture.

Hydrofluoric acid, HF, used for etching on glass, is a powerful corrosive. One fatal case is recorded of poisoning by this acid, in which half an ounce was swallowed, and death took place in thirty-five minutes.[1]

ALKALINE CORROSIVES.

The chief poisons of this class are the caustic alkalies: **potash, soda, and ammonia; and their carbonates.** These, like the acid corrosives, act as simple irritants when sufficiently diluted. Cases of poisoning by the alkaline corrosives are rare, and are usually accidental. One fatal case occurred in Bombay in twenty years, namely, a case of suicide by caustic ammonia.

In Europe, cases of poisoning by the corrosive alkalies are commonly accidental, and owe their origin to the extensive use of these substances, in the arts especially carbonates of potash and soda. Impure carbonate of soda is sold in the bazaars of Bombay under the names of *Sajjikhara* and *Bangadakhara*; impure carbonate of Potash, as *Javakhara*, and the mixed carbonates as *Papadakhara*.[2]

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[1] See *Physiological Action of Hydrofluoric Acid and Fluorides* by L. A. Waddell, M.B.—*Ind. Med. Gaz.*, 1883.

[2] Sakharam Arjun, *Catalogue of Bombay Drugs.*

Symptoms.—These are similar to those caused by the corrosive acids, except that the vomited matters are alkaline and do not effervesce on the ground; and purging which is not present in poisoning by the corrosive acids—is a frequent symptom in alkaline poisoning. In poisoning by liquid ammonia or its vapour, and by the carbonates of ammonia, inflammation of the air-passages is a constant symptom. Caustic ammonia is less powerfully corrosive than caustic potash and caustic soda, and carbonate of soda is less corrosive than carbonate of potash. As in poisoning by the corrosive acids, the greater the degree of concentration of the poison, the greater the danger.

Post-mortem appearances and modes of death are similar to those in poisoning by the corrosive acids. **Treatment** also is the same, except of course, that dilute acids, preferably dilute vegetable acids, should be given, instead of dilute alkaline solutions. In cases of poisoning by ammonia inhalation of acetic acid vapour may be used to allay irritation of the air-passages.

Fatal dose, &c.—Forty grains of caustic potash caused the death of an adult in seven weeks, from exhaustion. About half an ounce may be looked on as an ordinary fatal dose of caustic potash or caustic soda. About half an ounce of carbonate of potash has in more than one instance, in adults, caused death in two to four months. Carbonate of soda is much less poisonous: a case of recovery after swallowing twelve ounces is on record. As regards caustic ammonia, a quarter of an ounce of the strong solution has caused death, and half an ounce may be regarded as an ordinary fatal dose.

Liquor potassæ (B.P.) contains 5·84, and liquor sodæ (B.P.) 4·1 per cent. of caustic alkali. Strong solution of ammonia (B.P.) contains 32½ per cent. and solution of ammonia (B.P.) 10 per cent. of NH_3. Compound camphor liniment (B.P.) contains about 7·3 per cent. of NH_3, and has given rise to more than one case of poisoning.

Detection.—Free potash and soda are most conveniently separated from organic mixtures by dialysis; after which the quantity present may be estimated (in the fluid which has passed through the membrane) by a standard acid. Free ammonia is best separated by distillation. Potash and ammonia are distinguished from soda by giving (1) a precipitate with tartaric acid in excess, and (2) a precipitate with platinic chloride in presence of hydrochloric acid. Ammonium may be distinguished from potassium salts (1) by their volatility, and (2) by their evolving ammonia when heated with solution of caustic potash.

Lime, CaO.—May be included among the alkaline corrosives, but from its little solubility, is much less dangerous than the poisons just described. The symptoms, treatment, &c., are the same as in poisoning by potash and soda. Malingerers have been known to produce ophthalmia, by applying lime to the conjunctiva.

Other corrosive salts.—Certain metallic salts, *e.g.*, **mercuric chloride** and **zinc chloride,** possess a corrosive action : these will be described with the other compounds of these metals. A more or less destructive action on the tissues is also exerted by **oxalic** and **acetic acid,** see vegetable acids ; by **bromine,** see non-metallic irritants ; and by **carbolic acid,** see narcotics, group 2.

CHAPTER XXII.

Non-Metallic Irritants.

PHOSPHORUS.

Red or amorphous phosphorus is not poisonous. Ordinary yellow phosphorus especially in fine division is an extremely active irritant poison. It contained about 1½ to 4 per cent., in various pastes used for destroying vermin, and to a varying extent, usually about 15 per cent., in the composition with which the heads of some kinds of lucifer matches are tipped.[1] Cases of poisoning by solid phosphorus usually arise from swallowing vermin pastes, or lucifer match heads (*see* Case CCVI), and are generally in adults suicidal, and in children accidental. Phosphorus vapour is also highly poisonous, but the symptoms produced by it usually differ from those of poisoning by solid phosphorus (*see* below).

Case CCVI.—**Phosphorus poisoning by match-heads.**—A case of attempted poisoning by phosphorus was reported from Purnea in 1897. The suspected substance consisted of a packet of betel-nut and a prepared *betel*, the pepper leaves (*pân*) mixed with catechu and lime for chewing. It was found to contain the tips of four lucifer matches. Phosphorus was detected in the match-heads.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

In poisoning by solid phosphorus (acute poisoning).—The symptoms may appear almost immediately, but in many cases do not appear for one to six hours ; in a few cases their appearance has been delayed longer, and one case is recorded where five days elapsed before they appeared.

The first symptoms are those of ordinary irritant poisoning with the following points of difference : (1) the breath may be phosphorescent and have a garlicky odour ; (2) the vomited matters and other evacuations may be phosphorescent ; and (3) diarrhœa is sometimes absent. Subsequently jaundice sets in, usually before the end of the third day, often after a remission of the symptoms, and is accompanied most commonly by (*a*) retention of urine followed by fatal coma, delirium being sometimes present ; or less commonly by (*b*) hæmorrhage from the mouth, bowels, and genito-urinary organs, and spots of purpura

[1] In other kinds, the non-poisonous red phosphorus is substituted for the poisonous yellow variety ; and the heads of "safety" matches contain no phosphorus.

under the skin, with death ultimately from exhaustions ; or still more rarely by (*c*) cramps and fatal tetanic convulsions.

Death in a few cases occurs before the end of the second day and before jaundice has set in. Usually death takes place within a week. In one case the patient survived eight months. A little over one-ninth of a grain has caused death. Three-quarters of a grain to two grains may be looked on as an ordinarily fatal dose ; recovery, however, has been recorded after swallowing five grains.

Phosphorus vapour.—One or two acute cases of poisoning by phosphorus vapour are on record, but as a rule this form of poisoning is chronic in character. The chief symptoms present in chronic cases are caries of the teeth, and painful necrosis of the jaws, ' phossy-jaw ' most commonly of the lower jaw followed in many cases by death from debility. Cases of this form of poisoning have chiefly been observed in workers in phosphorus, especially lucifer match makers : hence the term " lucifer match maker's disease," applied to this form of poisoning. Owing to improvements in the method of manufacture of lucifer matches, and specially to the introduction of red as a substitute for yellow phosphorus, cases of this form of poisoning are now much less frequent than formerly.

Post-mortem appearances.—In acute cases fatty degeneration of the liver is always, or almost always, present, and has been found far advanced in a case where death occurred in twenty-four hours. The phosphorus liver, except that as a rule it is enlarged and not diminished in size, resembles to the naked eye the liver of acute yellow atrophy. Fatty degeneration also may be present, of the muscular fibres of the heart, of the kidneys, and of the epithelial cells of the intestinal mucous membrane. Spots of extravasation are often present under the serous and mucous membranes, and in other tissues. The skin may be yellow, and the stomach contents phosphorescent. Signs of inflammation of the mucous membrane of the alimentary canal are not commonly present. In exceptional cases the *post-mortem* appearances have been entirely negative.

Treatment.— In acute cases, emetics may be given and vomiting promoted, or the stomach-pump used. No oil or fatty matters should be given, as these dissolve phosphorus. Turpentine in 40-minim doses often repeated, is recommended as an antidote.

Detection.—Phosphorus readily undergoes oxidation in the body, hence after death analysis may fail to detect its presence. Solid yellow phosphorus is easily recognised by its physical characters. If present in organic mixtures in considerable quantity, it may be separated as a sediment by washing, afterwards melting it, if finely divided, under warm water ; or it may be extracted from organic matters by carbon

disulphide, in which it is soluble. If present only in small quantity, one of three processes may be employed, *viz.* (1) Mitscherlich's. Acidulate the matters with H_2SO_4 and distil them to dryness in the dark, using a well-cooled glass condensing-tube, which will show luminosity of phosphorus to be present. (2) A modification of Marsh's process, by which phosphorus, if present, becomes converted into gaseous hydrogen phosphide (PH_3), which burns with an emerald green flame, and produces a black precipitate in silver nitrate solution, the liquid, after removal of the excess of silver, showing the presence of free phosphoric acid. (3) Lipowitz's method. Acidulate the matters with H_2SO_4, and boil fragments of sulphur in them for an hour; remove and wash the fragments of sulphur, which, if phosphorus is present, will be found to have become luminous in the dark, owing to the deposition of phosphorus upon them. Phosphorus boiled with HNO_2 becomes converted into phosphoric acid, the presence of which may be recognised by precipitation with a mixture of ammonia, ammonium chloride, and magnesium sulphate solutions. In this way, also, its quantity may be estimated.

CHLORINE, BROMINE, AND IODINE.

Chlorine, largely used as a disinfectant and in bleaching, is a highly irritant gas, causing great irritation and inflammation of the air-passages, and acting as an irritant also on the conjunctiva. Workmen in chlorine factories are, however, said to become in time to a certain extent habituated to its presence. **The hypochlorites** contained in bleaching-compounds, *e.g.*, chloride of lime and **liquor sodæ chlorinatæ,** also act as irritant poisons.

Treatment.—Inhalation of diluted hydrogen sulphide; this, however, must be employed with caution, as hydrogen sulphide is in itself highly poisonous.

Bromine.—This in the liquid form is a corrosive poison. In the form of vapour its effects are similar to those produced by chlorine. One case of death in seven hours from an ounce of liquid bromine is recorded. **Bromide of potassium** in single doses has not been known to give rise to symptoms of poisoning. In large doses taken for a considerable time, it causes impairment of the functions of the brain and spinal cord, such as diminished activity of reflex action, cloudiness of intellect, impairment of memory and of articulation, and tendency to stupor.

Iodine.—Free iodine is a corrosive irritant; in poisoning by it the vomited matters are often blue or black owing to its action on starch. Twenty grains has caused death, but recovery is recorded from 1½ drachms. Iodine in small doses, often repeated, is liable to give rise to chronic poisoning, the chief symptoms of which are, irritability of the stomach, vomiting and purging, accompanied by salivation and wasting of the body generally, and specially of the breasts or testicles. **Iodide of potassium** has frequently been given medicinally in comparatively large doses (100 grains or more a day) without producing ill-effects. Sometimes, however, small doses, often repeated, give rise to symptoms resembling those of severe catarrh, and in exceptional cases such symptoms have even arisen from single small doses. In exceptional cases also, the ordinary symptoms of catarrh have been accompanied by somewhat severe symptoms of irritant poisoning.

NITROUS ACID.

The vapours of nitric acid, and the red gas evolved during the oxidation of matters by nitric acid,[1] are highly poisonous, giving rise when inhaled to inflammation of the air-passages and lungs. A few cases of death from the inhalation of such vapours are on record. In some of these the fatal result has followed on exposure for a few minutes to the vapours arising from a quantity of nitric acid, accidentally spilled by the breaking of a large vessel filled therewith. In these cases a noticeable feature has been the slight amount of discomfort felt for the first two or three hours after the accident, death nevertheless occurring rapidly (within ten to fifteen hours).

Sulphur dioxide, commonly called Sulphurous Acid. This gas, like nitrous acid, acts as an irritant to the air-passages. From Woodman and Tidy's experiments it appears that when the quantity is small, animals soon get accustomed to its presence, and thereafter do not suffer nearly so much from its irritant action.

OXALIC ACID.

Oxalic and Acetic Acids may be conveniently considered here :—

Poisoning by oxalic acid is rare in India, but tolerably frequent in Europe. In England, in the five years ending 1880, seventy-four deaths from oxalic acid were registered, of which sixty-five (about seven-eighths) were suicidal, and the rest accidental. I have met with but four fatal cases in Bombay in twenty years. Of these three were suicidal, and the fourth apparently homicidal. Many accidental cases owe their origin to the resemblance in appearance of oxalic acid to sulphate of magnesia. Homicidal cases (probably owing to the strongly acid taste of the poison) are rare. Oxalic acid and the acid alkaline oxalates are chiefly used in the arts for cleansing purposes, *e.g.*, cleansing leather, wooden boards, &c., and removing ink stains and iron moulds from linen.

Symptoms.—Oxalic acid and the acid alkaline oxalates possess both a local and a remote action. Of these, the remote action is much the more serious, and is usually the cause of death. **Local action.**—This is corrosive or irritant in character according to the degree of concentration of the poison. Swallowed in concentrated solution, the symptoms due to the local action of the poison are immediate burning pain in the mouth and throat, with sense of constriction, followed rapidly by pain in the abdomen, and vomiting of matters containing altered blood. The interior of the mouth has a bleached white appearance ; and if the patient lives long enough, purging sets in, the stools containing blood. Swallowed in dilute solution, the symptoms due to local action are those of non-corrosive irritant-poisoning. There is an acid taste, but no burning pain, in the mouth ; and vomiting does not come on for fifteen or twenty minutes : in one case it did not come on for seven hours. **Remote action.**—The symptoms due to this are twitchings of the muscles, in some cases amounting to tetanic convulsions ; numbness, tingling and cramp in the limbs ; great depression of the heart's action : slow spasmodic respiration ; collapse, and stupor or

[1] Nitrogen peroxide (NO_2) and nitrous anhydride (N_2O_3) ; the latter, by combination with water, yields nitrous acid (HNO_2).

insensibility, and sometimes delirium. These symptoms may be unaccompanied, or almost unaccompanied, by vomiting, pain, and other symptoms of local action. **After symptoms.**—In cases of recovery, loss of voice has been observed, in one case complete for eight days, in another partial for more than a month. Alteration of the voice is sometimes present in acute cases. Numbness and tingling of the limbs and twitchings of the muscles, may remain for some time after the first effects of the poison have disappeared. So also may irritability of the stomach; and as in other cases of corrosive poisoning, death may occur after a considerable interval, from starvation.

Fatal period.—Exceptionally short, usually under one hour. Death has occurred in three minutes, in ten minutes, and in one case, not until the fourteenth day, from starvation. Woodman and Tidy mention a case where a man is reported to have walked ten miles after swallowing an ounce of oxalic acid.

Fatal dose, about half an ounce; cases, however, are reported of death from one drachm (in a boy aged 16), and three drachms (in a female aged 28), death taking place in respectively twenty-one hours and one hour. Cases of recovery after swallowing an ounce or more, are reported.

Post-mortem appearances.—These vary according to the degree of concentration of the poison and rapidity of death. If the poison has been swallowed in a tolerably concentrated form, the lining membrane of the mouth, throat, and gullet is found white, shrivelled, and easily detached. If death has been rapid, the mucous membrane of the stomach may be pale, but usually is deep red, in places black, and may be found eroded. Perforation is rare. The stomach has been found so soft as to tear easily. The intestines may be found inflamed, and the lungs are often congested. Congestion of the brain has been found; and in one case, probably from violent vomiting, apoplectic effusion was present.

Treatment.—Administration of saccharated solution of lime, or of chalk suspended in water. Magnesia or carbonate of magnesia may be given instead of chalk. After administration of antidotes, warm water may be given freely. Vomiting should be promoted. Alkalies are inadmissible, and the stomach-pump should not be used if much corrosion be present, and, if used, should be introduced with great caution.

Oxalates.—Two acid potassium oxalates are in common use in the arts, *viz.*, the binoxalate, and the quadroxalate. Both are sold under the names of salt of sorrel, and essential salt of lemons, and both are nearly as poisonous as oxalic acid. The binoxalate has caused death in eight minutes. Half an ounce of it has proved fatal, but recovery is recorded from one ounce. The symptoms, treatment, &c., are precisely the same as in poisoning by oxalic acid.

Detection.—It should be remembered that alkaline oxalates are found in many plants, *e.g.*, in wood sorrel, and in its Indian substitute Rumex vesicarius (*Chuka*); and also that oxalate of lime is found in many plants[1] In cases, therefore, of alleged poisoning by oxalic acid or an oxalate, the *post-mortem* appearances are, and the determination of the quantity of poison may be of great importance.

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[1] *E.g.*, in rhubarb root and squills. *See* also Arums.

Oxalic acid is entirely dissipated by heat. In solution it yields : (1) A white precipitate with insoluble in acetic acid, but slowly soluble in cold, and which, when collected, dried, and heated, is converted into metallic silver with a slight explosion. (2) A white precipitate with sulphate of lime solution, insoluble in acetic acid, which, when dried and heated, becomes converted into carbonate of lime without charring. **From organic mixtures**, oxalic acid and soluble oxalates may be separated by boiling with water, filtering, and precipitating the filtrate with acetate of lead ; subsequently decomposing the oxalate of lead by suspending it in water, and subjecting it to the action of a current of hydrogen sulphide. Insoluble oxalates should be first decomposed by boiling with solution of caustic potash.

Acetic acid, Tartaric acid, and Citric acid.—*Acetic acid* acts as a corrosive if concentrated, but as an irritant when dilute ; one fatal case is recorded in a girl, æt. nineteen, and another in a child aged two. Vingar contains about 5 per cent. of this acid, and might possibly, in large doses, act as a poison. Acetic acid may be separated from organic mixtures by distillation and recognised (1) by its odour, and (2) by boiling with sulphuric acid and alcohol, when a peculiar aromatic smelling vapour (acetic ether) is evolved. *Tartaric acid* and *Citric acid* in large doses act as irritant poisons ; one ounce of tartaric acid has caused the death of an adult, and one fatal case, also in an adult, from four or five tablespoonfuls of cream of tartar (potassium bitartrate) is on record. Citric acid is believed to be more poisonous than tartaric acid.

CHAPTER XXIII.

METALLIC IRRITANTS.

ARSENIC, &c.

Arsenic is the favourite poison employed by homicidal poisoners in India, as in Europe. It is fortunate for the ends of justice that it is so, as the most infinitesimal traces of this poison can be detected with such absolute certainty and ease that there is almost no possibility of its escaping detection. Its comparative tastelessness, the minute quantity of the dose necessary to destroy life, the readiness with which it can be procured in any bazar, and the resemblance of its symptoms to those of the natural endemic disease—cholera—all render it an easy and effective agent in the hands of the subtle poisoner. It is less commonly used for suicide. For statistics of poisoning by arsenic see Appendix VIII.

Action.—Arsenical compounds act (*a*) locally as irritants, and (*b*) remotely on the nervous system ; hence in cases of arsenical poisoning there may be present : (1) Irritant symptoms ; and (2) Nervous symptoms.

1. **Irritant symptoms.**—Arsenical compounds act as irritants to the mucous membrane of the stomach and intestines, exerting this action even when introduced into the system by channels other than the mouth, *e.g.*, even when absorbed through a wound. They also exert an irritant action on the various emunctories.

Hence in cases of arsenical poisoning there may be present : (*a*) The usual symptoms of irritant poisoning (unaccompanied, however, by any metallic or acid taste in the mouth), namely, epigastric and abdominal pain, thirst, vomiting, tenesmus, purging, &c., and even perforation of stomach, with presence of blood in the vomit and stools ; and (*b*) symptoms due to the irritant action of the poison on the skin, kidneys, liver, &c., such as conjunctivitis, painful cutaneous eruptions and desquamation of the cuticle, salivation, dysuria, suppression of urine leading to uræmic coma, and jaundice.

2. **Nervous symptoms.**—The symptoms resulting from the remote action of arsenical compounds on the nervous system vary greatly in different cases. Thus there may be : (*a'*) **Collapse**, with coldness of the surface and feeble pulse ; or

(*b'*) **Numbness and tingling** of the extremities, cramps, and even paralysis ; or (*c'*) **Convulsions**, choreic, epileptiform, or tetanic, and lock-jaw ; or (*d'*) **Delirium**, and acute mania ; or (*e'*) **Headache**, drowsiness, and stupor, deepening into coma ; and irritant symptoms may be inconspicuous.

Types of Arsenical Poisoning.—In the great majority of **acute cases**, well-marked and severe **irritant symptoms** are present. Such cases either (*a'*) prove rapidly fatal—say within twenty-four hours—by collapse ; or (*b'*) the usual symptoms of irritant poisoning are followed by various nervous symptoms, the patient either recovering or dying in one or other of a variety of modes ; from exhaustion (see *Cases* 217 and 218) or by coma, or in tetanic convulsions. In some of these irritant cases, remissions, or even intermissions, of the irritant symptoms, have been observed. In a few acute cases, irritant symptoms **may be absent** (see *Case CCX*) or slight, and the nervous symptoms well marked (see *Cases CCIX & CCXII*) ; such cases usually prove rapidly fatal either by collapse or by coma.

Case CCVII.—**Irritant Arsenic Poisoning—Large Dose.**—The victim, a native Christian missionary of Calcutta, was believed to have been poisoned by his wife and her paramour. Deceased was seized with violent vomiting and purging and died in a few hours. The wife reported the death to have taken place from cholera, but the police, on suspicion, had the body examined, and the stomach, its contents, and portions of other viscera were forwarded for analysis. More than 42 grains of solid white arsenic were detected in the stomach alone. The woman and her paramour were tried at the High Court, but were let off, owing to insufficient evidence to connect them with the purchase and administration of the poison.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case CCVIII.—**Slow Arsenic Poisoning—Maybrick Case.**—Mr. Maybrick, a cotton broker of Liverpool, aged 49, married Florence, an American lady, aged 21. They had two children, but the marriage proved unhappy. Seven weeks before his death in 1889, Mrs. M. went to London and lived some days at a hotel as the wife of another man. About April 12—19th, 1889, Mrs. M. purchased arsenical fly-papers. On April 13—20th, Mr. Maybrick visited London and consulted Dr. Fuller for dyspepsia, who prescribed for him mild remedies, but no arsenic; in one bottle of medicine ostensibly made according to Dr. Fuller's prescription, arsenic was subsequently found.

Up to Saturday, 27th April, Mr. M. was in usual health, he then became sick, numbed, and in pain, and had cramps. About this date fly-papers were found by the servants soaking in Mrs. M.'s room, in a sponge-basin carefully covered up. On the 29th she again purchased two dozen fly-papers from another druggist. On 1st and 2nd May, Mr. M. went to his office and had his lunch sent to him by Mrs. M., and in one of the jugs, found at the office after his death, arsenic was found. On the evening of the 3rd May he was seen by Dr. Humphreys and complained of being sick from his revelenta food, and had persistent vomiting and coughing and tingling in throat on the 4th and 5th. The vomiting lessened on the 6th, and Fowler's solution

was ordered, but only a quantity equal to $\frac{1}{350}$ grain was actually taken. On May 7th the throat was red, dry and glazed and diarrhœa commenced, and the result of a consultation was that Mr. M. must have taken some irritant in his food or drink. On 8th and 9th severe tenesmus setting in with bloody diarrhœa. Dr. Humphreys suspected arsenic and examined the urine and made a rough analysis of some Neave's food the patient had been taking. The patient died on the 10th. The *post-mortem* showed signs of irritant poisoning; and an ulcer of epiglottis (caused by the lodging of a speck of arsenic); but no arsenic was found in the stomach or its contents or in the spleen. Arsenic was found in the liver, intestines and in the kidneys. The quantity separated amounted to over 0·1 grain. The liver weighed 48 ozs, and from 12 ozs. of the liver 0·076 grain of arsenic reckoned as As_2O_3 was separated. *Facts connecting Mrs. Maybrick with the death* were:—On the night of either May 9th or 10th she was observed to remove from the table an opened bottle of meat juice and take it to an inner room and then replace it surreptiously. In replacing it she was observed to take it from the pocket of an inner jacket. The lining of this pocket was found to be impregnated with As_2O_3 and the juice contained 0·5 grain As_2O_3. The following things contained arsenic:—

Mrs. M.'s dressing gown, her apron, and handkerchief wrapped round a bottle, a portion of a handkerchief, Price's glycerine, medicine purporting to be that prescribed by Dr. Fuller, three bottles of saturated solution of arsenious acid lavatory drain. Mrs. Maybrick was convicted and sentence commuted to penal servitude for life.—T. Stevenson, M.D., *Guy's Hosp. Rept.*, 1889.

Case CCIX.—**Narcotic and Nervous Symptoms.**—(*a*) A child was reported to have had vomiting in half an hour after eating some jaggery. It died soon after, evidently in a convulsion, for it is reported that "the eyes rolled upwards and the lips and tongue became blackened." Over thirty-two grains of white arsenic were found in the stomach.—*Mad. Chem. Ex. Rept*, 1898. (*b*) In a suicidal case, suspected to be opium poisoning on account of the narcotic symptoms, arsenic was found in very large quantity and no trace of opium. The man died in about eight hours without vomiting or purging. The pupils were contracted to pin points.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 9.

Case CCX.—**Absence of Symptoms.**—Orfila I, *Obs.* IV, 314, relates a case of a woman aged 27 who expired in about 12 hours from a large dose of arsenious acid, without any sign of pain or vomiting and but little thirst, although the usual *post-mortem* signs were found.

Case CCXI.—**Accidental—Large Dose—Absence of Vomiting.**—On September 1901, a Mussulman male, aged 18, was brought to the Calcutta College Hospital. His friends states that about 2 P.M. after a meal he took in mistake for chalk a *tola* or about half ounce of white arsenic. He became very ill some time later and was admitted at 4 P.M. conscious. Extreme restlessness. Patient is crying out that his stomach is burning, and his agony is evidently great. Saliva pouring from the mouth. Bowels moved two or three times after admission; but there was no vomiting even after an emetic. Stomach washed out. The washings contained small lumps of white arsenic. He became rapidly unconscious 20 minutes after admission, and died 4½ hours after taking the poison.—C. Robertson-Milne, *Ind. Med Gaz.*, 1902, p. 209.

Case CCXII. **Arsenical Poisoning—Irritant Symptoms slight.**—Of three hundred and five fatal cases reported to the Bombay Chemical Analyser's Office during the ten years ending 1884 six (and

as only meagre reports were furnished with many cases, possibly others also) were cases of this form. In four of the six the duration of the case was stated, and in all four death occurred within fourteen hours. In two of the six, there was no redness of the mucous membrane of the stomach. In one of these (**a**′), a female, who vomited once only, and had no purging, there was also no redness of the mucous membrane of the intestines. In the other (**b**′), a man, who had vomiting, but no purging, there was one patch of redness about the middle of the rectum. *Post-mortem*, appearances of irritation were well marked in the other four cases. The symptoms reported in these were respectively : (**c**′) heat in the abdomen and thirst, slight vomiting and purging before admission into hospital, none after. (**d**′) had vomited and purged four times before admission into hospital. While in hospital was drowsy, vomited once only, and had no purging. Conjunctivæ eight hours after admission noticed to be tremendously injected. (**e**′) had fever and severe pain in the abdomen, no vomiting, and no purging. (**f**′) Great thirst, restlessness, picking at the bed-clothes, and incoherence, no vomiting and no purging. Cases (**d**′) and (**e**′), although under medical observation, were not, during life, recognised as cases of poisoning. In case (**d**′) only one and a half grains of arsenious oxide was found in the contents of the stomach. In case (**f**′) the quantity found was one hundred grains. In the other four cases, the quantity found ranged from nine to fifteen grains—K. M. (*Beng M. R.* for 1868-69) mentions a case where a girl, æt. seven, died in three hours, neither vomiting nor purging being present. Similar cases are recorded by various authors. Christison (*Poisons*, p. 308 *et seq.*, 1845) gives fourteen cases, all fatal within twelve hours, in which only slight irritant symptoms were present In five of the fourteen, *post-mortem* appearances of irritation were either altogether absent, or trifling only.

In chronic cases both irritant and nervous symptoms are usually present. Sometimes in chronic cases the amount of gastric irritation is slight, while the irritant action of the poison on the skin, causing skin eruptions with pigmentation, bronchitis, etc., bronchial tubes and emunctories other than the intestines, is well marked. In chronic cases, the nervous symptoms frequently take the form of numbness and tingling of the extremities, and paralysis : peripheral neuritis. This last effect has occurred in epidemic form amongst beer drinkers through contamination of arsenic in the **beer.** These cases show that arsenic is cumulative. The sequence of symptoms in chronic poisoning is (1) digestive, (2) laryngeal catarrh, bronchitis and skin affections, (3) disturbance of sensibility, (4) motor paralysis with pigmentation and keratosis.

Diagnosis from Disease.—Acute irritant cases with collapse greatly resemble **cholera** ; and may be mistaken for it by medical men well acquainted with cholera, see *Case CCXIII*, and in India a common way of attempting to conceal homicidal poisoning by arsenic, is to report the case as one of death from this disease. Sometimes, also, especially in cases where two or more persons, after partaking of food in company, are attacked

by cholera in quick succession, a groundless suspicion of arsenical poisoning arises. The chief points which distinguish arsenical poisoning *from cholera*, are : 1. The presence in the former of blood in the stools ; 2. The absence in the former of the rice-water appearance of the stools, characteristic of cholera (this appearance may, however, be present in the later stages of arsenical poisoning), and, 3. In cholera, pain in the throat does not precede vomiting ; while in irritant poisoning the reverse is the case. The prevalence or absence of cholera in the locality at the time may also serve as an aid to the diagnosis. Cases where the irritant symptoms are slight, are sometimes not recognised during life as cases of poisoning.

In chronic cases, persistent gastric irritation not yielding to treatment, accompanied by numbness and tingling of the extremities, with tendency to paralysis, should arouse suspicion, and indicate the necessity of subjecting the urine or other evacuations to analysis. It may be mistaken for Addison's disease and Beriberi.

Case CCXIII.—**Arsenic poisoning mistaken for cholera.**—(1) In 1899 a Muhammadan woman, aged 26, died after violent purging and vomiting which was reported as cholera by her husband's relatives. The brother of the deceased, however, suspected foul play and informed the police, who caused a *post-mortem* examination to be made. The stomach and intestines were reported by the Assistant Surgeon to be "healthy, the former containing some fluid of a rice-water colour," and he attributed the cause of death to cholera, but forwarded the viscera for chemical examination as the case was suspicious. Arsenic was detected in the viscera, also in the stains of vomited matter on the clothes of the woman and in the earth taken from the spot on which she had vomited. The police then arrested the husband of the deceased on suspicion and had the house searched. A glass phial was found, in which a large quantity of white arsenic, in powder, was detected, mixed with sugar and rose-water, which were probably added to mask the supposed acrid taste of white arsenic.

(2) Two other fatal cases of arsenic poisoning alleged to be cholera occurred in 1899 in Backergunge :—The civil surgeon in forwarding the viscera of two Muhammadan women aged 40 and 20, stated that the police report :—"The two deceased vomited,purged and expired. It is suspected that some sort of poison had been administered with the food." As his *post-mortem* examination detected nothing abnormal in the stomach and intestines, which were found to be "healthy and containing digested food," he ascribed the two deaths to cholera. On chemical examination very marked quantities of arsenic were detected in the viscera in both cases, and arsenic was also found on the clothes and beddings stated to have been soiled with the vomit and purging of the two deceased. These three cases are of medico-legal interest, firstly, from the close resemblance of the symptoms to cholera with which disease homicidal arsenic poisoning cases have been mistaken even by experienced medical men ; and secondly, in the entire absence of irritant signs in the alimentary canal.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Interval between swallowing the poison and first appearance of symptoms.—This is usually half an hour to an hour. Cases, however, have been reported where the symptoms appeared almost immediately. Taylor [1] mentions a case where the symptoms came on while a man was in the act of eating a cake containing the poison. I once met with a case where the symptoms appeared while a man was drinking a cup of tea, made with water from a kettle, into which arsenious oxide had been introduced. On the other hand, a few cases are reported in which this interval has been delayed to two, to eight or nine hours. In some of these cases the prolongation of the interval is difficult to account for ; in others it appears to have been due to fulness of the stomach, to sleep, or to intoxication (see *Cases CCXIV*), and occasionally there are almost no symptoms (*Cases CCIX—CCXII*).

Case CCXIV.—**Arsenical Poisoning ; delayed symptoms.**—(**a**) (Christison on *Poisons*, p. 299). A man took seven drachms of arsenious oxide at eight in the evening, went to bed at half-past nine, and slept till eleven, when he awoke with slight pain in the stomach, vomiting, and cold sweats—he died in nine hours.—(**b**) (*Beng. M. R.* for 187 -72). Five persons, members of the same family, were poisoned by sweetmeat containing arsenious oxide ; one of the five, a child, æt. four, was roused from sleep to partake of the sweetmeat and fell asleep again afterwards ; in her case, the symptoms did not appear for two and a half hours, while in the other four—all adults—the symptoms appeared in about an hour Two of the adults had not supped previous to eating the sweetmeat—both these died. The other three individuals had just finished their evening meal, and all three recovered —(**c**) (Woodman and Tidy, *For. Med.*, p. 163). A female took ½oz. of arsenious oxide after a meal. No symptoms appeared for eight hours, when pain, vomiting, and purging set in ; the stomach-pump was used. Result, recovery.—(**d**) (Christison on *Poisons*, p 308, one of the fourteen cases referred to under 9). "The subject was a man so addicted to drinking, that his daily allowance was a pint of brandy. When first seen, there was so much tranquillity, that doubts were entertained whether arsenic had really been swallowed, but at length he was discovered actually chewing it. This state continued for nearly five hours, when some vomiting ensued. Coldness of the extremities and spasmodic flexion of the legs soon followed ; and in a few minutes more he expired."—(**e**) (*ib.*, p. 309). A man swallowed three drachms of arsenious oxide, then went about for two hours, bidding adieu to his friends ; he was then persuaded to take emetics, which caused free and easy vomiting ; he hardly suffered at all for five hours, but died nine hours after taking the poison.

Fatal period.—In acute cases this is usually under twenty-four hours. In many cases, especially those in which marked nervous symptoms appear early, death takes place in under

[1] Taylor, *Poisons*, p. 292.

twelve to fourteen hours (see *Cases CCXII*). In one case a young man died with tetanic symptoms in twenty minutes[1] ; this is the shortest fatal period recorded. Longer fatal periods than three days are sometimes met with. Taylor[2] mentions cases of death in six days, seven days, fifteen days, and sixteen days. In one case (a woman accidentally poisoned by external application of a solution of arsenic), death did not occur for two years.

Post-mortem appearances.—Gastric mucous membrane is usually reddened from inflammatory action, and has been found so even where the poison has been introduced, by channels other than the mouth. It has been found intensely inflamed even when death has taken place within two hours after swallowing the poison. It may be reddened in patches, or the redness may have a dotted or striated appearance, or the whole mucous membrane may be deep red, with dark petechi or ecchymosed spots from underlying extravasated blood. Frequently the inner surface of the stomach has a corrugated appearance, and is covered with tenacious mucus entangling particles of the poison, if the latter was given in solid form. Its contents are often dark in colour from altered blood. When arsenic is given as a powder, sometimes minute specks or patches of whitish or yellow powder (due to conversion of the white arsenic into yellow sulphide) are formed embedded on the surface of the mucous membrane of the stomach or intestines, and each speck may be the centre of inflammatory patch. The redness and patches sometimes extend into the **duodenum** ; more rarely the intestines are found inflamed throughout their whole length. Commonly the rectum is found inflamed. **Ulceration** of the gastric mucous membrane is not common, but has been found in case of death in ten hours. **Perforation** of the stomach is very rare, but is occasionally found (see *Cases CCXV*). Sometimes in fatal cases the stomach and intestines show little or no signs of inflammatory action ; this has been observed even in a case where well-marked irritant symptoms were present during life (see *Cases CCXVI*). Congestion, or lividity of the **endocardium**, especially of the left ventricle, is frequently, according to some almost invariably, found.[3]

Out of thirty-three cases in which the condition of the[4] heart was noted, in eight only was the endocardium found natural. Congestion of the brain, lungs, kidneys, or liver is sometimes met with (see *Case CCX*).

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[1] Taylor, *Poisons*, p. 308.
[2] *Ib.*, pp. 27, 309.
[3] See case by C. L. Bose in *Ind. Med. Gaz*, 1892, p. 142.
[4] *Beng. Medico-legal Rept.*, 1870-72, p. 255.

Arsenic exerts a marked antiseptic action on the tissues, and hence, in fatal cases, *post-mortem* appearances of gastric irritation may remain recognisable for a considerable period. *Post-mortem* appearances indicative of death from arsenical poisoning, have been found coupled with *post-mortem* appearances pointing to death, from mechanical violence (see *Cases CCXXII a* and *b*); hanging (see *Case LXXVII* and p. *CLXXXV*); and in bodies found under circumstances pointing to death by drowning (see *Case CCXXII c*).

Case CCXV.—**Perforation of the Stomach in arsenical poisoning.**—This was reported in two of the three hundred and five Bombay fatal cases. (**a**′) In a case where a man died eight days after swallowing the poison; on *post-mortem* examination, the stomach was found inflamed and perforated at one place. In this case, however, the body had been buried, and was not exhumed for examination until twenty days after death. (**b**′) In a case reported by Dr. R. H. Batty; in this case a woman, æt. about thirty five, after a quarrel with her husband, swallowed a quantity of arsenious oxide. Duration of case not stated. *Post-mortem* appearances: much congestion of the membranes of the brain, also of the brain, lungs, kidneys, and liver. Heart normal. Œsophagus pale. Mucous membrane of stomach intensely red, with white particles adhering to it. Stomach perforated in three places on the posterior wall; two of the perforations very minute, the third "about the size of an ordinary quill"; from the latter, a long ropy mucous substance was protruding, in which there was a large quantity of minute white particles of arsenious oxide. Small intestines very red throughout, and containing particles of solid arsenious oxide.

Case CCXVI.—**Arsenical Poisoning; Absence of usual appearances of Inflammation of the stomach and intestines.**—Christison, besides the five cases mentioned under 9, gives two other cases in which, on *post-mortem* examination, the mucous membrane of the stomach and intestines was found to be free from signs of inflammation.—Besides cases 9 *á* and *b*, I have met with one other case (out of three hundred and five), in which only trifling signs of inflammatory action were present.—Harvey (*Beng. M. R.* for 1870-72) records absence of signs of inflammation in four cases out of one hundred and ninety-one. In one of these cases, the symptoms were "vomiting, purging, dryness of the mouth, thirst, anxiety, vertigo, and prostration." Death occurred in nine hours. In this case, the "whole of the intestinal tract" was found healthy.

Mortality.—Guy states this at 52 per cent. For India it has not been accurately estimated.

Returns for Bombay, where all cases are not reported, for the ten years ending 1884, show a total of 652 persons poisoned, and 305 deaths, equal to a mortality of about 45¼ per cent.

Treatment.—(*a*) *Elimination.* This should be chiefly relied on. Vomiting should be encouraged, and copious draughts of warm water given. It may be necessary to administer emetics, or use the stomach-pump. (*b*) *Prevention of*

action. Hydrated ferric oxide should be given in considerable quantity. It is estimated that thirty-two parts by weight of this antidote are required to render insoluble one part by weight of arsenious oxide. The antidote must be *freshly prepared* as it loses its power if kept for any length of time.

To prepare it, a quantity of a solution of a ferric salt, *e.g.*, ferric choloride, should be either rubbed up in a mortar with magnesia, or precipitated by solution of ammonia ; in the latter case, the precipitate must be washed on a calico filter before administration.

(*c*) *Counteraction of effects*. This indication must be carried out on general principles. Demulcents should be given to allay irritation, and other symptoms treated as they arise.

Fatal dose.—Minimum for an adult, under circumstances favourable to the action of the poison, two to three grains of arsenious oxide. Cases, however, of recovery, under free vomiting, are recorded from doses of one to two ounces of arsenious oxide. In one very exceptional case of recovery, from a large dose (*Case CCXVII*,) the poison swallowed—two masses of arsenious oxide, weighing together 105 grains—was passed per anum. It has been found that persons in the habit of taking small doses of arsenic daily, gradually increasing the quantity, become ultimately able to swallow as much as four to six grains of arsenious oxide, without experiencing the slightest symptoms of poisoning. This habit of "*arsenic eating*" is practised by the peasants of Styria under the belief that it increases the respiratory powers. Chevers[1] points out that the same habit prevails to a certain extent in the Panjab, arsenic being there eaten either as an alternative to opium eating, or as an aphrodisiac. It has been noticed, in the case of horses, that the administration of arsenic, in small doses daily, improves their condition, probably by stimulating digestion.

Case CCXVII.—**Arsenical Poisoning; exceptional recovery** (*Ind. Med. Gaz.*, 1872, p. 183).—A Parsee, admitted into the Jamsetjee Jejeebhoy Hospital, Bombay, had swallowed two masses of arsenious oxide. Sixteen hours afterwards, he passed, per rectum, a mass of arsenious oxide weighing eighty grains, and about forty-five hours after swallowing the poison he, in the same way, passed a smaller mass weighing twenty-five grains. The symptoms present were comparatively slight : there was no vomiting, but some diarrhœa ; he was drowsy, his eyes were suffused, and he complained of headache and pain in the abdomen. He left the hospital quite well.

Arsenical compounds used as poisons in India.—In the great majority of cases arsenious oxide is employed ; in a few

[1] *M. J.*, p. 117.

the sulphides (orpiment and realgar) are used, either alone, or mixed with arsenious oxide. In exceptional cases, the arsenites of copper are employed (see *Appendix VIII).*

ARSENIOUS OXIDE.

Common white arsenic is known in the vernacular as *Sankhya*,[1] *Phatkya somul, or Somul khar.* This is yearly imported in large quantity, chiefly from the Persian Gulf, and is readily purchasable all over India.[2] The chief legitimate *uses to* which it is put in India appear to be as follows :—

As a preservative agent, especially for wood. Chevers mentions that with this object it is thrown into the holds of vessels, and placed round wooden foundation piles, and applied to the woodwork and walls of houses. (2) In preserving and preparing the thicker kinds of skins for leather, and to a certain extent for preserving skins generally. (3) By goldsmiths in gold-working. (4) For the purpose of destroying rats and other vermin. (5) Medicinally, internally as a cure for fevers, syphilis, and other diseases ; and externally as a parasiticide and depilatory especially amongst prostitutes ; and as a healing ointment for sores in horses and cattle. It has already been mentioned that it is used to a certain extent in the Panjab, as an alternative to opium eating, and as an aphrodisiac.

Homicidal use.—Of all poisons arsenious oxide is the one by far the most frequently employed in India for homicidal purposes. When so employed, the vehicle is most commonly sweetmeat or bread or other food.

Sweetmeat, poisoned with arsenic, often consists of but little more than sugar or "*gur*" (coarse sugar), and coarsely-pounded arsenious oxide. Often a club or stick and a piece of flat board, or a couple of stones, are used for pounding the arsenic, and particles of the poison are found adhering to them. When bread is the vehicle used, the coarsely-pounded arsenious oxide is often simply placed between two layers of or mixed with the dough. Sometimes, however, it is ground up with the flour, and the grindstones are found to have particles of the poison adhering to them. In some cases it is the person grinding the flour who adds the poison to it ; in others, the poison is put into the handmill by another, during the temporary absence of the person using it. Sometimes the vehicle is cooked vegetable food, *e.g.*, cooked rice, pulse, &c ; also, in cases of alleged poisoning, arsenious oxide is found in sweet oil, in tamarinds, in *chuna* (lime) used with betel nut for chewing, and in one case it was found it mixed with realgar in a "*biri*" or native cigarette.

Very often the quantity of the poison added to the food in a homicidal case, is very great (see *Cases CCXVIII*), much

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[1] Or the "conch shell" from the vitreous lustre of the lumps of crude arsenic.

[2] The White Arsenic Act and Bombay Sale of Poisons Act appear to have some effect in restraining its sale to a certain extent.

more than enough to kill several persons, and the particles of arsenious oxide large enough to be clearly visible and weighing several grains (see *Case CCXVIII d*). Arsenious oxide, when used for homicidal purposes, is generally used alone. It is, however, found sometimes in food; with the sulphides of arsenic, with sulphate of copper, with mercuric sulphide, with sulphate of iron, and with pounded glass; and in the Baroda case (*Case CCXXVI*) it was found mixed with diamond dust. Frequently in one and the same case, several persons are poisoned.

This was so in 98 out of the 507 cases of arsenical poisoning reported to the Bombay Chemical Analyser, during the ten years ending 1884.[1] Some of these 98 cases of multiple poisoning appear to have been, however, the result of accident. In multiple homicidal cases, very frequently some of the victims are children. In one exceptional year (1878-79), out of thirty-eight persons reported to the Bombay Analyser's Office, as having died from arsenic poisoning during the year, twelve were children.

The *motives* in India, most commonly leading to homicidal poisoning by arsenious oxide, appear to be revenge and sexual passion.

Common types of the crime are (1) A being at enmity with B, gives him (see *Case CCXVIII a*) or his children (see *Cases CCXVIII c* and *CCXIX b*) some poisoned sweetmeat, or introduces arsenious oxide into his food; of which often others as well as B partake. As a result a number of persons, often the members of one family, children as well as adults, are poisoned (see *Cases CCXIX a* and *d*); or (2) a wife being anxious to get rid of her husband, puts arsenious oxide—often supplied by a paramour—into her husband's food. In some cases where husbands are poisoned by their wives, the motive is not homicidal, but connected with the belief in the *aphrodisiac* virtues of arsenic before referred to. Thus in a case where a woman confessed to having put a white powder (afterwards found to be arsenious oxide) into her husband's food, she alleged that the powder was given to her as a charm, or medicine, "to increase her husband's love for her." In *Case CCXX a*, this belief also may have led to the administration of the poison. *Case CCXX b* is a curious example of a poison prepared for a particular individual, going astray and poisoning others. It is seldom that in India acquisition of money or property forms the motive for arsenical poisoning. When *theft* is the object, dhatura (which see) is the poison usually employed. One or two cases of road robbery in which arsenious oxide was the poison used, have, however, been reported. In exceptional cases also superstition leads more or less directly to arsenical poisoning (see *Case CCXX c*).

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[1] *Beng. Medico-legal Rept.* for 1870—72 states that of 203 cases of poisoning by arsenious acid occurring in Bengal, N.-W. Provinces, Oudh and the Panjab during the three years, fourteen were cases of multiple poisoning; and of ninety-seven cases of arsenical poisoning reported to the Chemical Analyser, Madras, in the two years 1882-83, twenty-six were multiple cases.

It should be borne in mind that the ease with which arsenious oxide can be obtained in India, and the difficulty of tracing its purchase, tends not only to increase the frequency of its use for homicidal purposes, but also to facilitate the fabrication of false charges of attempted poisoning by surreptitious introduction of arsenic into exhibits. Again also, it must be recollected that an individual, while in custody, may from fear make a false confession of poisoning. In *Case CCXXI* there is little doubt but that such a false confession was made.

Case CCXVIII.—**Arsenical Poisoning. Sweetmeat, &c., containing arsenious oxide in large proportion.**—(*a*) (*Bo. Chem. Analyser's Rept.*, 1872-73). In a case tried before the High Court, Bombay, it was proved that a man went up to another, a police Sepoy, while standing on duty in the public streets, and offered him some sweetmeat. He took it, bit off a mouthful, but finding it to have a gritty taste, spat it out. From eight hundred and sixty grains of the remainder, I extracted six hundred and ten grains of arsenious oxide. The police Sepoy, it was stated, had run away with the wife of the man who attempted to poison him.—(*b*) (*Rept.*, 1874-75). In a case from Ahmednagar, in which a man died in twelve hours after eating some poisoned bread 5½ lbs. of the bread were found to contain one thousand five hundred and fifteen grains of arsenious oxide.—(*c*) (*Rept.*, 1878-79). A woman was seen feeding two children, æt. respectively four and six, with sweetmeat; both children died. Tne stomach of the elder child contained one hundred grains of arsenious oxide, and arsenious oxide was found in relatively large quantity in an unconsumed portion of the sweetmeat. The motive in this case was stated to be a quarrel with the parents of the children.—(*d*) (*Rep.*, 1882-83). Five persons, two adults and three children, inmates of a leper hospital in Bombay, were poisoned by sweetmeat containing arsenious oxide to the extent of about twelve grains per ounce. A large quantity of tamarinds was given at the same time to the same persons. The tamarinds contained about fifty grains per lb. of arsenious oxide. Some of the fragments of arsenious oxide contained in the tamarinds were as large as small beans. The motive in this case, it was stated, was to get rid of a leper husband, whose wife the accused wanted to marry.

Case CCXIX.—**Arsenical Poisoning. Homicidal multiple cases** (*Bo. Chem Analyser's Rept.*, 1880-81).—(*a*) In a case from Uran, a man and his wife and two children were all four poisoned by arsenious oxide contained in bread, given to them, it was alleged, by a neighbour who had a quarrel with the family. Two of the four died.—(*b*) In a case from Hyderabad (Sind), three children were poisoned by sweetmeat containing arsenic, given to them, it was alleged, by a man at enmity with their parents. One of the three, a baby, appears to have been poisoned by sucking the fingers of the other children.—(*c*) In a case from Ahmednagar, four persons, one of whom died, were poisoned by arsenious oxide contained in food. In this case, the accused was, it was said, on bad terms with the persons poisoned, and was seen seated near some cooking-pots in which their food was being prepared, leaving just as they were about to commence their meal.—(*d*) (*Rept.* for 1879-80). In a case also from Ahmednagar, two children, both of whom died, and three adults were poisoned. In this case, it was alleged that the aunt of the children was the poisoner. She was seen, whilst the food

was being cooked, of which the persons poisoned afterwards partook, to throw something into the pot containing it, and was known to have recently purchased arsenic.—(*e*) (*ib.*) In a case from Hubli, it was reported that a man took some flour from a woman who was grinding it, afterwards throwing it back on to the handmill she was using. The woman having cooked the flour, she and her family partook of it: all were attacked with symptoms of irritant poisoning; all, however, recovered.—(*f*) (*Rept.*, 1881-82). In a case from Kaira, a man, it was alleged, gave some sweetmeat to another, with a request that he would give some of it to others that he named, saying it was a "*prasad*" (offering) of a goddess. The man to whom the sweetmeat was given, retaining some for himself, distributed the rest to the persons named, and these again gave some of it to three other persons. All who partook of the sweetmeat suffered from the usual symptoms of irritant poisoning; two died, one on the third, the other on the sixth day.—(*g*) (*Rept.*, 1879-80). At a mosque in Bombay, two Sayads were accosted by a man, afterwards arrested, who handed to them some food of which they partook; both were shortly afterwards attacked with symptoms of irritant poisoning. One of the two died; arsenious oxide was found in his viscera, and in the food which had been given to the two men. The individual arrested proved to be an imbecile, and apparently had no motive for injuring the persons poisoned. His story, which was very likely true, was that he was accosted by a man whom he did not know, and asked to take some food to the two Sayads.

Case CCXX.—**Arsenical Poisoning; exceptional cases.**—(*a*) *Bo. Chem. Analyser's Rept.* for 1884). In a case tried before the High Court, Bombay, four men were charged with the murder of a young female, a dancing girl. The evidence went to show that one of the accused was deeply in love with the girl, who, however, had rejected his addresses. On this the lover called in the assistance of the other accused persons, and asked them to prepare—at least, so it was urged for the defence—a love-philtre to be given to the girl, which would cause her to look favourably on his suit. The result was that a number of sweetmeat balls were prepared and distributed, with some ceremony, at an assembly where deceased and others were present. Apparently one of these sweetmeat balls contained poison, *viz.*, the one given to the deceased, as she and her brother, to whom she had given a portion of the ball handed to her, were the only persons who suffered from symptoms of irritant poisoning. After death twenty grains of arsenious oxide was found in the contents of deceased's stomach. On the whole, the evidence in this case was not inconsistent with the view, that the theory set up by the defence was true, and that there was no murderous intent.—(*b*) (*ib.* for 1878-79). The history of a case from Gadag, in which four persons—two children, who died, and two adults, who recovered—were poisoned by arsenious oxide, was thus given by the assistant-surgeon in charge of the dispensary:—"The mother of the deceased children obtained three small sweetmeat balls from one of her paramours, with the object of administering the same to a man named Dushrath Sonar, who was also in love with her. The man who prepared the balls, and gave them to the woman, states that he mixed some kind of white powder with the balls. The powder was procured by him from a mendicant Byragi (Hindu ascetic), and the sweetmeat balls were made specially mixed with the powder to poison Dushrath Sonar; but the woman, instead of giving them to the Sonar to eat, kept them in her house. During the absence of the woman from her house on some business, her mother happened

to find the sweetmeat balls, and, not knowing that they were poisoned, gave two of them to the children to eat; the third ball was eaten by herself and her other daughter, who was in the house."—(*c*) (*ib.* for 1876-77). The history accompanying a case from Amraoti was as follows:—"A man lost some ornaments, and suspected his sister of stealing them. Under the advice of a 'wise man,' he put outside his door a copper pot, with a lump of cowdung in it, advertising his friends that he had done so, and that if the thief put the ornaments into the pot, nothing further would be said. This failed. The 'wise man' thereupon assembled the neighbours, and an ordeal was instituted, each person being required to eat a small quantity of sugar." The result was that the sister died with symptoms of irritant poisoning, and one and a half grains of arsenious oxide was found in the contents of her stomach.

Case CCXXI.—**Apparently false confession of Arsenical Poisoning** (*Bo. Chem. Analyser's Rept*, 1884).—In a case from Nasik a man died suddenly, and his brother accused deceased's wife of poisoning him. The wife was taken into custody, the body disinterred and examined; no signs of irritant poisoning were found. The viscera were forwarded for analysis. In the meantime the wife, while in custody of the police, confessed to having put arsenic into her husband's food, and some white substance, stated to have been produced by her, was, on examination, found to be arsenious oxide. On analysis, however, not the slightest trace of arsenic could be found in the viscera of the deceased.

Abortifacient use.—Arsenious oxide is sometimes given or taken with the object of causing abortion, usually with fatal results.[1]

In one case, in Bombay in 1883 *post-mortem* examination of a female four months advanced in pregnancy, disclosed a mass of paste containing arsenious oxide, lying in the upper part of the vagina near the os uteri.

Suicidal use.—Suicides by poison in India usually select opium; but a certain number use arsenious oxide. It would appear that in Bengal, N.-W. Provinces, Panjab, and Oudh, about *one-third* of the fatal cases of arsenical poisoning are suicidal, but that for one suicide by arsenic there are rather more than seventeen suicides by opium.[2] In Bombay also, about one-third of the fatal cases of arsenical poisoning reported to the chemical analyser's office, appear to be suicidal; and these suicidal cases about equal one-tenth of the total number of suicides by poison, shown in the mortality returns for the whole presidency. Sometimes, in suicidal cases, the quantity of arsenious oxide found after death in the contents of the stomach, is very large.

Taylor[2] refers to a case where the quantity found was four ounces. In one case of suicide, at Bombay, 360 grains were found, and several

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[1] *Beng. Medico-legal Rept.*, 1870-72.
[2] *Med. Jurisp.*, ii, p. 270.

times over 100 grains were found. The discovery in the contents of the stomach after death, of a large quantity of arsenious oxide, to a certain extent indicates the probability of suicide. It, however, by no means negatives homicide especially in India, where very large quantities are given, or attempted to be given, in homicidal cases. In case *CCXVIIIc*, for example, the quantity found was 100 grains. Case *CCXXII a* is still more conclusive on this point, the victim being an adult instead of a child. Taylor also mentions two other cases, both charges of homicide, in which the quantity found was large (see *Cases CCXXII b* and *c*).

Case CCXXII.—**Arsenical Poisoning — Homicide — Large quantity of poison found** (Brown and Stewart, *Trials for murder by Poison*, p 358) —(*a*) Dr. Christison, the great toxicologist, writing to the *Edinburgh Medical Journal*, December 1857, cited a case undoubtedly one of murder, where between 90 and 100 grains of arsenious oxide was found in the contents of the stomach of an adult. The poison was administered in whisky punch, with sugar, the arsenic being kept in suspension by constant stirring. Professor Christison's letter had reference to an argument put forward for the defence in the *Madeline Smith case* (Edinburgh, 1857), namely, that as 822 grains of arsenious oxide were found in the contents of the stomach of the deceased, the case must have been one of suicide. Another argument of the defence was that the arsenic purchased by Madeline was mixed with soot while no soot was found in the stomach or intestine of the deceased—her quondam lover,—and a girl was unlikely to know how to remove the soot from the arsenic—verdict was 'not proven.' (*b* and *c*) Taylor (on *Poisons*, p. 157) mentions two other cases, both charges of homicide, in which, after death, the quantity of arsenious oxide found in the stomach was large, viz, *Reg* v *Dodds*, in which 150 grains were found, and *Reg.* v. *Hewitt*, in which 154 grains were found.

Accidental cases.—Accidental poisoning from internal administration of arsenious oxide is sometimes met with, generally from the poison being mistaken for some inert mineral subtance (see *Case CCXXIV*) become by carelessness or accident mixed with articles of food. The possibility also that in some cases arsenious oxide is intentionally administered without actual homicidal intent, has already been alluded to (see *Case CCXX a*).

External application of arsenious oxide, also occasionally causes fatal poisoning (see *Case CCXXIII*). In the case referred to above, in which death did not take place for two years, the poison was applied in solution to the skin for the cure of itch, its application being followed by an erysipelatous eruption. *Cases CCXXV a* and *b* are additional examples of this form of accidental poisoning. It may be here pointed out that the continued application of arsenious oxide to the unbroken skin, may cause an erysipelatous or eczematous (see *Case CCXXV c*) eruption thereon. This may be followed by denudation of the epidermis, and sloughing and ulceration owing to the caustic action of the poison.

The question as to what effect long-continued application of arsenious oxide has on the unbroken skin, arose in the Baroda case (*Case CCXXVI*).

Case CCXXIII. — **Arsenical poisoning by puncture.** — A Bengali had scrotal tumour and had been suffering from rheumatic fever for about a week. A person named Satyabadi Mangraj, ostensibly in the endeavour to cure the man, punctured the tumour and applied some irritant or poisonous drugs to it, from the effects of which the man died. The left testicle and portion of the scrotum of the deceased, which exhibited puncture marks, were forwarded here for examination, and arsenic was detected in them.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case CCXXIV.—**Arsenical Poisoning ; accidental cases.** – (*a*) In Bombay, some years ago, a number of school children were poisoned by swallowing portions of a mass of arsenious oxide which they had found lying on the ground.—(*b*) (*Bo. Chem. Analyser's Rept.*, 1873-74). Five lumps of arsenious oxide, weighing together 128 grains, were found in the stomach of a woman who died in the Jamsetjee Jeejeebhoy Hospital, Bombay. Her story was that she had eaten the arsenic in mistake for "Khadu" (pipe-clay). "Khadu" eating seems to be a common practice among Hindu females.—(*c*) (Taylor, *Poisons*, p. 354). In the Bradford lozenge case a confectioner, intending to adulterate lozenges with plaster of Paris, mixed with them a quantity of white arsenic, which had been supplied to him through mistake. More than 200 persons were poisoned, of whom seventeen died.—(*d*) In tea and coffee.—Mr. C—, a resident of Bow Bazar, Calcutta, and his family and cook were seized, in 1899, with symptoms of irritant poisoning after partaking of tea and coffee prepared by his cook. The only one who escaped was a child, who took some of the warm milk with which the tea and the coffee had been prepared, but none of the tea or coffee. All members of the family, with the exception of this child, showed symptoms of irritant poisoning, vomiting and purging, and pain in the abdomen. The nephew and the cook suffered most severely, and were removed to the Medical College Hospital, where both of them died. The others recovered. The viscera of the cook were forwarded for examination, and arsenic was detected in them. A large quantity of white arsenic was found as a deposit in the kettle in which the water was boiled, and this was evidently the source from which the tea and coffee became contaminated with the poison. Arsenic was also detected in the vessels in which the coffee and tea were prepared, as well as in the coffee decoction. Neither the milk nor the sugar contained arsenic, hence the child escaped. As to how the arsenic was introduced into the water kettle nothing could be ascertained. It was believed to be accidental, put in instead of soda to soften the water, especially as several cooks keep white arsenic in their kitchens to kill rats and cats.—(*e*) *In bread.*—A Muhammadan of Bow Bazar, Calcutta, found a poor woman of the neighbourhood sitting weeping at her door, and on his enquiring into the cause of her distress, she told him that she and her children were starving, and she had no means of getting food that day. The man, pitying her, bought five seers of flour from a shop close by, and made it over to her with a few pice to enable her to buy other necessaries. The woman prepared some *chapatis* (cakes) with a portion of this flour, and shared the bread with her two children and two co-lodgers. They all soon afterwards suffered from symptoms of irritant poisoning, and were removed to hospital,

where their stomachs were washed out, and they were treated for irritant poisoning. They all recovered. The remaining *chapatis* and flour and the stomach-washings of all these persons were forwarded for examination. White arsenic was detected in the *chapatis*, and arsenic was detected in the stomach-washings. The flour from which the *chapatis* had been made contained no arsenic. How arsenic came to be mixed with the *chapatis* remained a mystery. Nearly all Muhammadans keep arsenic in their houses as a depilatory, and the poison is sold in the bazar by the same shop-keepers who sell spices and salt. The risk therefore of this deadly poison finding its way accidentally into the food is very great.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899. (*f*) As **Love-Charm.**—A young Muhammadan wife, aged 14 years, who was in the habit of running away from her husband had administered to her by the latter "some drug as a love-charm with the object of causing her to love him, and from the effects of which she died." The civil surgeon finding some of the internal organs congested, the mucous membrane of the intestines slightly congested in parts and containing about two ounces of rice-water stools, ascribed the death to cholera and did not send the viscera for chemical examination. The police, however, sent the vomited matter for analysis, and arsenic was detected in this as well as in the sugar which had been given to her.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 9.

Case CCXXV.—**Arsenical poisoning; External application.**—(*a*) (Taylor, *Poisons*, p. 304). The mother of a girl, æt. nine, rubbed some white precipitate ointment, mixed with arsenic, on her child's head, in order to kill vermin. No symptoms appeared until the fifth day, when the child seemed unwell and complained of thirst. There was slight purging, with cramps on the eighth day. Death took place on the tenth day. On *post-mortem* examination, inflammation of the mucous membrane of the stomach and duodenum was found.—(*b*) (Taylor's *Manual*, p. 99; and Blyth, *Poisons*, p. 510). In 1876 a number of infants were poisoned in England by arsenious oxide contained as an adulterant in violet-powder. Some of the powder was found to contain over 38 per cent. of $As_2 O_3$. In one case reported by Dr. Tidy, the powder was applied to the skin of a newly-born infant, at intervals, for three days. The skin became intensely red, and ultimately in some parts assumed a sloughy appearance. The child died on the tenth day.—(*c*) (Taylor, *Poisons*, p. 11). Two shepherds were engaged in sheep-dipping for nine hours, using a mixture of arsenious oxide and solution of carbonate of potash. Both suffered; one, on the fourth day after the dipping, had eczema of the scrotum, and vesicles on the thighs, slight fever, and great thirst. Dr. Watson, who reported this case, states that other shepherds, even when using $As_2 O_3$ only, suffered from eruptions, chiefly on the hands, forearms, scrotum, and thighs.

Case CCXXVI.—**The Baroda Case.**—In this case "Colonel Phayre, the Resident at Baroda, experienced one morning a feeling of nausea, accompanied by salivation, and a peculiar taste, which he described as metallic; these symptoms came on about half an hour after he had swallowed a small quantity of sherbet, made of pumalo juice. Hastily concluding that the sherbet was bad, and had been the cause of the symptoms, he threw it away; but in the act of replacing the tumbler on the table, he noticed a sediment lying at the bottom of it. This sediment was proved, on analysis, to consist of arsenious oxide, mixed with finely-powdered diamond." (Dr. Wellington

Gray, *Bo. Chem. Analyser's Rept.*, 1874-75). It was alleged that this attempt to poison Colonel Phayre was instigated by the then Gaikwar of Baroda, and a Court of Inquiry was held. One of the Residency peons was suspected of having introduced the poison into Colonel Phayre's sherbet. On searching this man, a packet of arsenious oxide was found in his belt, and a sore was found on his skin, in such a situation as to make it possible that it had resulted from continued contact with the arsenic. Hence arose the question—Is the long-continued application of arsenious oxide to the skin liable to produce a sore thereon ?

Case CCXXVII.—**Arsenic poisoning by post.**—In August 1899, Mr. P——, P. W. D., Shwebo, Burma, received a postal package from Rangoon containing a bottle of beer. He opened it, and being apparently suspicious showed it to his native servant, who took a teaspoonful and shortly afterwards became desperately ill. The contents of the bottle on being examined showed that the beer was charged as full as possible with arsenic. About the same date Mr. Green of the Telegraph Department, Bhamo, received from Rangoon by post a packet of cocoa. When he opened it he saw arsenic, and handed the packet to the police. The packet has now been analysed, and shows enough arsenic in one spoonful to kill half a dozen men.—*Englishman*, 18th Aug. 1899.

Cattle poisoning by arsenious oxide.—A large number of horned cattle are yearly poisoned in India.[1] With very few exceptions the poison used is arsenious oxide. Thus, as may be seen from table in *Appendix XI*, arsenious oxide was found in 714 out of 743 cases of cattle poisoning, reported to the Bombay Chemical Analyser's Office during the ten years ending 1885. Nearly always, where the animals killed are horned cattle, they are poisoned for the sake of their skins.[2] The usual plan adopted is to make some powdered arsenious oxide into a paste with oil, and insert a mass of this, often wrapped in paper, into a cavity scooped out of a head of jowari or other grain, or enclose it in a bundle of grass. In a few cases, the arsenious oxide is mixed with one or other of the following :—orpiment, realger, red lead, litharge, or pounded glass. Cases of horse poisoning also sometimes come under notice. The motive for these appears generally to be to gratify spite against the owner of the animals. In one case of horse poisoning, occurring in Bombay, a native gentlemen lost seventeen horses in three months. The bodies of the first fifteen were not examined, but the sixteenth and seventeenth were both found to have been poisoned by arsenious oxide. For the symptoms caused in cattle by administration of arsenious oxide and other poisons see *Appendix XI.*

Form.—Arsenious oxide is met with in the form of (*a*) white masses looking somewhat like lumps of white earthenware ; these are at first translucent, but become opaque by

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[1] In 1884, 288 head of cattle were reported to the Indian Chemical Examiners as killed by poison. In Bombay, 677 animals, almost all horned cattle, were killed by poison during the ten years ending 1884.

[2] By *Chamars* or *Chaklers* (leather-workers) ; or by *Mahars* or *Dhers* (Pariahs), who claim the bodies of animals dying of disease. Gribble remarks that he has found ordering the bodies to be buried in quicklime effectually stops cattle-poisoning in districts where this crime prevails (*Med. Jur.*, p. 212.)

keeping. (*b*) A more or less fine powder composed of irregular shaped fragments, obtained by mechanically powdering form (*a*); and (*c*) A fine powder composed entirely or almost entirely of minute crystals. Forms (*a*) and (*b*) are the forms in common use in India; form (*c*) is only occasionally met with.

The difference in appearance under the microscope of forms (*b*) and (*c*) was a matter of much importance in *Case CCXXVII.* Powdered arsenious oxide is usually met with in England, coloured with soot or indigo, as directed under the Arsenic Act (14 Vic. cap. 13, see p. 111),[1] and in a case of poisoning it may be of importance to note the nature of the colouring matter found mixed with the arsenious oxide.

Case CCXXVIII.—**The De Ga Case** (*Bo. Chem. Analyser's Rept.*, 1872-73).—In this case a number of the members of a Portuguese family of position, resident in Bombay, were poisoned by arsenic. The circumstances of the case were as follows: A man, believed to be a Hindoo, who afterwards disappeared and has never been traced, left at the family residence in Bombay a present of cakes. Some of these cakes were passed on to another house, where other members of the family resided, and these, in their turn, sent a portion to a third house. All who partook of the cakes suffered; three died. The cakes, on examination, were found to contain an interior layer of jam, mixed with a quantity of coarsely pounded arsenious oxide. In the course of the police inquiry into this case, suspicion arose that the poison had been abstracted from a particular druggist's shop in Bombay. It, however, turned out that the only arsenious oxide in this shop was a quantity contained in a jar. A portion of the contents of this jar, submitted to me for examination, proved to be entirely composed of minute unbroken crystals, much smaller in size than many of the fragments of arsenious oxide contained in the cakes. Hence it was highly unlikely that the poison found in the cakes had been obtained from the shop in question.

Properties.

Taste either absent or slightly roughish or sweetish; not strongly metallic, as is the case with many white irritant poisonous powders or acid like oxalic acid. Specific gravity about 3·7. A pinch of powdered arsenious oxide weighs about 17 grains, a teaspoonful about 150 grains, and a tablespoonful about 530 grains (Taylor). **Solubility.**—Cold water dissolves about half a grain to a grain per ounce. Boiling water dissolves more, and water boiled for an hour with it will take up about 12 grains per ounce.[2] A much larger quantity of powdered arsenious oxide than this may, however, be suspended in mucilaginous fluids. When finely powdered arsenious oxide is mixed with water, a small quantity rises to the surface and floats thereon, forming a film. The fact that such a film was observed on a particular fluid supposed to have contained the poison administered, may be an important piece of evidence. Alkalies and alkaline carbonates, owing

[1] Although the Sale of Poisons Act (see p. 112) has been in force in Bombay for nearly twenty years, I can only recollect one case in which on examination I found powdered arsenious oxide mixed with one of the colouring materials mentioned in *s.* 17 of the Bombay Act—I. B. L.

[2] The absence of severe symptoms in *Case CCXVII* is no doubt attributable to the sparing solubility of the poison.

to the formation of alkaline arsenites, augment, and, according to Taylor, organic matter as a rule decreases, the solubility of the poison. Arsenious oxide is very soluble in hydrochloric acid. **Effect of heat.**—Solid arsenious oxide when heated volatilises without charring or fusion. Its vapour received on a moderately heated surface, condenses in minute crystals of characteristic appearance, the majority of which are more or less perfect octahedra (see Fig. 10)

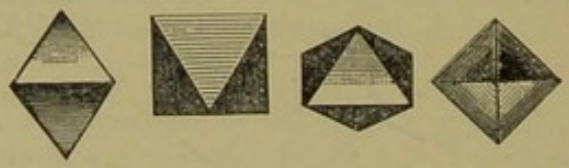

Fig. 10. Sublimate of Arsenious Oxide Crystals × 100.

Detection.—(1) By the effect of heat on the solid as stated above. (2) Boiled with water the solution of arsenious acid so obtained : (*a*) acidulated with hydrochloric acid yields a yellow precipitate with hydrogen sulphide, soluble in solution of ammonia ; (*b*) yields a yellow precipitate with ammonio-nitrate of silver ;[1] (*c*) gives a green precipitate with ammonio-sulphate of copper ;[2] and (*d*) the solution (or the powdered solid), boiled with nitric acid and the fluid evaporated to dryness, yields a residue of arsenic acid, which when dissolved in water gives a red brown precipitate with solution of silver nitrate. (3) Powdered arsenious oxide mixed with powdered charcoal and powdered sodium carbonate,[3] and heated in a narrow tube (the "*Reduction process*"), see Fig. 11, yields a sublimate of metallic arsenic as a ring, hair-brown in colour where the film is thin, and dark grey or black and lustrous where thicker. Such a ring cut off and heated in a wide tube, sublimes readily with formation of arsenious oxide which condenses on the side of the wide tube, in minute crystals of the characteristic appearance before noted. The wide tube should first be warmed above the metallic ring, as arsenious oxide is apt to condense on a cold surface as an amorphous powder. This "reduction process" may be used for the identification of other solid dry arsenical compounds, other than white arsenic. For details of Reinsch's and Marsh's tests see p. 461.

Fig. 11. (*b*) Sublimate of metallic arsenic, by the Reduction process.

SULPHIDES OF ARSENIC.

Two of these are in common use in India, *viz.*, the yellow sulphide, **orpiment**, King's yellow or *Hurtal*, As_2S_2, and the red sulphide, **Realgar**, *Sandaracha* or *Mansil*, As_2S_2. Both appear to be favourite medicines of the *hakims*, and to be in common use as depilatories ; for this last purpose a

[1] Prepared by adding ammonia to silver nitrate solution, in quantity just sufficient to dissolve the precipitate at first thrown down.

[2] Prepared from copper sulphate solution, in a similar way.

[3] Black flux.

mixture of orpiment and lime or carbonate of lime appears to be often employed. The yellow sulphide is largely used in India as a pigment for children's toys, painting tent poles and otherwise.

Orpiment is obtained in large quantities from the mines in Chitra on the borders of the Hindu Kush. The miners are described in 1899 as "crooked and bent, clothed in the most filthy rags, with dead yellow faces, almost the colour of the orpiment itself after being exposed to the air and light. They are small of stature and give one the idea of horrible gnomes. But worse than this—they are all pitted and scarred with the terrible marks of what, I believe, must be a sort of skin disease, due to constant contact with the pigment. The affector appears to take more violent hold on those employed in the orpiment industry the longer they are exposed to its baneful influence, but, from enquiries made, it does not appear to cause death. It may be also that their unsightly bodies are made more so by the custom or habit they have got into of eating pieces of the pigment. They say it acts upon them in the same way as a dram of brandy or other spirits upon us, and does them no harm, but our feelings in the matter prompted us to refuse any of the unappetising looking stuff, which they offered to us." The orpiment is carried down to Peshawar, where it is sold for 12 to 15 rupees a maund (80lbs.). It is also brought from the Nari Province of Northern Tibet to Bageshwar Bazaar near Almora.

Both sulphides as met with in commerce, usually contain much arsenious oxide, and are more or less actively poisonous according to the quantity of arsenious oxide present as the sulphide is insoluble in water and also HCl. In India the sulphides of arsenic are used for criminal purposes much less frequently than arsenious oxide.

In Bengal, &c., during the three years ending 1872,[1] 223 cases of human poisoning by arsenious oxide were reported, as against 17 by the sulphides (all by orpiment). In Bombay, during the ten years ending 1884, sulphides of arsenic were detected in less than 6 per cent. of the total number of cases of arsenical poisoning brought to the notice of the Chemical Analyser to Government.[2]

Human poisoning by the sulphides.—None of the seventeen cases mentioned above were homicidal; nearly all appear to have been cases of suicide. Chevers,[3] however, gives details of two cases of attempted homicide by orpiment introduced into food; and Waddell[4] mentions three fatal cases of poisoning by orpiment, of which two were homicidal, as having been brought to his notice in Bengal in one year (1884). In Bombay a few cases of poisoning or attempted poisoning by the sulphides have occurred of which some

[1] Report before cited, pp. 245, 260.
[2] See *Appendix VIII.*
[3] *M. J.*, p. 123.
[4] *Beng. Chem. Ex. Rept.*, 1884.

(see *Cases* below) were cases of homicide or attempted homicide ; the poison, in a few cases realgar, in a few others orpiment, and in a few the mixed sulphides, having been given, or attempted to be given, in articles of food.

Case CCXXXIX.—**Cases of poisoning by the Sulphides of Arsenic** (*Bo. Chem. Analyser's Repts.*).—(*a*) In Bombay several persons were poisoned, all of whom, however, recovered, by orpiment contained in food. The poison was introduced into the food in turmeric powder, which, on examination, was found to contain over 90 grains of orpiment per ounce.—(*b*) The wife of a man who was very ill with fever, confessed to giving him orpiment, apparently in some *congi* (rice-starch). The husband died three days afterwards ; traces of arsenic were found in his viscera. The *post-mortem* appearances were : much congestion, and inflammation in patches of the gastric mucous membrane ; small intestines also inflamed, and in parts in a state approaching mortification ; liver and spleen enlarged, and signs of commencing inflammation of both lungs.—(*c*) In another case orpiment was found in some cooked rice. A man who had partaken of a portion of this rice suffered from symptoms of irritant poisoning, but recovered.—(*d*) Several persons, all of whom recovered, were poisoned by bread made from flour in which, on analysis, orpiment was found.—(*e*) An apothecary, stationed in Sind, noticed some red powder at the bottom of a cup of tea he was drinking ; this proved to be realgar One of his servants taxed with having attempted to poison his master, confessed to having put the powder into the tea at the instigation of a man, who told him that it was a charm which would lead to the early transfer of the apothecary.—(*f*) A woman confessed to having given to a child, who died from arsenical poisoning, some sugar mixed with rat poison. This rat poison proved to be a mixture of flour and realgar.—(*g*) The servant of a shopkeeper at Karachi brought to his shop, as part of a meal intended for him, an omelette, in which some red powder was visible ; this turned out to be realgar.—(*h*) In a case in which two persons died from poisoning by arsenic, some flour and bread, of which they had eaten a portion, was found to contain mixed orpiment and realgar. -(*i*) In a case of attempted poisoning some sweetmeat, forwarded for examination, was found to contain both realgar and orpiment.

Abortifacient use.—Orpiment seems to be sometimes employed as an abortifacient, or ingredient of abortifacient preparations.

In one of the 17 cases above noted orpiment appears to have been taken with the object of procuring abortion. In several cases in Bombay, orpiment was found in packets discovered in the possession of persons charged with procuring abortion ; and in one or two cases in powders stated to have been given with this object. In one of these last-mentioned cases, the poison was apparently present in the form of sulpho-arsenite of calcium. In one or two cases it was mixed arsenious oxide and orpiment, in the paste used for arming abortion sticks. In another case in which it was stated that abortion had been procured by the local application of drugs, a board used for mixing, and two stones used for grinding the drugs employed, were found to be stained with realgar and red lead.

Realgar as an adulterant in Opium.—In a few cases realgar has been found in small quantity, in opium seized in the possession of vendors of the drug, charged with selling adulterated opium,[1] though no specific cases of arsenical poisoning have been repeated from this adulteration.

Use as cattle poisons.—The sulphides are occasionally, but not often, used as cattle poisons. During the last ten years in Bombay, of the cases of cattle poisoning in which arsenic was detected, in about 1½ per cent sulphides only, and in a somewhat smaller number mixed arsenious oxide and sulphides, were found. Of the two sulphides, orpiment appears to be more commonly used than realgar.

Detection.—When pure, the sulphides are practically insoluble in water and hydrochloric acid. Heated *per se*, they yield a mixed sublimate of sulphide and oxide. Their identification is best effected by the reduction process, converting the ring of metallic arsenic obtained into arsenious oxide, to which, after solution in boiling water, the liquid tests for arsenious oxide may be applied.

Arsenites of Copper.

Two of these are in common use as pigments, namely, *Scheele's green* Cu H As O_3 (acid cupric arsenite) and *Schweinfurth's* or *emerald green* (aceto-arsenite of copper), 3 Cu As_2 O_4 + Cu $(C_2 H_3 O_2)_2$. Both are known in India under the name "*Hirwa.*" Both, although insoluble in water, are readily dissolved by the acid fluids of the stomach, and when absorbed give rise to the usual symptoms of arsenical poisoning. They are seldom used in India either by homicides or suicides, occasionally accidental cases occur. In Bombay, two instances of alleged attempt at homicide by arsenite of copper (see *Cases CXXX a* and *b*) have occurred ; and a case of suicide by arsenite of copper was reported a short time ago in Bombay city. Cases of poisoning by the arsenites of copper, usually arise either from their being used in ignorance to colour confectionery or toys or from their accidental absorption into the system, from other articles coloured by them.

A whole family were poisoned by *halwa* (a kind of sweetmeat) thus coloured in Bombay, and Taylor records a fatal case arising from eating blancmange, coloured with arsenite of copper. Again, in several instances, arsenite of copper is used to colour small sugar-plums known as *til-gul*, which are sold at the *Makar Sakrant* festival ;[2] and Dr. W. Center states that the confectioners of Lahore use arsenite of copper to colour their wares.[3] Taylor mentions several instances of children being poisoned by confectionery coloured with these compounds. Cases of the second class are often cases of chronic or slow poisoning,

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[1] *Bo. Chem. Analyser's Rept.*, 1886.

[2] January 12th or 13th. In one instance the *til-gul*, from a vendor's stock ; green, red, and yellow sugar-plums, was coloured respectively with aceto-arsenite of copper, mercuric sulphide, and chromate of lead.

[3] *Ind. Med. Gaz*, 1874, p. 116.

arising from inhalation of particles of the poison, detached from wall papers coloured with arsenical green Chevers mentions one such case as having occurred in India, also another where the poisoning resulted from sleeping in a bedroom, the walls of which had been coloured with arsenite of copper, loosely put on with size.[1] Children again are sometimes poisoned, by sucking green arsenical paint off toys (see *Case CCXXX c*).

Case CCXXX.—**Poisoning or attempted poisoning by the Arsenites of copper** (*Bo. Chem. Analyser's Rept.*).—(*a*) A woman was found in the act of putting something into a pot of drinking water standing in the house of a Bhora (trader). She was seized, and a packet found in her hand, in which was a quantity of aceto-arsenite of copper. In the struggle the pot got broken, and the water spilt, but aceto-arsenite of copper was found in some earth collected from the spot.—(*b*) A woman charged a man, described as her "kept husband," with an attempt to poison her, by giving her in lieu of *gulchand* (a sweetmeat containing Indian hemp and conserve of roses) a substance which, on examination, was found to consist chiefly of sugar and arsenite of copper.—(*c*) A child, about ten months old, was admitted into the J. J. Hospital, Bombay, suffering from symptoms of irritant poisoning, the result of sucking the paint off a toy parrot painted bright green with arsenite of copper.

Detection.—Both arsenites of copper are soluble in solution of ammonia, with formation of a blue liquid, which on evaporation redeposits the compound. Both also are soluble in hydrochloric acid, the solution yielding (1) evidence of the presence of copper to the usual liquid tests for this metal (see copper), and (2) evidence of the presence of arsenic to Reinsch's process (which see p. 158) The presence of arsenic in these compounds may also be demonstrated by the reduction process as directed for the sulphides. The presence of acetic acid in the aceto-arsenite may be recognised by heating the compound with sulphuric acid, when free acetic acid is liberated ; or with sulphuric acid and alcohol, when acetic ether is evolved.

Other Poisonous Arsenical Compounds.

Rough on Rats—Has been used for suicide, see following case.

Case CCXXXI.—**Suicide by Rough on Rats.**—A young married Muhammadan woman, separated from her husband and living in Calcutta, committed suicide by eating "Rough on Rats." Arsenic was detected in the viscera, and in the washings of her stomach. The sample of rough on rats, of which the deceased had partaken, was found to contain 81·02 per cent. of arsenious acid. The *post-mortem* examination revealed the presence in the uterus of a four weeks' fœtus — L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1896.

Fly-powder.—This is a black powder, consisting of, or containing, metallic arsenic, partly converted into arsenious oxide.

'Fly-papers' were used as a source of arsenic in the Maybrick case (see p. 434).

Arseniuretted Hydrogen.—This highly poisonous gas is evolved when hydrogen is set free from materials, or in liquids, containing

[1] *M. J.*, p. 125.

arsenic (see *Marsh's Process*, p 461). A few cases of poisoning by it, all accidental, have been reported

Akaline Arsenites.—These are more soluble in water than arsenious oxide, hence the greater solubility of the latter in alkaline liquids. Cases of poisoning have been recorded from Fowler's solution (Liquor Arsenicalis B P. and I P.) This is a weak solution of potassium arsenite, coloured with compound tincture of lavender ; strength, I.P., four grains of arsenious oxide to the ounce ;[1] or B.P. of 1885, 4 375 grains to the ounce, or 1 per cent. Cases (see *CCXXV*) have also occurred from the use of arsenious oxide, mixed with potassium carbonite, solution (potassium arsenite), as a sheep wash ; and Taylor mentions a case in which 340 school-children were poisoned by drinking tea made with water from a boiler into which mixed arsenite and arsenate of sodium had been put, in order to cleanse it from deposit.

Alkaline Arsenates.—Salts of the acids derived from arsenic anhydride potassium and sodium arsenates. These rarely give rise to cases of poisoning. Taylor[2] refers to three accidental cases, and gives details of one attempt at homicide ; in the latter, arsenate of potassium was given in wine. Paper soaked in solution of an alkaline arsenate mixed with sugar, is used for poisoning flies, under the name of *Papier Moure* or *Fly paper*. Arsenate of potassium is used for preserving skins, and has lately been imported into India for this purpose. Chevers[3] mentions two cases (both in the Panjab) of attempted cattle poisoning by pieces of grass moistened with solution of potassium arsenate.

Arsenic in dyeing materials.—A large number of dyes, of various colours, are obtained from rosamiline, a red colouring matter prepared by the action of an oxidising agent (usually arsenic acid) on aniline. Red aniline dyes have been found to contain arsenic, and workmen engaged in their manufacture have been known to suffer from cutaneous eruptions, and the usual symptoms of chronic arsenical poisoning. Cases also are reported of cutaneous eruptions arising on the feet, apparently due to wearing socks dyed red with aniline colours. Taylor further mentions that arsenate of aluminia is used by dyers as a mordant with various colours, and that fabrics dyed in this way have been found to contain arsenic.

Liquid reactions of arsenic acid—Arsenic acid differs from arsenious acid in giving (1) a red-brown precipitate with silver nitrate, and (2) in moderately strong solution, a precipitate with a mixture of ammonia, ammonium chloride, and magnesium sulphate solutions. An acidulated solution of arsenic acid is precipitated by sulphuretted hydrogen much more slowly than a similar solution of arsenious acid.

DETECTION OF ARSENIC IN VISCERA, &c.

In the presence of organic matter, the ordinary tests for the recognition of arsenic become inapplicable. Further, the ready volatility of arsenic precludes incineration being employed for the destruction of organic matters mixed with it. Hence to separate arsenic from organic matter, and bring it into a form in which it may be readily recognised, special processes

[1] This was the strength of the preparation of the B. P. of 1867.
[2] *Poisons*, p. 351. [3] *M.J.*, p. 133.

are required. Before describing these, certain points bearing on the inferences to be drawn from the analytical results must be considered.

1. Disappearance of Arsenic from the Body (*a*) after death.—Arsenic, like other inorganic poisons, cannot disappear by putrefaction. Hence it may be detected in human remains after any period of interment. Its antiseptic power and the sparing solubility of its most commonly-used compounds, tend specially to favour this. On the other hand, arsenic, being volatile at the temperature of combustion, may disappear when a body is burnt ; though it has been detected in partly-burnt bodies. See *Case CCXXXIII.* (*b*) **Disappearance during life.**—During life, vomiting and purging tend to free, first the stomach, and subsequently the intestines, from the poison. In exceptional cases complete disappearance from the contents of the stomach may take place very rapidly.

Taylor[1] mentions a case where this occurred within 24 hours ; and I once met with a case in which arsenic could not be detected in the contents of the stomach of a woman, who died from arsenical poisoning in six hours.[2] On the other hand, two cases are recorded, one of death in six, and the other of death in seven days, in both of which arsenic was found after death in the contents of the intestines.[3] During life also, absorption of the poison takes place very rapidly. Taylor found it in comparatively large quantity in the liver in a case of death in three hours.[4] Again, during life, absorbed arsenic tends to undergo elimination from the body, by the kidneys and other emunctories. Complete elimination may undoubtedly take place in 15 days, and may, there is good reason to believe, take place even in a shorter time than this (see *Cases CCXXXII a* and *b*). On the whole, therefore, (1) Entire absence of arsenic from the body is quite consistent with the supposition of death (after some days) from arsenical poisoning ; it, however, strongly indicates survival for some days ; and (2) In a case of death from arsenical poisoning, absence of arsenic from the alimentary canal is a moderately strong indication that the individual lived some time after swallowing the poison, the indication being stronger if arsenic is found to be absent from the contents of the intestines, as well as from the contents of the stomach.

Case CCXXXII.—**Death from Arsenical poisoning. Complete elimination of Arsenic from the Body.**—(*a*) (Taylor, *Poisons*, p. 335). A woman was charged with poisoning her husband by arsenic. The husband suffered from the usual symptoms of arsenical poisoning, and died from exhaustion on the fifteenth day. No arsenic could be found in the viscera of the deceased. Mr. Herapath, of Bristol, who made the analysis, stated that "neither in his reading nor experience had he known arsenic to have been detected so long as 15 days after its

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[1] *Poisons*, p. 335.

[2] *Bombay Chem. Analyser's Rept*, 1879-80 ; the Poison was given in food ; arsenic was detected in the liver.

[3] Taylor, *Poisons*, p. 336.

[4] *Ib.*, p. 334.

administration."—(*b*) (*Bo. Chem. Analyser's Rept.*, 1874-75): "In a case from Ahmednagar, a man lived three days after a dose of about 75 grains of arsenic. He is said to have suffered during the whole time from purging and vomiting." Not a trace of the poison could be found in either the stomach or liver. Dr. Wellington Gray, who made the analysis, remarks in reference to this case: "It is quite possible that arsenic may have existed in the more distant tissues of the body, for the examination of which no opportunity was given." Arsenious oxide was detected in some bread, a portion of which had been eaten by the deceased.

Case CCXXXIII.—**Detection in Cremated Remains.**—Two persons suffered from choleraic symptoms, and one of them died and was cremated; but when the other one also died in a few days, suspicion was aroused. The viscera of the latter and all the suspected articles connected with the case were sent for chemical examination including ashes from the scene of cremation. Arsenic was found in the visceral matters and excreta, and even in earth scraped from the spot where the washings of a tumbler had been spilt. Interest attaches to the fact that appreciable quantities of arsenic were easily detected in the ashes and bones from the scene of cremation, contrary to expectation, for a volatile poison like arsenic would be dissipated by fire and lost beyond the possibility of detection in anything reduced to ashes; but the conditions under which cremation is usually carried out here evidently do not favour complete combustion, and sublimation of the volatilized arsenic on the cooler parts of the funeral pyre is liable to take place and its loss thus prevented. This is borne out by another such case which was examined during the year, in which arsenic was easily detected in ashes and charred bones, &c., sent from the cremation ground. The point is one which is worth noting by magisterial and police-officers who have to investigate cases of suspected poisoning, in which the corpse has been cremated.—*Mad. Chem. Ex. Rept.*, 1902.

2. Conversion in the Body of arsenious oxide into yellow sulphide of Arsenic.—It has already been pointed out that this may occur; the reverse change cannot, however, take place. The discovery, therefore, of arsenious oxide in the body, shows that the poison administered contained arsenious oxide. On the other hand, the discovery of yellow sulphide of arsenic in the body does not prove that the poison was administered in the form of yellow sulphide.

3. Presence of Arsenic in earth.—Arsenic is sometimes found in minute quantity in earth, but has hitherto only been found in earth in a form insoluble in water. It has been alleged, however, that arsenical earth may, under the action of the air, yield a soluble arsenical compound. Further, it has been found, that when arsenic in solution is introduced into the alimentary canal of a dead body, *post-mortem* imbibition takes place and arsenic passing through the walls of the alimentary canal, becomes imbibed by tissues external to, but in contact therewith.

In the case, therefore, of an **exhumed body,** in the viscera of which arsenic has been detected, it may be alleged that the arsenic

found therein was derived from the surrounding earth. Either of two cases may arise. The parietes of the body may be found (1) **intact,** or (2) **not intact,** and the viscera more or less mixed with earth. In case (1), the discovery of any notable quantity of arsenic in the body completely negatives the theory of earth derivation. The presence of traces even can hardly be accounted for in this way. In case (2) the earth derivation theory is in the highest degree improbable if a notable quantity of **soluble arsenic** is detected. Whenever, however, case (2) arises, a portion of the surrounding earth should always be submitted to analysis, and even in case (1) it is advisable to preserve a portion of the surrounding earth, so that it may be examined for arsenic, should traces only thereof be found in the body. In India **vomited matters** are frequently found mixed with earth ; here, again, it is important to ascertain whether or not arsenic present in such matters, is present in a form soluble in water. Should soluble arsenic be present, and especially if it be present in notable quantity, earth derivation is improbable. Earth and gravel are often found in the stomachs of **cattle.** Hence the presence of a minute quantity of insoluble arsenic in the bodies of such animals may possibly be accounted for on the theory of earth derivation.

Quantity of Arsenic found.—The quantity of arsenic found in the viscera of an individual may, to a certain extent, affect (*a*) the presumption as to suicide or homicide ; or (*b'*), the presumption as to the cause of death as has already been considered. Bearing specially on the possibility of a minute quantity of arsenic being discovered in the viscera, in a case of death from causes other than arsenical poisoning, are the following points :— (1) the existence of the habit of arsenic eating, and the frequent use by *hakims* of arsenic in the treatment of disease ; (2) the possibility of earth derivation just discussed ; and (3) the fact that arsenic is *not* a natural constituent of the body, although the contrary was at one time asserted. It must not be lost sight of, also, that arsenic may be present in small quantity as an impurity, in drugs administered for medicinal or other purposes and in reagents. Antimony and bismuth[1] compounds are liable to contain traces of arsenic ; so, also, is sulphuric acid, and it has already been mentioned that realgar has been found in opium.

PROCESSES for Separating Arsenic from Organic Mixtures.

The prinicipal processes employed for the separation of arsenic from organic mixtures, are : (1) Deposition as metallic

[1] Dr. Richardson, in the case of *R.* v. *Smethurst* (*Case CCXXXIV* **b**), stated that in the bismuth usually administered in medicine (sub-nitrate), he had found nearly half a grain of arsenic per ounce, and that in one case, where for dyspepsia five grains of bismuth had been given three times a day for six days, he had found about a fiftieth of a grain of arsenic in the patient's urine. Dr. Thudicum at the same trial, stated that he had found both arsenic and antimony in sub-nitrate of bismuth, and also in grey powder.

arsenic on copper, or Reinsch's process ; (2) Separation as arseniuretted hydrogen, or Marsh's process ; Separation by distillation as chloride of arsenic ; and (4) Separation by precipitation as sulphide of arsenic.

Many of the reagents used in the above process, *e.g.*, sulphuric acid, hydrochloric acid, metallic zinc and metallic copper, are specially liable to contain arsenic. All should, therefore, be ascertained to be arsenic-free before use. As regards metallic copper, however, see Reinsch's process.

Reinsch's Process.—This consists in boiling the suspected liquid acidulated with about one-fourth of its volume of hydrochloric acid (or solid matters cut into small pieces and mixed with hydrochloric acid diluted with about four volumes of water), with a succession of pieces of clean, bright, metallic copper foil or gauze. If arsenic is present, a steel-grey or black stain—an alloy of arsenic and copper—forms on the surface of the foil or gauze. The stained pieces of copper are then washed, dried, and heated in a test-tube,[1] when the stain, if arsenical, disappears, and a sublimate of arsenious oxide is obtained, which, under the microscope, is found to consist of minute crystals of the characteristic appearance before noted. Unless such crystals are obtained, the presence of arsenic has not been demonstrated, because the staining of the copper may be due to (1) the action of organic matter only, or the formation of sulphide of copper ; or (2) the deposition on the copper of metals other than arsenic, *e.g.*, mercury, antimony, silver, bismuth, &c. Under the circumstances of the process, however, of the metals other than arsenic which deposit on copper, two only yield sublimates, *viz.*, mercury, which yields a sublimate of minute globules of metallic mercury, and antimony, which yields a non-crystalline sublimate.

Reinsch's process is the most generally applicable of all. It cannot, however, be used in cases where the liquid contains matters which dissolve the copper, *e.g.*, nitrates, chlorates, or ferric chloride. It is only also in such cases that the presence of arsenic in metallic copper can lead to error.[2] Hence, if the copper dissolves, or the deposit forms only very slowly thereon, one of the other processes should be resorted to.

Marsh's Process.—This consists in introducing a liquid suspected to contain arsenic, into a vessel from which hydrogen gas is being evolved. If arsenic be present, the nascent hydrogen attacks it, forming arseniuretted hydrogen. The arsenical nature of the gas evolved may be proved : (1) By passing it through a narrow hard glass tube, heated to redness for a portion of its length ; when a deposit of metallic arsenic forms in the cool part of the tube beyond the heated portion. (2) By igniting the gas, and holding a piece of cold white procelain in the flame, when a deposit of metallic arsenic forms thereon, see fig. 12. (3) By passing the gas through solution of silver nitrate, when a black deposit of metallic silver is thrown down, and the arsenic is converted into arsenic acid, which remains in solution.

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[1] In the same way as the metallic ring in the reduction process (see p. 152).

[2] Unless such substances are present, the copper does not dissolve during the process. If the copper remains undissolved and becomes rapidly coated, an arsenical deposit formed on the copper cannot be due to the presence of arsenic in the copper employed.

The arsenical nature of these products of the process is proved as follows:—(1) The portion of the narrow tube containing the deposit or ring of metallic arsenic, is heated, in a wide tube, like the metallic ring in the reduction process (see p. 152). It volatilizes readily, yielding a similar crystalline sublimate. (2) The spots on porcelain, where thin, are seen to be hair-brown in colour, and (*a*) are soluble in chloride of lime solution, (*b*) are insoluble in stannous chloride solution, and (*c*) dissolved in aqua regia; the solution, when evaporated to dryness, yielding a residue of arsenic acid, which gives a brick-red precipitate with silver nitrate solution. (3) The silver nitrate solution is treated with excess of hydrochloric acid, filtered, and the filtrate evaporated to dryness; silver nitrate solution added to the residue, gives a brick-red precipitate.

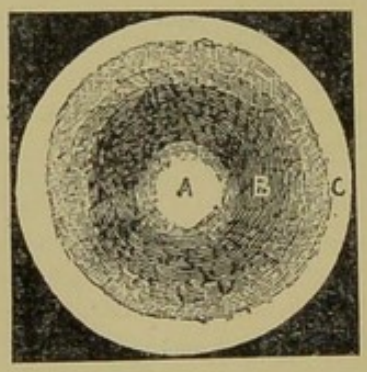

FIG. 12. Deposit in Marsh's Test.

A.—Metalic Arsenic. B.—Mixed Arsenic and arsenious oxide. C.—Arsenious oxide.

The apparatus used may be an ordinary gas-bottle, such as is employed for preparing hydrogen gas, fitted with a tube filled with fused calcium chloride (for the purpose of drying the gas evolved), to which is attached a long narrow hard glass tube, ending either in a jet, or a downward bend. The materials used may be zinc and dilute sulphuric acid, or zinc and hydrochloric acid. A quantity of hydrogen gas must be allowed to escape before heat is applied to the narrow tube (avoidance of explosion). Before the suspected liquid is introduced, the narrow tube must be heated to redness for about fifteen minutes. If no deposit forms, the materials are arsenic-free. In this way the purity of the hydrochloric acid used in Reinsch's, and other processes, may be ascertained. **Bloxam's** modification of Marsh's process consists in evolving the hydrogen gas required, by electrolytic decomposition of water acidulated with sulphuric acid. In this way the use of zinc (which frequently contains arsenic) is avoided. In another modification, **Fleitmann's**, applicable to arsenic but not to antimony, the hydrogen is evolved by heating zinc with potassic hydrate solution.

Marsh's process is not applicable to the sulphides of arsenic, or to solutions containing arsenic as arsenic acid, or as an arsenate (see however below).

The Chloride Distillation Process.—The substance under examination (cut into small pieces if a solid) is first thoroughly dried on a water-bath. The dry residue is then distilled to dryness with the strongest obtainable hydrochloric acid, and the residue in the retort distilled again to dryness with a little more of the same acid. Under these conditions, arsenic, if present, distils over as chloride of arsenic, and may be recognised in the distillate, by subjecting this to Reinsch's or Marsh's process.

Precipitation as Sulphide of Arsenic.—Mixtures containing little organic matter may be boiled with dilute hydrochloric acid, filtered, and the filtrate precipitated by washed sulphuretted hydrogen. If much organic matter be present, this must be first destroyed by boiling the substance under examination (cut into small pieces if a solid) with dilute hydrochloric acid, and adding to the boiling liquid from time to time, a small quantity of crystallized potassic chlorate. The organic

matter having been destroyed, the liquid is filtered, sulphurous acid added to it,[1] and washed sulphuretted hydrogen passed through it. The precipitated sulphide is separated by filtration, washed, dissolved in ammonia, the solution filtered, and the filtrate evaporated to dryness. The residue of impure sulphide of arsenic may then be subjected at once to the reduction process, or (for quantitative determination of the arsenic present) treated as follows :—Boil with strong nitric acid, evaporate to dryness, dissolve in a little water, filter, and add to the filtrate a mixture of solutions of magnesium sulphate, ammonium chloride, and ammonia. After twenty-four hours' filter, wash the precipitate with ammonia-water, dry and weigh. It consists of ammonium magnesium arsenate, and contains 39·47 per cent. of metallic arsenic.

ANTIMONY.

Antimonial poisoning is extremely rare in India. It usually arises from the potassio-tartrate or tartar emetic. A few cases also are recorded of poisoning by the chloride (butter of antimony).

Tartar Emetic.

This, also called potassio-tartrate of antimony and tartarized antimony, produces effects on the system very similar to those produced by arsenious oxide. Unlike the latter, however, it has a strong metallic taste. Tartar emetic has a very marked depressant action on the heart, and on the nervous system generally. Hence, in poisoning by it **prominent symptoms** are extreme faintness, collapse, and muscular weakness. Loss of voice has been noticed, and choleraic symptoms[2] and convulsions often precede death. In exceptional cases (as in arsenical poisoning), vomiting is slight or absent, necessitating the administration of emetics. Tartar emetic applied to the skin produces a pustular eruption thereon, and may become absorbed, giving rise to constitutional symptoms. A pustular eruption on the skin has also been noticed in cases of poisoning by internal administration of the drug.

Acute poisoning by tartar emetic is seldom homicidal ; it is frequently accidental from the poison being mistaken for some harmless powder, *e.g.*, Epsom salts, or carbonate of soda. It may also be remarked that, although tartar emetic is popularly well known to be a powerful emetic, it is not equally well known to be a powerful poison. It is possible that this may explain the mysterious Bravo case (see below).

Case CCXXXIV.—**Antimonial poisoning.**—**(a) The Bravo Case** (July, 1876). In this case Mr Bravo, a young married man of good position, died undoubtedly from poisoning by tartar emetic. Deceased, on the evening he was attacked with symptoms of poisoning, stated—so one of the witnesses at the inquest deposed—that, owing to jealousy of his wife, he had taken poison. Shortly after this he became very ill, and medical assistance was sent for. Sir W. Gull, one of the physicians called in, stated that he told the patient that his symptoms were due to poisoning, and asked him how he came by it. He answered, " I took it

[1] To reduce the arsenic acid, Marsh's process may be applied to the detection of arsenic acid and the arsenates, if these be first treated with sulphurous acid.

[2] Christison, *Poisons*, p. 432 (2nd Ed.).

myself." Asked what he had taken, he replied, "Laudanum." Told that he must have taken more than laudanum, he said, "Before God, I only took laudanum." There was no evidence to show how deceased came by the tartar emetic, from the effects of which he died, and the coroner's jury returned a verdict of wilful murder against some person or persons unknown.—(**b**) *Reg.* v. **Smethurst** (Browne and Stewart's *Trials*, p. 448). In July, 1859, Thomas Smethurst, a surgeon, was tried at the Central Criminal Court for the murder by poison of Isabella Bankes, a lady with whom he had contracted a bigamous marriage. Deceased, just before her death, made a will, leaving all her property to the prisoner. The medical witnesses for the prosecution deposed that, in their opinion, the cause of death was slow poisoning by some irritant, and on analysis traces of antimony were found in the viscera of deceased. For the defence, it was urged that several of the symptoms of slow poisoning by arsenic or antimony were absent; *e.g.*, there was no conjunctivitis, no skin disease, and no excoriations at the orifices. That the symptoms, &c., might have been due to acute dysentery. That the vomiting and diarrhœa from which deceased suffered might have resulted from her being in an early stage of pregnancy. That the traces of antimony found in the viscera (and a minute quantity of arsenic found in an evacuation passed by deceased) might have been due to the presence of arsenic in the bismuth, and of antimony in the grey powders, administered as medicines. The prisoner was convicted. Subsequently memorials, backed by the opinions of eminent medical men, were presented to Government in the prisoner's favour. The whole case was referred to Sir B. Brodie, and on his report the prisoner was pardoned.—(**c**) **Case of Dr. Pritchard** (*ib.*, p. 397). In July 1865, Dr. Pritchard, of Glasgow, was tried for the murder of his wife and mother-in-law, the first by slow poisoning with antimony, and the second by poisoning with antimony and aconite. Antimony was found in the viscera of both. The prisoner was convicted, and subsequently confessed his guilt.

Chronic poisoning.—Some remarkable trials for murder, by the administration of repeated small doses of tartar emetic, have taken place in England (see *Reg.* v. *Smethurst*, and Dr. Pritchard's trial, *Case* **b** and *CCXXXIV* **c**). In some cases of chronic antimonial poisoning, the failure of treatment to control the prominent symptoms, *viz.*, nausea, vomiting, and diarrhœa, with and, in another similar case, realgar and sulphate of copper were found in poisoned sweetmeat, great depression and muscular weakness has been the first thing to excite suspicion as to the true nature of the case.

Preparations containing Tartar Emetic.—Vinum antimoniale B.P. and I.P. contains 2 grains of tartar emetic per ounce. Tartar emetic is also contained in small quantity in several quack pills, *e.g.*, Dr. Johnson's, Mitchell's, and Dixon's pills,[1] and forms one-fifth by weight of the Unguentum antimonii tartarati B.P. and I.P.

Fatal Period.—Shortest recorded, seven hours (in a female, æt. 21).[2] Longest, one year.[3] Usual, ten hours to four days.

Fatal Dose.—Smallest (in a child), three-quarters of a grain. Largest non-fatal, half an ounce. Taylor considers that, under circumstances favourable to the action of the poison, ten to twenty grains

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[1] About one-sixteenth to one-twenty-fifth of a grain in each pill (Blyth, *Poisons*, p. 547).

[2] Wormley, *Poisons*, p. 218.

[3] Guy's *For. Med.*, p. 426.

taken at once, might prove fatal to an adult; but that, if taken in divided doses, a smaller quantity might suffice.[1]

Post-mortem appearances.—Similar generally to those of arsenical poisoning. Aphthous inflammation of the mouth, throat, and gullet, and aphthous ulceration of the small intestines, have been observed.

Treatment.—The usual treatment for irritant-poisoning, with the administration as an *antidote* of an infusion containing tannin, *e.g.*, solution of tannic acid, decoction of oak-bark or of cinchona bark, or strong tea. Stimulants may be required to counteract depression.

Other Antimonial Compounds.

Trichloride, or Butter of Antimony, $Sb Cl_3$.—A strong solution of this is used for browning gun-barrels; also sometimes in surgery as a caustic; and in pharmacy as a source of oxide of antimony. It is highly corrosive, giving rise, when swallowed, to symptoms of corrosive poisoning, plus constitutional effects similar to those caused by tartar emetic. A few fatal cases of poisoning by the chloride of antimony are recorded. In one of these narcotism succeeded the usual irritant symptoms. The *post-mortem* appearances are those of corrosive poisoning.

Antimony trioxide, $Sb_2 O_3$, although insoluble in water, is soluble in the fluids of the stomach. It is used in medicine in the form of Pulvis antimonialis—an imitation of the old James's powder—a mixture of one part of oxide of antimony to two of phosphate of lime. Its action on the system is similar to that of tartar emetic, but milder in degree. Overdoses of it have given rise to dangerous symptoms.

Antimony trisulphide, $Sb_2 S_3$.—This is met with in two forms: (1) as a black crystalline mass or powder—native sulphide of antimony, black antimony, or "surma";[2] and (2) as an orange-coloured powder—precipitated sulphide of antimony. Although pure sulphide of antimony is probably inert, the following points of medico-legal interest attach to it: (1) Commercial black sulphide of antimony frequently contains arsenic, hence—if not first thoroughly purified—tartar emetic prepared from it is liable to contain arsenic. (2) The orange sulphide of antimony, plus a variable proportion of antimony trioxide, forms the antimonium sulphuratum of the B.P. and I.P., and this forms about one-fifth by weight of Plummer's pills (Pilula hydrargyri sub-chloridi, composita, B.P. and I.P.).[3]

Detection of Antimony.

Antimony after absorption is eliminated mainly by the urine, and may be detected during life in this fluid. It is probably eliminated from the body at least as rapidly as arsenic. Like arsenic also, antimony does not disappear by decomposition, and has been detected in the body after long periods of interment.

Tartar Emetic.—This is a white crystalline powder which, when heated, chars, yielding, if a spirit-lamp only be used, no metallic or

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[1] *Poisons*, p. 464.

[2] Used in India as a collyrium. Women, according to Balfour (*Cyclopædia* iii, 248), always use kohl or lamp-black instead of surma.

[3] The presence of antimony as an occasional impurity, in grey powder and subnitrate of bismuth, has already been noticed see foot-note, p. 460.

crystalline sublimate. It is almost insoluble in alcohol, ether and chloroform. One part dissolves in fifteen of water at 58° F., and in two parts of boiling water. The solution (1) on evaporation yields tetrahedral crystals; (2) gives no precipitate with potassium ferrocyanide; (3) gives a dirty yellow white precipitate with infusions containing tannin; (4) if concentrated, gives, with strong hydrochloric acid, a white precipitate soluble in tartaric acid, and in excess of hydrochloric acid; (5) acidulated with hydrochloric acid, and treated with sulphuretted hydrogen, yields an orange-coloured precipitate of antimony sulphide insoluble in ammonia, but dissolving on digestion with sulphide of ammonium.

Sulphide and Oxide of antimony dissolve on boiling with strong hydrochloric acid, the solution (and solution of chloride of antimony) yielding: (1) with water, a white precipitate soluble in tartaric acid; and (2) when moderately diluted and treated with hydrogen sulphide, a precipitate of antimony sulphide, of the characters stated above.

Detection of Antimony in organic mixtures.—To **Reinsch's process** (*see* p. 461) antimony, like arsenic, yields a deposit on copper, which, however, sublimes only at a high temperature, yielding an amorphous sublimate of Sb_2O_3. For Reinsch's process in the case of antimony, the **Galvanic deposition process** may be substituted. This consists in placing in a concentrated hydrochloric acid solution of the matters under examination, a slip of platinum foil, with a piece of pure zinc in metallic contact therewith. Metallic antimony is deposited on the platinum. The stained platinum is washed, boiled with nitric acid, the acid solution evaporated to dryness, and the residue dissolved in dilute HCl, and tested for antimony by hydrogen sulphide. Deposits of antimony obtained by Marsh's process may be similarly treated. To **Marsh's process** antimony yields deposits distinguishable from arsenical deposits (p 462) as follows: (1) The metallic ring in the tube is deposited closer to the heated portion, is sublimable only with difficulty, and yields no sublimate of octahedral crystals. (2) The spots on porcelain are smoky black (not brown), insoluble in chloride of lime solution, but slowly soluble in stannous chloride solution. (3) In the vessel containing the silver nitrate solution, the antimony falls (as antimonide of silver) with the deposit, and may be recovered by boiling the deposit for some time with tartaric acid. **Precipitation as Sulphide.**—The organic matter may be destroyed in the same way as when this process is used for separation of arsenic. The precipitated sulphide may then be collected, and dissolved by boiling it with strong hydrochloric acid, and the amount of antimony present estimated volumetrically by a standard solution of iodine; the antimony solution being first treated with sodium tartrate and carbonate, to weak alkaline reaction.[1]

MERCURY.

One of the most poisonous salts of mercury—the perchloride—is sold in every bazaar and is kept in the shops alongside spices so that accidental poisoning is not uncommon in India.

Mercurial poisoning may be acute or chronic.—**If acute,** the symptoms may be either those of corrosive, or those

[1] Under the conditions stated, Sb_2O_3 oxidizes into Sb_2O_5. The end reaction is the permanent appearance of free iodine in the liquid under test.

of non-corrosive irritant-poisoning. **If chronic**, either salivation or mercurial tremors, or both, may be present; and in two cases of chronic poisoning by an organic mercurial compound (mercuric methide), the brain was specially affected.

Acute mercurial poisoning is rare in India. Accidental cases are, however, occasionally met with, and very rarely homicidal cases.[1]

Symptoms.—Acute mercurial poisoning most commonly arises from swallowing corrosive sublimate, in which case, and also when the nitrates are swallowed, the symptoms present are those of corrosive poisoning.

In acute cases other than these, the symptoms are those of non-corrosive irritant-poisoning, and vary in severity according to the activity of the compound swallowed. Mercuric compounds are more active than mercurous compounds. Soluble mercurial salts have a strong metallic taste. In corrosive cases (1) Intense burning pain in the mouth and throat comes on immediately, and (2) The lining membrane of the mouth and throat becomes white and shrivelled. These characters are absent in non-corrosive cases. In both corrosive and non-corrosive cases, the usual symptoms of irritant-poisoning are present, and more or less complete suppression of urine is a common symptom. In some cases coma has been observed. If the case is prolonged, salivation, as in chronic poisoning, may appear; but this is not a common symptom in acute cases.

Case CCXXXV.—**Acute Mercurial poisoning.**—A convict, in Port Blair, was brought to the hospital on the evening of the 3rd September 1896, in a very low condition, suffering from great pain in the throat and abdomen, and passing bloody stools and vomiting bloody matter. He said he had been bitten by a centipede in the leg, and as he was in great pain some one gave him a draught to take, saying that it would relieve him. He swallowed the draught and immediately he felt a burning in his mouth and gullet. Directly afterwards the whole throat became painful, and he could hardly swallow, and he became restless. Soon he began to vomit food mixed with blood and passed bloody stools with great pain. He was in this condition when brought in the hospital. In the hospital he had all the symptoms of irritant poisoning. Besides bloody stools and vomit, he had suppression of urine followed by bloody urine in very small quantities. The whole of the fauces were inflamed. Soon the mouth and gums became ulcerated, followed by loss of many teeth. He became very low day by day, as he could not take nourishment well. He constantly complained of pain and burning sensation in his abdomen, and was always very thirsty. There was, however, no fever, until he got diffused cellulitis of the left side of the neck, face, and forehead, and he died on the 12th October 1896. His viscera, stools, and the vomit which he had ejected on admission into the hospital were

[1] In one such case the deceased, a prostitute, died from the effects of an irritant poison administered to her in sweetmeat by a man, afterwards tried and convicted of her murder. It was alleged that the poison used was *ruskapur* (see calomel), but the evidence on this point was very unsatisfactory (Chevers, *M. J.*, p. 266). See also *Case CCXXXV* above.

forwarded for examination. Traces of mercury only were detected in the portions of viscera sent for analysis. But both mercury and arsenic were detected in his vomit and stools. It appears from this case that mercury is not so easily eliminated from the system as arsenic. For although the man was in the hospital for nearly a month and-a-half, traces of mercury were still detected in his viscera, but no arsenic could be found in them. In this case, as the symptoms of mercurial poisoning were so marked, and as the quantity of arsenic found in the stools and vomit was so very small, it may be presumed that arsenic was present in only small quantity as an impurity in the mercurial preparation which had been administered to the deceased.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Post-mortem appearances.—These, according to the case, may be those of corrosive, or those of non-corrosive irritant-poisoning. Perforation of the stomach is rare. The gastric mucous membrane may be found covered with a greyish deposit of metallic mercury, or there may be a black deposit of the sulphide. The intestines and urinary organs are generally much congested. In acute poisoning from external application of mercurial compounds, *post-mortem* appearances of irritation of the alimentary canal are present.

Treatment.—The usual treatment for corrosive or irritant-poisoning, with the administration as an antidote, of albumen (*e.g.*, white of egg), or other albuminous fluids.

Chronic mercurial poisoning is liable to arise in persons whose occupation exposes them habitually to the vapours of metallic mercury or its compounds, or to constant contact with mercurial compounds. It may also arise from often repeated small doses of any mercurial preparation, and hence may result from the abuse of such preparations in the treatment of disease. Cases of this last description used formerly to be of frequent occurrence in India.

Symptoms.—These may be debility, nausea, and vomiting accompanied by colicky pains, and followed by salivation. In other cases, mercurial tremors are the first symptoms to appear.

Salivation.—This commences with a coppery taste in the mouth. The gums swell and become tender and spongy. There is profuse ptyalism, fœtor of the breath, and febrile disturbance. A blue line may be present on the gums. In extreme cases, the tongue and cheeks swell, ulceration appears in the mouth, the jaws become necrosed, and the teeth drop out. Mercury is present in the saliva. Salivation may (1) **Last for almost any period**: in one exceptional case it is said to have lasted six years. (2) **Intermit,** and recur after an interval of three months or more. In exceptional cases also, an interval of three months or more has been observed between the discontinuance of mercurial treatment, and the first appearance of salivation. (3) **Appear in acute cases,** but rarely appears in these under twenty-four

hours, although one case is reported where it appeared in three hours. (4) **Arise from very small doses.**—Idiosyncrasy in some cases renders an individual specially sensitive to the action of mercury; a case, for example, is recorded where salivation was caused by two grains of calomel. In other cases, idiosyncrasy appears to have the opposite effect Children, it may be noted, bear mercury better than adults. (5) **Arise from causes other than administration of mercury.**—Thus it has resulted from the administration of compounds of arsenic, antimony, copper, lead, bismuth, and gold; also from administration of iodine, sulphuric acid, hydrocyanic acid, digitalis, cantharides, colchicum, croton oil, opium, carbolic acid, and nitro-benzene, and may occur idiopathically. In non-mercurial salivation, mercury is, of course, absent from the saliva.

Cancrum oris, a disease liable to affect children, especially those that are cachectic or badly fed, has been mistaken for mercurial salivation. Taylor[1] mentions a case in which a child, having died from cancrum oris, a charge of malpraxis was brought against the medical attendant. It was, however, proved that no mercury had been administered.

Mercurial tremors, or shaking palsy.—This as a rule comes on gradually, affecting first the muscles of the arms, and subsequently those of other parts of the body. The affection begins with unsteadiness and quivering, increasing to tremors, which ultimately become so violent as to resemble convulsions. All voluntary movements requiring the aid of the affected muscles, can only be performed by violent starts. In advanced cases, walking, articulation, and mastication, all become affected. Finally there is loss of memory, sleeplessness, delirium, and death. The skin is dry, and has a brown tint. Salivation may or may not be present.

Mercurial Preparations and Compounds.

1. **Corrosive mercurial salts,** namely, corrosive sublimate and the nitrates of mercury.

(*a*) **Corrosive sublimate, Mercuric chloride, $HgCl_2$.**—*Talachikna sumbul, Darchikna* (*Hind.*). This occurs in heavy crystalline masses, or as white crystalline powder. In the crude form, as obtained in the bazaars, it is an impure mixture with subchloride.

Heated, it melts and sublimes in prismatic crystals. It is freely soluble in alcohol and ether, and is soluble in sixteen parts of cold or three of boiling water, and more soluble in solutions of alkaline chlorides than in pure water.

The ordinary medicinal **dose** is one-sixteenth to one-eighth of a grain, and three to five grains may be regarded as a minimum fatal dose. A case of recovery after swallowing an ounce is on record. The usual **fatal period** is one to five days, but in one case death occurred in half an hour. Corro-

[1] *Poisons* p. 370.

sive sublimate is readily absorbed through the unbroken skin, and acute poisoning, non-corrosive in character, may arise from its absorption. It is contained, to the extent of half a grain per ounce, in the Liquor hydrargyri perchloridi B.P. and I.P.

Case CCXXXVI.—**Corrosive Sublimate—Suicide.**—In a case of suicide by mercurial poisoning, nearly eight grains of corrosive sublimate were found in the visceral and vomited matters. The unfortunate individual suffered such intolerable agonies from the poison that he rushed into the backyard and jumped into a well from which he was rescued and taken to hospital. He was a photographer by profession, and the chemical examination was extended to every substance found in his dark room, besides the examination of various articles of food and drink, before suspicion which rested upon innocent persons was removed.—*Mad. Chem. Ex. Rept.*, 1898.

Case CCXXXVII.—**Corrosive Sublimate in pudenda—Homicide**—*Death*—In 1898, in Madras, a man surreptitiously thrust a piece of corrosive sublimate into the pudenda of his wife to punish her. Intense local inflammation resulted, followed by ulceration and constitutional symptoms, from which the woman died 12 days after. Accused got 10 years' rigorous imprisonment.—*Mad. Chem. Ex. Rept.*, 1898.

(*b*) **Nitrates of mercury,** *viz*, normal mercurous $Hg_2 2NO_3$ and normal mercuric $Hg 2NO_3$. These salts are freely soluble in water containing nitric acid, but pure water is liable to decompose them, with formation of sparingly soluble basic nitrates. Heated, they decompose, giving off red fumes of nitric oxide, and leave a residue of mercuric oxide. Swallowed, they produce symptoms similar to those caused by swallowing corrosive sublimate. A fatal case from external application of nitrate of mercury in a liniment is recorded; also a case of chronic poisoning from its use as a local application to the neck of the uterus; and another case where a workman whose occupation for four years had been packing skins brushed over with solution of nitrate of mercury, died of chronic mercurial poisoning: others, however, similarly employed in the same factory were unaffected.

2. **Other mercuric compounds**—(*a*) **Mercuric cyanide** $Hg(CN)_2$.—This is a white soluble salt which, when heated, gives off an inflammable gas (cyanogen), and yields a sublimate of metallic mercury. Although non-corrosive, it is little less active than corrosive sublimate; ten grains has caused death. A case of acute poisoning (non-fatal) from swallowing the **sulphocyanide** $Hg(SCN)_2$, is recorded. This, more correctly mercuric thiocyanate, is sold in little cylinders as a toy under the name of Pharaoh's serpents, so called from the serpentine form of the copious ash yielded by them when burned.

(*b*) **Subsulphate of mercury,** *Turpeth mineral* $HgSO_4 (HgO)_2$.—This is a yellow powder which, although sparingly soluble in water (1 in 2000 in cold, and 1 in 600 of boiling), has a strong metallic taste. Taylor mentions two fatal cases, in which the quantities swallowed were respectively forty and sixty grains.

(*c*) *White precipitate, Ammoniated mercury*—**Mercurammonium chloride,** NH_2HgCl.—This is prepared by adding solution of ammonia to solution of corrosive sublimate. It is a white powder which when boiled with water, becomes yellow. It is soluble in nitric acid

but insoluble in water, alcohol and ether. According to Taylor, it frequently contains mercuric chloride as an impurity. It is only used medicinally as an external application for the cure of parasitic affections. Swallowed, it has caused severe symptoms in several cases, and at least one death. Chronic poisoning has arisen from its external application. Cases of recovery after swallowing thirty, forty, and one hundred grains, are recorded.

(*d*) **Mercuric oxide,** *Red precipitate.*—This in its usual form is a red powder, slightly soluble in water. Heated strongly, it decomposes, with evolution of oxygen. When prepared by precipitation it is yellow in colour, and in this form is contained in the Lotio hydrargyri flava B.P. Cases of poisoning by it are rare. A fatal case from swallowing an ounce, and a case of recovery after swallowing half an ounce, have been reported.

(*e*) **Mercuric sulphide,** *Cinnabar*, or 'Chinese *Sindur*,'[1] *Vermilion*, *Hingula* (*Mar.*) *Hingul*, *Rasa sindura or Shingarf.*—This is met with either as a dark red crystalline mass, or as a bright red powder. It is only soluble in nitro-muriatic acid, and is entirely volatilised by heat. No acute case of poisoning by it in man has been met with, but cases of chronic poisoning have occurred from its use as a colouring matter for vulcanite plates supporting artificial teeth. A case of chronic poisoning from its over-use as a fumigant is referred to by Taylor.

(*f*) **Mercuric methide.**—In two cases of slow poisoning by inhalation of mercuric methide vapour, in addition to salivation, there was impairment of the special senses, of motor power, and of the cerebral functions generally. In one of the two death took place by coma. In the other the patient became idiotic, and after remaining in this state for a year, died of pneumonia.

3 **Mercurous compounds.**—Insoluble or sparingly soluble mercurous compounds are much less actively irritant than similar mercuric compounds. Mercurous compounds are, however, prone to become converted into mercuric compounds. Some mercurous compounds, *e.g.*, the oxide and iodide, undergo this change spontaneously, or under the influence of light only. Others, *e.g.*, calomel, are more stable, but this even is liable under certain conditions to become converted in the body into mercuric chloride. Of the sparingly soluble or insoluble mercurous compounds, the only one of medico-legal interest is—

Mercurous chloride, Calomel—'*Ras-kafur*' or "mercurial camphor" on account of the vitreous camphor-like appearance of the masses of crude calomel, which is in India largely mixed with perchloride. Calomel occurs as a heavy, white, crystalline mass or amorphous powder, almost tasteless, and insoluble in water, alcohol and ether. It is entirely volatilised by heat, and is blackened by solution of ammonia. The *ras-kafur* of the Indian bazaars contains a considerable but varying quantity of corrosive sublimate. An ordinary medicinal dose of calomel is two to five grains. In large doses it acts as an irritant poison, and in exceptional cases fatal salivation has been caused by ordinary medicinal doses. At the temperature of the body calomel is liable to be converted into corrosive sublimate by solutions of sodium or potas-

[1] This vernacular name *China Sindūr* is because it comes from China as distinguished from the ordinary Sindūr called Matiya Sindūr or 'earthy,' lead oxide.

sium chloride, and specially by solutions of ammonium salts. In at least the following two cases death appears to have resulted from this transformation.

Case CCXXXVIII.—**Mercurial poisoning. Fatal result attributed to the conversion of calomel into corrosive sublimate.**—(*a*) ('Edinburgh *Med. and Surg. Jour.*, vol. liv, 1840, p. 250). A physician prescribed for a child, powders containing in each ½ a grain of calomel, 5 grains of ammonium chloride, and 5 grains of sugar. After taking a few of these powders the child died, with all the symptoms of poisoning by corrosive sublimate. The apothecary who made up the prescription was charged with causing the death of the child, it being supposed that he had by mistake substituted corrosive sublimate for calomel. This led to experiments being instituted, the result of which was to clearly show that calomel, by the action of ammonium chloride solution, is at the temperature of the body, and even at ordinary temperatures, decomposed, with formation of mercuric chloride and metallic mercury. (*b*) *Bo. Chem. Analyser's Rept.* In the year 1860 the following case was referred to Dr. Haines, then Chemical Analyser, Bombay, for opinion. A soldier in hospital at Canton, suffering from fever, was ordered pills, each containing three grains of calomel, two to be taken every two hours, with two spoonfuls of a mixture composed as follows :—Ammon. sesquicarb. ℥ij ; Liq ammon. acet. ℥vj ; Water ℥vj. After two doses symptoms of gastric irritation came on, but two more doses appear to have been taken before the medicine was stopped. After several days' treatment the man died, and after death violent inflammation and ulceration were found in the stomach and pharynx. Experiments made by Dr. Haines with reference to this case showed that, at the temperature of the body, solution of acetate of ammonia decomposes calomel, with formation of mercuric chloride and metallic mercury, the action being more rapid if excess of carbonate of ammonia is also present.

4. **Metallic mercury.**—*Rasa Para*, or liquid metallic mercury, when swallowed even in large quantity (one to two pounds), seldom produces any ill-effect. In exceptional cases, however (*Cases CCXXXIX a* and *b*), symptoms of chronic mercurial poisoning have been produced. A popular belief appears to exist in some parts of India to the effect that liquid mercury, when swallowed, causes injury to health. It was administered with this object in case *b* (see also cases *c* and *d*). Metallic mercury in vapour, or in fine division, readily acts on the system ; hence workmen in mercury mines, barometer makers, mercurial gilders and platers, and others who are constantly exposed to mercury vapour, are liable to suffer from chronic mercurial poisoning, especially from mercurial tremors The action of mercury in fine division is very similar to that of an insoluble mercurous salt, and in fine division it may be absorbed through the unbroken skin, and cause chronic poisoning Mercury in fine division forms one-third by weight of Pilula hydrargyri B.P. and I.P. (blue pill), and Hydrargyrum cum creta B.P. and I.P The finely divided mercury contained in the latter preparation, is, in hot climates, liable to undergo conversion into mercuric oxide, the preparation as a consequence becoming poisonous.

Case CCXXXIX.—**Mercurial poisoning. Metallic mercury swallowed.**—(*a*) (Taylor, *Poisons*, p. 360). For the purpose of causing abortion, a girl swallowed 4½ ounces by weight of mercury. It had no effect on the uterus, but in a few days she suffered from a trembling and

shaking of the body (mercurial tremors) and loss of muscular power. These symptoms continued for two months, but there was no salivation, and no blue mark on the gums.—(*b*) (*Bengal Med. Legal Rep.*, 1869). The following case was referred to Dr. Bateson, Civil Surgeon, Umballa. An individual was charged with attempting to poison a woman by administering to her liquid mercury in food. The woman is said to have vomited twice after taking the mercurialised food, and to have had "a red swelling of the gums, with bleeding on pressure of the finger," attributed by the sub-assistant surgeon who saw the case to the action of mercury. At the first inquiry the charge broke down, owing to the sub-assistant surgeon stating that mercury (liquid metallic) was not a poison. A conviction, however, was subsequently obtained, apparently under *s.* 328 of the *Penal Code* (see p 111). Remarking on this case, Dr. Bateson says: "It seems it is customary, any way about here, to administer mercury in some thickish food to spite an enemy, to thwart an intrigue, or to punish accessories to one. The present case belonged to the last kind"—(*c* and *d*) (*Bo. Chem. Analyser's Rept.*, 1874-75). In two cases during this year metallic mercury was found in articles of food; in one 29 grains of mercury was extracted from a small quantity of sweetmeat, and in another three grains was extracted from some food.

It may be remarked that in above case *b* the question arose, Is liquid mercury a poison? On this point, Taylor[1] says: "Although liquid mercury is not in itself poisonous, it is liable to be converted into poisonous compounds in the body." Cases *CCXXXIX a* and *b*, however, show that liquid mercury sometimes acts as a poison.

Detection of Mercury.

Elimination of absorbed mercury takes place mainly by the urine and saliva, and may be rapid or slow. The first is most likely to occur in cases of acute poisoning by a soluble mercurial selt, such as corrosive sublimate. Mercury was found to be completely absent from the viscera in a fatal case of poisoning by corrosive sublimate lasting only four days; and Taylor agrees with Orfila in considering that, if in acute poisoning by corrosive sublimate the individual survives fifteen days, it is probable that no mercury will be found in the body. Hence death may occur from mercurial poisoning, and analysis fail to detect the presence of mercury. On the other hand, elimination of mercury occurs in some cases very slowly, and mercurial preparations are often used in the treatment of disease. Hence the discovery of mercury in small quantity in the viscera of a deceased individual, is quite consistent with the supposition of death from causes other than mercurial poisoning.

Solid mercurial compounds are most readily identified by reduction. The compound is mixed with powdered sodic carbonate, or powdered sodic carbonate and powdered charcoal, introduced into a

[1] *Poisons*, p. 360.

test-tube and heated, when globules of metallic mercury sublime. In solution—

Mercuric salts[1] give (1) a yellow precipitate with potassic hydrate; (2) a white precipitate with solution of ammonia; (3) a scarlet precipitate with potassium iodide soluble in excess; (4) no precipitate with hydrochloric acid; (5) a white precipitate, subsequently becoming grey or black, with stannous chloride; and (6) with sulphuretted hydrogen a precipitate at first white, subsequently orange, and lastly black.

Mercurous salts give (1) a black precipitate, with potassic hydrate, or solution of ammonia; (2) a white precipitate with hydrochloric acid or chlorides, blackened by ammonia; (3) a black precipitate with sulphuretted hydrogen; (4) with potassium iodide solution, a green precipitate, soon changing to grey if excess be added.

In organic mixtures mercury may be detected by **Reinsch's process.**—On heating the coated copper, a sublimate of globules of metallic mercury is obtained. Or the matters having been boiled with dilute hydrochloric acid (1 to 4), the solution may be treated by the **galvanic deposition process,** as for antimony, using gold foil in place of platinum foil. The coated foil is then heated in a tube as in Reinsch's process (p. 461.)

Quantitative estimation of mercury may be effected by precipitating it as **sulphide.** Corrosive sublimate present in sufficient quantity in organic mixtures, may be separated therefrom by exhaustion with ether.

ZINC.

Poisoning by this metal is rare in India and usually accidental, from swallowing either the sulphate or the chloride. Of these the first is a non-corrosive, and the second a corrosive irritant. Besides their local action, zinc compounds, when absorbed, exert a remote specific action on the nervous system, causing great prostration of strength, collapse, convulsions, and, in some cases, impairment of special sensation, *e.g.*, of smell, sight, and taste.

Zinc sulphate, White vitriol, $ZnSO_4$—*Safed tutiya.*[2]—This is a white crystalline, freely soluble salt, the crystals of which closely resemble in appearance those of magnesium sulphate.[3] In a few instances zinc sulphate has been used criminally, but, as a rule, cases of poisoning by it are accidental, and arise from its being mistaken for magnesium sulphate. When swallowed, it rapidly causes free vomiting, leading to complete, or almost complete, ejection of the poison; hence fatal cases are rare. **Symptoms.**—The usual symptoms of non-corrosive irritant poisoning, with cramps, convulsions, and great prostration of strength. **Post-mortem appearances.**—Those of irritant poisoning. **Dose.**—The least quantity likely to prove fatal cannot be stated with certainty. Half an ounce has caused death, but a dose of two ounces has been recovered from. As an emetic, zinc sulphate is given, in doses of ten to thirty grains, but it should be borne

[1] If the salt under examination is mercuric cyanide, it should be decomposed by HCl before other reagents are added.

[2] *i.e.*, White metallic salt.

[3] And also those of oxalic acid.

in mind that zinc sulphate is a poison. Hence if, as is sometimes the case in narcotic poisoning, vomiting is not produced, repeated doses are to be avoided. **Acetate of zinc** appears to act similarly to the sulphate, and may be used instead of it as an emetic.

Zinc chloride, $ZnCl_2$.—This is a white, very soluble, and very deliquescent salt, easily fusible, and in the solid condition often met with in cylindrical sticks. A strong solution of it—over 200 grains per ounce—is sold as a disinfectant, under the name of Sir William Burnett's disinfecting fluid. Cases of poisoning by zinc chloride are usually accidental, and most commonly arise from swallowing Burnett's fluid. A case, however, is recorded where death resulted from the application, by a quack, of zinc chloride as a caustic to a cancerous breast. **Symptoms.**—When swallowed in concentrated solution, as is usually the case, the symptoms are those of corrosive poisoning, followed, unless death occurs rapidly, by nervous symptoms, *e.g.*, muscular weakness, tetanic convulsions, impairment of sight, &c. **Post-mortem appearances.**—The lining membrane of the mouth and throat may be found bleached and white, or abraded and inflamed. The gastric mucous membrane has been found gray and corrugated, or inflamed, and in places destroyed ; in one case the stomach was found perforated in two places. Where life has been prolonged, contractions of the gullet and stomach have been found. **Dose.**—Severe symptoms have been produced by twelve grains of the chloride. Half an ounce of Burnett's fluid has caused death, but recovery has taken place from doses of one to one and a half ounces.

Treatment of Zinc Poisoning.—The usual treatment for corrosive or non-corrosive irritant poisoning, according to the case. Carbonate of soda should be given as an antidote. Albuminous fluids may also be administered.

Detection.—Solutions of zinc salts (1) acidulated with HCl, give no precipitate with sulphuretted hydrogen ; (2) give a white precipitate with ammonium sulphide ; (3) give a white precipitate with ammonia solution, soluble in excess ; (4) give a white precipitate with potassic hydrate solution, soluble in excess, and forming a solution from which sulphuretted hydrogen throws down a white precipitate ; (5) if a solution of a zinc salt be precipitated with sodic carbonate, the solution boiled, and the precipitate collected and ignited with a little cobalt nitrate solution in a platinum dish, the residue in the dish becomes bright green. **From organic mixture,** zinc may be separated by burning away the organic matter. The ash may be dissolved in dilute acid, zinc obtained from the solution as sulphide, the sulphide dissolved in a little nitric acid, and the solution treated as in (5) above.

COPPER.

In India attempts at homicide, by the administration of the sulphate of copper in food or sweetmeat, are not uncommon, but the strong disagreeable metallic taste of this and other soluble copper salts, prevents their being used homicidally to any great extent. Acute—usually mild—accidental cases, from the contamination of food by copper cooking vessels (subacetate or *verdigris*) are also tolerably frequent in India. Suicidal cases (see *Case CCXL*) and cases where the poison has

been taken with intent to cause abortion, and homicidal cases (*see* below) are occasionally met with; and a fatal accidental case in a child, from sucking pieces of the sulphate, has been reported.

Case CCXL.—**Sulphate of copper poisoning — suicide.**—A Eurasian lady in Calcutta in 1897, took a large quantity of sulphate of copper and died from the effects thereof. The mucous membrane of the stomach and upper intestines was stained blue. About 58·6 grains of sulphate of copper were recovered from the stomach alone. Copper sulphate is rarely used as a poison, either for homicidal or suicidal purposes, on account of the large dose which is necessary, its disagreeable taste, the great pain which it causes, and its uncertain results.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case CCXLI.—**Sulphate of copper—homicidal poisoning.**—In 1880 a whole family were poisoned (not fatally) by a discharged khitmatgar introducing blue vitriol into the food. Sulphate of copper was detected in the remains of food.—Dr. Warden, *Beng. Chem. Rept.* for 1880.

Symptoms.—A strong metallic taste in the mouth, followed by violent vomiting, and the usual symptoms of non-corrosive irritant poisoning. The vomited matters are usually bluish or greenish, becoming deep blue on addition of ammonia (coloration due to bile is unaffected by ammonia). In severe cases these irritant symptoms may be followed by convulsions, paralysis, and insensibility. In severe cases, also, suppression of urine is common; and jaundice, not present in arsenical or mercurial poisoning, is a tolerably constant symptom.

Fatal cases are rare.—One ounce of the sulphate has caused, and probably less might cause, death, but doses of more than an ounce have been recovered from. Death has occurred (in the case of the child mentioned above) in four hours. In adult cases the fatal period is usually about three days.

Post-mortem appearances.—Those usual in non-corrosive irritant poisoning, plus a yellow tinge of the body, and a blue or green colour, deepened by ammonia, of the contents of the stomach and intestines. Perforation of the intestines has been observed.

Treatment.—The usual treatment for non-corrosive irritant poisoning, with the administration, as an antidote, of albumen or albuminous fluids.

Chronic Copper poisoning.—This has been met with, but is not common, among workers in metallic copper and its salts. It is also reported to have arisen from the use of plates as supports for artificial teeth, made of gold largely alloyed with copper. More frequently chronic copper poisoning has been traced or attributed to the contami-

nation of articles of food with copper. The presence of copper, however, in articles of food habitually consumed, provided the quantity present be minute only, does not seem to give rise commonly to chronic poisoning. **Symptoms.**—At first lassitude, giddiness and headache, loss of appetite, and a constant metallic taste in the mouth. Afterwards, great muscular debility, a constant desire to vomit, and diarrhœa, with colicky pains. A purple or green line may be present on the gums, and in some cases the hair is said to have acquired a greenish tint. Acute colic, with constipation and local paralysis (symptoms of chronic lead poisoning), are absent in chronic copper poisoning. **Treatment.**—General, as indicated by the symptoms, and immediate removal from the toxic influence.

Contamination of articles of Food with copper.—Copper salts have been used to colour pickles, preserved fruits and vegetables, and confectionery. Sulphate of copper also has been added to bread, in order, it is said, to promote the fermentation of the dough, and make the bread whiter. Articles of food are very liable to become accidentally contaminated when prepared or kept in copper vessels. On metallic copper (1) pure water has no action if the copper be clean and air is excluded, but if the water is boiled in contact with the copper, and air be present, solution takes place ; (2) the solvent action of water on copper is increased when saline matters, especially ammonium salts and chlorides, are present in solution therein ; (3) acid and fatty food materials, boiled and allowed to cool, even in perfectly clean copper vessels, take up copper, but acid food materials, boiled in clean copper vessels and poured out at once, do not dissolve the metal ; (4) in all cases the liability to contamination is greater if the copper vessel used is dirty. Copper cooking vessels are frequently tinned inside for protection ; the tin used should be free from lead, otherwise chronic lead poisoning may result.

Metallic Copper, except in very fine division, may be regarded as inert. Cases of chronic poisoning among coppersmiths, from constantly handling metallic copper, have been reported in England ; and also cases among workmen using, as in certain printing processes, copper in a state of very fine division.

Sulphate of Copper, *Blue vitriol*, *Mora tut* or *Nila tutia*, readily obtainable in India, occurs in blue efflorescent crystals, which, when heated, lose water and fall into a colourless powder. The salt is very soluble in water, its solution responding to the tests for copper and combined sulphuric acid. Medicinally it is given internally in one-quarter to two-grain doses as an astringent, and in five to ten-grain doses as an emetic. For fatal dose and criminal use in human poisoning in India *see* previous page. A few cases of its use in India, as a cattle-poison, have been met with.

Subacetate of Copper, *Artificial verdigiris—Zangal* or *Pitra*. Several subacetates of copper exist, all compounds of normal cupric acetate and cupric oxide. They are blue or green in colour, partly soluble in water ; are used as pigments, and appear to be as poisonous as the sulphate. Half an ounce of the subacetate has proved fatal to an adult. Food contaminated with copper, derived from vessels in which it has been prepared or kept, commonly contains copper either as subacetate or as carbonate (natural verdigris). The subacetate, prepared by boiling or steeping metallic copper in an acetous organic fluid, is a common popular emetic remedy in India in cases of poisoning.

Other Copper Salts.—Green verditer and blue verditer, both oxy-carbonates, and Brunswick green, an oxychloride of copper, all used as pigments, are poisonous. So also are the arsenite and aceto-arsenite (*see* p. 453). The symptoms produced by these last two compounds, however, are those of arsenical poisoning.

Detection.—Copper in minute quantity is nearly always present in the human liver and kidneys, and in the liver and kidneys of domestic animals. Traces of copper have been detected also in wheat and barley, and in a large number of vegetables. Articles of food, again, frequently contain copper in minute quantity as an accidental impurity.[1] Hence the detection of copper in minute quantity in human viscera, is quite consistent with death from a cause other than copper poisoning. **Solution containing copper** give (1) a dark brown, almost black precipitate, with sulphuretted hydrogen; (2) a blue precipitate with ammonia, dissolving in excess, with formation of a deep blue or purple solution; (3) a blue precipitate, with potassic hydrate, insoluble in excess; (4) a chocolate brown precipitate with potassium ferrocyanide; and (5) when slightly acidulated with sulphuric acid, deposit metallic copper on a clean iron wire. **Organic matters containing copper** may be incinerated, the ash treated with nitric acid, again incinerated, and the residue dissolved in dilute hydrochloric acid; the solution is then filtered and tested for copper as above. Or for quantitative estimation, the solution may be poured into a weighed platinum dish, a piece of metallic zinc added: this dissolves, the copper deposits on the dish as metallic copper, and after washing and drying, may be weighed in this form.

LEAD.

Lead poisoning may be acute or chronic. In acute cases the symptoms are those of non-corrosive irritant poisoning, except that there is constipation, not diarrhœa. In chronic cases, much more frequently met with than acute cases, the characteristic symptoms are colic and local paralysis, met with accidentally in painters, typesetters and men in charge of storage batteries.

Acute Lead Poisoning: Symptoms.—When a soluble compound, *e.g.*, the acetate, is swallowed, a burning pain in the mouth and throat comes on soon after swallowing the poison, followed by vomiting, and afterwards by colic with constipation. The fæces, if any be passed, are black. Cramps of the flexors follow, and there may be paralysis of the extensors and a blue line on the gums as in chronic poisoning. Giddiness, stupor, and even coma have been observed. Sparingly soluble compounds cause similar effects, except that the first symptoms do not appear until some hours after swallowing the poison. Fatal cases are rare. **Post-mortem appearances.**—More or less redness of the mucous membrane of the alimentary canal may be found, but this is not always present. **Treatment.**—Promote vomiting or use the stomach-pump, and then give sulphate of magnesia as an antidote. Subsequently opium may be required to relieve pain, and purgatives to overcome constipation.

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[1] Traces of copper are frequently present in native liquor. I found traces of copper in about 80 per cent. of a large number of samples, purchased in different districts of the Bombay Presidency.—I. B. L.

Chronic Lead Poisoning.—May arise from swallowing, inhaling, or external application, of lead or its compounds Hence it is met with in those whose occupation exposes them to constant contact with lead or lead compounds ; and is also met with as the result of wilful or accidental contamination of articles of human consumption or use, with compounds of lead. In chronic lead poisoning, lead colic, or lead palsy, one or both, may be present.

Lead colic, painter's colic, or **colica pictonum.**—In this the prominent symptoms are :—At first indigestion, constipation and feeling of depression, with loss of appetite, thirst, a metallic taste in the mouth, and fœtor of the breath. Afterwards there is pain about the umbilicus, usually relieved by pressure, hard obstinate constipation, and quick shallow respiration. The urine is scanty, there is a blue line on the gums, and sometimes delirium at night. Vomiting is a common symptom, but febrile disturbance is rare.

Lead palsy.—This may be the first to appear, or it may follow after one or more attacks of lead colic. It usually commences in the extensor muscles of the hand and forearm, causing **wrist-drop.** Afterwards the muscles of the lower extremities may become affected, and even the muscles of the trunk. As in lead colic, there is a blue line on the gums.

Blue line on the gums is believed to be due to a deposition of lead sulphide in the capillaries, and is rarely absent in chronic lead poisoning. A similar line has, however, been observed in chronic poisoning by other metals, *e.g.*, mercury and silver.

Other effects of lead on the system are (1) it checks the elimination of uric acid, predisposing, therefore, to gout ; (2) insanity in some cases, it is believed, is traceable to chronic lead poisoning ; (3) in pregnant females lead poisoning predisposes to miscarriage, and it (4) may cause albuminuria.

Chief occupations exposing to risk of lead poisoning are,—lead miners, smelters, and refiners ; plumbers, pipe layers, printers, and type founders. Lapidaries, barmen, and fishmongers also suffer ; the first from handling masses of lead in which precious stones are embedded while being cut ; the second from constantly handling pewter pots, and the third from contact with wet, lead-covered surfaces, on which fish are commonly exposed for sale. Again, cupellers, makers of white and red lead and other lead compounds, painters and dyers and others using lead pigments, flint glass makers, and potters using lead glaze, are all liable.

Chronic Lead Poisoning in non-workers in lead is most frequently due to accidental contamination of drinking-water with lead. It may, however, arise from accidental contamination or wilful adulteration of matters other than drinking-water.

Contamination of drinking-water.—Pure water has no action on lead if air be excluded ; but if air be present, lead hydroxide, slightly soluble in water, is formed. This, by the action of carbon dioxide, becomes converted into a basic carbonate of lead, insoluble in water, but soluble in solution of carbonic acid. The solvent action of water on lead is favoured by the presence of ammonium salts, especially ammonium nitrate. On the other hand, sulphates, phosphates, and carbonates retard or prevent the action. Hence drinking-waters, free, or nearly

free, from ordinary saline impurities, are especially liable to contamination from lead pipes, lead-lined cisterns, &c.

Accidental contamination of other matters—This may arise from the article having been made, or from its being preserved, in vessels made of or soldered with lead, or in earthenware vessels glazed with lead glaze, or other vessels painted inside with a lead paint. Sometimes the contamination is mechanical in character, assisted, perhaps, by oxidation of the lead : *e.g.*, chronic lead poisoning has arisen from the use of flour, ground with stones filled in with lead ; and from the use of farinaceous foods, or snuff, or tobacco, wrapped in lead foil. In other cases, the contamination arises from a solvent action exerted by the article, such action being specially liable to be exerted by (1) fatty and saccharine matters, and (2) acid matters (except those acid from the presence of sulphuric acid). Thus, milk kept in lead or lead-glazed pans, sugar made in lead vessels, and soup kept in lead-soldered tins, are all liable to contamination Again, chronic lead poisoning has arisen from drinking cider and beer conveyed in lead pipes ; from drinking wine contained in bottles in which shot, used for cleaning them, have been carelessly left ; from eating pickles contained in lead-capped jars ; and from drinking new rum, contaminated with lead from the lead worm of the distilling apparatus. Old rum, however, is generally free from lead, owing to its precipitation as an insoluble compound, by tannic acid contained in the wood of the casks in which the rum is kept.

Wilful adulteration, &c.—Acetate of lead has been added to cheap wine in order to sweeten it. Red lead and chromate of lead have been used to adulterate snuff, and to colour articles of confectionery. Chronic lead poisoning has arisen from the use of hair dyes, cosmetics, and lotions, containing lead ; and from the external application of white lead as a dressing to a scalded surface.

Chronic Lead Poisoning is occasionally met with in India as the result of the contamination of drinking-water, and also as the result of the administration of oxide of lead in quack medicines.

Treatment and prophylaxis.—In chronic lead poisoning the first indication of treatment is immediate removal from the toxic influence. In the case of non-workers in lead, the discovery of the toxic influence is frequently a matter of difficulty, necessitating the analysis of all matters habitually used by the patient. Colic may be treated by a combination of purgatives and anodynes : *e.g.*, Epsom salts and senna followed by opiates. In both lead colic and lead palsy either soluble sulphates or iodide of potassium may be given, or the two may be combined, each dose of iodide of potassium being followed after an interval of two hours by a small dose of sulphate of magnesia. Workers in lead should be recommended extreme cleanliness, the least possible contact, and the use as a drink of very dilute sulphuric acid. Every precaution also should be taken to remove or keep down lead dust in the workrooms. The following processes have been recommended for the protection of drinking-water conveyed in lead pipes : (1) Lining the pipes with tin, and (2) keeping the pipes filled for some time with water containing sulphates, or with a solution of an alkaline sulphide. Where, however, a water is liable to contamination, the use of lead pipes, lead-lined cisterns, &c., should be entirely avoided.

Metallic lead is generally regarded as powerless to cause acute poisoning. A case, however, is reported of semi-acute lead poisoning

from swallowing small shot, and another (p. 487) where death resulted from accidentally swallowing a quantity of melted lead, the lead in this case acting as a mechanical irritant. Chronic cases due to the action of metallic lead are often met with.

Soluble Lead salts—(1) *Acetate of lead, Sugar of lead.*—This is a white crystalline salt, very soluble in water, sparingly soluble in alcohol, and insoluble in ether; heated, it chars, yielding no sublimate. It is not very poisonous, and has been given in divided doses to the extent of eighteen grains, or even more, daily for a week or ten days without ill effect. The same quantity in minute doses spread over a longer period would be far more likely to cause serious symptoms. One ounce has often caused acute poisoning. Fatal cases are rare.

(2) **Subacetate,** *Goulard's extract* is generally met with in strong solution, formed by digesting strong solution of the normal acetate with PbO. The solution is frequently milky, owing to the action of atmospheric carbon dioxide. Its action is similar to that of the acetate.

(3) **Nitrate of Lead,** a white crystalline salt, very soluble in water, but insoluble in alcohol, is probably as poisonous as the acetate.

Sparingly soluble or insoluble lead compounds (1) **Monoxide of lead,** *Litharge, Massicot.—Murdasang,* yellow or reddish yellow in colour, is slightly soluble in water. Two tablespoonfuls of it have been swallowed without ill effects. Chevers, however, mentions two cases of chronic poisoning, arising from its use by quacks in India, as a cure for syphilis. In one, serious symptoms came on after swallowing twenty-five grains daily (mixed with white sugar) for five days. In the other, two *sowars* (troopers) suffered from lead colic, after swallowing on each of three successive days, one hundred and twenty grains of litharge mixed with sixty grains of "*bans lochan*" (tabashir). In Europe, litharge has often given rise to chronic poisoning, frequently indirectly, from the solvent action of acetic, fatty, or other acids upon it.

(2) **Red lead,** *Minium*—**Sindura.**—The toxic action of this is similar to that of litharge. Taylor mentions a case where a woman recovered after swallowing 2½ ounces. In this case no symptoms appeared for nine hours. Red lead (in the Bombay Presidency, and possibly in other parts of India also) often forms an ingredient of the paste used for arming abortion-sticks (*see* p. 297). In a case recently tried in Bombay, a woman, a professed abortionist, convicted of causing miscarriage, was found to have in her possession a number of sticks so armed. Red lead, alone or mixed with arsenious oxide, is sometimes in India employed as a cattle-poison (see *Appendix XI*).

(3) **White lead** or *carbonate of lead,* $PbCO_3$, containing a variable quantity of lead hydroxide; is insoluble in water, but soluble in dilute acids. One fatal case of acute poisoning by it in a child æt. five, is mentioned by Taylor. In this case, although no urgent symptoms were present for three days, the child died in ninety hours.

(4) **Chloride of lead, $PbCl_2$,** slightly soluble in cold, more soluble in boiling water; has in one case—non-fatal—caused acute poisoning. An oxychloride is also met with, used as a paint, under the name of Turner's yellow.

(5) **Chromate of lead, $PbCrO_4$,** a yellow insoluble salt, used as a paint under the name of chrome yellow; has, in one or two instances—owing to its having been used to colour confectionery—caused fatal acute poisoning. As already mentioned it is used to colour the sweetmeats known as "*til-gul.*"

(6) **Sulphate of lead, $PbSO_4$,** a white insoluble salt; is said to be inert. But Woodman and Tidy remark that this is doubtful, as "cases are recorded of sempstresses being poisoned by sucking thread mixed with sulphate of lead, for the purpose of increasing its weight."

(7) **Sulphide of lead,** *Galena*, **PbS.**—This, like sulphide of antimony, is sold in India under the name of *Surma*, for use as a collyrium. Owing to its insolubility, it is probably, either inert, or only very slightly active. No case of poisoning by it appears to have been recorded.

Detection.—Lead-salts in solution give (1) (except the solution be very weak), with hydrochloric acid, a white precipitate not dissolved or blackened by ammonia, but soluble in boiling water; (2) with sulphuretted hydrogen in slightly acidulated solutions, or with ammonium sulphide in neutral or alkaline solution, a black precipitate; (3) with potassic hydrate, a white precipitate soluble in excess; (4) with potassium iodide, a yellow precipitate, soluble in boiling water, and crystallising out on cooling in minute silky crystals; and (5) a yellow precipitate with potassium chromate. Insoluble lead compounds (the sulphide and sulphate excepted) are readily dissolved by nitric acid. The sulphide is only partly dissolved by boiling with nitric acid, the remainder being converted into sulphate. The sulphate may be identified by boiling it with carbonate of ammonia solution: this converts it into carbonate, which, after separation and washing, may be dissolved in acetic acid, and the solution tested for lead. **From organic mixture** lead may be recovered by incineration; the ash, if treated with sulphuric acid, and again incinerated, yields sulphate of lead, which may be decomposed and brought into solution as above.

OTHER METALS.

Tin.—The only compounds of this metal of medico-legal interest are stannous chloride, $Sn\,Cl_2$, and stannic chloride. Solid crystalline hydrates of these salts may be met with, but more commonly the salts are met with in strong acid solution. They are used as mordants in dyeing and are active irritants. Cases of poisoning by them are rare. Solution of carbonate of ammonia and albumen, are indicated as antedotes.

Bismuth.—Two cases of poisoning by the subnitrate of bismuth are on record. In one an adult died in nine days from 3ii; in the other recovery took place from a dose of 3vi. In both cases the symptoms were irritant. In the fatal case, suppression of urine, salivation, and delirium were present, and well marked post-mortem appearances of irritation were found. Subnitrate of bismuth, Taylor remarks, frequently contains arsenic acid (see also footnote, p. 460).

Silver.—The only salt of this metal of toxicological importance is the nitrate. This is a powerful corrosive irritant, and has in two or three cases caused death. Accidental poisoning by this salt sometimes arises from a portion of a stick slipping down the throat while being used as a caustic. Common salt is the best antidote. In chronic poisoning by silver, a blue line appears on the gums, and the whole surface of the body in time assumes a greyish blue or black colour. (For Cyanide of Silver, see *Cyanides*).

Chromium.—Chromic acid is a powerful corrosive. Cases of chromium poisoning in man have been almost entirely due to the bichromate, red chromate, or dichromate of potassium. This salt is a corrosive irritant, not, however so corrosive as chromic acid, and in addition has a remote specific effect on the nervous system, causing cramps, dilated pupils, and insensibility. Two drachms has caused death in four hours; and in another case a man, while drawing off a solution of the salt with a syphon, accidentally swallowed a small quantity, and died in five hours. Workmen engaged in the manufacture of potassium dichromate in the manufacture of Swedish safety matches, are liable to suffer from chronic poisoning. The prominent symptoms of this are a bitter taste in the mouth, increased flow of saliva, and violent catarrh, terminating in ulceration and destruction of the nasal septum. Eruptions on the skin, followed by deep and intractable ulcers, are also present. These symptoms are not observed in workmen engaged in making the neutral or yellow chromate, K_2CrO_4. This, however, when swallowed appears to act similarly to the dichromate, except that it is non corrosive. Probably other soluble dichromates and chromates act similarly to the potassium salts. The antidote indicated in the treatment of acute poisoning, is magnesia or its carbonate.

Iron.—The only two compounds of this metal of medico-legal interest are ferrous sulphate and ferric chloride. Both are irritants, and have been administered in Europe for the purpose of causing abortion. Ferrous sulphate, green vitriol, *hira kasis* or *hira tutiya*, *bala dokta*, $FeSO_4$, has in a few cases been used homicidally. It is not a very active poison. One ounce has been recovered from, but severe symptoms were present. Ferric chloric, Fe_2Cl_6, is generally met with in the form of the pharmacopœial tincture, which contains per 100 volumes, 5 parts by weight of iron, equal to about 14½ parts by weight of Fe_2Cl_6. Large doses of the tincture—as much as three ounces—have been recovered from, but smaller doses have caused severe symptoms, and in one case death was caused in five weeks by an ounce and a half.

Barium.—The soluble salts of this metal, and the carbonate (insoluble in water, but soluble in the acids of the stomach) are active non-corrosive compound irritants. When swallowed they cause the usual symptoms of irritant poisoning, with giddiness, cramps, and convulsions. In some cases paralysis and dilated pupils have observed. Cases have been reported of poisoning by the chloride, nitrate, acetate, and carbonate; this last occurs native as the mineral *witherite*, and is used as a rat poison. The smallest doses reported to have destroyed life are sixty grains of the carbonate, and a hundred grains of the chloride, but half a teacupful of the carbonate has been recovered from, and the chloride has been administered medicinally in gradually increasing doses, until the quantity daily administered, in divided doses, has reached forty-eight grains or more, without ill-effects being produced. The proper antidotal remedy in barium poisoning is a soluble sulphate.

Gold.—Auric chloride, $Au\,Cl_3$, is a powerful corrosive poison, but no case of poisoning by it in man is on record. A fatal case from six grains of the fulminate, in which, in addition to irritant-symptoms, convulsions and salivation were present, has been reported.

Osmium.—The tetroxide of this metal, OsO_4, commonly called osmic acid, a very volatile solid, is an active irritant poison, almost as active as arsenious oxide. A few cases of accidental slow poisoning by this substance, one of them fatal, have been reported.

Cadmium.—One fatal case of poisoning by the chloride of this metal in a boy æt. fourteen is reported.[1] The quantity swallowed appears to have been about 250 grains. Death took place in an hour and a half. The symptoms were very similar to those caused by chloride of zinc.

Experiments on animals have shown that compounds of the following metáls also are poisonous:—Strontium, cobalt, nickel, uranium, thallium

[1] *Ind. Med. Gaz.*, 1866, p. 156.

platinum, palladium, iridium, and rhodium. Compounds of manganese, and of molybdenum, appear also to be feebly poisonous.

ALKALINE AND EARTHY SALTS.

Certain alkaline and earthy salts, poisonous only in large doses, may conveniently be considered under this head. Cases of poisoning have been reported from large doses of the following :—

Sodium chloride, Common salt.—This, in large doses, acts as an irritant poison. Half-a-pound has caused death with symptoms of irritant-poisoning, followed by paralysis.

Potassium nitrate, *Nitre, Saltpetre, Sal prunelle, Sorakhara,* in doses of an ounce or more, has, in several instances, caused death. In one case, however, recovery took place after swallowing six ounces. When swallowed in poisonous doses, besides acting as an irritant, it acts remotely on the nervous system, causing great prostration of strength, and, in some cases, convulsions and partial paralysis. Suppression of urine also has been observed. In some of the fatal cases, death has occurred rapidly, *e.g.*, in two hours and in three hours.

Potassium chlorate, in large doses acts as a poison, giving rise, in children, to irritant symptoms with lividity of the surface and collapse ; and, in adults, to nephritis. One ounce may be regarded as a fatal dose for an adult, and two drachms has caused death in children.

Acid potassium sulphate, *Bisulphate of potash, Sal polychrest, Sal de duobus,* in large doses, acts as an irritant poison ; ten drachms has caused death in two hours. The salt, in some countries, is popularly believed to possess the power of causing abortion, and fatal cases have arisen from its employment with this object. It is liable to contain as impurities sulphate of zinc and arseniate of potash.

Potassium bitartrate (see *Tartaric Acid*, p. 432).

Common or potash alum, *Phatki.*—This also, in large doses, acts as an irritant poison, and has, in one or two cases, caused death. Burnt alum, or alum deprived by heat of its water of crystallization, has a slight caustic action.

Sulphate of magnesia, *Epsom Salts,* Christison mentions a remarkable case of poisoning by this salt. A boy, aged ten, was given by his father two ounces of Epsom salts in a teacupful of water as a laxative. The boy died of collapse within an hour ; there was no vomiting or purging. Another point of medico-legal interest attaching to this salt, is the close resemblance its crystals bear to those of oxalic acid and sulphate of zinc.

MECHANICAL IRRITANTS.

Under this head may be classed all substances which are liable, when swallowed, to cause symptoms of irritant-poisoning, solely in consequence of their mechanical action on the parts with which they come in contact.

Many definitions of the term "a poison" exclude such substances. As already pointed out, however, the question whether or no such

substances may properly be called poisons, is for medico-legal purposes in India a matter of little importance. In India, in fact, when it is alleged that an individual has committed an offence, by administering or attempting to administer one of these substances, *e.g.*, pounded glass; the questions which a medical expert has to consider are: (1) What has been the effect of the administration of the substance? and (2) Is the substance one which it is "deleterious to the human body to swallow,"[1] or an "unwholesome thing?"[2] and not, Is the substance "a poison"?

Substances which, when swallowed, may act as mechanical irritants, are: (1) Hard, sharp angular or pointed solid matters, *e.g.*, pounded glass, pins, and needles (see also *Arums*, (2) Substances which swell largely by imbibition of water, *e.g.*, sponge; and (3) Liquids at a high temperature, *e.g.*, boiling water or melted lead. Of these, the following require special notice:—

Pounded Glass.—This, in many parts of India, is popularly believed to be a very active poison, and has been used both in attempts at suicide and in attempts at homicide. The Bombay Analyser's records for the ten years ending 1884 show that, during that period, this substance only was detected in thirty-one cases of alleged attempted human poisoning. In twenty-three of these it was detected in bread, sweetmeat, or some other article of food; in three more in vomited matters, two of these being cases of attempted suicide by females; in one case it was found after death in the contents of the stomach of a man (*Case CCXLIII e*); in another in some pills; and in the three remaining cases pounded glass, *per se*, was sent for identification. In nearly all these cases, the glass found was coloured glass, resembling fragments of bangles; and in two only it was reported that the individuals suspected of having used the glass with criminal intent were males. Five cases,[3] all from the Central Provinces, of alleged attempted homicide by pounded glass all being alleged attempts by wives to poison their husbands; and Chevers[4] mentions a case brought to the notice of the Chemical Examiner, Bengal, in which a servant attempted to poison his master by pounded glass introduced into a mess of spinach, and also a Bombay case, in which a man seized in the act of committing a robbery, attempted suicide by swallowing fragments of a wine bottle.

The more finely the glass is pounded, the more likely are the particles to become completely enveloped in mucus, &c., and to be thus prevented from injuring the mucous membranes. Hence, as the ill-consequences arising from swallowing pounded glass, are solely due to

[1] *Ind. P. C.*, ss. 321, 326.
[2] *Ib.*, s. 328.
[3] *Beng. Medico-legal Rep.*, 1870—72, p. 292.
[4] *Med. Jur.*, p. 287.

the mechanical injury it inflicts, the more finely it is pounded, the less likely is swallowing it to cause harm. Considerable quantities of pounded glass, in large angular fragments even, have often been swallowed without ill effects being produced. On the other hand, cases are recorded where swallowing pounded glass has caused symptoms of irritant poisoning (see *Cases CCXLIII a* and *b*), and there is reason to suppose that, in exceptional cases, swallowing pounded glass may even cause death (see *Cases CCXLIV a*, *b*, and *c*). In Europe and America it is also employed for homicidal and suicidal purposes. By experiment Le Sauvage[1] found that 2½ drachms of pounded glass given to a cat without injury and a dog took 6 ounces in 8 days without any obvious symptoms, and Le Sauvage himself swallowed a considerable number of the particles without inconvenience following.

Case CCXLII.—**Homicidal Poisoning by Pounded Glass.**—In 1897 two cases of attempted poisoning with pounded glass occurred in Bombay during the year, namely, at the Central Jail, Yerrowda, where pounded glass was detected in a powder given to a warder in the Jail who was too zealous in detecting tobacco amongst the convicts, and in a case from Thana where blue powdered glass was detected in the bread prepared for a man by his wife, the powder having been obtained by pounding her bangles.

Case CCXLIII—**Poisoning by Pounded Glass**—(*a*) Christison, *Poisons*, p. 654).—Portal relates a case of a man who undertook for a wager to eat his wine-glass, and actually swallowed part of it. He was attacked with acute pain in the stomach, and subsequently with convulsions. The treatment consisted in giving bulky food (cabbage) followed by an emetic. The man recovered —(*b*) (Chevers, *M. J.*, p. 288, quoted from N. Sydenham *Soc. Year Book* for 1863, p. 401). A woman swallowed a quantity of coarsely powdered glass in order to "scour out" her stomach. Intense pain in the stomach came on, with tenderness; the pulse became small, 100 per minute; there was thirst and pallor. An emetic was given, and the next day the urgency of the symptoms had passed off. The woman recovered.

Case CCXLIV.—**Poisoning by Broken Glass**—(*a*) (Christison, *Poison*, p 653). In a case which occurred in Paris a woman, after a hasty dinner, became unwell, and next morning was seized with violent pain in the stomach and vomiting, and died in convulsions. Forty-two days after death her body was exhumed, black points and patches were found in the bowels, together with a quantity of broken glass. The medical witnesses differed as to the cause of death—(*b*) (*ibid*, p. 654). In a case published by Mr. Hebb, of Worcester, a child, eleven months old, died of a few days' illness in very suspicious circumstances. On *post-mortem* examination the inside of the stomach was found lined with a tough layer of mucus streaked with blood. The villous coat was highly vascular, and covered with numberless particles of glass of various sizes, some of which simply touched, while others lacerated it. No other morbid appearance could be detected in the body—(*c*) (*Bo. Chemical Analyser's Rep.*, 1875—76). A male adult was attacked with symptoms of irritant poisoning, and died in forty-eight hours. The mucous membrane of the stomach was found reddened, but not rugose. A quantity of powdered glass was found in contents of the stomach. No irritant substance other than pounded glass could be found in the viscera.

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[1] In Paris in 1820. *Edinb. Med. Surg. Jour.*, 1824, p. 225.

Treatment.—This should consist in the administration, first of bulky food so as to envelope the fragments, and then of emetics and laxatives.

Diamond Dust.—Diamonds and diamond dust are popularly believed in India to be very poisonous. Thus, in the Baroda case (p. 449), a mixture of arsenious oxide and diamond dust was employed, and Chevers[1] mentions two Indian cases of attempted suicide by swallowing an unbroken diamond. Like pounded glass, any injurious action possessed by diamonds or diamond dust is solely mechanical.

Chopped Hair.—This also may act as a mechanical irritant. Chevers[2] mentions that a belief exists in some parts of India that "tiger's smellers" are poisonous, and states, on the authority of Baboo Kanny Lall Dey, that chopped hair is sometimes used by cattle poisoners.

Boiling Water.—Several English cases of accidental death of children from swallowing boiling water have been recorded, the fatal result being due to suffocation arising from injury and inflammation of the larynx.

Melted Lead.—Swallowing melted lead has caused death. Christison mentions a case which occurred at the burning of the Eddystone lighthouse. A man looking up at the fire with his mouth open, swallowed a quantity of melted lead which fell from the building, and died in twelve days. Seven and a half ounces of lead had reached the stomach, which was severely burnt and ulcerated.

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[1] *Ib.*, p. 289.

[2] *Ib*, p 291.

CHAPTER XXIV.

VEGETABLE IRRITANTS.

A LARGE number of plants yield matters capable of acting as irritant poisons. Some of these are simple irritants, possessing little or no remote specific action on the nervous system. Others are compound irritants, causing, in addition to irritation, cardiac depression, *e.g.*, squills and *gloriosa superba*; or acting on the brain and spinal cord, *e.g.*, *cocculus indicus*.

A few owe their activity to the presence of an alkaloid or vegetable base, *e.g.*, stavesacre and the veratrums; these may be called '*alkaloidal* irritants.' Of the remainder, a few, *e.g.*, *cocculus indicus* and *plumbago zeylanica*, contain crystalline active principles, not alkaloids. In the great majority, however, the active principle is oily or resinous in nature. The terminations **ine** and **ia** are used indifferently to denote alkaloids, *e.g.*, *strychnine* is also called *strychnia*. The termination **in** denotes a non-alkaloidal substance, *e.g.*, *picrotoxin*, *plumbagin*.

ALKALOIDAL IRRITANTS.

The detection of these and other alkaloidal poisons mainly depends on the elimination of the alkaloid, and its recognition by chemical or physiological tests. The elimination of alkaloids from organic mixtures is generally effected by **Stas' process** or one of its modifications something as follows :—

The substance under examination is finely powdered and digested with alcohol, slightly acidulated with an organic acid, say acetic or tartaric acid. The acid alcoholic tincture is strained off, and evaporated at a low temperature nearly to dryness. To the syrupy residue, water faintly acidulated as above is added, and the liquid filtered. The acid watery filtrate is now neutralized with sodic carbonate, and after neutralization, shaken with some liquid which will dissolve the alkaloid, but which is not miscible with water, *e.g.*, ether, amylic alcohol, or chloroform. The ether or other solvent used is then separated from the water, allowed to evaporate to dryness, and the residue tested for the presence of an alkaloid. Previous to testing, the residue may require purification. This may be effected by re-dissolving it in ether, amylic alcohol or chloroform, and shaking the solution so obtained with water slightly acidulated with sulphuric acid. The acid watery fluid is then separated, neutralised, and treated like the original neutralized filtrate. In testing the residue, or purified residue, the first thing is *to ascertain whether or not an alkaloid is present.* This may be effected by dissolving a portion in very dilute hydrochloric acid, and testing the solution so obtained, by what may be called the group-tests for the alkaloids. The chief of these are, solution of iodine in potassium iodide, solution of

auric chloride, solution of platinic chloride, and mercuric potassic iodide solution.[1] All these give precipitates with alkaloids. Having, by means of these group-tests, ascertained that an alkaloid is present; appropriate tests, chemical or physiological as the case may be, may then be applied to other portions of the residue, for the purpose of identifying the particular alkaloid present.

Dragendorff has contrived a complete method for the separation of plant principles from organic mixtures, an outline of which is as follows. The process essentially consists in—

A. Preparing an acid watery solution of the matters under examination, by digesting the finely divided matters with water acidulated with sulphuric acid, filtering, pressing, and twice repeating the digestion. The filtrates are mixed, evaporated to a syrup, and this is macerated for a day with four volumes of alcohol, filtered, and the residue washed with spirit. The alcohol is then driven off by evaporation from the alcoholic filtrate, water (if necessary) added, and the liquid filtered again.

B. Extracting this while still acid by agitation with (1) petroleum ether, (2) benzene, and (3) chloroform. The solvents are to be used in the order named, and each, after use, separately evaporated in small portions in suitable dishes.

C. Saturating the acid watery solution with ammonia (previously removing any residual chloroform by agitation with petroleum ether) and **extracting the ammoniacal fluid** as in B with, in succession (1) petroleum ether, (2) benzene, (3) chloroform, and (4) amylic alcohol; and finally (5) drying up the ammoniacal fluid by evaporation with powdered glass, and extracting the dry residue with chloroform.

The following Table shows the principal substances likely to be found in the various residues. Non-poisonous substances are mentioned in brackets thus (Theine)[2]

Solvent.	B Residues from Acid Fluid.	C Residues from Alkaline Fluid.
1. Petroleum ether ...	Piperine, picric acid, carbolic acid, camphor, and capsicin.	Liquid volatile alkaloids and aniline, also strychnia, brucia, veratria, emetine, and (quinine).
2. Benzene ...	Cantharidin, santonin, digitalin, and (theine); elaterin, colocynthin, colchicin and absinthin.	Strychnia, atropia, and hyoscyamine; also (quinine, cinchonine, and narcotine), brucia, physostigma, veratria, aconitia, and emetine.
3. Chloroform ...	Picrotoxin, helleborin (cinchonine), digitalein, saponin, and jervine.	Morphia (and cinchonine).
4. Amyl alcohol ..	....	Morphia, solanine, saponin, salicin.
5. Chloroform ...	....	Curarine.

[1] Prepared by adding potassium iodide solution to solution of mercuric chloride, until the precipitate at first formed is just re-dissolved.

[2] For details of the process, see Dragendorff on Organic Analysis.

Cadaveric alkaloids formed by decomposed dead tissues will also be extracted by these processes. In bodies which are likely to contain ptomaines, the opium or *Strychnos* alkaloids are best searched for by the gypsum method recommended by Hilger and Küster; Kippenberger's iodine process for the purification of the crude alkaloids extracted by chloroform was also found to be very satisfactory. It is desirable that new solvents for the extraction of the alkaloids should be tried. Meconic acid and meconine cannot always be detected, as they are decomposed both during life and after death.

The chief alkaloidal irritants are Stavesacre, Aconite, Sabadilla, Hellebore, Colchicum, Laburnum, Emetine and Apomorphia.

Ranunculaceæ.

Stavesacre—*Delphinium Staphysagria.*—The seeds of this plant have an acrid taste, and from experiments on animals have been ascertained to act as a compound irritant poison, their special remote action being to cause cardiac depression, and paralysis of the respiratory movements. They contain several alkaloids, of which the two most important are staphisagrine, which paralyses the motor nerves like curare; and delphinine, which appears to act very similarly to aconitine, paralysing both the spinal cord and the heart. For other poisons belonging to this order, see *Non-alkaloidal Irritants*, p. 516, and *Aconite* (see "Cardiac Poisons," Chap. XXV.)

Melanthaceæ.

Sabadilla or Cevadilla—*Asagræa officinalis (Veratrum officinale, Sabadilla officinarum* or *Schœncraulon officinale.*—From the fruit and seeds of this plant the poisonous alkaloid, or mixture of alkaloids, used in medicine under the name of veratria or veratrine,[1] is obtained. This is an active poison. The medicinal dose is one-twelfth to one-eighth of a grain. In over-doses it causes violent sneezing, and the usual symptoms of irritant poisoning coupled with great depression of the action of the heart and collapse. Veratria also first stimulates and then paralyses the peripheral extremities of the sensory nerves; hence a peculiar pricking sensation followed by numbness is one of the symptoms of poisoning by it. In cases of poisoning by veratria, this pricking and numbing sensation is said to be more felt in the fingers and toes and in the joints, than in the tongue; while in cases of poisoning by aconite, which has a similar effect on the sensory nerves, the pricking and numbing sensation is more felt in the tongue. The seeds contain about ·3 per cent. of veratria.

Detection.—Veratria may be extracted from organic mixtures by Stas' process, and recognised by the following special tests: (1) It excites violent sneezing. (2) Strong hydrochloric acid dissolves it without change of colour, but on warming the liquid becomes red. (3) Strong sulphuric acid dissolves it, forming a yellow solution, which gradually changes to orange and finally becomes red; on the addition of bromine water to the sulphuric acid solution, a purple colour is produced.

Veratrum album, or *White hellebore* and **Veratrum viride,** American or *green hellebore*. The rhizomes or root-stocks of these, and

[1] Commercial veratrine has lately been found to consist mainly of two alkaloids, veratrine and cevadine, both powerfully sternutatory.

of other species of veratrum, cause symptoms similar to those caused by veratria. Twenty grains of white hellebore root has caused death, and probably less would prove fatal. Green hellebore root, officinal B. P. and I. P., is less irritant than white hellebore and rarely occasions purging; except this, its action is similar to that of white hellebore root. The medicinal dose of green hellebore root is 1 to 2 grains. Formerly, the veratrums were believed to owe their activity to the same principles as sabadilla. Lately, however, it has been found that they contain the alkaloids of sabadilla in small quantity only, and that the alkaloids present in them are chiefly jervine, pseudo-jervine, rubi-jervine, and veratralbine, all non-sternutatory bases. All four give a play of colours with strong sulphuric acid, the two last giving colours very similar to veratria, while jervine and pseudo-jervine give a yellow changing to yellow brown, and after a time to green, the green tint becoming more developed on dilution.

Colchicum autumnale, or *Meadow Saffron*.—The whole of this plant, a native of Europe, is poisonous, owing to the presence of colchicine, a nitrogenous substance classed by some chemists as an alkaloid. The corm and seeds are used in medicine chiefly in the treatment of gout and are a constituent of quack remedies for gout. In over-doses, colchicum causes burning pain in the throat and abdomen, violent vomiting and purging, and the usual symptoms of irritant poisoning, coupled with great collapse. The brain, as a rule, is unaffected. In fatal cases death usually occurs within twenty-four hours. *Post-mortem appearances.*—After death the stomach and intestines are usually found inflamed, though this may be absent. In exceptional cases, however, *post-mortem* appearances of irritation of the alimentary canal have been altogether absent. Colchicum is seldom used criminally as a poison (see, however, *Case*, p. 408).

Dose.—The medicinal dose of the powdered corm is 2 to 8 grains. The B.P. and I.P. in addition contain—an extract, and an acetic extract of the corm, dose $\frac{1}{2}$ to 2 grains; also a wine prepared from the corm (strength 1 to 5), and a tincture of the seeds (strength 1 to 8), dose of either 10 to 30 minims. In two cases a quantity of tincture equal to 48 grains of the dried corm caused death. This is the smallest fatal dose on record. More than one case of recovery after swallowing one ounce of the wine has been reported.

Treatment.—The general treatment of irritant poisoning, with free administration of decoctions containing tannin. Stimulants in form of brandy by the mouth (or if vomiting is present ether injections) should be given to counteract depression, and the patient kept warm.

Detection.—The fresh corm is pear-shaped, about 2 inches long by 1 inch or rather more in width; brown externally, white, firm, and starchy within. When cut it exudes a milky juice, its taste is bitter and acrid. The seeds are reddish brown externally, white within, spherical, and about one-tenth of an inch in diameter. For the separation of colchicine from organic mixtures, Stas' process may be employed, using chloroform as a solvent. Colchicine differs from alkaloids, in being removable from acidulated watery solution by agitation with chloroform; hence the acid watery filtrate obtained in Stas' process may first be shaken with petroleum ether in which Colchicine is insoluble to remove impurities, and then without neutralization with chloroform. Colchicine, unlike alkaloids also, is not precipitated by mercuric potassic iodide

solution. The special chemical test for colchicine is the reddish violet colour produced by the action of strong nitric acid upon it. It does not, like veratria, excite sneezing.

The physiological test is not trustworthy for colchicine, a French committee of experts concluded that "experiments on animals do not afford the means of determining that poisoning by colchicine has taken place." Ogier obtained the reactions of colchicine isolated by the usual process from the exhumed bodies of dogs which he had poisoned with it five and a half months before. In the bodies of animals poisoned with it, Obolonski detected colchicine four and a half months after death.[1]

Hermodactyl, *Surinjan.*—Under the name of *surinjan* two kinds of *hermodactyl* are sold in the bazaars of India, *súrinján-i-shirin* or tasteless hermodactyl, and *súrinján-i-talkh* or bitter hermodactyl. Both varieties of hermodactyl are corms, more or less resembling colchicum corms. Of the two the tasteless variety appears to be nearly inert, while the bitter variety acts like colchicum. The bitter variety has lately been ascertained to be the corm of *Colchicum luteum*, growing in Cashmere ; and the sweet variety, the corm of *Merendera persica*. Dymock[2] notes that the sliced bulb of the true narcissus (*N. Tazetta*) is sold in Bombay as bitter Surinjan, but that it may be detected by its larger size and tunicated structure. Its action is similar to that of other species of narcissus (see *Amaryllideæ*).

Leguminosæ.

There are several poisonous peas in India. **(Laburnum)** *Cytisus Laburnum.*—All parts of this plant, common in Europe, are poisonous. Several cases of poisoning by it, mostly accidental, have occurred in England. The usual symptoms of laburnum poisoning are vomiting and purging, followed by drowsiness and insensibility, with muscular twitchings and dilated pupils. Its active principle is the alkaloid cytisine. Cytisine is said to be the active constituent of Persian and Australian insect powder.

Broom – *Cytisus scoparius vel Spartium scoparium.*—The tops of this plant, also a native of Europe, are officinal in the B.P. and I.P. In large doses they cause vomiting and purging. They contain a crystalline non-poisonous substance scoparin, and the poisonous liquid volatile alkaloid sparteine, the action of which is identical with that of conia, a similar alkaloid contained in conium maculatum, which see.

Coniferæ.

Yew – *Taxus baccata.*—Several cases of poisoning by this plant have occurred in England, most of which have ended fatally. The majority of the cases have been accidental, from children eating the berries or leaves, or from a decoction of the leaves having been given as a cure for worms. In a few cases death has resulted from swallowing a decoction of the leaves with intent to procure abortion. The

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[1] Dixon Mann., *For. Med.*, 619.

[2] *Mat. Med.*, p. 837.

prominent symptoms are vomiting, followed by narcotism, with, in some cases, convulsions and dilated pupils. The respiration is slowed, and death usually occurs by asphyxia, due to paralysis of the respiratory muscles. The active principle appears to be an alkaloid taxine. Yew leaves are sold in the Indian bazaars under the name of *birmi* and *taliopatr*. They resemble savin leaves, except that they have a lancet-shaped apex (see *Savin*).

Other Irritant Alkaloids.

Emetine.—This is the alkaloidal active principle of ipecacuanha, and is an irritant to the gastric mucous membrane, rapidly causing vomiting ; it is also a cardiac depressant.

Apomorphine.—This is an artificial alkaloid, prepared by heating morphine with hydrochloric acid. It is the most active emetic known ; one-tenth to one-quarter of a grain of the hydrochloride of apomorphine by the mouth or $\frac{1}{30}$ grain to $\frac{1}{10}$ grain hypodermically injected, rapidly causes free vomiting, and may be employed to excite vomiting in cases of poisoning, especially where the gullet is obstructed.

In cases of **poisoning** by the alkaloidal irritants (and by alkaloids generally) administration is indicated of gallic acid, or tannin or decoctions containing tannin. These form insoluble compounds with alkaloids. Or animal charcoal, which removes alkaloids from solution by adhesion, may be given with a similar object.

NON-ALKALOIDAL VEGETABLE IRRITANTS.

The great majority of these do not contain any substance capable of detection by chemical processes. Hence, many can only be recognised by their botanical or physical characters. A few, however, contain matters separable from organic mixtures by chemical processes and capable of identification by chemical or physiological tests. When such matter is a *glucoside* or other crystalline substance, its separation may, in many cases, be effected by a modification of the process for elimination of alkaloid just described. This essentially consists in extracting with immiscible solvents, *e.g.*, ether, benzene, &c., the un-neutralized, instead of the neutralized acid watery filtrate (see *Picrotoxin* and *Plumbagin*).

Anacardiaceæ.

Marking-nuts, *Bhela*, *Bhilawa* (Hind.), *Bibba* (Bomb.), *Shen-kottai*, *Sherankottai* (Tam.), the fruit of the Semecarpus *Anacardium*. Marking-nuts appear to be seldom, if ever, in India, given internally as a poison. The bruised nut, however, is used as a local irritant application for the purpose of

procuring abortion; and the juice, like vitriol in England, is thrown over the body to cause injury. A case of this last kind terminating fatally, where marking-nut juice mixed with other irritants was employed, is recorded.[1] Again, in a case recently tried before the High Court, Bombay, a Hindoo was convicted of causing hurt to his wife, by throwing marking-nut juice over her face; blistering of the skin and severe ophthalmia of one eye, lasting several days, being the result. Marking-nut juice is also used by malingerers for the purpose of producing ophthalmia and skin eruptions; and Dr. W. Gray once met with a case where a man introduced three marking-nuts into his wife's vagina, apparently as a punishment for infidelity. The juice, more or less diluted, is said to be used as an application to the skin, for the purpose of imitating bruises in support of a false charge.[2]

Identification.—Marking-nuts in the dry condition in which they are usually met with, are black in colour and more or less heart-shaped, with a rough projection at the base (see Fig. 13). They measure, excluding this projection, in longest diameter from about 7 to 11-tenths of an inch, and weigh from about 25 to 55 grains each. They have a thick cellular pericarp, the cells of which contain the irritant juice. Inside the pericarp is a large flat non-acrid kernel. An acrid juice similar to that found in the pericarp is contained in the thick root bark of the tree.

The acrid juice is soluble in alcohol, ether, and oils. It contains anacardic acid and cardol. Although both these substances are readily decomposed by heat, irritant effects have been produced by exposure to the vapour of the juice. Anacardic acid may be extracted from the juice as an insoluble lead salt, by digesting an alcoholic solution with oxide of lead. Water added to the alcoholic solution after removal of the

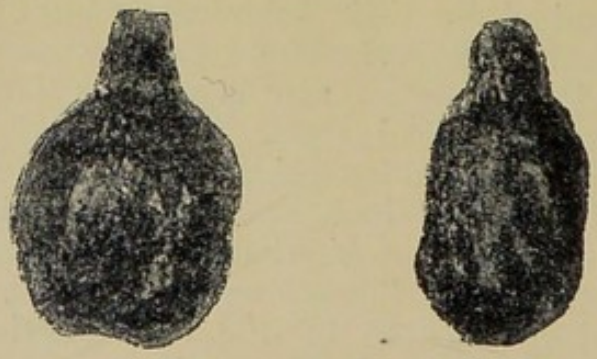

Fig. 13.—Marking-Nuts.

anacardic acid, causes separation of the cardol. Cardol is a yellow oily liquid, insoluble in water, but soluble in alcohol and ether. It blisters the skin strongly, and, according to Basiner, when subcutaneously injected in large doses, causes, in warm-blooded animals, stupor and paralysis. Marking-nut juice may be recognised by (1) its solubility in

[1] Basiner, quoted by Dymock, *Mat. Med.*, 2nd ed., p. 204.
[2] *Op. cit.*, p. 203.

alcohol, ether, and oils ; (2) Its vesicating action on the skin ; and (3) if a few drops of an alcoholic solution of the juice are placed in a porcelain dish, and a drop of solution of potassic hydrate is added thereto, a bright green colour is at once produced, which, on rolling the fluid about in the dish, rapidly changes to reddish brown. When applied to the skin it should be diluted with oil, and used with caution. When applied diluted it may be some time before it begins to act. Testing in this way some of the fluid used in the Bombay case mentioned above, no effect was noticed for forty-eight hours, after which a painful and very persistent eruption was produced.

These when bruised yield a brown, highly acrid, oily juice, turning black on exposure to the air. This juice, when applied to the skin, vesicates strongly, raising black blisters, containing a fluid which causes an eczematous eruption on any part of the skin it comes into contact with.[1] Internally administered, the juice appears to be much less actively irritant than it is when externally applied. According to Dymock,[2] the juice of one nut mixed with a seer of milk is an ordinary internally administered dose in native medical practice ; and Mahomedan writers speak of 12 to 24 grains of the juice, given in oil or melted butter, as an ordinary medicinal dose, and of 2 dirhems (=96 grains) as a poisonous dose.

Cashew-nuts, *Kaju* (Hind., Mar., Bomb.), *Kottai-mundiri* (Tam.), *Hijli-badam* (Beng.) ; the fruit of *Anacardium occidentale*.—The pericarp of the cashew-nut contains a brown acrid juice of similar composition and properties to marking-nut juice. Its alcoholic solution, however, treated with potassic hydrate solution, turns reddish-brown, and not bright green, like an alcoholic solution of marking-nut juice. Cashew-nut juice appears to be seldom, if ever, used criminally in India. The kernel of the nut is non-acrid, and is eaten raw, or more usually slightly roasted, or cooked.

Rhus.—Some species of this genus of Anacardiaceæ yield a milky juice possessing irritant properties, very similar to those of marking-nut juice. Exposure simply to the vapour of this juice is said to cause distressing symptoms. Woodman and Tidy[3] mention as poisonous—*Rhus radicans*, poison-oak or poison-ivy ; *Rhus vernix*, poison-Sumach ; and *Rhus toxicodendron*. Among the plants of Sind, Murray[4] mentions as yielding a similar acrid juice, *Rhus acuminata* (syn. *Rhus succedanea*, Linn.), *Tatree* (Hind.), *Arkkol rikul* (Panj.). Regarding *R. Toxicodendron* and other species see :—J. C. White's *Dermatitis Venenata*, 1887 (the American journals frequently contain reports on cases) ; Morrow's *Drug Eruptions* (Syd. Soc. Ed.) ; Albert Billet on Dermatitis from Varnish Sumach in Annamite Soldiers (extracted *Brit. Journ. Dermat.*, November 18th, 1896, p. 456) ; McCartney (The *China Med. Missy. Journ.*, vol. viii, No. 2, June 1894) ; also Mathews in the September

[1] The other ingredients of the preparation were "*nerium odurum*, *plumbago zelanica*, sulphate of copper, beetles (genus *Mylabris*), and a snake."
[2] Dymock, *op. cit.*, p. 203, and *Ind. Med. Gaz.*, Aug., 1900.
[3] *For. Med.*, p. 282.
[4] *Plants of Sind*, p. 86.

number ; Nicholson of Kew Royal Gardens has known several cases. Schonberg (*Philad. Polyclinic*, October 16th, 1897) says there is no specific, but certain remedies relieve the itching and burning, and subdue the inflammation. He places such remedies in the following order : (1) Saturated solution of boric acid ; (2) fluid extract of Grindelia robusta (℥j to aq. ℥iv) ; (3) aqueous solution of sodium hyposulphite (℥j to ℥j) ; (4) Labarraque's solution (25 to 50 per cent.) ; (5) black wash diluted a-half with lime water ; (6) bromine mx. xv to ℥j ol. olivarum.

Asclepiadeæ.

Madar—*Calotropis gigantea*, Brown (*vel Asclepias gigantea*, Willd.), *C. procera*, Brown (*C. Hamiltonii*, Wight), *Ak*, *Madar* (Hind.), *Akanda* (Beng.), *Akra*, *Rui* (Bomb.), *Erukku*, *Erukam* (Tam). These two shrubs closely resemble one another, and are known by the same vernacular names. One

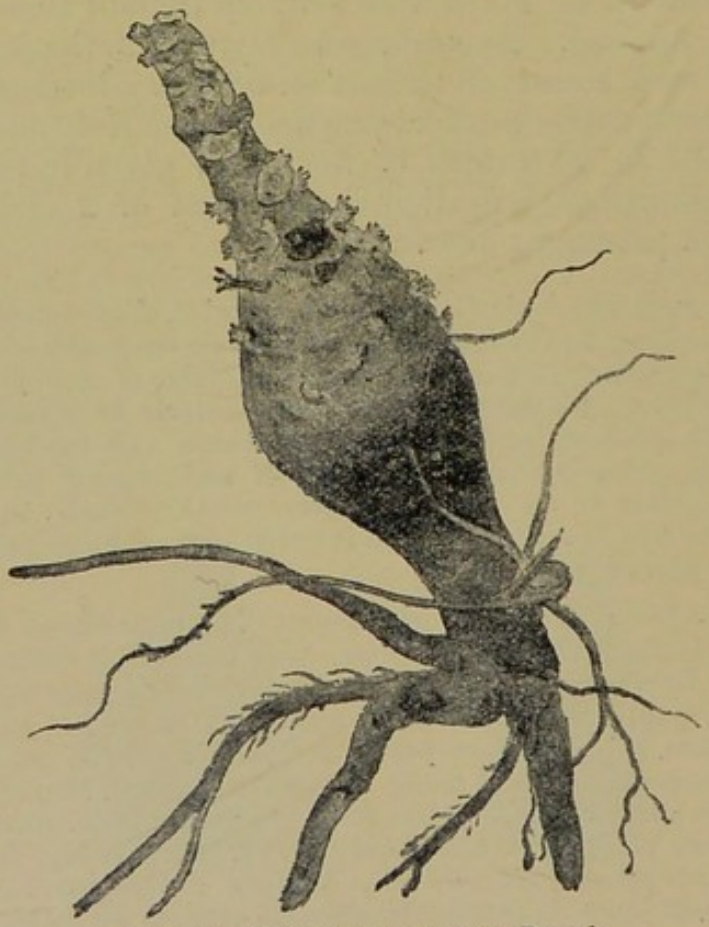

FIG. 14.—Calotropis gigantea—Root ½.

or other of them is found growing wild almost everywhere in India. The leaves and stalks, when incised, yield an acrid milky juice, used in native medicine as an external application in cutaneous affections and as a depilatory. The fresh or dried juice, or the root bark, is also given internally as an alterative or purgative. An ordinary medicinal dose of

the powdered root bark as an alterative is 3 to 10 grains three times a day. In doses of 30 to 60 grains the root bark acts as an emetic, and has been used as a substitute for ipecacuanha.

FIG. 15.—Calotropis gigantea—Stem, Leaf, and Flower ½.

In India *madár* juice appears to be used criminally, chiefly for purposes of infanticide, and as an abortifacient, more rarely for suicide and still more rarely for homicide. According to Chevers and others, forcing *madár* juice down the throat is method of infanticide employed by the castes among which female infanticide prevails. *Madár* juice is also given internally, and applied locally, for the purpose of causing abortion. The leaves have also been administered for criminal purposes with food. It is also used as a cattle poison.

The active principle appears[1] to be a yellow bitter resin, besides which the root-bark also contains two substances named by Warden and Waddell,[1] 'madár-alban' and 'madár-fluavil' closely resembl-

[1] Warden and Waddell in *Pharm. Jour.*, August 22, 1885.

ing the alban and fluavil found in gutta-percha. It contains no alkaloid.

Case CCXLV.—**Poisoning by Madar.**—In 1896 a piece of cloth stiffened with a sticky substance alleged to be *madár* juice and taken from the stomach of a cow was sent for examination. An alcoholic extract of the rag was given to a cat which died within half an hour. The symptoms noticed were :—Vomiting, profuse salivation, severe tetanic convulsions, extremely slow and stertorous breathing and dilation of the pupils.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Identification.—The root-bark (officinal I. addn. to B. P.) occurs in short, flat or arched pieces $\frac{1}{8}$th to $\frac{1}{4}$th of an inch thick. The outer surface is yellowish grey, soft and corky, fissured lengthwise, and can be easily separated from the middle cortical layer, which is white, mealy, and traversed by narrow brown liber rays. The taste is mucilaginous, bitter and acrid, and the odour peculiar (Dymock). Figs. 14 and 15 show the general appearance of the root, leaves, flowers, &c., of *C. gigantea.* Drury describes the flowers of *C. gigantea* as rose-colour and purple mixed, and those of *C. procera* as pale purple.

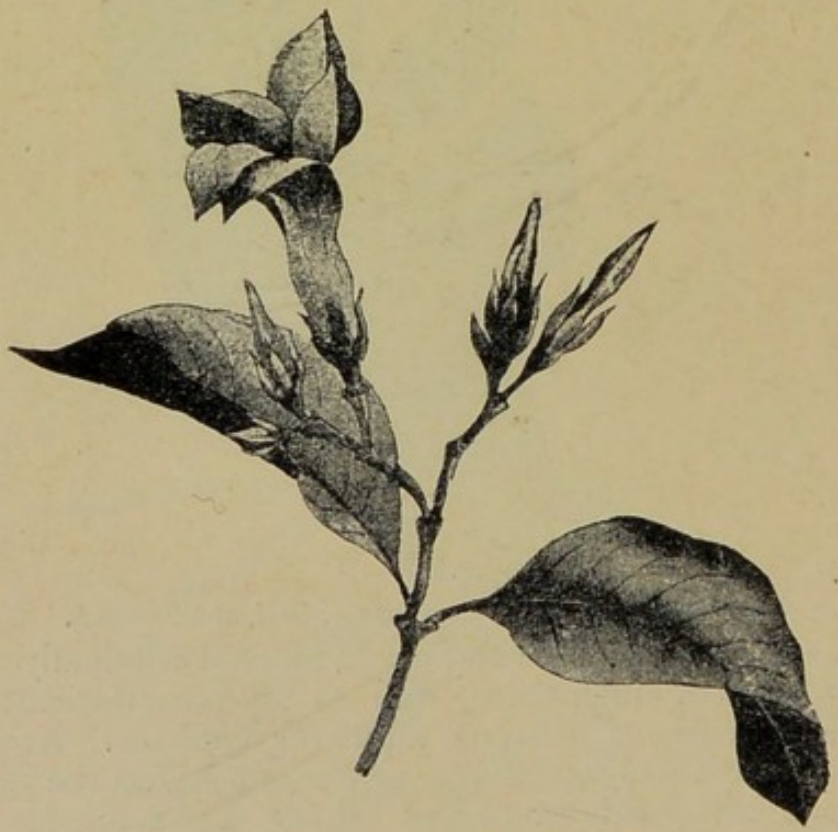

Fig. 16.—Cryptostegia grandiflora, or *Nerium g.*

Cryptostegia grandiflora, Syn. *Nerium grandiflorum* (see Fig. 16).—This is a climbing plant belonging to the N. O. *Asclepiadeæ.* The stalk yields a milky juice, which, when dried, solidifies into a substance resembling india-rubber. One fatal case of poisoning by this plant has been reported as follows :—

Case CCXLVI.—**Poisoning by Nerium grandiflora.**—The pounded leaves mixed with water were swallowed. Persistent vomiting

came on half an hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present. No alkaloid could be found in the leaves.

Tylophora fasciculata, vern. *Bhui-dori* (see Fig. 17).—This plant is abundant in the Southern Konkan, where it is used as a rat-poison. One homicidal case of poisoning by administration of the pounded roots in food, has been reported (see *Case CCXLVII*). From the symptoms stated to have been

Fig. 17.—Tylophora fasciculata.

present in this case, *viz.*, tingling in the mouth, dryness of the throat, giddiness, loss of power over the extremities, and insensibility with dilated pupils, the poison appears to be narcotico-irritant in its action.

Case CCXLVII.—**Tylophora fasciculata poisoning.**—Asst.-Surgeon Narayen Ananta, in charge of Pandharpur dispensary,

reported, in April 1880, the following case :—A Mahomedan family, consisting of six adults and a servant boy æt. about fourteen, were attacked soon after a meal with symptoms of poisoning. The servant boy died in about two hours. The others were seen the next morning, when they complained of dryness of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated that soon after taking their mid-day meal on the previous day they felt some tingling sensation in the mouth, followed by dryness of the tongue and throat and giddiness, and loss of power over the extremities. After this they became insensible. Three of them vomited and recovered consciousness at about 8 P.M. ; the other three remained insensible till midnight. On *post-mortem* examination of the body of the boy, the following appearances were noted :—Face bloated, tongue and eyes slightly protruding, veins of the neck turgid. Lungs engorged ; right side of the heart full, left empty. Slight congestion of the pia mater. A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, was at enmity with the persons poisoned, and asked a friend to recommend him something to kill rats with. The friend advised him to use bhui-doree. On this accused, it was reported, obtained some bhui-doree roots, and having reduced them to powder mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared.

Tylophora asthmatica, Wright & Arnott, *Antamūl*, *Jangli pikwān*.—This plant, used as an emetic in India, caused three fatal cases of poisoning in Madras in 1898 (see case below). An alkaloid named tylophorine was extracted by Dr. Van Gezel.

Case CCXLVIII—(*a*).—A young man, suffering from gonorrhœa, took the juice of this plant about 10 P.M., and died next morning with slight convulsions of upper extremities and unconsciousness.

(*b*)—A man and his wife were given this plant by a native quack doctor also as a cure for gonorrhœa. At 7 P.M., three hours after, both complained of acrid feeling in mouth and throat followed by nausea, vomiting, purging, collapse and death next day. In both cases the alkaloid *tylophorine* was extracted from the viscera. The accused native doctor was sentenced to 18 months' rigorous imprisonment. His defence was that three days doses had been taken all at once.—*Mad. Chem. Ex. Rept.*, 1898.

Convolvulaceæ.

Scammony, the dried milky juice of the *Convolvulus scammonia*, is an ash grey gum resin, in rough cinder-like irregular fragments, with a black shining splintery resinous fracture. It is used in medicine, in doses of 3 to 8 grains, as a drastic purgative. No case of poisoning by it in the human subject is recorded, but in large doses scammony would no doubt act as an irritant poison. Its active principle is a resin named jalapin, identical with the resinous active principle of one variety of jalap.

Jalap.—The dried tuberous roots of the *Ipomœa purga* (*syn. Exogonium purga*), and other species of Ipomœa, is similar in action to scammony. Both the powdered root, and a resin extracted from it by rectified spirit, are used in medicine, the first in doses of 10 to 30 grains, and the second in doses of 2 to 5 grains. One variety (from *Ipomœa orizabensis*) contains jalapin ; another contains convolvulin, a resin acting similarly to jalapin, but differing from it, in being insoluble in ether, in which jalapin is soluble.

Kala-dana seeds.—*Kálá-dánah*, *Mirchai* (Hind., Beng., and Bomb.), *Kodi kakkatan-virai* (Tam.); the seeds of *Ipomœa hederacea* v. *cœrulea*. These are used in India as a substitute for jalap, the medicinal dose being 30 to 50 grains of the powdered seeds. The active principle is a resin considered by Flückiger and Hanbury to be identical with convolvulin. No case of poisoning by these seeds has been reported, but in large doses the powdered seeds would doubtless give rise to symptoms of irritant poisoning.

Identification—Dymock gives the following description of the seeds:—"The seeds resemble in shape those of most of the convolvuli, being in the form of a segment of a sphere; they are generally about $\frac{3}{16}$ths of an inch in length, and nearly as much in breadth, but sometimes much smaller. Their weight varies from $\frac{1}{2}$ to nearly 1 grain; the colour of the testa is black, except at the umbilicus, where it is brown. Upon soaking the seeds in water the testa bursts and discloses the delicate albumen which envelopes the folded cotyledons and radicle. These have an acrid taste and earthy odour." The same author notices that in Bombay the seeds of *Ipomœa muricata* are more common than those of the true kaladana. These are similar in action and appearance to true kaladana seeds, except that they are larger and heavier, weighing about 3 grains each, and are rather lighter in colour.

Ipomœa Turpethum, *Nisot*, *Nakpatar*, *Pithori* (Hind.), *Nishotar*, *Phukari* (Bo.), *Shivadi* (Tam.), *Teori* (Beng.).—The root of this plant, common throughout India, is used in native practice as a purgative. It appears to contain a resin similar to jalapin and convolvulin. The medicinal dose of the powdered root is from fifteen to thirty grains.

Cucurbitaceæ.

Elaterium.—This is the sediment from the expressed juice of the *Ecbalium elaterium* (*syn. E. officinarum*), or squirting cucumber. It is a powerful cathartic, and is used in medicine as a purgative in doses of one-sixteenth to half a grain. One grain has caused severe symptoms, and probably but little more would be required to cause death. The active principle is elaterin, a white crystalline substance obtainable by adding ether to a chloroform solution of elaterium elaterin is soluble in alcohol, and not precipitated from its alcoholic solution by tannin.[1] Dymock notices that the fruit of this plant, or of a closely allied species, is sold in the Bombay shops under the name of *Kateri-indrayàn*.[2]

IDENTIFICATION.—The fruit is $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, oblong ovoid pale yellowish green, and covered with numerous short fleshy prickles, terminating in white elongated points. When ripe it separates suddenly from the stalk, violently expelling the juice and seeds.

White bryony—*Bryonia dioica*.—This is a common hedge plant in England, climbing by its tendrils on bushes, &c. It has small faint green flowers, and red clustered berries, each

[1] *Pharmacographia*, p. 262.

[2] *Mat. Med.*, p. 352.

containing six seeds. The root is spindle-shaped, fleshy, and pale, and was formerly used in medicine as a purgative. A decoction of the root has caused death, and children have been accidentally poisoned by eating the berries. The active principle is bryonin, apparently a glucoside.

Cuscuta reflexa, *Akasweli, Ghagar bel* (see Fig. 18).—This is a parasitic plant with white bell-shaped flowers, common on bushes in some parts of India. According to Asst.-Surgn. Dulip Singh,[1] the *dhais* (nurses) in the Panjab have great faith in a decoction of this plant as an abortifacient.

FIG. 18.—Cuscuta reflexa.

A decoction of 180 grains of the plant, made with boiling water, suffices, it is stated, to produce depression with nausea and vomiting, followed by abortion.

Citrullus colocynthis—*Indrayan* (Hind.), *Peykomatti Tumat* (Tam.), *Kururundawan* (Mar.).—The colocynth of the pharmacopœias used in medicine as a purgative in doses of from 2 to 8 grains, is the dried and powdered fruit pulp of this plant. In large doses it acts a an irritant poison, and has in Europe in several instances caused death.

[1] *Ind. Med. Gaz.*, January 1885.

Christison[1] mentions a case where a teaspoonful and a half of the powder (about 90 grains) proved fatal, and Taylor[2] cites the case of an adult female who took 120 grains of the powder in order to cause abortion, and died in fifty hours. A case of recovery from a dose of 3 ounces is, however, reported. The active principle is a glucoside colocynthin. In India both the fruit pulp and the root are used in native medicine as purgatives.

IDENTIFICATION.—The dried fruit of Indian colocynth is yellow-brown in colour, and about the size and shape of an orange. It contains a scanty greyish-white pulp, in which are a number of brown seeds.[3] "The root is fibrous, tough, and stringy, and of a yellowish-white colour. All parts of the plant are very bitter, and the dust when dry very irritating to the eyes and nostrils" (Dymock).

Other Cucurbitaceæ.—Many other plants of this order possess properties more or less resembling those of the three just mentioned. Some, it is true, yield edible fruits, but "there is reason to believe that some if not all the edible sorts of gourds owe their freedom from poisonous properties to cultivation, for some in a wild state are found to possess them in much activity."[4] The principal Indian species mentioned by different writers as being either in common use as purgatives, or as having given rise to cases of poisoning, are as follows :—

The bottle-gourd, Lagenaria vulgaris.—*Tumbi*, *Karwi-tumb* (Hind.), *Tiktalau* (Beng.), *Karwa-bopla* (Bo.), *Shora-kai* (Tam.), *Hurrea-kuddoo* (Duk), *Anapa-kai* (Tel.).—The fruit of the wild variety of this is bitter and powerfully emetic and purgative. The wild variety, dried, is made into musical instruments, bottles, &c., and it is stated that some sailors were once poisoned by drinking beer which had been standing in a bottle made from one of these gourds.[5] Dr. Kirtikar informs me that he has met with two cases in which smelling the fruit produced violent sneezing.

Citrullus amarus.—This is the wild form of the *C. vulgaris*, or 'water-melon.' The fruit is very bitter, and is used medicinally as a purgative. The dried fruits are sold in the bazaars of Sind under the name of *kirbut*.[6]

Common Cucumber—Cucumis sativus.—The fruit of the wild form of this, also called *C. Hardwickii*, vern. *Pahari indrayan*, is said to possess properties similar to those of officinal colocynth.

Cucumis trigonus (syn. *C. pseudo-colocynthis*), *Karit* (Dymock), *Indrayan*, *Bislumbhi* (Phar. of Ind.).—This has bitter fruit of the size and shape of a small egg. The fruit is used as a substitute for colocynth. In 1883 a case was reported to the Bombay Chemical Analyser's Office, in which it was stated that the roots of this plant had been administered for the purpose of procuring abortion. A variety, *C. trigonus* var. *pubescens*, *Takmaki*, is much less bitter, and is used as a vegetable.

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[1] *Poisons*, p. 595.

[2] *Poisons*, p. 522.

[3] These are of flattened ovoid form, a measure two-tenths by three-tenths of an inch, and are disposed in vertical rows on three thick parietal placentæ, which project to the centre of the fruit, then divide and turn back, forming two branches directed towards one another (Dymock, p. 337).

[4] Lindley, quoted by Birdwood, *Bo. Veg. Prod.*, p. 157.

[5] Lindley, quoted by Birdwood, *Bo. Veg. Prod.*, p. 157.

[6] Murray's *Plants of Sind*, p. 41.

Trichosanthes dioica, *Pulbul, Potole.*—Kanny Lall Dey[1] states, with reference to this plant, "The bulbous part of the root is a hydragogue cathartic." This plant is cultivated in Bengal and Guzerat for its fruit, which is used as an article of food. An alcoholic extract of the unripe fruit, in three to five grain doses, is described as a powerful cathartic.[2] *T. cucumerina, Kadu-padavala* or *Ranpadavala* (Mar.), has similar medicinal properties, and is the Patola of Bombay; it is not cultivated and the fruit is never eaten. Similar properties appear also to be possessed by *T. palmata, Lal-indrayan* (Hind.), *Kaundal* (Bomb.), *Mákál* (Beng.), *Koratti, Shavari-pazhan* (Tam.), the fruit of which, Dr. Kirtikar informs me, is sometimes used as a cattle-poison.

Momordica cymbalaria (syn. *Luffa tuberosa*), *Kadavanchi* (Mar.) (see Fig. 19).—Dymock, in regard to this, writes: "The whole plant is acrid. The fruit is about 1 inch by 1¼ inch, has eight prominent ribs, is covered with

FIG. 19.—Momordica cymbalaria.

silky hairs, and while still green dehisces into four parts discharging its seeds." The roots are tuberous and ovoid. Three cases in the last few years have been reported to the Bombay Chem. Analyser, in which it was stated that abortion had been caused by the administration of a decoction of these roots.

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[1] *Drugs of India*, p. 118.
[2] *Beng. Disp.*, p. 351.

Momordica Charantia, *Karela* (Hind.), *Kárlá* (Bomb.), *Pava-kai* (Tam.) see Fig. 20.—The fruit of this is bitter, but wholesome. It is eaten, but requires to be steeped in salt water before being cooked. A case was reported to me in 1879, in which it was stated that swallowing a decoction of the roots of this plant caused abortion at the seventh month.[1]

Luffa acutangula, var. amara, *Karvi-turai* (Hind.), *Kadu-sirola*, *Kadu-dorka* (Bomb.), *Ghosha-lata* (Beng.), *Sendu-bir-kai* (Tel.)—Dymock describes the fruit as smooth, 3 inches to 5 inches long, ovoid, marked with ten prominent sharp longitudinal ridges, and having at the apex a small operculum rather more than ½-inch in diameter, which is deciduous. The seeds are grey, and marked with small, irregular, black, prominent specks. Sakharam Arjun[2] describes the fruit as violently cathartic and emetic.

FIG. 20.—Momordica charantia.

Modecca palmata.—In Madras in 1898 a girl ate some of the fruit of this gourd and was attacked by severe irritant symptoms and died a week after.[3]

Luffa echinata, *Kukar-wel*, *Deodangri* (see Fig. 21).—The fruit of this is described by Dymock as "oval, about the size of a nutmeg, armed with numerous long rather soft diverging bristles, obscurely divided into three cells, by numerous dry fibres, and opening at the top with a perforated stopple, which falls off when the seeds are ripe. Seeds about eighteen (ovate, compressed, black and scabrous), testa very hard, kernel white." The fruit of this is

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[1] *Bo. Chem. Analyser's Rept.*, 1879-80.
[2] *Bo. Drugs*, p. 59. [3] *Trans. Bo. Med. and Phys. Soc.* 1887.

also stated by Sakharam Arjun to possess purgative properties, and Dr. Kirtikar [1] has reported a fatal case in an adult of poisoning by the fruit. One

Fig. 21.—Luffa echinata.

fruit only was eaten ; death took place in nine hours, the symptoms present closely resembling those of cholera.

Euphorbiceæ.

The **Euphorbias,** all yield an acrid milky juice possessing properties similar to those possessed by the juice of *E. resinifera*, and probably also possessing the same chemical composition.[2] Various writers mention the following Indian species, as plants the juice of which is employed in native practice, externally as caustic or vesicant, or internally as a purge. Occasionally, also, the juice of one of the euphorbias, or a twig of one of them, is used as a local irritant application for the purpose of causing abortion ; or homicide is attempted by mixing the juice with food.

[1] *Mad. Chem. Ex. Rept.*, 1898, and Dr. Warden, *Pharm. Jour.*, 1890, p. 997.
[2] Flückiger has also found euphorbon in *E. Tirucalli* and *E. cattimaudoo.*

Euphorbium, or Gum Euphorbium, *vern. Farfiyun*, is the dried milky juice obtained by incising the fleshy branches of *Euphorbia resinifera*, a leafless perennial plant resembling a cactus, growing only in Morocco. It is used in Europe in veterinary practice as a vesicant. Applied to the skin it causes irritation and vesication, and when swallowed is an extremely active irritant poison. A teaspoonful given to an adult in mistake for rhubarb, caused death in three days. Inhalation of the dust raised in grinding euphorbium, is reported to have caused headache, giddiness and stupor.[1]

Flückiger found euphorbium to owe its acrid properties to an amorphous neutral resin readily soluble in cold spirits of wine. Of this 38 per cent. was present in the sample examined. In addition, the sample contained 22 per cent. of *euphorbon*, a crystalline substance, sparingly soluble in cold but freely soluble in boiling alcohol, and soluble also in ether. The remaining 50 per cent. was made up of mucilage, malates, and mineral compounds. If euphorbon, deposited from solution in alcohol in a thin film, is moistened with oil of vitriol, and strong nitric acid be slowly added by means of a glass rod, a fine violet hue appears.[2] Lactucerin contained in Lactucarium, gives, however, the same reaction.

FIG. 22.—Euphorbia Rothiana.

Euphorbia Tirucalli, Milk hedge *Thor niwal* (Bomb.); *Kali* (Tam.); *Tirucalli* (Mal.); *Lunkasij* (Beng.).—Dymock mentions that one to four drops of the juice of this are given as a purge.

[1] Christison, *Poisons*, p. 589. [2] *Pharmacographia*, p. 504.

Euphorbia neriifolia, *Sehund*, *Thohar* (Hind.), *Mansasij* (Beng.), *Newarang*, *Mingut* (Bo.), *Ilaik kalli* (Tam.).—Ainslie, quoted by Dymock, states that the usual dose of the juice of this plant, given by native practitioners as a purge, is about twenty grains.

Euphorbia antiquorum, *Schadida-calli* (Mal.), *Shadray Kullie* (Tam.), *Bontajammoodoo* (Tel.), *Narashij*, *Seyard* (Hind.), *Narsij* (Beng.), (Drury).—Dymock also mentions *E. pilulifera*, *E. thymifolia*, and *E. parviflora*, all three known in the Southern Concan under the name of Nayeti.[1] Drury refers to the use as a vesicant of the fresh juice of *E. cattimandoo*;[2] and W. Gray[3] mentions a case in which the juice of *E. Rothiana* (see Fig. 18) was administered internally to a sick man, who shortly afterwards died, but whether from the disease, or the effects of the medicine, could not be made out from the particulars furnished of the case.

Corollacarpus epigæa (*Syn. Bryonia epigæa*), *Rakas-gaddah*, *Akas-gaddah* (Hind.), *Karwi-nai* (Bo.), *Akasha-garudan* (Tam.) (see Fig. 23).—

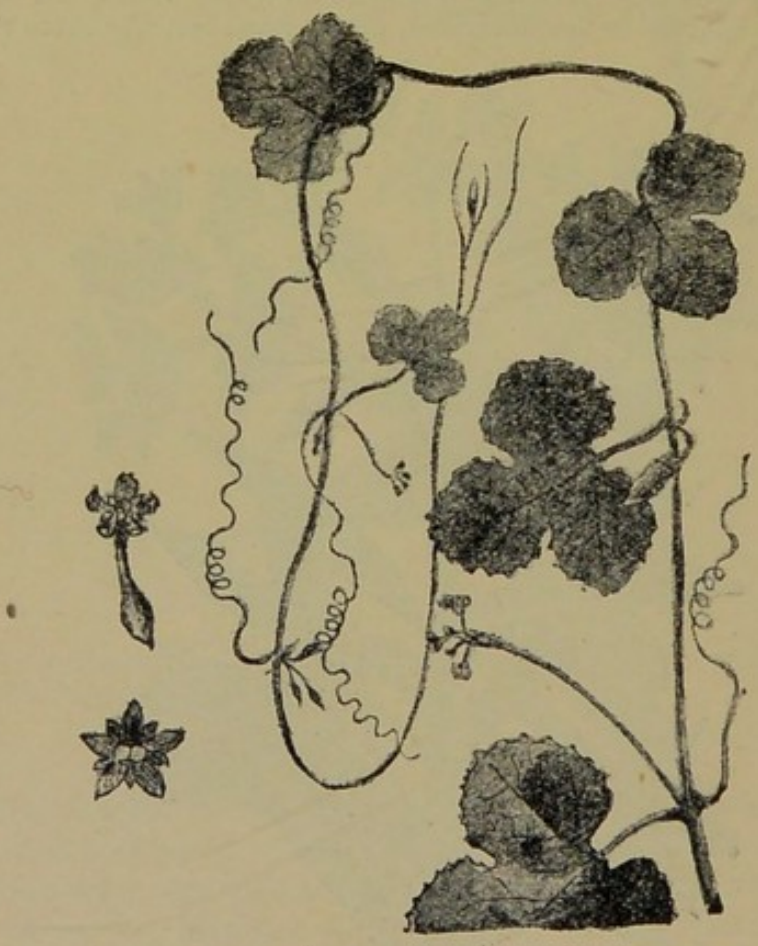

Fig. 23.—Co ollacarpus epigæa.

The root of this plant contains a yellow bitter principle, which, Dymock suggests, may possibly prove to be identical with bryonin. The root is used, in doses of about one drachm in twenty-four hours, as a purgative.

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[1] *Mat. Med.*, p. 694.

[2] *Useful Plants*, p. 204.

[3] *Bo. Chem. Analyser's Rept.*, 1874-75.

Croton Seeds and Oil.—*Croton Tiglium.*—*Jamálgota* (Hind. and Bomb.); *Jaipal* (Beng.); *Nervalam* (Tam.), *Naypalum* (Tel.), *Cadelavancu*, *Neervaula* (Mal.).—Both the seeds of this plant, and the oil expressed therefrom—croton oil—are highly poisonous. The oil is used in medicine as a purgative in doses of one-third of a minim to one minim, Applied to the skin, it vesicates. The Linimentum crotonis B. P., used as a counter-irritant external application, consists of one volume of croton oil to seven volumes of a mixture of equal parts of cajuput oil and rectified spirit. Three drops of the oil proved fatal to a child one year old, and half a drachm has caused death in an adult. In one case an adult died in four hours from a dose of 2½ drachms. One or two grains of the seeds when swallowed, suffice to cause severe pain, with copious watery stools. A case also is reported in which severe symptoms (plain and collapse but no purging) appear to have been produced, by inhaling the dust raised in emptying packages of the seeds.

Case CCXLIX.—**Croton-oil poisoning,** homicidal (attempt).—In a boarding school at Patna in 1899 a boy servant was beaten by the cook and complained to his mother who remonstrated with the cook, but obtaining no satisfaction she threatened to have her revenge. The cook, as usual, prepared the evening meal which was partaken by four or five boys. A short time after they all exhibited symptoms of irritant poisoning, attended with frequent vomiting, looseness of bowels and pain in the abdomen. The medical man, who was called in, treated the cases as croton-oil poisoning. Some vomited matter and cooked food (rice and vegetable) were sent for examination, and croton oil was detected in them. A quantity of curry powder was also forwarded, but it was found to contain no poison. The boys all recovered. It was suspected that the woman had mixed powdered croton seeds with the cooked food in the kitchen during the cook's absence, croton seeds being readily obtainable from any *baniya's* shop in the bazar.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Kobert, from recent researches, attributes the activity of croton oil to croton oleic acid (distinct from crotonic acid) present in the oil both free and as a glyceride. Besides this, cotton oil also contains the glyceride of a peculiar acid,—tiglic or tiglinic acid,—isomeric with angelic acid, $C_5 H_8 O_2$.

Identification.—The seeds are oval, more arched on the dorsal than on the ventral surface, about half an inch long by nearly two-fifths of an inch broad, and weigh about four grains each. The testa is black, thin, and brittle, and more or less covered by a thin cinnamon brown coat. The kernel is white, is enclosed in a delicate white membrane, and easily splits into two halves, between which lie two foliaceous cotyledons, and a short thick radicle. The oil may be extracted from the seeds or other matters by exhaustion with ether, and recognised by its vesicating action on the skin.

The seeds of the following are stated to resemble those of croton tiglium in appearance and properties. *Baliospermum montanum*, vern. *Danti*. These, Dymock states, are often sold as *Jamálgota* by druggists; and *Croton oblongifolium*, *Baragach* (Beng.), *Ganasur* (Bo.), *Gonsurong* (Goa).

Castor-oil Seeds and Oil.—*Ricinus communis.*—*Arandi* (Hind.), *Erendi* (Bo.), *Bherenda* (Beng.), *Amanak-kani-chedi Sittamunak*, *Valluk* (Tam.), *Citavanakoo*, *Avanak*, *Pandiavanak* (Mal.), *Sittamindi*, *Amidum* (Tel.).—Castor-oil, if expressed from the peeled and winnowed

seeds, without the aid of heat, is mildly purgative. The seeds, however, are highly poisonous. Three grains of the seeds has caused alarming symptoms, and a case is reported where three seeds proved fatal to an adult in forty-six hours. Fatal cases of poisoning by castor-oil seeds administered in food have been reported. The poisonous principle of the seeds is an albumenoid body (*ricin*) a 'tox-albumen' resembling the active principle of *abrus* seeds (which see) which gives rise to violent inflammation of the alimentary canal, but not to catharsis, and ten seeds contain about one-tenth of a grain of ricin, or sufficient to cause death in an adult.[1]

IDENTIFICATION.—Castor seeds resemble *croton tiglium* seeds in shape and internal structure, but are somewhat smaller. The testa also differs in colour, being grey marked with brown blotches. The oil is distinguished from other fixed oils by being soluble in glacial acetic acid and in alcohol. It is completely soluble in four volumes of spirits of wine at 15° C. There is also a large variety of castor seed, of a reddish colour with brown blotches, the oil obtained from which is much used for industrial purposes.

Physic Nuts—*Jatropha curcas.*—*Jangli arendi* (Hind.), *Bág-bheranda* (Beng.), *Moghli erendi* (Bo.), *Kattamanakku* (Tam.), *Galamark* (Goa).—The fruit of this and of the other jatrophas named below (physic nuts), contain oily poisonous seeds. The action of these seems to be similar to that of croton tiglium seeds, but somewhat milder in degree. The oil expressed from the seeds irritates the skin, and given internally in doses of twelve to fifteen drops is powerfully purgative. Severe vomiting and purging have been caused by swallowing a few grains of the cake left after expression of the oil from the

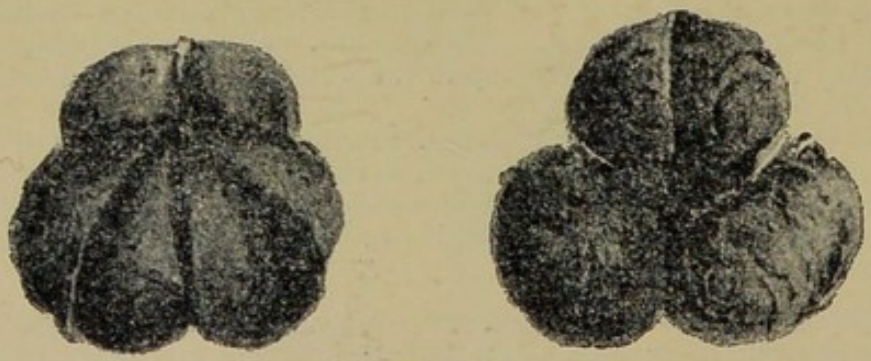

FIG. 24.—Physic Nuts (*Jatropha multifida*).

seeds. Several cases of accidental poisoning by physic nuts are recorded, and Chevers mentions one where in addition to the usual irritant symptoms, muscular twitchings, deafness, inpairment of sight, and loss of memory were present. The fruits of *J. multifida* and of *J. glandulifera*, *Undarbibi*, *Jangli erendi* (Bo.), *Lal-bherenda* (Beng.), *Addaley* (Tam.), *Nela-amida* (Tel.), are quite as poisonous as those of *J. curcas.*

IDENTIFICATION.—The fruits of all are three-celled and three-seeded. *J. multifida* has fruit as large as a walnut of the shape shown in Fig. 24. Those of *J. curcas* are of about the same size, but more uniformly oval in shape, and those of *J. glandulifera* are not bigger than a hazel-nut, oval, and marked externally with six deep longitudinal

[1] Stillmark, *Drop. Arb.*, iii, 1889.

FIG. 25.—Jatropha leaves (1, curcas ; 2, glandulifera ; 3, multifida).

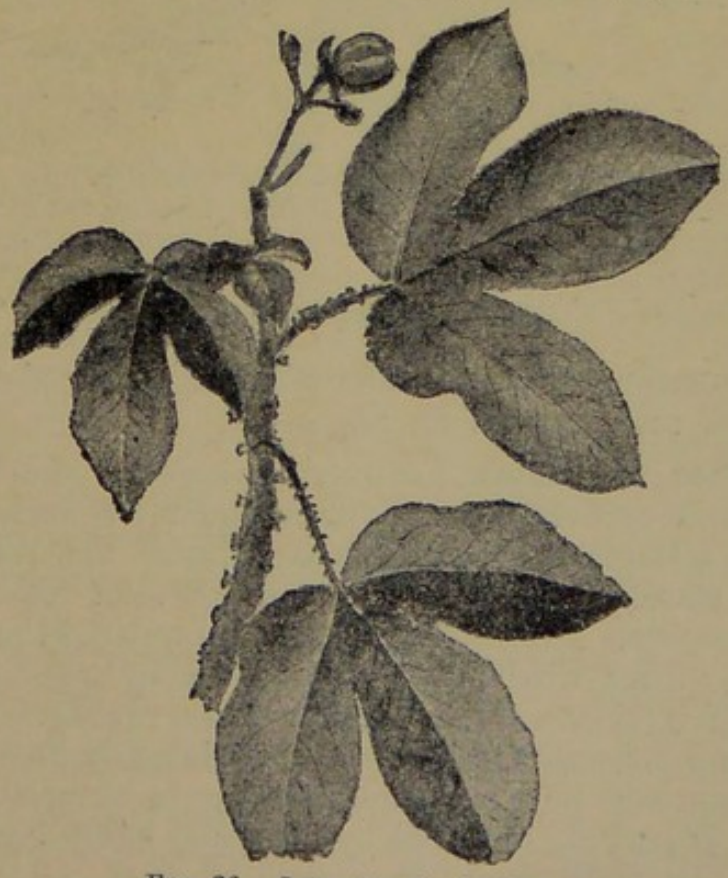

FIG. 26.—Jatropha glandulifera.

grooves. The three plants also may be distinguished by the shape of their leaves (see Fig. 25). The seeds of all three varieties, in shape and internal structure closely resemble castor-oil seeds. *J. curcas* seeds are about three-quarters of an inch long and rather less than half an inch broad. *J. multifida* seeds are somewhat broader, and *J. glandulifera* seeds are only three-tenths of an inch long and two-tenths of an inch broad. *J. curcas* and *J. multifida* seeds are black with a white scar at one end, while *J. glandulifera* seeds are grey with two brown stripes on the dorsum.

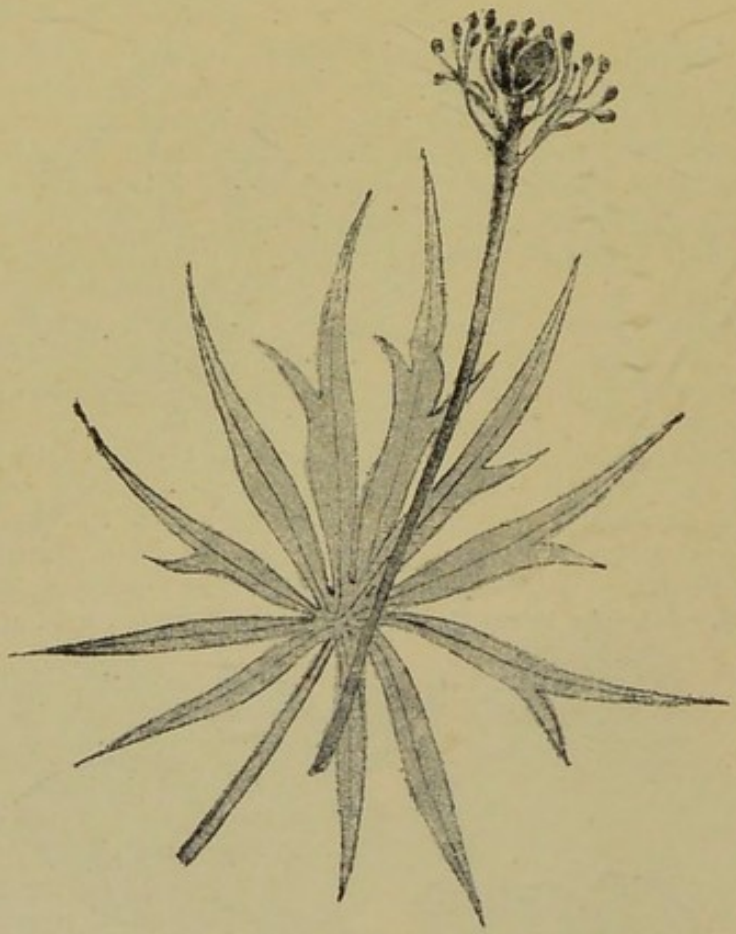

FIG. 27.—Jatropha multifida.

Other Euphorbiaceæ.—The following other plants of this order are of medico-legal interest:—

Manihot utilissima (*Jatropha manihot*), the Cassava.—This plant is cultivated in Southern India for food, the boiled root being a staple of diet. It is a native of the West Indies, where its starchy root is used as an article of food under the name of cassava. From the root also is prepared the *tapioca* of commerce, after dissipating the poison by roasting. Two varieties of it exist—a sweet and a bitter variety. The latter abounds in a poisonous milky juice containing hydrocyanic acid, to which its toxic power is due. Owing to its volatility, however, this is entirely removed by heat, and hence bitter cassava root may be utilised as an article of food, after the juice

has been squeezed out and the root has been cooked. Two fatal cases of poisoning by this root were reported from Madras in 1898; one a child, and another several families.[1]

Jatropha urens.—This also is a native of the West Indies, has leaves covered with stinging hairs, merely touching which has, it is said, in two instances caused serious symptoms. In one of the two reported cases extreme collapse came on in a few minutes. In the other "the pain and swelling in the part touched, lasted for some days."[2]

Hippomane Mancinella, *Manchineel.*—This tree, also a native of the West Indies, yields an acrid milky juice, which, applied to the skin, causes violent inflammation, and if administered internally acts as an irritant poison. Christison mentions that the *H. biglandulosa* and *H. spinosa* are equally poisonous.[3]

Hura cerepitans, the Sand-box tree.—Chevers, on the authority of Dr. H. Cleghorn, remarks that this, introduced from the West Indies, is not uncommon at the Presidency-towns. The seeds are violently purgative.[4]

Lebidieropsis orbiculata, *Wodisha* (Tel.), *Wodagu marum* (Tam.) (Drury); *Odwan, Nachutu* (Tam.).—Drury, in regard to this shrub, states, "The bark or outer crust of the capsules is said to be very poisonous;" and Gribble[5] mentions that it has recently been identified as the probable poison, in some cases of irritant poisoning occurring in the Madras Presidency.

Karla-juri or Pasu.—*Cleisanthus collinus* (Benth.), *Cluytia collina* (Roxb.) *Lebidieropsis orbicularis. Vern.* '*New-larg.*' The bark of this tree, which grows in Chota Nagpur, is used by the Kols for poisoning fish-like *cocculus indicus*, and also occasionally as a human poison, and is said to cause vomiting and purging with cramps in the limbs and death in a day or two—See *Case* below. The rind of the capsule is said by Roxburgh to be poisonous.

Case CCL.—**Poisoning by Karla-juri—Suicidal**—In 1897, some reddish brown bark of a tree called '*Karla-juri*' was sent for examination from Singbhum, along with the viscera of a woman who was said to have died from its effects, having been eaten by her in order to commit suicide owing to a quarrel. She died two days after taking the poison. No poison was detected in the viscera of the deceased. But the alcoholic extract of the bark, which was administered to a full grown cat, produced the following symptoms:—vomiting, weakness in the extremities, tremor of the head, widely dilated pupils, extreme prostration, and death in five hours. The ethereal extract of the bark was not poisonous. A portion of the plant was sent to the Botanic Gardens and identified as an *Euphorbiaceous species*, named *Cleistanthus collinus* (Benth. in *Flora of British India*).—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Liliaceæ.

Aloes.—*Elwa* (Hind. and Beng.), *Elia, Pivalabola, Kalabola* (Bo.), *Kariya-pólam* (Tam.).—This well-known medicinal substance is the inspissated juice of the leaves of the *Aloe vulgaris* and other species of aloe. It is a powerful drastic purgative, acting specially on the rectum.

[1] *Mad. Chem. Ex. Rept.*, 1898.
[2] Taylor, *Poisons*, p. 504.
[3] *M. J.*, p. 255.
[4] *M. J.*, p. 275.
[5] *Poisons*, p. 592.

The usual medicinal dose is three to five grains. In large doses aloes is an irritant poison; two drachms has caused death; and a case was recently reported to the Bombay Chemical Analyser's Office in which a man appears to have died from the effects of swallowing, as a purgative, a decoction of wild aloe leaves. Aloes has a stimulant action on the uterus, and in Europe is frequently given or taken for the purpose of procuring abortion. A form in which it has often been used for this purpose is hiera picra or holy bitter, a mixture of four parts aloes to one of canella bark. Aloes also is an ingredient of Morrison's, and most quack purgative pills. The active principle of Barbadoes aloes is barbaloin, a glucoside. Other varieties contain nataloin and socaloin, bodies probably members, with barboloin, of a homologous series.

Squill.—Officinal squill is the sliced and dried bulb of *Urginea Scilla* (syn. *Scilla maritima*). In doses of six to fifteen grains it acts as an emetic, and in larger doses as an irritant poison, causing vomiting, purging, griping pain, strangury, and bloody urine. In poisonous doses squill causes marked depression of the heart's action. Convulsions also have been observed in poisoning by this drug.[1] Twenty-four grains of the powder has caused death. The active principle is scillitin, apparently a glucoside.

Urginea indica.—*Kánde, Jangli-piyaj* (Hind. and Beng.), *Kol-Kanda, Kochinda*[1] (Bo.), *Nari vengayam* (Tam.).—The bulb of this, if young and small, acts similarly to officinal squill, and is largely used in India as a substitute for it.[2] It has, however, been stated that when the bulbs grow old and large they lose their activity. In a case referred to me in 1883, a quantity of food on examination was found to contain portions of bulbs exactly resembling those of *Urginea indica*. This food, it was stated, had been given by a woman to her husband, who noticed it to possess a bitter taste, and after eating a portion of it suffered from vomiting.

Identification.—Tunicated bulbs (*U. indica* as large as a common onion, *U. scilla* larger), each scale made up of polyhedral cells, covered on both sides by an epidermis provided with stomata. The cells are loaded with mucilage, and contain numerous needle-shaped crystals of calcium oxalate.

Gloriosa superba.—*Lánguli, Karihári, Kulhári* (Hind.), *Bisha-languli* (Beng.), *Indai, Nagkaria* (Bo.), *Kalaippaik-kizhaugu* (Tam.).—The tuberous root of this plant is popularly believed in India to be highly poisonous. Burmese girls are said to commit suicide by its roots when crossed in love.[3] According to Moidin Sheriff, however, it is not poisonous in twelve-grain doses, but acts as an alterative tonic and antiperiodic.[4] In large doses it appears to be poisonous, acting in the same manner as squill (see Case *CCLI*), and Warden has recently isolated a bitter principle from the root, which he has named *superbine*, and considers to be closely allied to, if not identical with, scillitin.

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[1] Christison, *Poisons*, p. 214.

[2] *Scilla hyacinthoides* (syn. *Ledebouria hyacinthoides*). *Paharikanda Nanijangli-Kando* (Bo.), *Shiri-naru-vengayam* (Tam.), has a scaly bulb about the size and shape of a small pear, which is used as, and appears to be an equally satifactory substitute for, officinal squill.

[3] But Mr. Hunter, Chem. Exmr., Rangoon, has only had about six such cases referred in eleven years.

[4] Dymock's *Mat. Med.*, p. 833.

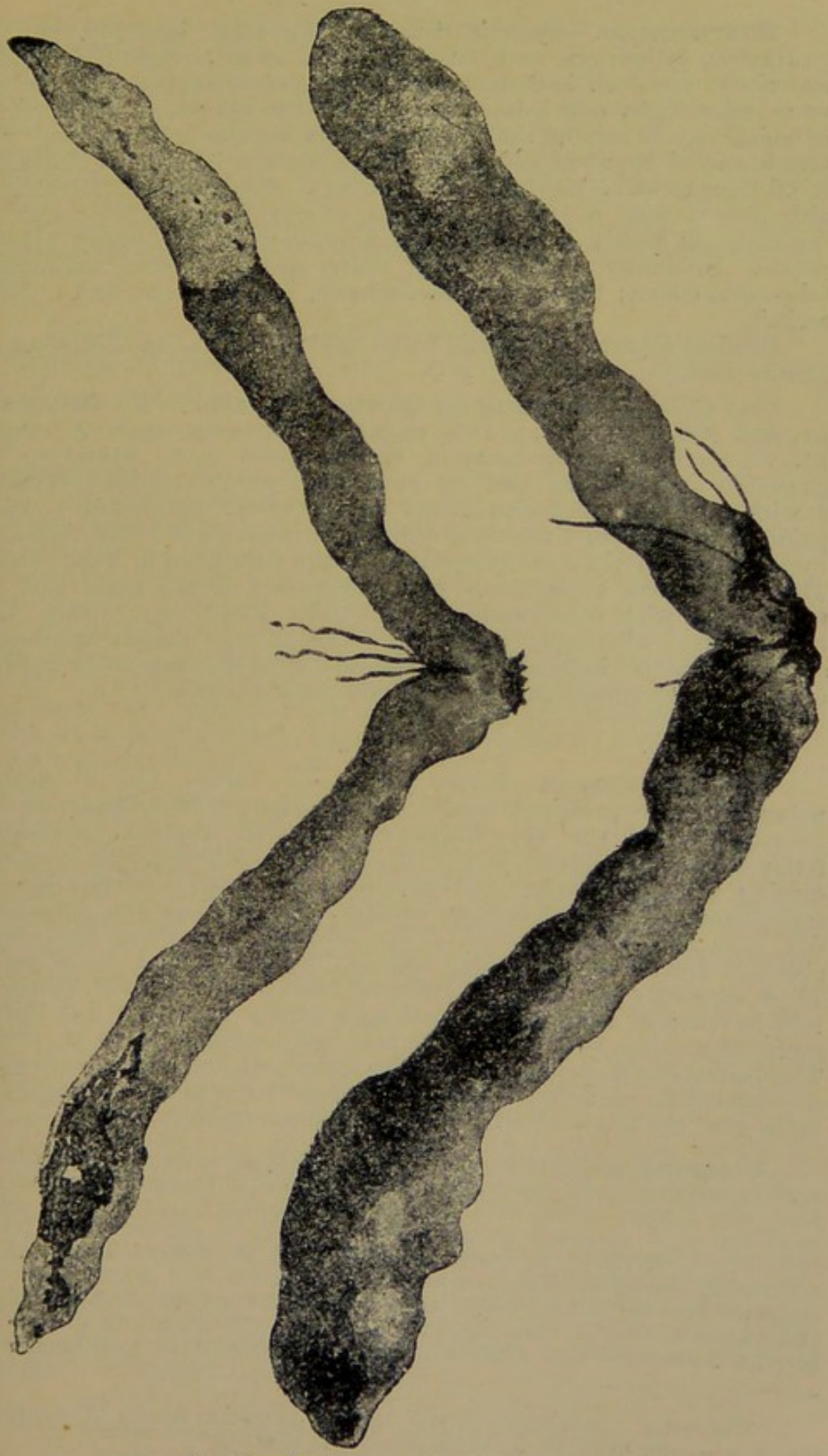

FIG. 28.—Gloriosa superba—Root nat. size.

IDENTIFICATION.—Dymock describes the root (see Fig. 28) as "tuberous, cylindrical, and flattened, often seven to eight inches long and about one inch in diameter; it consists of two tubers which unite at a right angle, one being much smaller than the other; at the point of union may be seen on the upper surface a circular scar marking the attachment of the stem, and on the under surface, immediately beneath it, another, to which a tuft of thin rootlets is often attached. The tubers are covered with a brown epidermis, except at the point, which is tapering and nearly white, like the growing part of a young kidney potato. Internally they are juicy, white, and farinaceous, and have a faint acrid odour; the taste is mucilaginous, feebly bitter, and a little acrid."

Gloriosa superba root is said to be used in India as an adulterant of aconite root.

Case CCLI.—**Poisoning by Gloriosa superba.**—Dr. Battacharjee, *Ind. Med. Gaz.*, 1872, p. 153, reports the following case:—A female, æt. 18, swallowed a quantity of the powdered root. Symptoms of poisoning appeared in half an hour, and were: retching, violent vomiting, spasms, and contortions of the body, with fearful racking pain; from time to time there were short intervals of relief, followed by recurrence of the same symptoms. Death took place in four hours. The *post-mortem* appearances were congestion of the brain and its membranes, with extravasations of blood. The lungs, liver, and kidneys were all deeply congested. The gastric mucous membrane showed signs of inflammation. The peritoneal covering of the fundus of the uterus (unimpregnated) was also found inflamed.

Ranunculaceæ.

The Hellebores.—These, natives of Europe, are all highly poisonous. The principal species are *H. niger*, or Christmas rose, the *melampodium* of the old Pharmacopœias; *H. fœtidus*, bear's-foot, fetter-wort, or felon-grass, and *H. viride*.[1] They are compound irritants, causing violent vomiting and purging (the latter, however, has in some cases absent), and great collapse. Convulsions and insensibility have also been observed. Two poisonous glucosides have been obtained from the hellebores, namely, helleborin and helleborein. These, especially the latter, are powerful heart poisons. Black hellebore root in doses of a few grains, acts as a drastic purgative, and thirty grains of an aqueous extract of the root has proved fatal to an adult. The leaves of the hellebores are also poisonous, and a case is reported where a child, æt. 2, was killed by two dessert-spoonfuls of an aqueous infusion of the leaves of *H. viride*, given as a vermifuge.

Anemone pulsatilla and other species of anemone, and *Ranunculus acris* or 'buttercup,' *R. sceleratus*, and other species of ranunculus, contain an acrid oily matter, acting as a vesicant when applied to the skin, and when swallowed as a compound irritant poison, causing, in addition to the usual symptoms of irrritant poisoning, depression of the heart's action, slow respiration, paralysis, and convulsions. The acrid oily matter may be separated from the plants by distillation with water; and the plants, on drying and exposure, after a time lose their activity. The acrid oily matter on keeping decomposes into anemonic acid, apparently inert, and anemonin.

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[1] The name "hellebore" is also applied to certain species of veratrum plants belonging to the N. O. *Melanthaceæ* (see p. 186).

[2] *Plants of Sind*, p. 73.

which is actively poisonous. Murray, notices that *R. sceleratus* grows in Sind and the Panjab, and is virulently poisonous.

Actæa racemosa (syn. *Cimicifuga racemosa*), Black snake root or black cohosh.—The rhizome and rootlets of this plant are officinal in the United States Pharmacopœia. In large doses it causes nausea and vomiting, and depresses the action of the heart. In one case abortion is reported to have followed its administration. *Adonis vernalis*, regarded by some as species of anemone, must also be mentioned as a poisonous plant belonging to this order. It contains a glucoside (adonidin) acting as a cardiac depressant like digitalis. Vomiting and diarrhœa are more readily produced by *Adonis vernalis* than by digitalis.

To this order also belong *Delphinium staphysagria* (see Alkaloidal Irritants, p. 490) and *Aconitum napellus* and *A. ferox*, which see.

Thymelaceæ.

Mezereon.—*Daphne mezereon*, and *D. laureola* [or Spurge-Laurel] and other species of the same genus, are compound irritant poisons. A few accidental fatal cases of poisoning by the bright red berries of *D. mezereum* are recorded, the symptoms being vomiting and purging, followed by narcotism with dilated pupils. The bark also is poisonous, and appears to contain a fatty vesicating oil. Several members of this genus are found in India, and Burton Brown[1] mentions that the root and stem of one species (apparently *D. papyracea*), growing on the hills, is a powerful irritant, known under the vernacular name of '*Gundhera*,' and that it can be recognized by the peculiar woody tissue which forms the inner bark, and which is composed of long white fibres, easily separable from the wood.

Lasiopsiphon speciosus, vern. *Rametha.*—The bark of this shrub, common on the Ghauts, is a powerful vesicant, and is used for poisoning fish. Dr. W. Gray mentions a case in which administration of the leaves of the plant caused irritant symptoms, followed by abortion and death.[1] Dymock describes the bark as acrid in taste and consisting "of an outer tuberous portion, which is of a light brown colour, and divided by numerous transverse and longitudinal fissures, so that it can be easily separated, and of an inner layer, which is white, tough, and silky like mezereon."

Aroideæ.

The tuberous roots of many of the **arums**, a genus of this order when taken into the mouth, cause immediate burning pain, great swelling of the tongue, and salivation, and when swallowed give rise to symptoms of irritant poisoning. The roots of many contain much starch, and are used, after washing and baking, as articles of food. Pedler and Warden consider the activity of the roots to be due to mechanical irritation set up by the needle-shaped crystals of oxalate of lime with which these roots abound. The following may be specially mentioned :—

Arum maculatum, 'lords and ladies,' cuckoo-pint.—This, common in England, has given rise to several cases of accidental poisoning, chiefly among children, from eating the leaves. In some of the cases convulsions and dilated pupils are reported to have been present. The tuberous root—poisonous when fresh—after steeping in water and baking, is used as an article of food under the name of Portland Sago.

[1] On 'Poisons used in the Punjab,' quoted by Chevers, p. 285.
[2] *Bo. Analyser's Rept.*, 1874-75, p. 10.

Arum seguinum—*dumb cane.*—A native of the West Indies. Two drachms of the juice of this plant has been known to prove fatal in a few hours.[1]

Arum monatum, *Konda-rakis* (Tel.), and *Arum lyratum. Adavi.*—These are both, Drury states, natives of the mountainous parts of the Northern Circars. The root of the first is so poisonous that it is used to poison tigers; the root of the second is used as an article of food, but requires careful cooking.

Synantherias sylvatica (syn. *Arum sylvaticum*), *Uzomut* (Goa), *Wajrmut* (Mar.)—Dymock notices that the seeds of this produce the local effects noted above, followed by numbness, and states that the crushed seeds are used in the S. Concan, on account of their benumbing effect, as a remedy in toothache.

Arum colocasia, (syn. *Colocasia antiquorum*), vern. *Kachu* or *Bish Kachu.* It is used as an article of diet in India when roasted or boiled. Two cases of poisoning by the tubers of this plant, both non-fatal, were reported in Bengal, in 1886 (see below). Dr. Kirtikar informs me also, that he has met with cases in which irritation of the throat followed the eating of the tuberous root of *Amorphophallus campanulatus* (vern. *Suan, Madanmast*), and the spadix of *Pythonium Wallichianum* (vern. *Shewla*), two plants belonging to this order, the named portions of which are commonly used as vegetables in India.

Case CCLII.—**Arum—Kachu poisoning.**—In the case from Dibrugarh in Assam, a sick coolie had some fried *Kachu* administered to him and experiencing a burning sensation spat it out whereon a pig ate what been ejected and died in an hour, and a second pig was given some and also died. Dr. Warden failed to extract from the tubers any active principle, but found them to contain bundles of needle-shaped crystals of oxalate of lime, which would mechanically account for the irritant symptoms.

Amaryllideæ.

Daffodil.—*Narcissus pseudo-narcissus.*—This, common in England, is mentioned by Guy and others as an irritant poison. Other species of narcissus also have a similar action (see *Hermodactyl*, p. 187). The root of an Indian plant of this order, namely, *Crinum asiaticum*, vern. *toxicarium*, is officinal in the Pharm. of India as an emetic, and Dymock mentions that the bulb of *Crinum ornatum*, *Gadambikanda* (Bo.), is extremely acrid, and is used for blistering cattle, a slice being bound on the skin.

Other Orders.

Argemone mexicana, N. O. *Papaveraceæ; Bharbhand* (Hind.), *Brahma-dandi* (Sans.), *Shiál kánta* (Beng.), *Dàruri* (Bo.), *Feringi-datura* or *Pila datura* (Duk.). The seeds of this plant yield an oil which, when swallowed, causes vomiting and purging. In 1878 four cases of accidental poisoning in Bombay from the use of this oil in food, in each of which several persons were affected, were reported.

Identification.—The seeds are contained in prickly capsules, three-quarters to one and a half inches long. They are dark brown in colour, nearly globular, about one-fifth of an inch in diameter, and covered with minute, regularly arranged, projections and depressions. One hundred of them weigh about three grains. The oil, shaken with an equal volume of strong nitric acid, acquires a deep crimson colour,

[1] Christison, *Poisons*, p. 602.

the acid at the same time becoming similarly coloured. The crushed seeds, warmed with strong nitric acid, give a similar reaction. Dragendorff has found the seeds to contain an alkaloid possessing reactions similar to those of morphia.

Capsicum annuum or 'Chillies,' N. O. *Solanaceæ; Lal-mirch* (Hind., Bo., and Beng.), *Milagày* (Tam.).—The fruits of this and of other species of capsicum, contain an exceedingly acrid, volatile, non-alkaloidal substance, capsicin, apparently the active principle; and also a volatile alkaloid, with an odour like conia. Applied to the skin, capsicum causes irritation and vesication, and, taken internally in sufficient quantity, acts as an irritant poison. Owing to the volatility of the active principle, the fumes arising from burning capsicum are highly irritant. The medicinal dose is half a grain to one grain.[1] Woodman and Tidy mention a case where quack pills containing capsicum proved poisonous to a woman, aged seventy-four; and Taylor[2] mentions a case where a quack was tried for causing the death of a boy, aged fifteen, who was suffering from hip-joint disease, by giving him a mixture containing Cayenne pepper; the prisoner, however, was acquitted. Capsicum is frequently used in India for purposes of torture. Chevers mentions its use for this purpose in the following ways:—Introduction into the nostrils, eyes, vagina, or urethra; burning it under the nose, rubbing it on the breasts of females, and covering the head with a bag which has contained it.

IDENTIFICATION.—The appearance of the fruit is well known. The seeds are of a flattened kidney shape, about a quarter of an inch long and wide, and closely resemble datura seeds. Like datura seeds, the testa under the microscope is seen to be covered with convoluted ridges. They differ from datura seeds (1) in having a pungent taste; (2) the convex border is single, not double, as in the datura seed; and (3) on section the embryo is seen to differ in shape from that of the datura seed (see p. 266, and Figs. 33 and 34).

Cocculus indicus, or Levant Nut.—The fruits or berries of the *Anamirta cocculus*, N. O. *Menispermaceæ;* vern. *Kakmari* (Hind.), *Kákphul*, *Karwi* (Bo.), *Kákkáy-kolli-virai* (Tam.).—These are highly poisonous, owing their activity to the presence of *picrotoxin*, a crystallisable non-alkaloidal principle, contained in the seeds, but not in the pericarp of the fruit. The pericarp, in fact, is non-poisonous, and an entire berry might therefore possibly pass through the body without causing bad symptoms. *Symptoms:*—Picrotoxin is an irritant poison, causing vomiting, purging, &c., with extreme giddiness, faintness, dimness of vision, followed by delirium and epileptiform convulsions, stupor, and loss of voluntary power.

A few cases of poisoning by Cocculus indicus berries have occurred in Europe and America. In one case a child died from the application of an alcoholic tincture of the berries to the head. A decoction or extract of *cocculus indicus* has been used in England as an adulterant of

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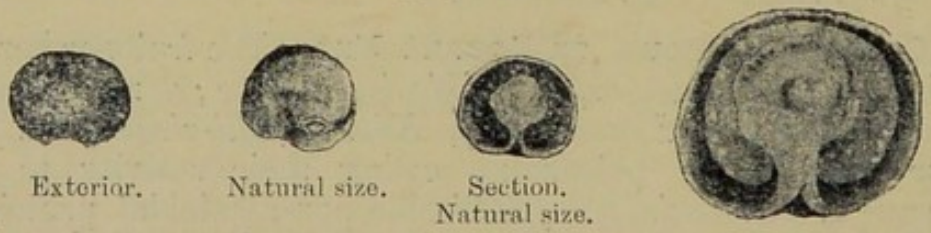
[1] Bentley and Redwood, *Mat. Medica*, p. 625. Taylor, *Poisons*, p. 505, gives the medicinal dose as five to ten grains.

[2] *Poisons*, p. 505 (*R.* v. *Stevens*, C. C. C., May 1864).

beer, porter, &c., in order to increase its intoxicating power ; and it is said to be largely used for the same purpose by the liquor retailers of Bombay. In England *cocculus indicus* has been used by thieves to stupefy their victims in order to facilitate the commission of theft ; and in 1881 a case was referred to the Bombay Analyser, in which it was alleged that it had been used for a similar purpose. The Bombay records also show that during the last ten years cocculus indicus was detected in three cases of alleged cattle poisoning. In India cocculus indicus berries are used as in England as a fish poison. In medicine, cocculus indicus is only used as an external application as a parasiticide (see also *Spinal poisons*).

Fatal period.—Of six persons accidentally poisoned by decoction of the berries, two died within half an hour, the remaining four recovering after several hours.[1]

Identification.—The dry berries are nearly globular, about half an inch or rather less in diameter, and have a blackish wrinkled surface. On section they are seen to contain a peculiar mushroom-shaped body, consisting of a cup-shaped seed, supported on a stalk formed by a projection inwards of the endocarp (see Fig. 29). The pericarp is tasteless, the seed is bitter. From organic mixtures picrotoxin may be separated by digesting the matter under examination with alcohol, evaporating the alcoholic tincture nearly to dryness, and treating the extract so obtained with acidulated water. The acid watery solution is then to be filtered, shaken with ether, and the latter separated and evaporated to dryness, when picrotoxin, if present, will be found in the residue. Picrotoxin is not precipitated from solution by the group tests for the alkaloids (see p. 185). It has a bitter taste, reduces alkaline copper solutions like grape sugar, and dissolves in strong sulphuric acid, forming a yellow solution, which on addition of a trace of potassium dichromate becomes violet, changing into brown.



Exterior. Natural size. Section. Natural size. Enlarged Section.

Fig. 29.—Cocculus Indicus.

Dolichandrone falcata (ss. Spathodea falcata, and Bignonia spathacea), N. O. *Bignoniaceæ*, vern. *Mersinghi*.—Dymock notes that "this small tree has the reputation of being used to procure abortion." The bark is also, it is stated, used as a fish poison. I found, however, no ill effects to follow the administration of a considerable quantity of a decoction of the bark to a small dog.

Ergot.—This is the sclerotium (compact mycelium, or spawn B. P.) of *Claviceps purpurea*, a fungus liable to be

[1] Wharton and Stille, *M. J.*, 499.

developed within the paleæ of numerous plants of the order Graminaceæ. Rye so affected constitutes the ergot of rye used in medicine. Other cereals, *e.g.*, wheat and oats, are liable to the affection.[1] In large single doses ergot causes the usual symptoms of irritant poisoning, accompanied by headache, giddiness and stupor, depressed action of the heart, and dilated pupils. Acute poisoning by ergot is very rarely met with. One case, however, is recorded where a woman in the fourth month of pregnancy, having swallowed a quantity of powdered ergot, aborted and died soon afterwards from peritonitis. Outbreaks of ergotism, or chronic poisoning by ergot, arising from the use of affected grain as food, have occurred in France and Germany. Ergotism shows itself in two forms—a convulsive and a gangrenous form. Both commence with gastro-intestinal disturbance. In the first giddiness, aberrations of vision, loss of sensation in the hands or feet, spasms and convulsions, are the prominent symptoms. In the second, dry gangrene of the extremities is the principal effect.

Ergot causes contractions of the uterus, especially of the pregnant uterus, and hence is used sometimes criminally as an abortifacient. In the early stages of pregnancy, however, it sometimes fails to excite contractions of the uterus. Thus Taylor mentions a case where a woman took about a teaspoonful of tincture of ergot three times a day for eleven weeks, and died at about the third month of pregnancy without having aborted.[2] The medicinal dose of powdered ergot in uterine diseases is 5 to 15 grains three times a day, but its administration should not be continued for any length of time. The dose for a woman in labour is 20 to 60 grains. Doses of 30 to 120 grains have caused symptoms of poisoning

Identification.—Ergot appears to contain more than one active principle,[3] none of which, however, possess chemical characters sufficiently distinct to enable them to be recognised with certainty. Ergot of rye consists of fusiform grains $\frac{1}{4}$ of an inch to $1\frac{1}{2}$ inch in length, and about $\frac{1}{6}$ to $\frac{1}{3}$ of an inch thick. Externally the grains are deep purple, internally they are white or pink. They have a peculiar fishy odour, which becomes more developed on the addition of potash. Ergots of other grains chiefly differ from ergot of rye in length and thickness.

Gamboge, *Ussaráh-i-Rewand*, *Gotaganba* (Pers., Hind. and Bo.), *Mukki* (Tam.).—This is a gum resin from *Garcinia morella*, N. O. *Guttiferæ*, and is used in medicine in doses of one to five grains as a drastic purgative.

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[1] Chevers mentions that in India a disease called "*leera*" appears in barley and oats, and a similar disease called "*kindol*" appears in *Bajri*, and points out that grain thus affected resembles ergot of rye.

[2] Taylor's *Manual*, p. 513.

[3] The latest researches are those of Kobert; according to this authority ergot contains three active principles, *viz.* (1) ergotinic acid, this paralyses the spinal cord, but does not appear to act on the uterus; (2) sphacelinic acid, this causes spasmodic contraction of the arterioles, resulting in gangrene or extravasations of blood; and (3) cornutin, a convulsant causing clonic and tonic spasms.

One drachm has caused death. A case, however, occurred in Bombay in which a girl, æt. 19, intending to commit suicide, swallowed there drachms, but recovered under treatment. **Identification.**—A tawny or brownish orange substance, generally met with in cylinders 1 to 2½ inches in diameter, with an acrid taste, forming a yellow emulsion with water, and violently purgative.

Moringa pterygosperma, the Horse-radish tree, N. O. *Moringeæ*, *Sahjna* (Hind.), *Shegva*, *Shegat* (Bo.), *Murungai* (Tam.)—The fruit of this tree is eaten as a vegetable, and the root is used as a substitute for horse-radish, which it exactly resembles in taste. Kany Lall Dey[1] states that one of the methods of procuring abortion in use near Calcutta, is the administration of a dose consisting of about half an ounce of pounded sahjna bark mixed with twenty-one black pepper-corns, and that this is a very dangerous means, the mother as a rule dying when it is resorted to.

Lal-Chitra.—*Plumbago zeylanica.*—*Chitrak* (Hind.), *Chitta* (Beng.), *Chitra* (Bo.), *Chittira* or *Chittira Mulam* (Tam.); and *Plumbago rosea*

Fig. 30.—Plumbago zeylanica.

(syn. *P. coccinea*), *Lal-chitra*, *chita*, or *chitra* (Hind., &c.), *Shivappu chittira* (Tam.), N. O. *Plumbagineæ* (see Fig. 30).—The roots, and probably other por-

[1] Chevers, *M. J.*, p. 716.

tions of these plants, contain a highly acrid crystallisable non-alkaloidal principle called *plumbagin*. The bruised roots applied to the skin cause vesication. Taken internally, in large doses, plumbago root acts as an irritant or narcotico-irritant poison.

Plumbago root in India is sometimes administered internally as a poison, and Chevers [1] refers to two fatal cases, one of them a case of homicide, in which it was so employed. More commonly in India plumbago root is used for the purpose of causing abortion. With this object it is sometimes given internally, and has been more than once detected plumbagin in pills stated to have been administered for this purpose. Usually, however, it is employed as a local irritant application to the *os uteri*, a portion of the root or a twig of the plant being pushed into the vagina, and sometimes even into the uterus. In other cases the cotton-covered end of an abortion-stick (see p. 294) is smeared with a paste made from the powdered roots; and I once met with a case in which a lump of such paste was simply thrust into the upper part of the vagina, and was found there after death. It is also used as an irritant to skin by malingerers or to support false charges, see following case.

Case CCLIII.—**Lal-Chitra applied to skin to fabricate a 'bruise.'**—In 1898 a case is reported of a false charge of dacoity having been made at Murshedabad, Bengal, which the alleged injuries of the complainant were shown by the civil surgeon to have been artificially produced by the application of this irritant. The man, Jitan Ali Mir, was found guilty of bringing a false charge and sentenced to four years' imprisonment.—(*Ind. Med. Gaz*, 1900, p. 8.)

Detection.—The roots are $\frac{1}{4}$ to $\frac{1}{2}$ an inch in diameter, dark brown externally and reddish within; from them and matters containing it, plumbagin may be extracted by digesting the substance under examination with alcohol, straining this off, and evaporating the tincture to dryness. The dry residue from the tincture should then be digested with a small quantity of water rendered slightly alkaline with caustic potash, the solution obtained filtered, acidulated with hydrochloric acid, and shaken with ether. The ether is then separated, evaporated to dryness, and the residue tested for plumbagin. Plumbagin treated with caustic potash solution dissolves, forming a bright crimson liquid. Hydrochloric acid added to this changes the colour to yellow, and on standing the liquid deposits yellow flocculi of plumbagin, which may be separated by shaking the acidified fluid with ether. An alcoholic solution of plumbagin gives a crimson precipitate with solution of basic acetate of lead.[2]

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[1] *M. J.*, p. 252.

[2] A colouring matter obtained from rhubarb root gives, with caustic potash solution, a crimson colour similar to that given by plumbagin. An alcoholic solution of it, however, gives, with acetate of lead solution, an orange precipitate, not a crimson precipitate like plumbagin.

Plumieria acutifolia, (syn. *P. acuminata*), N.O. *Apocynaceæ ; Khair-champa* (Bo.), *Gobur champa* (Beng.), *Dolochápo* (Guz.) (see Fig. 31).—This small tree, common in India, has blunt truncate branches and white and yellow flowers. It abounds in viscid juice, which dries into a substance resembling India-rubber. "The root is a violent cathartic, and the blunt-ended branches are used to procure abortion."[1] A case of poisoning by the bark has recently been reported.[2] The quantity taken was about a square inch. This was pounded, mixed with water, and swallowed by a man, aged 25, as a remedy for colic. The symptoms were vomiting, depressed heart's action, and somewhat dilated pupils. The plant does not give any blue or green reaction with hydrochloric acid, like *Cerbera thevetia* and *C. odallum* (see p. 299). It contains plumieric acid in combination with calcium.[3]

Fig. 31.—Plumieria acutifolia.

Fig. 32.—Randia dumetorum.

Randia dumetorum, N. O. *Rubiaceæ ; Mainphal* (Hind.), *Gelaphal* (Bo.), *Maruk-ka-lán-kay* (Tam.), *Menphal* (Beng.), *Mindhal* (Guz.) (see Fig. 32).—Dr. George Bidie[4] states that the fruit of this is apparently an

[1] S. Arjun, *Bom. Drugs*, p. 210.
[2] K. R. Kirtikar, in *Trans. Bo. Med. and Phys. Soc.*, 1886.
[3] Watts, *Dict.* viii, p 1656.
[4] *Pharm. of India*, p. 118.

irritant emetic, and is used to produce emesis by the poorer classes in Mysore, the dose being one ripe fruit well bruised. According to Ainslie, an infusion of the root bark also acts as an emetic; and Dymock mentions that the bruised nut is used in the Concan to preserve grain from the attacks of insects, and as a fish poison. Chevers,[1] on the authority of Edgeworth, states that the fruit is used in the neighbourhood of Jalandhar, as an ingredient in medicines given by the mouth for the purpose of procuring abortion.

IDENTIFICATION.—Dymock[2] gives the following description of the dried fruit:—"About the size of a crab apple, globular or oval, reddish brown, crowned with the rim of the calyx. It consists of a pericarp and shell, which contains the seeds embedded in pulp. The shell is hard and thick, two-celled, the dividing septum being thin and membranous. The pulp is grey, and has a nauseous taste and smell. The seeds are small and oblong, about $\frac{1}{8}$th of an inch in length, slightly flattened, very hard, and of a brown colour. The average weight of the fruit is about sixty grains." In the dried fruit the seeds are found agglutinated together into two rough masses, each something of the shape of a coffee bean, but larger, one mass in each cell of the fruit.

Rue, *Ruta graveolens*, N. O. *Rutaceæ*, yields by distillation a pale yellow volatile oil of a strong disagreeable odour and acrid bitter taste. The oil—officinal B. P. and I.P.—appears to be the active principle of the plant, and is used in medicine, internally as an emmenagogue in doses of from two to five drops, and externally, as a rubefacient. Garrod gives the medicinal dose of the powdered leaves as twenty to forty grains. In large doses, rue acts as an irritant poison, causing vomiting and prostration, with a feeble slow pulse and coldness of the extremities. Swelling of the tongue and salivation have also been observed. In Europe, rue has been frequently given or taken, it is said with success, as an abortifacient. *Ruta angustifolia*, *Sudab* (Hind.), *Sutap* (Bo.), *Arvada* (Tam.), is cultivated in most parts of India, and is used in native medicine in the same way that *R. graveolens* —for which it appears to be a perfect substitute—is used in Europe.

Savin.—The leaves and tops, and the berries of *Juniperus sabina*, N. O. *Coniferæ*, contain an acrid volatile oil – oil of Savin—which, when applied to the skin, acts as a vesicant, and when swallowed, as an irritant poison. In addition to its irritant action on the alimentary canal, savin causes congestion of the kidneys and uterus. Owing to its action on the kidneys, strangury, hæmaturia, and even suppression of urine, may be present in cases of poisoning by it. Savin is used in medicine as an emmenagogue in doses of five to fifteen grains of the powdered tops, or one to fifteen minims of the oil. In England, savin is popularly believed to be an effectual abortifacient, and cases of poisoning by it are generally due to its having been given with this object. Savin often fails to cause abortion; sometimes it succeeds, generally, however, at great risk to life. Several cases are recorded where its administration caused abortion, followed by the death of the woman.

IDENTIFICATION—There is no reliable chemical test for the oil. If the leaves or tops have been given, fragments of these may be found and identified by comparison with a known specimen. The woody fibres, like those of other coniferæ, exhibit circular discs. The leaves are minute and have a sharply-accuminated point, while those of yew, another poisonous plant of the same order, have a lancet-shaped apex. Savin leaves differ also from yew leaves in giving off when rubbed a strong peculiar odour.

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[1] *M. J.*, p. 720. [2] *Mat. Medica*, p. 408.

Soap-nuts, *Ritha* (Hind. and Bo.), *Ponnau-kottai* (Tam.), *Ringin* (Mar.), the fruit of *Sapindus trifoliatus* (Syn. *S. emarginatus*), N. O. *Sapindaceæ*.—These are used in India as a detergent, and also in native medicine. According to Dymock, the pulp, in four-grain doses, is given internally as an anthelmintic and tonic, and a native authority recommends its administration in seventy-grain doses, with about eight grains of scammony, as a purgative. Soap-nuts contain the glucoside saponin, a white amorphous powder, soluble in water, and forming a solution which froths like a solution of soap. Saponin is an undoubted poison. Blyth states that one and a half to three grains of saponin administered by the mouth produces slight symptoms in the human subject, and estimates that forty grains administered subcutaneously to an adult would endanger life. Saponin locally applied acts as an irritant, subsequently producing paralysis and anæsthesia ; absorbed into the system, it paralyses the nerve-centres and the heart. Hence, as stated by Blyth, in poisoning by saponin the symptoms would probably be great muscular prostration, weakness of the heart's action, and diarrhœa, and after death *post-mortem* appearances of irritant poisoning would probably be found. Saponin is present in many other plants, *e.g.*, in senega ; in sarsaparilla ; in the bark of *Quillaia saponaria* (soap bark), and in *Agrostemma Githago or* 'common *corn-cockle*.' Blyth suggests that accidental admixture of corn-cockle seeds with wheat, may possibly account for some of the mysterious cases of poisoning which have occurred from time to time after eating cakes, bread, &c. IDENTIFICATION.—The dry berries of *S. trifoliatus* have a shrivelled brown translucent skin, and are met with either in threes united together or separate, and showing a heart-shaped scar on one side ; each berry contains a single dark red-brown seed of similar shape to the fruit. The fruit-pulp has a fruity smell ; its taste is sweet at first, afterwards very bitter. **Saponin** may be obtained from matters containing it by digesting them with hot spirit, from which the saponin deposits as the liquid cools. The deposited saponin may then be purified by dissolving it in the least possible quantity of boiling water. On the addition of absolute alcohol to this, the saponin precipitates. Saponin is insoluble in cold alcohol and in ether, strikes a red colour with sulphuric acid, and dissolves in water, forming a soap-like solution.[1]

Myrobolans, *Terminalia bellerica*, N. O. *Combretaceæ : Bhairah, Bahera* (Hind. and Beng.). *Behada, Hela* (Bo.), *Taurik-kay* (Tam.).—Two cases of accidental poisoning by the fruit of this tree have been reported. In one, three boys were poisoned ; all, however, recovered. In the other, a woman and two children, one of whom was a weakly girl of eight or nine, were poisoned, and of these the girl died, the two others recovering. The symptoms present were nausea and vomiting, followed by narcotism. The narcotic properties of the fruit reside in the kernel, but it is not known to what they are due. IDENTIFICATION.—The fresh drupe is obovate, somewhat five angled, about the size of a nutmeg, fleshy, and covered with a grey silky down. When dry it is of the size of a gall-nut, and of a dirty brown colour and astringent taste. It contains abundance of tannin. The stone is hard, and encloses a sweet oily kernel.

Trianthema monogyna, N. O. *Ficoideæ Khapra* (Bo.), *Nasurjanghi* (Duk.), *Sabuni* (Beng). *Sharunnay* (Tam.), *Ghelijehroo* (Tel.).—The root of this, a common weed on rice fields, is used in native medicine as a cathartic. Edgeworth, quoted by Chevers, states that the stem of *Trianthema pentandra*, closely allied to *T. monogyna*, is given internally and used locally as an abortifacient, by the village midwives about Jalandhar, and that it is known under the names of *Bis-kopra* and *Itsit*.

Other common English plants mentioned by various writers as irritant or narcotico-irritant poisons, and which may be included in this sub-class, are—

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[1] Blyth, *Poisons*, p. 439. [2] Chevers, *M. J.*, p. 273.
[3] *Bo. Chem. Analyser's Rept.*, 1878-79, p. 14.

Ilex aquifolium or holly, N. O. *Aquifoliaceæ ; Sambucus nigra*, or elder, and *Viburnum opulus* or guelder rose, *N. O. Caprifoliaceæ ; Caltha palustris* or marsh marigold, N. O. Compositæ ; and *Ligustrum vulgare* or privet, N. O. Oleaceæ. To this sub-class also belongs Spigelia root, the root of *Spigelia Marilandica*, Maryland or Indian pink root, N. O. *Loganiaceæ*, a native of the S. United States. This is an irritant cathartic, and in overdoses a narcotico-irritant poison. In this place also may be mentioned **cotton root bark,** the bark of the root of *Gossypium herbaceum*, and other species of gossypium. This, officinal in the U.S.P., is said to cause contraction of the uterus and to be a substitute for ergot.

JEQUIRITY OR INDIAN LIQUORICE.

Abrus precatorius, N. O. *Leguminosæ ;* vernacular *Rati, Gunj, Gungchi* (Hind.), *Gunza* (Bo.), *Gundumani* (Tam.) *Charroti* (Guz.).—

The seeds, roots, leaves, and other parts of this plant are irritant when applied to mucous membranes, but may be swallowed in considerable quantity without producing any ill effect, but if a small quantity of the seeds or of other portions of the plant be bruised or their juice injected under the skin of an animal, it rapidly proves fatal, producing general depression, drowsiness, fall of temperature, and hæmorrhagic lesions somewhat as in poisoning by snake-venom.

It is largely used in India for the criminal poisoning of cattle and occasionally for homicidal purposes (see case below). For poisoning cattle it is used by the low caste leather-workers (*chamars*) in order to procure hides cheap. They pound the decorticated seeds into a paste with water and the mass into small sharp-pointed spikes or 'needles' (*sui* or *sutāri*) which they harden in the sun. When used, two of the *suis*, which are about three-quarters of an inch in length, are inserted into holes in a wooden handle by their base. A blow is then struck with great force, driving the *sui* protruding from the handle into the animal's flesh, where it is left, and causes death within 18 to 24 hours.

Action.—The irritant and poisonous action of Jequirity seeds was ascribed by Cornil and other continental pathologists to a bacillus. Dr. L. A. Waddell disproved this theory,[1] and in conjunction with Dr. Warden showed that the active principle was a chemical solution of a proteid nature which they isolated and called *abrin*. Abrin is a tox-albumen bearing much resemblance to snake-venom ; and animals may become immune against it by repeated doses and like snake-venom it has been resolved into globulin and other forms of albumin.[1] It acts as a blood-poison imparting to the red blood cor-

[1] *The Non-bacillar Nature of Abrus-Poison*, Beng. Secretariat Press, Calcutta, 1884.

puscles, a tendency to coagulate and form thrombi. Of the seed half a grain subcutaneously injected, is sufficient to kill cats in twenty to forty hours, and one and a half to two grains is sufficient to kill cattle within forty-eight hours. In animals killed by abrus poisoning, œdema of the subcutaneous tissue is found at the seat of the injury if the animal has lived over twenty-four to thirty hours. The mucous membrane of the stomach and intestine is found highly injected, and numerous hæmorrhagic points are seen on the surface of the mucous membrane of the intestine, and also in the interior of vascular organs, *e.g.*, the lungs, liver and spleen.[1]

Identification.—The seeds are spherical, about the size of a pea, polished, and of a bright scarlet colour with a large black spot at one end, other varieties are white or blackish, their microscopical structure is peculiar.[2] Their average weight is about one and three-quarters to a little over two grains.

The root of this plant is officinal in the Pharmacopœia of India as a substitute for liquorice, and the seeds are used as small weights by jewellers, a "*rati*" being the weight of one seed.

There is at present no chemical test for detecting the presence of this tox-albumen ; but the microscopic structure of the seeds is characteristic[3] in conjunction with the physiological test.

Case CCLIV—**Hypodermic poisoning by Jequirity** (*abrus*) *seeds—Homicidal.*—(*a*) At Bankipur, Bengal, in 1880, a man was killed by a *sutāri* driven into his neck by a *chamār* at the instance of a woman. The latter deposed as follows :—"I used to earn my living at Sunt Aman Khan's. His *chela* turned me out and would not give me sufficient food. I stole a seer of rice, and he abused and beat me. I was crying over my ill-fate. Mugyra said 'why are you crying. I said 'If some one killed him it would be well.' She said 'call Suntokhi, and he will put you up to something.' I then went to Suntokhi Chamār and told him to get some medicine that would kill Aman Khan. He said he would go to Magha and bring some. After ten days he told me he had not been to Magha. Mugyra then told me to go to Dooly Chamār who was a great poisoner and had killed several persons. Dooly on being spoken to asked for 50 or 100 rupees. I therefore remained quiet. After ten days Dooly came to my house and wanted five rupees and seven pieces of cloth of seven colors and black pigeons and a black kid. I gave him one rupee and a half the price of the things. The next morning he came to me for five rupees advance, saying he would destroy my children if I did not pay it, by means of witchcraft. I paid him five rupees ; after this he again threatened me, and I gave him ten rupees. When eight or ten days had passed he said he would do what I wanted, and on the night fixed, he smoked in my

[1] L. A. Waddell, *op. cit.*

[2] By Dr. Norris Wolfenden and others. *Proc. Roy Soc.*, 1889.

[3] Described by Dr. D. D. Cunningham, *Ind. Med. Gaz.*, 1882, and reproduced in *Pharmacograph. Indica*, I, 432.

house and then at midnight *stabbed the wrong man.* Both prisoners were sentenced to transportation for life under ss. 304 and $\frac{34}{35}$ of the *Penal Code.*" The wound was penetrating about $\frac{3}{4}$ inch deep on the right cheek, it was incised and "2 small black hard, substances" extracted. The patient died on the third day—'the brain and its membranes and the lungs, liver, spleen and kidneys were congested. The coats of the stomach were congested, and some ecchymosed spots were visible on its internal surface.'—Dr. Warden in *Pharmacograph. Ind. I*, 446.

(*b*).—In 1873 a man near Rawalpindi when sleeping was awakened in the morning by two blows on the neck and appears to have seen his assailant retreating. After he went to work, his mother found two substances, each a little larger than a barley-corn on his bed. At midday he complained of pain in the neck, and his mother found two punctures, and out of one of these she picked a small black substance similar to those found on the bed. He was taken to Rawalpindi on a *charpoy*, arriving the following morning and immediately examined by Dr. Ince who reported: 'I found a swelling on the right side of the neck in which were two small punctures about 2 inches apart. He was then sensible but suffering from severe pain in the neck, difficulty of swallowing and much fever. The swelling and pain rapidly increased, and erysipelas supervened. He died exactly three days after being stabbed. The *post-mortem* examination showed much swelling of neck, extending over right side of chest also, and the skin had a livid appearance. On cutting into the swelling much blood was found and inflammation products which had extended to the right lung, which also was much inflamed and adherent to the ribs by means of bands of lymph. The spleen was enlarged.' The 'three small black substances' were examined by Dr. Center, who recognised a part of *suis* seed in cattle-poisoning, and microscopically their structure was found to agree with those of *rati* (jequirity) seeds on insertion below the skin of a dog, the animal died in 50 hours and on *post-mortem* examination diffuse inflammation wound puncture was found.—Dr. Center, *Panjab Chem. Ex. Rept.*, 1873.

(*c*).—In 1871 in Bengal a man was murdered by a *sutari* being driven into his side; lately another man was wounded by a *sutari* while asleep and died from 'lock-jaw;' a third man was wounded with a *sutari*, but escaped death by the affected part being excised. This man's cousin, however, died from the effects of a *sutari* being driven into his cheek [see case *a* above]—*Beng. Police Rept.*, 1871. (*d*) and (*e*) One case of homicidal abrus '*sui*'-poisoning was reported in the Panjab in 1893, and another in 1899.

CHAPTER XXV.

ANIMAL IRRITANT POISONS.

These may be divided into (1) Poisons secreted by living animals, (2) poisons generated by dead animal tissue, including food-poisoning.

POISONS SECRETED BY LIVING ANIMALS.

SNAKE-VENOMS.

Death from snake-bite is usually *accidental*. From 45,000 to 20,000,[1] deaths are annually reported in India as being due to 'Snake-bite,' but there is no doubt that this alleged cause of death conceals some undiscovered crime. Cases of undoubted murder by hanging, strangulation, abortion, &c., have been found to be conveniently reported as 'Death by snake-bite.' It is desirable therefore that the bodies of persons alleged to have died from snake-bite should be sent by magistrates, whenever possible, for examination by the civil surgeon or other medical officer.[2]

In 1900 the reported mortality from snake-bite in India was no less than 22,393 deaths, namely, in Madras Presidency, 2,037 ; in Bengal, 10,557 ; in Bombay, 701 ; in N.-W. P. & Oudh, 6,056 ; in Panjab, 893 ; in Burma, 874 ; in Central Provinces, 994 ; in Assam, 170 ; in Coorg, 1 ; in Berars, 104 ; in Ajmere-Merwara, 4 ; in Bangalore, 2.

Homicide by snake-bite has not been reported of late years ; but cases of cattle thus poisoned are reported (see p. 540) ; and many of the native quack-doctors keep dried cobra-venom as a remedy.[3] So that it may occasionally be used for homicidal purposes though undiscovered. The crime of using snakes for murder is mentioned in Hindu and

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[1] This death-rate is over 100 per million, ranging from about 45 per million in the Panjab to about 130 per million in Bengal. In one district of Bengal, namely, Burdwan, the snake-bite death-rate was 173 per million as the average of the 10 years ending 1869.

[2] A non-poisonous snake may be sent as evidence of the alleged bite with the body of a person who has been murdered otherwise.—*Beng. Medico-legal Rept.*, 1870—72, p. 159.

[3] In a case of poisoning in Calcutta in 1884, amongst the suspected articles sent me for examination from the house of the accused was a gummy mass of dried cobra venom weighing over 100 grains.—L. A. Waddell.

Muhammadan law; and formerly criminals in India were sometimes executed by snake-bite.

In Hindu law it was enacted that "if a man by violence throws into another person's house a snake or any other animal of that kind, whose bite or sting is mortal, this is *Shahesh*, i.e., Violence." The magistrate shall fine him 500 puns of cowries and make him throw away the snake with his own hand."—Halhed's *Code of Gentoo Law*, pp. 262, 263.

Muhammadan law strangely provided that "if a person bring another into his house, and put a wild beast into the room with him, and shut the door upon them, and the beast kill the man neither *kisas* nor *diyat* is incurred; *and it is the same if a snake or scorpion* be put into the house with a man, or if they were there before and sting him to death. But if the sufferer be a child, the price of blood is payable" (quoted by Chevers, *M.*, 381).

An execution by snake-bite is thus described by Terry of Sir Thomas Roe's suite:

"There was another condemned to dye by the Mogul himself (while we were at Amadavar) for killing his own mother, and at this the King was much troubled to think of a death suitable for so horrid a crime; but upon a little pause he adjudged him to be stung to death by snakes which was accordingly done. There were some mountebanks there which keep great snakes to show tricks with them; one of these fellows was presently called to bring his snakes to do that execution, who came to the place where that wretched creature was appointed to dye, and found him there all naked (except a little covering before) and trembling. Then suddenly the mountebank (having first angered and provoked the venomous creatures) put one of them to his thigh, which presently twined itself about that part, till it came to his groin, and there it bit him till the bloud followed, the other was fastened to the outside of his other thigh twining about it, and there bit him likewise. Notwithstanding, the wretch kept on his feet for near a quarter of an hour, before which time the snakes were taken from him; but he complained exceedingly of a fire that with much torment had possessed all his limbs, and his whole body began to swell exceedingly. . . . About half an hour after they were taken from him, the soul of that unnatural monster left his growing carkasse."

There are also the classic instances of the employment of snakes in war by Hannibal and Antiochus defeating the Romans in a naval action by throwing earthen pots filled with serpents into their ships, and similar episodes are related of the Saracens; and in respect to *suicidal* use there is the story of Cleopatra and others.

Case CCLV.—**Homicide by Snake-bite.**—In this case, two snake charmers were convicted at Purneah, Bengal, in 1869, of causing the death by snake-bite of three men. The prisoners, it was proved, partly by threats, and partly by assurances that it was in their power to prevent ill effects following, induced four men to allow themselves to be bitten by a krait. All four were poisoned, one only recovering. What the motive for the crime was did not appear.—Fayrer's *Thanatophidia of India*, p. 51.

The popular division of snakes into *poisonous* (or venomous) and *non-poisonous*, although not strictly correct

scientifically, may be adopted here for toxicological purposes. Poisonous snakes belong to one or other of two families, namely, the *Colubridæ* and Vipers or *Viperidæ*. All vipers are poisonous, but only two sub-families of colubrine snakes are decidedly poisonous, namely, *Elapinæ*, and the sea-snakes (*Hydrophidæ*).

Poisonous snakes are distinguished from non-poisonous by the presence of poison-glands. The poison-gland is situated one on each side of head above the upper jaw and behind the eye, and it communicates by a duct with the poison-fangs, which are enlarged, channelled or 'perforated' teeth of the anterior maxilla. There is no sure way of distinguishing a poisonous from a harmless snake by external characters except by the dentition—the presence of grooved teeth—and an intimate knowledge of the various genera, for which the zoological text books should be consulted.[1]

The chief points of distinction between the two families of poisonous snakes are roughly :—

Poisonous Colubrine Snakes.	Vipers.
1. Body usually long and cylindrical.	Body usually short with narrow neck.
2. Head small, seldom broader than body, covered by large scales or shields of special form or number.	Head large, broader than body, triangular and covered by numerous small scales usually.
3. Maxillary bone carries other teeth besides poison-fang.	Maxillary bone carries only poison fang.
4. Eye has round pupil.	Eye has vertically elliptic pupil.

The chief poisonous species of Indian land snakes are the following ; the most common deadly ones are marked * *, the less common deadly ones * :—

COLUBRINE—	
* * **Cobra,** *Naia tripudians.* Vern.—"*Nāga*," *Keautia*, '*Kāla Sānp*,' '*Gehusānp*.' Throughout India and up Himilayas to 8,000 feet.	Hooded elapine.
* **Hamadryad or 'Tree-Cobra,'** *Naia-bungarus* or *Ophiophagus elaps.* Vern.—*Sankerchor.* From Lower Bengal, southwards through India, Assam and Burma.	

[1] Boulenger's *Reptilia*, Fauna of British India, 1890, or Fayrer's *Thanatophidia of India*, or Ewart's abstract of the latter.

** **Blue Krait,** *Bungarus cæruleus.* * **Banded Krait,** *Bungarus fasciatus,* Vern. '*Sankni,*' *or Raj-sānp.*[1] *Callophis,* several species and *Adeniophis intestinalis.*	Non-hooded ; elapine.

VIPERINE —These are divided into 'Vipers proper,' *Viperinæ*, and the 'pit-vipers' *Crotalinæ*, the latter having a deep pit on each side of the snout between the eye and the nostril. The chief species are :—

** **Russell's Viper** or the Chain-Viper. *Viperu russelli* or *Daboia russelli.* Vern. '*Bora,*' '*Tic-polonga,*' '*Gunus.*' * **Keel-scaled Viper,** *Echis-carinata.* Vern. '*Fursa*' *Afæ*, or *Kapar.*	Viperine.
Trimeresurus, several species, terrestrial and arboreal. *Ancistrodon hypnale* or *Hypnale nepa.* Vern. '*Karawala*' in Ceylon and W. Ghats, south of Bombay and *A. himalayanus* from Sikhim to N. W.	Crotaline.

The Cobra is the most deadly of all snakes. After the Cobra the great Russell's Viper is the most deadly of Indian snakes, next comes the blue *Krait*, the great banded *Krait* (blue and yellow), and the little viper *Echis C.* (with a dart-shaped whitish dark-edged mark on head). The bite of the species of *callophis*, *trimeresurus*, and *ancistrodon* does not usually produce death in adult human beings and large animals.

Physical and Chemical characters of Snake-venoms.—The physical characters and chemical composition of snake-venom differs to some extent according to the species and family to which the snake belongs. The venom of the cobra when freshly ejected is a light amber coloured liquid like clear varnish of a specific gravity of about 1·046 and feebly acid reaction. It dries rapidly in the air into a yellowish film, like gum arabic, which tends to split up into bright yellowish scales and granules. This yellow powder has an acrid odour and is an irritant to mucous membranes. It is soluble in water, the solution becoming actively toxic. The dried venom retains its activity for several years, and may be heated up to 100 to 125° without losing it poisonous properties. In 1883 Dr. Weir Mitchell showed that rattlesnake-venom could be split up by dialysis, &c., into two toxic principles, a peptone (albumose ?) and a globulin, each with different properties ; and he considered that differences in the action of snake-venom of different species of snakes depends upon the relative properties of these two substances. Norris Wolfenden applied this discovery to the venom of the Cobra and Indian vipers, differentiating out several active constituents with different poisonous properties.

Action and Symptoms of Snake-Venom.—The physiological effects of snake-venom differ to a considerable extent in kind according to the species or family to which the snake belongs. The broad differences between the symptoms of poisoning by the colubrine Cobra and the Vipers were described by the earlier Indian observers, especially Dr. P. Russell,

[1] In Assam *B. liridus*, in Ceylon *B. ceylonicus* and E. of Sikkim *B. bungaroides.*

Sir Joseph Fayrer, Dr. Wall [1] and Dr. V. Richards. Their experiments were of a somewhat crude kind, the animals experimented upon usually receiving their poison by a bite from the snake, a method open to many fallacies. The more precise method of experiment by means of hypodermic injection of a measured quantity of fresh venom of ascertained strength and activity into a series of animals of given weights, and verified by control experiments, and *post-mortem* examination was first employed in India by Dr. L. A. Waddell, in a large series of observations conducted at his own expense, with the result of indicating the remedial treatment of snake-bite by inoculation.[2] In the then absence of research laboratories in India the further researches on exact modern lines into the essential nature of cobra and Indian viper venom were prosecuted in Europe with dried venom, notably by Lauder Brunton, Norris Wolfenden, Fraser and latterly Calmette.

Snake venom of both colubrine snakes and vipers has a **local** as well as a **remote** action. **Locally it acts as an irritant to the tissues,** and hence, when introduced into a wound, causes immediate burning pain in the wounded part, followed by swelling and inflammation. Even when applied to thin unabraded membranes such as the conjunctiva, it acts as a local irritant.

Its remote action is exerted mainly either on the **nervous system,** or on the **blood,** or on both ; and may not only be the result of its absorption into the system from a wound, but may even result from its absorption through unabraded delicate membranes, such as the mucous membrane of the stomach.[3] The remote action of the poison of the cobra and other colubrine snakes and including sea-snakes,[4] seems usually to be mainly exerted on the nervous system, whilst that of the Indian vipers is especially upon the blood. These two classes of effects are attributed by Weir Mitchell respectively to the toxic *peptone* which acts more particularly on the tissues causing inflammatory action with much swelling and extravasation of blood, whilst the globulin acts more particularly

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[1] *Proc. Roy. Soc.*, 1881, Vol. XXXII, p. 333.

[2] *The Effect of Serpent-Venom, Sc. Mem. Medl. Offrs.*, IV, India, Calcutta, 1889. See also p. 538.

[3] *Thanatophidia of India*, p. 64 ; L. A. Waddell in *Sc. Mem. Med. Offrs.*, IV, p. 26.

[4] For exhaustive experiments on the venom of sea-snakes, see *Physiological Action of the Poison of the Hydrophidæ*, by L. Rogers, M.D., I.M.S., *Proc. Roy. Soc.*, 7th May 1903, and reproduced in *Ind. Med. Gaz.*, pp. 269, &c., 1903.

on the nervous system, paralysing the heart and the respiratory centres.

Action on the Nervous System.—An interval varying in duration usually elapses between the bite of a poisonous snake, and first appearance of nervous symptoms. In the human subject, this interval in cases of cobra-bite may be 15 minutes about an hour, which is the average according to Wall,[1] but may be longer ; it is often longer in cases of bite by the less venomous snakes. **In Cobra-bite** in the human subject (*see* case, p. 537) the chief nervous symptoms are a feeling of intoxication, followed by loss of power in the legs, the patient staggering or falling if he attempts to walk or stand.[2] The loss of power then spreads to other muscles, those of the tongue and larynx becoming early affected, and the powers of speech and deglutition are lost, the saliva trickles away, the power of expelling it having ceased, as in glosso-pharyngeal paralysis. The paralysis then becomes general, the respiration slow, and it becomes weaker and weaker till death occurs by asphyxia, due to gradual paralysis of the respiratory movements and the heart beating for some time after the respirations have ceased. Nausea and vomiting are often early symptoms, and asphyxial tremors (not convulsions) as the general paralysis precludes these may precede death. The pupil, as a rule, is but little affected. Death seldom occurs before 20 minutes to half an hour, even when the largest doses are given. Very similar nervous symptoms usually follow the bite of other colubrine snakes, but as the poison is less active more chronic symptoms may develop.

Thus, Wall, in experimenting upon animals with the poison of *Bungarus faciatus*, found that in some cases symptoms were caused by it exactly resembling those seen in cobra-bite, while in others the first effects of the poison on the nervous system were slight, and soon passed off, but, after an interval of two to five days, were followed by a fresh set of constitutional symptoms. The animal became weak, purulent discharges took place from the eyes, nose, and rectum, the urine became albuminous, and death occurred from exhaustion several days after the bite. In these cases, however, there was no tendency to hæmorrhage.

Daboia-bite also causes marked nervous symptoms, but the paralysis is more general, does not specially affect the tongue and larynx, and salivation is, as a rule, absent. Convulsions are often present early in the case, and the pupil is

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[1] On *Indian Snake Poisons*, p. 12.

[2] Lauder Brunton considers that the terminations of the motor nerves are affected.—*Proc. Roy. Soc.*, 1875, Vol. 23.

usually dilated. In **Echis-bite** the nervous symptoms are, as a rule, comparatively slight in severity. *Mental shock* may, to some extent, modify the nervous symptoms present in a case of snake bite ; and from recorded cases it appears that the bite of a non-poisonous snake may give rise to mental shock so severe as to cause death.

Action on the Blood.—This depends to some extent on the amount of the dose, whether rapidly fatal or less rapidly fatal, and the blood changes are much more marked in viper than in colubrine poisoning.

In **Viper-poisoning** Martin of Melbourne working with antipodal snakes has shown that the very rapid deaths are due to an extensive intravascular thrombosis, especially of the pulmonary arteries, and this has been confirmed by Weir Mitchell in regard to the American vipers—the rattlesnakes. It has, moreover, been directly observed with respect to the great Indian viper, the Daboia, by Captain G. Lamb.[1] This intravascular thrombosis in the pulmonary arteries explains the leading symptoms in the rapidly fatal cases, namely, the gasping with quickened and laboured respiratory movement and violent convulsions soon ending in death.

The sites of the clotting, which is invariably and extensively present in cases of rapidly fatal viper-poisoning, are the pulmonary arteries and their main branches, the superior and inferior **venæ cavæ** and the right side of the heart. When death is delayed to ten to fifteen minutes owing to the smallness of the dose, the clots may be confined to the pulmonary arteries alone.

In the less immediately fatal cases of viper-poisoning the most striking characteristic of the blood is that it has *completely lost its power of coagulating*, and this condition seems to account for the large bloody extravasation and œdema and bloody oozing at the site of bite, the extensive hæmorrhages from mucous membranes, ecchymotic patches, and œdemas which are such promiment symptoms of the more chronic cases of viper-poisoning.

Cobra-poison causes active hæmolysis and prevents the blood from clotting for a very long time.[2] The poison dissolves out the hæmoglobin from the red corpuscles, but the poisoning danger as a rule ceases with the disappearance of the nervous symptoms, whereas, with vipers, the blood-poisoning symptoms may continue for days after the nervous symptoms

[1] *Ind. Med. Gaz.*, 1901, p. 444.
[2] D. D. Cunningham.—*Sc. Mem. Med. Offrs.*, 1897.

have disappeared, may end in death from exhaustion, and in echis-poisoning are often the chief symptoms present. Further, owing to this special tendency to blood-poisoning, danger to life in cases of daboia and echis-bite may continue long after the nervous symptoms have been recovered from ; while in colubrine snake-poisoning, danger as a rule ceases with the disappearance of the nervous symptoms.

Transmission of the poison.—Fayrer mentions a case where an infant died from snake-poisoning, the poison having been conveyed through the milk of the mother who had been bitten and also died. According to the same writer, the blood of animals, dead of snake-poisoning, if injected into other animals, destroys life. The bodies of animals killed by snake-poison may, however, be eaten with impunity by man and animals.

Case CCLVI.—**Cobra-bite—Accidental.**—A coolie was bitten on the shoulder by a cobra about midnight. He immediately felt a burning pain at the spot bitten, which increased. In 15 minutes afterwards he began, he said, to feel intoxicated, but he seemed rational and answered questions intelligently. The pupils were natural, and pulse and respirations normal. He next began to lose power in his legs and staggered. In 30 minutes after bite his lower jaw began to fall and frothy viscid saliva run from his mouth. He spoke indistinctly, and the paralysis of the legs increased. Forty minutes after the bite he began to moan and shake his head from side to side and the pulse and respirations were somewhat accelerated, but he was still conscious and able to answer questions. There was no paralysis of the arms. The breathing became slower and slower and at length ceased one hour and ten minutes after the bite, the heart beating for about a minute after the respiration had stopped.

Case CCLVII.—**Russell's Viper-bite—Chronic.**—A Muhammadan, aged 40, was bitten on the finger by a *Daboia*. The bitten part was excised soon after and stimulants given. The hand and arm became much swollen, and on the same day he passed blood by the rectum and bloody urine. The next day he was sick and still passing blood from both channels. In this state he remained eight days, constantly losing blood, and died on the ninth day.—*Ind. Med. Gaz.*, June, 1872.

Post-mortem Appearances.—The marks of the fangs should be searched for, and if found the state of the tissues around and underlying them noted. Injection and infiltration of blood or bloody serum into these, strongly indicates injection of venom. The areolar tissue at the puncture is usually purple tapering to scarlet at its periphery due to injection of blood from irritant poison. Internally, the *post-mortem* appearance most characteristic of death from snake-bite, is abnormal fluidity of the blood. In man, from reported cases, this appearance seems to be present both in colubrine and in viperine snake-poisoning. In the lower animals it is only found in the latter. The kidneys, lungs, and liver, may be found congested or normal in appearance, and in colubrine snake-poisoning particles of food, &c., may be found in the air-passages, having found their way into these, owing to the existence, during life, of laryngeal paralysis.

Antidotes and Treatment of Snake-bite.—The appalling loss of life and the horrible sudden nature of the death from snake-bite has always stimulated a search for antidotes.

Of the many so-called "antidotes" to snake-venom, however, permanganate of potassium was the only one that could be said to be of any use whatever, but even it is no true antidote; as it only destroys the venom when it actually comes into direct contact with it, and is powerless to counteract the poison once the latter has entered the circulation.

In 1888, as a result of a large series of experiments upon Indian serpents, undertaken expressly "to afford indications for combating the action of the venom on man," Dr. L. A. Waddell established the hypothesis that "immunity may be acquired by the imbibition of small doses of the venom,"[1] and in support of this view he instanced the then newly discovered (but still unformulated) doctrine of antitoxins, as demonstrated by Dr. Wooldridge in regard to anthrax protection,[2] in these words:—"the protection conferred by 'vaccine' being, it is alleged, attributable, in certain cases, to the action of the *soluble chemical products* resulting from the growth and development of the morbific germ."[3] In reviewing Dr. Waddell's monograph the *Pioneer* on the 2nd April 1889 in a long article said:—"Dr. Waddell propounds the theory that it is because the immunity is an acquired condition—a *toleration* to the venom established through the imbibition of small quantities of the venom * * * in other words that the snake inoculates itself against the consequence of its own virus. *And if the snake why not the man; for that is the conclusion evidently to which Dr. Waddell means to work up* * * * * Though after all it is a question whether it would be worthwhile for every one in India to be inoculated against the off chance of being bitten by a snake." Amongst the notices in European scientific journals of this research by Dr. Waddell on the artificial immunization against snake-venom, Professor Henry de Varigny gave an editorial notice of two columns in the *Revue Scientifique* of 22nd February 1890, calling attention to its great practical import for India and other tropical countries, as a life-saving measure.

Dr. Waddell in concluding that monograph stated[4] that he was about to submit his hypothesis with its antitoxin features

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[1] *An Inquiry into the Effect of Serpent-venom, &c., Sc. Mem. Medl. Offrs.*, IV, 1889; also *Ind. Med. Gaz.*, May 1889, p. 147. See also review in *Pioneer*, 2nd April, 1889; and in *Revue Scientifique*, Paris, 22nd February, 1890.

[2] *Proc. Roy. Soc.*, 1887, p. 313. [3] *Op. cit.*, p. 27. [4] *Op. cit.*, p. 28.

to actual experiment. Circumstances, however, prevented his doing this himself, owing to no facilities whatever having been given him for this work by the Government; but over *five years later*, M. Calmette[1] and Professor Fraser,[2] carried out the necessary experiments, after the antitoxin theory had become much more developed; and the protective antitoxin for snake-venom thus obtained is called "Serum Antivenimeux" or '**antivenene.**' It is the serum of the blood of an animal (usually a horse) which has been rendered immune against serpent venom by repeated injections of the venom.

This '**antivenene**' seems to have undoubted antidotal properties for cobra-bite, as it is prepared from cobra-venom. It has, however, little if any value against viper-venom which has been shown by Wall, Richards, Waddell, Wolfenden and Martin to have a different chemical composition and physiological action from cobra-venom; and Cunningham in 1896 by direct experiment found that "the antidotal material (antivenene) contained in the blood of animals which have been artificially immunised against colubrine (cobra) venom is inert against viperine venom and *vice versa*."[3] Latterly in the production of antivenomous serum a mixture of colubrine and viperine poison is used in the proportion of 80 of the former to 20 of the latter; and a supply of this new serum is now issued to every civil station and regiment throughout India. It rapidly deteriorates.[3]

The **local** treatment, however, should never be neglected, namely, the immediate sucking of the wounds, ligaturing the limb above the bite and applying freely an alkaline solution of permanganate of potassium with free scarification. And if the severer symptoms set in, an attempt to maintain breathing should be made by artificial respiration and galvanism.

Should the situation of the bite permit, at once apply a **ligature** above the bitten part. Wall strongly recommends that this should be a thick india-rubber cord or band, wound several times tightly round the limb.[4] Failing this, two or three ligatures, at intervals of a few inches apart, should be, as recommended by Fayrer, tied round the limb, and the one nearest the bite tightened by twisting with a stick. Then using, if necessary, a lens examine the part supposed to have been bitten. Usually two scratches, short cuts, or punctures, under one inch apart, will be found. Sometimes the punctures

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[1] Calmette's announcement was first made in February 1894.

[2] *British Med. Jour.*, 15th June, 1895; *Sc. Memoirs*, IX, pp. 1—30.

[3] G. Lamb, I.M.S., ; *ib.*, N. S., p. 11, 1902.

[4] Wall points out that after an incision has been made through the skin examination of the parts below will reveal to an experienced eye if injection of venom has taken place; and that any signs of irritation indicative of the wound being something more than a mere mechanical puncture, should be taken as showing that the individual has been poisoned as well as bitten.

are very minute and barely visible, a drop or two of blood or serum indicating their position. The situation of the poisoned wound having been made out, **free excision** should at once be resorted to. The excision should include not only a portion of the skin about one and a half inches square, but also the underlying tissues for some little depth. As recommended by Wall, the areolar tissue below and around the excised portion of the skin should be dissected away freely, and on parts, into which from their situation the fangs are able to sink in deeply, the excision should be carried still further. Thus on the fingers or toes, the soft parts should be excised down to the bone, or the finger, or toe amputated ; and if the bite is on the ball of the thumb, the fascia and a portion of the muscle should be included. After excision the wound should be washed with solution of caustic potash or potassium permanganate, and the ligature removed. The subsequent treatment may consist of the administration of stimulants, the employment of cold affusion, the use of artificial respiration (if there is a tendency to asphyxia), and general treatment of the symptoms as they arise. Main reliance must, however, be placed on early and free excision.[1]

Criminal Cattle poisoning by Snake-Venom.—The cattle of villagers are occasionally criminally poisoned by skin workers for the sake of their hides. In two cases in the North-West Provinces a cloth saturated with snake-venom was found in the rectum of the animal.

Test for Snake-Venom.—A small quantity of the watery solution or extract from a suspected rag, &c., sufficient to kill, should be injected into two fowls or rabbits, a different dose in each, and the same quantities mixed with antivenene, in which latter case the animals operated on should remain unaffected.

VENOMOUS INSECTS.

Scorpions.—These have in the last joint of the tail a hollow sting communicating with a poison-secreting apparatus, and serving like the poison fang in snakes, to convey venom into wounds made by it. The local irritant action of the venom is always very severe. Five children died from scorpion sting in Bengal, during the three years ending 1872 ; and from cases quoted by Chevers, it would appear that the sting, at any rate of the larger varieties, may cause death in adults. The darker variety is said to be more deadly.

Centipedes and Spiders are also provided with a poison-injecting apparatus connected with their jaws or mandibles. The bites of these cause effects very similar to those produced by the sting of a scorpion. The bite of some varieties of spider appears to cause severe constitutional symptoms and may even cause death.

Wasps, Bees, and Hornets are all provided with a poison sting. A single sting from one of these is not likely to cause serious effects, except in cases where it directly into a vein or where inflammation and swelling of the part stung interferes with some important

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[1] Several chemical substances, *e.g* , potassium permanganate, destroy the activity of snake-poison if mixed with it previous to its introduction into the body. These, however, only do so owing to their general action on organic matter. Hence once the poison has been introduced into a wound, these substances, owing to their having no special affinity for the poison, are practically useless as remedial agents. So also are the so-called snakestones, *i.e* , stones which are reputed to have the power of sucking out the poison when applied to the wounded part.

function, *e.g.*, respiration. Taylor mentions, however, two cases in which adult females died from shock after, apparently, a single sting of respectively a wasp and a hornet. A number of stings, as in cases where persons are attacked by a swarm of wasps or bees, has frequently caused severe constitutional disturbance, occasionally ending in death.

Lizards contrary to the popular belief at least those which up to the present have been met with in India, are not venomous.

Cantharides, the dried *Cantharis vesicatoria*, blister beetle, or 'Spanish fly,' applied to the skin causes irritation and vesication, and when swallowed or absorbed into the system in poisonous doses, gives rise to the usual symptoms of irritant poisoning, accompanied, when the poison has been taken by the mouth, by blistering of the mouth and throat. The evacuations usually contain blood. Special symptoms in poisoning by cantharides are : (*a*) salivation with swelling of the salivary glands and back of the throat, rendering swallowing painful and difficult ; and (*b*) strangury hæmaturia, inflammation of the genitals, and other similar symptoms, due to the special irritant action of the poison on the kidneys and urinary passages. In fatal cases convulsions generally precede death ; insensibility may or may not be present. Cantharides is seldom administered with homicidal intent ; cases of poisoning by it are usually accidental, or arise from its being given as an abortifacient, or as an aphrodisiac. As an abortifacient, cantharides often fails, but sometimes succeeds owing to the violent constitutional disturbance produced. There is no proof that the drug has any specific action on the uterus. As regards aphrodisiac action the drug may possibly excite sexual passion, but it is only likely to do so when given in quantity sufficient to endanger life or cause serious symptoms. Taylor[1] mentions an English case (*R.* v. *Wilkins*, Liverpool Lent Assizes, 1861) where a man was tried and convicted of administering powdered cantharides to a woman, in which the question arose whether or not an offence had been committed, seeing that the drug had been given solely with the motive of exciting sexual desire. Mayne, in his commentary on *s.* 328 of the *Indian Penal Code*, refers to this case as follows :—"In a case under a similar English statute, where it appeared that the prisoner had administered a drug to a female with intent to excite her sexual passions, in order that he might have connection with her, the conviction was affirmed."

Dose, &c.—The medicinal dose of powdered cantharides is one to two grains, and of the tincture (strength one to eighty) five to twenty minims. The smallest fatal doses recorded are of the powder, twenty-four grains ; and of the tincture, one fluid ounce. Recovery has, however, taken place from six ounces of the tincture, and in another case from sixty grains of the powder. The shortest fatal period recorded is twenty-four hours, and the longest (from one ounce of the tincture) seventeen days. Taylor mentions a case where death, with the usual symptoms of cantharides poisoning, resulted in five days, from the external application of cantharides ointment in mistake for sulphur ointment, as a cure for itch. **Treatment.**—General. Oily demulcents should be avoided, as cantharidin, the active principle, is soluble in oil. Opiate injections into the bladder, opium suppositories, and warm baths should be used to relieve pain. **Post-mortem appearances.**—These are usually, signs of inflammation of the alimentary canal, conges-

[1] *Poisons*, p. 529.

tion of the kidneys, and inflammation of the urinary passages. When the powder has been swallowed, glittering particles of it may be found adhering to the intestinal mucous membrane. Similar particles may be found in the vomited matters.

Detection.—The powder is greyish-brown in colour, and contains shining green metallic-looking particles. These resist putrifaction, and may be detected in the contents of the intestines after long periods of interment. The active principle, cantharidin, present in the powder to the extent of about one-half per cent. may be extracted therefrom, or from organic mixtures containing it, by taking advantage of the fact that it is soluble in alkaline liquids, but can be removed from these by acidulating them, and shaking them with chloroform. On separating and evaporating the chloroform, catharidin may be recognised in the residue by digesting this with a few drops of oil, and applying the liquid so obtained to the skin, when, if cantharidin is present, vesication will be produced.

Cantharidin is also present in the *Mylabris cichorii*, or *Telini fly* officinal in the I.P., as a substitute for cantharides, and possessing exactly the same action. The powder of these differs, however, from catharides powder in containing no shining particles. Catharidin has also been found in various other Indian blistering flies, *e.g.*, in the *Mylabris pustulata* and *M. punctum*.

POISONS GENERATED BY DEAD ANIMAL TISSUES.

POISONOUS ANIMAL FOOD.

Poisoning by Putrid Meat.—An intoxication, with symptoms more or less resembling those of poisoning, may arise from eating meat which (1) contains ptomaines or toxalbumoses (see p. 544), (2) conveys a true infection by pathogenic bacteria, septic or from sewerage, &c., (3) is infested by gross parasites (tape-worm, &c., see p. 546), (4) is poisoned by metallic salts from imperfectly tinned cooking pots or zinc or copper vessels. It most commonly occurs from eating old preserved canned or tinned meat, and often from sausages, hence the term "sausage-poisoning," or **Botulismus**; but it also occurs from other stale tinned meats, and may also occur from vegetable food.[1]

In the first two classes, besides the usual irritant symptoms, there is usually dryness of the skin and mucous membranes, and the narcotic symptoms of ptomaines (p. 544), dilatation of the pupils, and paralysis of the upper eyelids. In cases where the symptoms do not develop for some time, but

[1] An outbreak of severe diarrhœa in a Bengal jail was traced to the maize in the food.—W. J. Buchanan, I.M.S., in *Ind. Med. Gaz.*, 1900. And an attack of so-called cholera in Lord Hastings' camp in 1817 was attributed to unwholesome rice.—Chevers, *M. J.*, p. 301. But see *Lathyrism* and *Poisonous Food-grains*.

commence from 12 to 50 hours after the consumption of the tinned meat they are due to bacteria, there is generally fever, the digestive troubles are more like those of gastro-enteritis, and sometimes there is blood in the evacuation, and there may be pleuro-pneumonia, as in the Middlesborough epidemic of 1880, in which 490 persons died, and a pneumonia bacillus was isolated. Some of such meat when examined contains such a number of dead cocci and bacilli as to bear all the appearance of an artificial culture-broth. A *Bacillus botulinus* was found by Van Ermengen in a case of food-poisoning from raw ham, and a microbe like the *B.* enteriditis of Gaertner in the Bhowanipore epidemic of 1903 by Nield Cook.[1]

Cheese and Milk.—In more than one case symptoms of irritant poisoning have been produced by eating cheese. In such cases the cheese eaten has generally, but not invariably, been found to be rancid and to contain *tyrotoxicon*, which is obtained as needle crystals by alkalising and shaking with ether. It is not an alkaloid, but is considered by Vaughan to be diazobenzene and to be a product of micro-organism in the milk. In decayed cheese as well as the in milk of diseased cows a poisonous ptomaine or toxalbumose has been found.

Poisonous Fish.—Many cases, a few of them ending fatally, have been reported, in which persons have been attacked with symptoms of poisoning after eating fish, especially stale or tinned fish. In some of these cases the symptoms have appeared within a few minutes, in others not twelve or twenty-four hours, or more, after eating the fish. One or both of two sets of symptoms may be present, *viz.*, (1) the usual symptoms of irritant-poisoning, and (2) swelling and inflammation of the eyelids, with profuse lachrymation, accompanied by irritation of the skin and appearance of an eruption resembling nettle-rash. In some cases muscular debility, numbness of the limbs, delirium, and coma have been observed. Death has occurred within the hour, and has been delayed until the ninth day. Apparently, cases of fish-poisoning are divisible into four classes :

(1) **Idiosyncrasy,** rendering the fish poisonous only to the individual attacked and not to others ; (2) fish usually **non-poisonous,** becoming poisonous to all, attributed (*a*) to the presence in the fish of copper, (*b*) to the fish being in spawn ; (*c*) to the poisonous nature of food (*e.g.*, acrid mollusca, or acrid spawn or sewage), eaten by the fish ; (*d*) to the development of a poison by decay (see **Ptomaines**, p. 544), &c., &c. Cases of this kind are due to *shell-fish*, especially mussels and oysters, but have arisen from *hilsa*, herrings,

[1] *Ind. Med. Gaz.*, 1903, p. 362.

eels, mackerel, &c. (3) Cases arising from eating fish certain parts of which seem to be, nearly **always poisonous**: *e.g.* (*a*) a case cited by Blyth which occurred at the Cape of Good Hope, in which two adults died within twenty minutes from eating the liver of the toad or ball-bladder (*diodon*);[1] and (*b*) a case reported by Dr. Collas, of Pondicherry,[2] where three persons were poisoned by eating the *Gobus criniger*, in eating which the native females take great care, in preparing them, to remove the head and intestines, and wash the fish thoroughly. (4) **Putrid** fish.

The secretion of the skin glands of certain species of amphibia has been found to be poisonous. Blyth mentions that a poisonous alkaloid has been found in the skin secretions of the *Salamandra maculosa*, the *Triton cristatus*, or water salamander, and the common toad.

Ptomaines.

Ptomaines are chemical products of bacterial life in dead animal tissues, and as they are found by *post-mortem* decomposition, they have been called 'cadaveric alkaloids,' or *ptomaines*.

The poisonous properties found sometimes to be possessed by certain articles of food, *e.g.*, milk, cheese, sausages, &c., are in many cases the result of the development of poisonous ptomaines in the food, as has been already noted.

It is, therefore, quite possible that in the body of an individual, who has died from some other cause than poisoning, there may on examination be found an alkaloid, which, when tested by administration to an animal, proves to be poisonous.

Some of these ptomaines have been found to possess a physiological action similar to that possessed by certain vegetable alkaloids, *e.g.*, strychnia and atropine (*ptomatropine*). No ptomaine, however, has as yet been discovered, possessing all the exact, chemical characters of vegetable alkaloids which are capable of being identified by distinctive chemical reactions.[3] Hence, the objection that an alkaloid discovered in a case of supposed poisoning, may be a ptomaine produced by decomposition after death, mainly applies to cases in which the vegetable alkaloid, supposed to have been discovered, is one which can only be recognised by its physiological action, though none have yet been found to

[1] *Poisons*, p. 447. [2] Chevers, *M.*, p. 299.

[3] A Strychnine-like alkaloid has been obtained from a corpse (Mecke and Wimmer, *Pharm. Zeit.*). The alkaloid obtained forms white nodular crystals, its hydrochloride feathery tufts. It reacts like strychnine with picric acid, potassium dichromate, sulphuric and nitric acids, tannin, potassium ferricyanide, potassium thiocyanate, and after evaporating with chlorine-water it gives a dirty green with ammonia. With Fröhde's reagent it yields first a dirty violet, then an olive, and finally a green colour; with sulphuric acid a yellow, which changes to cherry-red, and then to rose; with Erdmann's reagent, a yellow colour. It is only slightly bitter to the taste, and has no physiological action on frogs.—*Treatment*, 1890.

possess the peculiar tingling sensation of aconitine when applied to the tongue.

DISEASED MEAT.

In cases of *diseased* meat, the disease may or may not consist in the presence of a parasite in the meat. The parasites, the presence of which in meat most commonly gives rise to cases, are the trichina spiralis and the various cysticerci.

Trichina spiralis.—Meat affected by this parasite contains, lying among the muscular fibres, small oval sacs, just visible to the naked eye,[1] each containing a coiled-up trichina (see plate IV, fig. *b*). Sometimes these sacs are so numerous as to give the meat a white speckled appearance. When meat thus affected is eaten without having been thoroughly cooked, a train of symptoms known as trichinosis is produced.

The pathology of trichinosis is briefly as follows:—The trichina while enclosed in its cyst is in a chrysalis condition. When the cysts are taken into the stomach or intestines of a warm-blooded animal, the trichina leaves the cyst and begins to produce young. Six to eight days after the ingestion of the cysts, these young trichinæ begin to leave the parent animal and to migrate through the wall of the intestines into the muscles, where they in their turn become encysted, and live by preying on the muscular fibre. The symptoms of trichinosis resemble to a certain extent those of irritant poisoning, differing from an ordinary irritant case chiefly as follows:—(1) There is generally a considerable interval, corresponding to the period of incubation of the worm, between eating the food and full development of the symptoms. (2) Although the pain in trichinosis is intense, the vomiting and purging are not very severe; and the pain is not confined to the stomach and intestines, but extends to the muscles as well, owing to the invasion of these by the trichinæ. (3) In trichinosis, pneumonia is almost a constant symptom; there is often, also, peritonitis, and sometimes paralysis of the muscles. Several outbreaks of trichinosis have been reported, chiefly in Germany, the most notable being one which occurred in 1863, in which 103 persons were attacked, of whom eighty died. There is no remedy, but it should be noted that trichinæ are destroyed by exposure for some time to the temperature of boiling water, and hence thorough cooking of trichinous meat prevents the occurrence of trichinosis.

Trichinæ are more frequently found in the flesh of the pig than in that of any other animal, hence cases of trichinosis have generally occurred from eating imperfectly-cooked pig's flesh in some form or other. In affected animals trichinæ, it is said, will always be found in the muscles of the eye.

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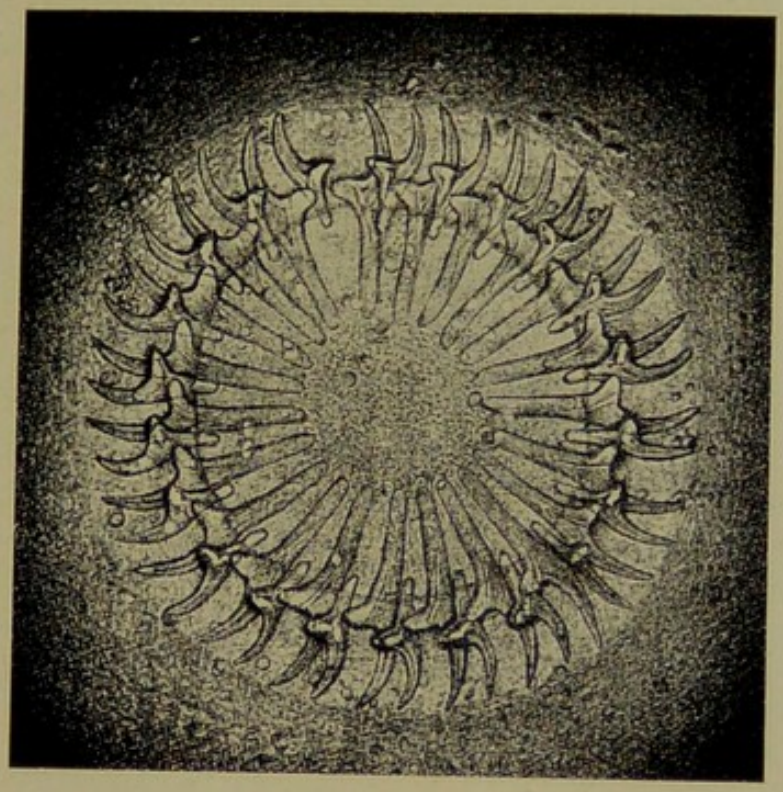
[1] Taylor gives the measurement of the sacs as $\frac{1}{50}$th of an inch long by $\frac{1}{100}$th of an inch broad. The worm varies in length from $\frac{1}{50}$th to $\frac{1}{8}$th of an inch. As many as 6,000 may be found in about sixteen grains of the affected meat.

Cysticerci.—These are the larvæ of tapeworms, and may be found in the flesh of all animals. Flesh containing them is popularly termed 'measly,' *e.g.*, measly pork.

In affected meat the cysticerci are seen as little sacs, filled with fluid, embodied in the muscle. From one side of the interior of the sac a neck projects, terminating in a head surmounted with a crown of hooks (see plate VI *a* & *b*). The pork cysticercus (*C. cellulosæ*) varies in size from a pea to a large bean, and develops into the *Tænia solium* (6 to 12 feet long). The cysticercus of ox flesh is smaller in size and develops into the *T. mediocanellata* (15 to 20 feet or more). Both these tapeworms affect the human subject. In rare cases also, the larval form of *T. solium* has been found in the human body. Another variety of tapeworm, *T. echinococcus*, is only known to affect the dog and wolf; the larval form of this tapeworm, however, affects other animals; *e.g.*, sheep, in which it specially affects the brain, causing "staggers," and the human subject, giving rise to hydatid tumours. Woodman and Tidy remark that *echinococcous* disease is alarmingly common in Iceland.

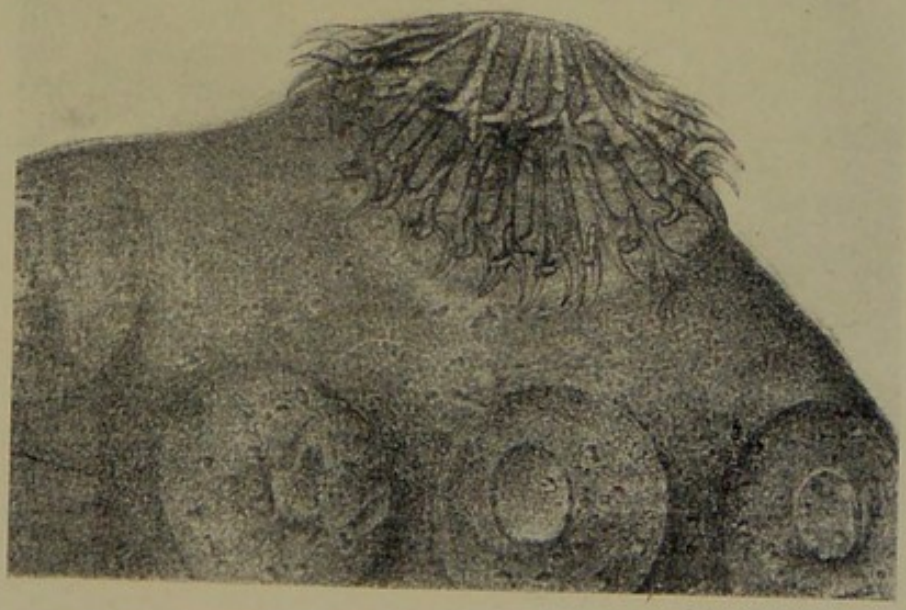
Other diseased Meat.—The flesh of animals affected with disease not specifically parasitic in character, may also, when eaten, give rise to symptoms resembling those of poisoning. Thus, Dr. Letheby met with a case in London, in which sixty-four persons, of whom one died, were attacked with sickness, diarrhœa, and great prostration of strength, after eating sausages made from diseased beef. In another English case, which occurred at Welbeck, in 1880, over seventy persons, of whom four died, were attacked with similar symptoms after eating ham, found, on examination, to contain a bacillus. In the great majority of the Welbeck cases, of which particulars could be obtained, the symptoms did not appear until twelve hours or more after eating the affected food. A bacteriological examination should be made in such cases.

a



HOOKLETS OF CYSTICERCUS × 63.

b.



HEAD OF CYSTICERCUS × 63

Thacker, Spink & Co., Calcutta From Micro-Photographs by Dr. Heneage Gibbes.

CHAPTER XXVI.

NERVE POISONS.

THESE may for descriptive purposes be divided into cerebral, spinal, cerebro-spinal, cardiac, &c. (see Table, p. 401).

CEREBRAL POISONS, OPIUM, &c.

Generally the poisons of this order including *narcotics, anæsthetics, inebriants and deliriants* act mainly on the brain, causing one or other of two sets of symptoms or both. These, in the order of their occurrence, are : (1) Excitement with quick pulse and flushing of the face, often accompanied by delirium, and more or less derangement of voluntary movement ; and (2) Sopor, deepening into more or less profound coma, with laboured and stertorous breathing.

The mydriatic deliriants, produce the first of these two sets of symptoms, accompanied by dilatation of the pupils as their prominent effect. The majority of poisons of this order—**narcotic poisons**—produce the second set of symptoms as their prominent effect. In poisoning by some of these, *e.g.*, alcohol, a first stage of excitement and delirium usually precedes the second or comatose stage ; but when the dose is large, this first stage may be absent. In others, *e.g.*, opium, the first stage is commonly absent, or only slightly marked ; but, if the dose is small, or the patient habituated to the action of the poison, a well-marked first stage may be present. **A few,** *e.g.*, hydrocyanic acid and the poisonous cyanides, **act with extreme rapidity,** paralysing the heart if the dose is large, and causing death by syncope; or in smaller doses, acting on the spinal cord as well as the brain, and although producing insensibility, quickly causing death by asphyxia due to paralysis of the muscles of respiration, and not by coma as is usual in cerebral poisoning.

No chemical antidote is available for the majority of these poisons, hence, in most cases, the **treatment** must consist in the use of measures directed to (*a*) procuring elimination of the poison, and (*b*) counteracting its effects. If the poison, as is usually the case, has been administered by the mouth, the first of these indications may be carried out by giving emetics (see p. 405), or using the stomach-pump; the latter being resorted to in preference to repetition of the emetic, seeing that many of these, *e.g.*, zinc sulphate, if not ejected by vomiting, are liable to become absorbed and act as poisons. The mea-

sures by which the second indication of treatment may be carried out vary according to the poison and the prominent symptoms. Thus, cold affusions, keeping the patient roused, sinapisms, &c., are indicated when narcotism has to be overcome ; and galvanism and artificial respiration when death threatens to occur by asphyxia. In the case of some cerebral poisons, special physiological antidotes are indicated, *e.g.*, atropia in opium poisoning.

OPIUM AND MORPHIA.

Opium. *Afim*, *Afiyún* (Hind.), is the inspissated juice obtained by incision from the unripe capsules of the poppy, *Papaver somniferum*, N. O. *Papaveraceæ*. It contains meconic acid and a number of alkaloids, those present in largest quantity being narcotine and morphia.

Indian opium, as a rule, contains more narcotine than morphia. Other varieties, as a rule, contain more morphia than narcotine. Of these two alkaloids, narcotine has no narcotic properties, and is officinal I.P. as a tonic and antiperiodic. Morphia, on the other hand, is a powerful narcotic. The percentage of morphia in different samples of opium varies from about 2½ to 15 or even 20 per cent. Indian opium often contains under 5, and seldom contains over 9 per cent. of morphia. Other alkaloids present in opium, *e.g.*, codeine, narceine, and papaverine, also possess narcotic properties. Another alkaloid, thebaia, the proportion of which in opium varies, seldom however exceeding 1 per cent., is a convulsant like strychnia, but less powerful.

Opium is so easily obtained everywhere in India and by its means the 'thin spun life' can be slit with such ease and freedom from physical suffering that, after strangulation, it is the most favourite means of suicide. In suicidal cases the opium is often mixed with mustard-oil in the belief that the latter facilitates the speedy action of the opium.

Of cases of poisoning **in India**, nearly 40 per cent. of the deaths reported to the chemical examiners, are due to opium. Such cases in adults are, as a rule, *suicidal*, and these are mainly amongst women, chiefly mistresses or *demi-monde*, deserted by their lovers, though a considerable number are 'failed' students. *Homicide* for the reasons already given (p. 400) is rather rare by opium. In very young children suicide is, of course, excluded, and cases are either accidental or homicidal. The practice of drugging young children with opium by *ayahs* and nurses, in order to keep them quiet, is widely prevalent in India, and often results in cases of the first description. So also, but less directly, does the habit of opium eating, cases being often reported, in which children, getting hold of the box in which opium is kept by their parents, eat a quantity and die. Poi-

soning by opium is a somewhat common method of infanticide in India.[1]

In England, according to statistics collected by Blyth, in the five years ending 1880, altogether 1,581 deaths were reported from poison. Of these, 643, or 40·7 per cent. were due to opiates. Of the 643 deaths, 160 occurred in infants ; two of these were cases of homicide. Of the adult cases, none were homicidal, and about 27 per cent. suicidal. In England, **drugging with opium** is occasionally adopted for the purpose of facilitating robbery ; it is seldom, if ever, used for this purpose in India, its place being taken by datura.

Symptoms.—When solid opium has been swallowed, there is usually an **interval** of half an hour to an hour before the symptoms appear. A shorter interval than this is sometimes observed, especially when the drug has been taken in solution on a nearly empty stomach. In other cases, the interval has been several hours in duration. Intoxication appears frequently to delay the appearance of the symptoms ; but in one exceptional case, reported by Christison, the appearance of the symptoms was delayed for eighteen hours without any apparent cause. **At first** there may be **slight excitement,** this, however, is soon followed by giddiness and drowsiness succeeded by **sopor,** gradually deepening into **coma,** with slow stertorous respiration. The breathing gets more and more shallow, and finally death occurs, usually from paralysis of the respiratory muscles. The **face** is usually pale, the lips livid, and the skin bathed in perspiration. All the **secretions** (that of the skin excepted) are more or less completely sus pended. **The pulse** may be at first natural or quickened ; afterwards it is usually slow, but becomes small, quick, and irregular, as death approaches. An **odour** of opium may be present in the breath. **The pupils** are contracted and insensible to light, but towards the end become widely dilated.

Rare symptoms.—Vomiting and even diarrhœa are sometimes present. Tetanoid convulsions and lockjaw have been observed, more particularly in children ; and when morphia has been taken. Guy also includes delirium, anæsthesia, and paralysis, as occasional symptoms. In rare cases, the symptoms assume a remittent form, the patient, after several hours' insensibility, recovering consciousness, but relapsing after an interval into coma, terminating fatally (see following case).

Case CCLVIII.—Case of the Hon. Mrs. Anson.—"This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit

[1] *Beng. Medico-legal Rept.* for 1870-72 states that, in the three years ending 1872, thirty cases of infanticide by opium poisoning were reported, and in addition thirty-seven cases of alleged infanticide by poison, of which the majority were probably opium cases. For recent statistics see Appendix VIII.

for half an hour, and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of landanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours, the patient revived, her face became natural, the pulse steady, the power of swallowing returned, she was able to recognise her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes; the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."

Unusual modes of administration.—A case is reported of death from application of a poultice to the abdomen containing about one ounce of laudanum.[1] Serious symptoms have arisen from the application of opium to a wound (see *Case CCLXI*). Death has occurred from the application of morphia to a wound; also from hypodermic injection of morphia, and from the injection of an enema of opium into the rectum. The introduction of opium into the vagina may cause death, and is a not uncommon method of attempting suicide in some parts of India.

Case CCLIX.—**Opium poisoning, Homicidal, in Children.**—In 1899, the mother of a female child, about 2 months old, left her child in the varandah of her house in Sitamari, while she went to fetch water. On returning she found the child sucking the finger of a woman who had come during her absence. This woman on being asked what she was doing, hastily wiped her right hand in a piece of rag and told the mother that she was giving the child some 'bread,' a piece of which she showed in her left hand. The woman then left, and the child soon commenced vomiting and died within a few hours. Opium was detected in the viscera of the child, and the rag on which the accused woman wiped her finger was also found to bear stains of opium. The bread which the accused held in the left hand contained no opium. The mother wiped the mouth of the child, when it vomited, with a piece of cloth which was also forwarded for examination and in the stains on which opium was detected.

(2) The civil surgeon of Patna forwarded the viscera of a Hindu male child, aged about six months, who was said to have met his death under the following circumstances as reported by the police:—"The relatives of the deceased stated that the mother of the deceased was nursing another child; the mother of the latter child took the deceased on her lap and went out when the deceased began to cry. The mother of the deceased, suspecting something wrong, took her child from the woman and brought it home, but the child died within a few hours." Opium was detected in the viscera of the child. Both of these cases occurred in the districts where opium is cultivated in Upper Bengal.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case CCLX.—**Opium poisoning with cut-throat—Suicidal.**—In 1897 in Calcutta a Jew was found lying dead in his room with a deep

[1] Tardieu, quoted by Blyth, *Poisons*, p. 288.

suicidal cut on the throat. The stomach was forwarded for analysis and found to contain lumps of solid opium. Death resulted from hæmorrhage, by opening of the wind pipe, and large blood vessels on both sides of the neck, but the presence of the large quantity of opium in the stomach indicated that the man was a determined suicide. Deceased evidently took opium first; but finding life still prolonged, had recourse to the knife to hasten his end.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897. Obviously, in cases of this description, there is no opium odour in the breath.

Case CCLXI.—**Poisoning from external application of opium into a wound** (Chevers, *M.*, p. 228).—A Burman boy was struck on the forehead, causing a gaping wound about an inch long. This the parents, about three hours after, stuffed with about forty-five grains of opium. On the third day he was brought to a medical man (Dr. H. W. Jones) in a semi-comatose state, but recovered under active treatment.

Diagnosis.—1. **From Apoplexy.** Here the chief points of distinction are: (*a*) **The age and appearance of the patient.** Apoplexy generally, but not invariably, attacks the old, and it is more common in fat than in thin persons. (*b*) **The history of the case.** In apoplexy, the symptoms, as a rule, come on abruptly; in opium poisoning they advance gradually. (*c*) **The state of the pupils.** In apoplexy, the pupils are dilated, except in apoplexy of the pons varolii, when they are contracted. In opium poisoning, the pupils are contracted, except towards the end of the case, when they become dilated. (*d*) **The odour of opium** in the breath. This, however, may be absent in opium poisoning. (*e*) Convulsions, a bloated face, and impossibility of rousing the patient, are all more in favour of apoplexy, than in favour of opium poisoning.

2. **From Uræmic Coma.** Here chief reliance would be placed on (*a*) the history of the case; (*b*) the presence in, or absence from, the urine, of matters indicative of disease of the urinary organs; (*c*) the state of the pupils, contraction pointing to opium poisoning; and (*d*) the presence or absence of an odour of opium in the breath.

3. **From other Narcotic poisoning.**—Alcoholic poisoning is sometimes difficult to distinguish from opium poisoning. In the first, the pupils are usually dilated, but may be contracted; and there is often an odour of alcohol, and not of opium, in the breath. In poisoning by carbolic acid, the pupils, as in opium poisoning, are contracted; here, however, the local action of the poison on the lining membrane of the mouth, would most probably serve to distinguish the case. Contracted pupils, also, are present in poisoning by Calabar bean, may be present in aconite poisoning, and also, except during the fits when the pupils are usually dilated, in poisoning by strychnia. The three poisons last mentioned, however, are not narcotic in action.

Fatal Dose: This is affected by 1. **Age.**—Children are extremely sensitive to the action of this drug. 2. **Habit.**—Persons in the habit of taking opium, or its preparations, acquire a resisting power to its action: *e.g.*, a case is on record of an opium-eater who was in the habit of swallowing nine ounces of laudanum (tincture of opium) daily; and another of a lady, aged twenty-six, who took ten grains of acetate of morphia three times a day for ten years. 3. **Disease.**—In some diseases, *e.g.*, tetanus, and diseases accompanied

by severe pain, large quantities of opium are tolerated. In other affections, *e.g.*, Bright's disease, comparatively small doses may produce serious effects. 4. **Idiosyncrasy.**—Some persons are easily affected by small doses of opium ; others are but little affected by large doses. **Quality of the drug.**—As already pointed out, the percentage of morphia in opium varies greatly. Garrod, however, remarks that, although good opium contains one-tenth of its weight of morphia, morphia is not ten times, but only about four times, as strong as opium. Hence, although ordinary Indian opium probably, as a rule, contains only one-fourth to one-half as much morphia as B. P. medicinal opium, it does not necessarily follow that the latter is from two to four times as strong as the former.

Fatal dose in Children.—Death has been caused in an infant, five days old, by two drops of tincture ; in another, nine months old, by four drops of tincture ; and in a third case, one grain of Dover's powder, equal to one-tenth of a grain of opium, nearly killed a child, four months old (Taylor[1]). In **Adults.**—In the case of these, the smallest fatal doses recorded are : two and a half grains of extract equal to four grains of crude opium (Taylor[2]), and four and a half grains of opium taken along with nine grains of camphor (Christison[3]). Christison also mentions three cases in which elderly persons, suffering from respectively (1) severe catarrh, (2) cough, and (3) asthma, died from doses equal to less than four grains of opium. In one of these cases, the fatal dose was twenty-five drops of the tincture, and in another, fifteen drops, of Battley's solution. The case just mentioned excepted, the smallest fatal dose of the tincture on record appears to be two drachms. Blyth, however, points out that the tincture, as usually sold in England, varies greatly in strength. Recovery has been recorded from very large doses of opium. Woodman and Tidy consider that four grains of opium (presumably English medicinal) would in most cases prove a poisonous dose.[4]

Fatal period.—Shortest recorded, forty-five minutes. Usual period nine to ten hours ; in rare cases, two to three days. The prognosis is favourable if the patient survives twenty-four hours.

Treatment.—If the poison has been introduced into a wound, &c., remove it as far as possible and wash out the part. If it has been swallowed, wash out the stomach well by the stomach pump ; if the latter is not available then give an emetic or inject apomorphine hypodermically. Endeavour to rouse patient and keep him roused by cold affusion, sinapisms, and flicking with a wet towel and in severe cases the faradic current. In the less severe cases a cold douche and walking the patient about may be sufficient but the forced perambulation should never be done where the surface of body is cold or where coma is present. For profound coma artificial respiration should be tried along with electricity. Administer hot strong infusion of

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[1] *Poisons*, p. 557.
[2] *Ib.*, p. 556.
[3] *Ib.*, p. 714.
[4] *For. Med.*, p. 371.

coffee freely if patient can swallow, also give a sniff of smelling salts. As a chemical antidote **Permanganate of Potassium** has been advocated by Moor [1] and his success confirmed by many others. Dr. Maynard, I.M.S., having used it successfully in 19 cases in India.[2]

Moor recommends 10 to 15 grains of potassium permanganate dissolved in 6 to 8 ounces of water to be repeated every half hour for three or four times. If crude opium or the uncombined alkaloid has been taken, the solution of permanganate is to be acidulated with a little sulphuric acid. One grain of permanganate in one ounce of water he recommends should be given for each grain of morphia or every 10 grains of opium taken. Luff [3] found that on mixing 3 grains of acetate of morphia with vomit and then treating the mixture with 4 grains of permanganate dissolved in 4 ounces of water, no morphine could be extracted from it; and he recommends that the stomach should be washed out at intervals with a weak solution of permanganate to oxidise any of the poison which may be excreted into it. The permanganate should not be used in concentrated solution as it may corrode.

Atropine hypodermically has been used as a physiological antidote to stimulate the respiratory centres, but its utility is somewhat doubtful. One-twentieth of a grain is injected and may be repeated till pupils dilate.

Case CCLXII.—The following case shows that in opium-poisoning very large doses of atropine are tolerated. This, to a certain extent, supports the theory that atropine is a physiological antidote for opium. Strychnine as well as ether hypodermically are useful.

Case CCLXIII.—**Hypodermic injection of Atropine in opium poisoning.**—During the four and a half years ending November, 1885, sixty-four adults poisoned by opium were treated in the Jamsetjee Jeejeebhoy Hospital, Bombay, by hypodermic injection of atropine in ¼ grain doses repeated at intervals, until dilatation of the pupils occurred. Of the 64, 31 died and 33 recovered. Of the 31 who died, 7 had been under 2; 11 over 2 and under 6; 8 over 6 and under 20; and 5 over 20 hours in hospital. The amount of atropine injected in the fatal cases was in 9 a ¼ of a grain; in 10 over ¼, but not more than ¾ of a grain; in 8 over ¾ and under 1½ grains; and in 4 over 1½ grains. The amount injected in the 33 cases of recovery was in 12 ¼ of a grain; in 12 more over ¼ to ¾ of a grain; and in 9 from over ¾ to 1½ grains.

Post-mortem Appearances.—Not characteristic. McLeod summarises them as follows in well-marked cases:—"Brain turgid; lungs congested; the head distended with liquid

[1] *Medical Rec.*, 1894; also *Permanganate Treatment of Opium Poisoning*, London, 1899.

[2] *Brit. Med. Jour.*, May 16, 1896.

Brit. Med. Jour., 1896.

liquid blood ; liver and spleen engorged ; mucous membrane of the stomach either natural or slightly and uniformly injected.[1]"

Opium-Eating, &c.—The habit of opium-eating widely prevails in India. Very generally, the crude drug is used. Sometimes, however, as in Rajputana, a watery decoction, known as "*kusoomba*," is employed. Opium-smoking is also much practised, a watery extract of the drug called "*chandul*" being commonly used for this purpose. The question whether opium-eating, smoking, &c., is or is not injurious to health has been hotly debated. There appears, however, to be a pretty general consensus of opinion among medical men, who have actually practised their profession in countries where these habits prevail, that, used in moderation, opium neither tends to injure health nor to shorten life. Abuse of opium, like abuse of alcohol, may cause derangement of digestion, and general impairment of health. Abuse of opium, however, is much less likely than abuse of alcohol, to injure health ; and appears to be much less common among opium-eaters, smokers, &c., than abuse of alcohol is among alcohol-drinkers. In persons accustomed to the use of opium, the preliminary stage of excitement, slight or absent in cases of poisoning, is a marked effect of a moderate dose. Chevers gives a case where a man, presumably an opium-eater, previous to committing murder, swallowed, apparently to nerve himself for the deed, so large a quantity of opium that he died a few hours after committing the crime, see following case. For the question of criminal responsibility in such cases see p. 362 also Alcohol.

Case CCLXIV.—**Running Amok while under the influence of Opium** (Chevers, *M. J.*, p 789).—A poorbea, having a dispute with his nephew in regard to some property which ended in litigation decided in the nephew's favour, armed himself with a straw chopper, and went in search of him. Not finding the nephew, he entered the nephew's house and severely wounded a woman, his nephew's wife, and her two children, killing one. Leaving the house, he then attacked and wounded a young man, who appears to have been simply a passer-by. He was shortly afterwards captured and put in confinement, but died during the day from the effects of the opium he had taken previous to committing the crime.

Action on animals.—It has been found that large quantities of opium may be given by the mouth to pigeons and other birds, without narcotism being caused. Blyth remarks that the explanation of this is that the poison is not absorbed, as subcutaneous injection of morphia has been found to act rapidly on all birds hitherto experimented on. In frogs, opium excites tetanus, followed by paralysis of reflex action.

Preparations of Opium.—Of the stronger **B.P.** and **I P. preparations**, the following quantities correspond to one grain of opium :—*Extractum opii*, ½ to 1 of a grain ; *pilula saponis comp.*, six grains ; *pil. plumbi cum opio*, eight grains ; *pulvis ipecacuanhæ comp.* (Dover's powder), *pulvis opii comp.* and *emplastrum opii*, ten grains ; *unguentum gallæ cum opio*, about 13½ grains ; *tinctura opii* (laudanum), 14½ minims. *Extract opii liquid*, and *vinum opii*, are both slightly stronger

[1] *Beng. Med. Rept.*, 1869, p. 109.

than the tincture.[1] **Various Patent medicines** and quack nostrums also contain opium ; among these may be mentioned *black drop*, an acetic acid solution of opium about four times as strong as the tincture. *Battley's liquor opii sedativus* has about the same strength as extractum opii liquidum, B.P., and *Nepenthe*, a nearly colourless alcoholic solution of opium, has about the same strength as laudanum. *Godfrey's cordial*, used as a sedative for children, contains one grain and a half of opium per fluid ounce. Other opiate preparations, used for the same purpose, are, Mrs. *Winslow's Soothing-syrup* and *Dalby's carminative*. The first contains about one grain of morphia, with other opium alkaloids, per ounce ; and the second, about one-sixth of a grain of opium per ounce.

Morphia.—The *symptoms*, &c., in poisoning by this alkaloid, or one of its salts, are similar to those of poisoning by opium, except that convulsions are apparently somewhat oftener present. The alkaloid itself is only very sparingly soluble in water, and is not officinal. The two salts of morphia most commonly employed, both of which are officinal, B. P. and I. P., are the acetate and the hydrochlorate. Both these are much more soluble in water than morphia ; the hydrochlorate being soluble in about sixteen parts of cold water, and less of boiling water, and the acetate more soluble than the hydrochlorate. The medicinal dose of either salt is one-eighth to half a grain. One grain of either may be regarded as a minimum fatal dose for an adult. The I.P. contains the following preparations of these salts :—Of the acetate, a solution, strength four grains to the fluid ounce ; of the hydrochlorate, a solution of the same strength ; also suppositories, half a grain in each, and lozenges, one thirty-sixth of a grain in each.[2] The morphia habit is not uncommon in the larger cities, and in Burma a widely popular brand of pills for 'the cure of opium eating' was found to contain morphia. The Burma Chemical Examiner in 1898 reported that in 51 cases analysed morphia was detected in the substances examined, and the use of these pills had now extended throughout Lower Burma and as far as Mandalay. Those consumed in the Arakan division were usually made locally, while those used elsewhere in Burma were apparently of Chinese manufacture.

Chlorodyne contains morphia. According to Blyth[3] *Brown's* chlorodyne contains in each fluid ounce of the mixture about seven grains of hydrochlorate of morphia, six drachms of chloroform, and 10½ drops

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[1] Five to six drops of the tincture equal about ten minims. The liquid extract and the wine of opium are prepared from *extractum opii* (one ounce to the pint), while the tincture is prepared from dry opium, an ounce and a half to the pint. One grain of opium is contained also in the following quantities of other B.P. and I.P. preparations :—Fifteen grains *suppositoria plumbi composita;* twenty grains *pulvis kino co.;* twenty-nine minims *linimentum opii ;* forty grains *pulvis cretæ aromaticus cum opio ;* ninety-six minims *tinct. opii ammoniata ;* half a fluid ounce *tinct. camphoræ co. ;* and about one ounce *enema opii.* Ten opium lozenges contain one grain of extract of opium.

[2] These are similar to the corresponding preparations of the B.P. of 1864. The B. P. of 1885 has the following :—Of the acetate, a hypodermic injection, strength one grain in ten minims, and a liquor, strength one grain in a hundred fluid-grains. Of the hydrochlorate, a liquor, strength one grain in a hundred fluid-grains, and suppositories and lozenges similar to those of the I. P. ; also a tincture of chloroform and morphia, containing in each dose of ten minims, one-forty-eighth of a grain of hydrochlorate of morphia, five-eighths of a minim of dilute hydrocyanic acid B.P., one minim and a quarter of chloroform, and one-third of a minim of ether.

[3] *Poisons*, p. 288.

of Scheele's prussic acid and 53 minims of Tincture of Indian Hemp. In poisoning by chlorodyne the pupil has been observed to be dilated,[1] doubtless due, as suggested by Dr. A. Powell, to the symptoms of prussic acid poisoning preceding and overshadowing those due to morphia. *Treatment.* Should keep in view all these constituents of this mixture. In a case reported by Dr. Hughes the pupils were fixedly dilated slightly and lips cyanosed. Ether and strychnia were given, but respirations ceased. Artificial respiration was kept up for three hours, procuring shallow breathing till death some hours after by cardiac failure.[2]

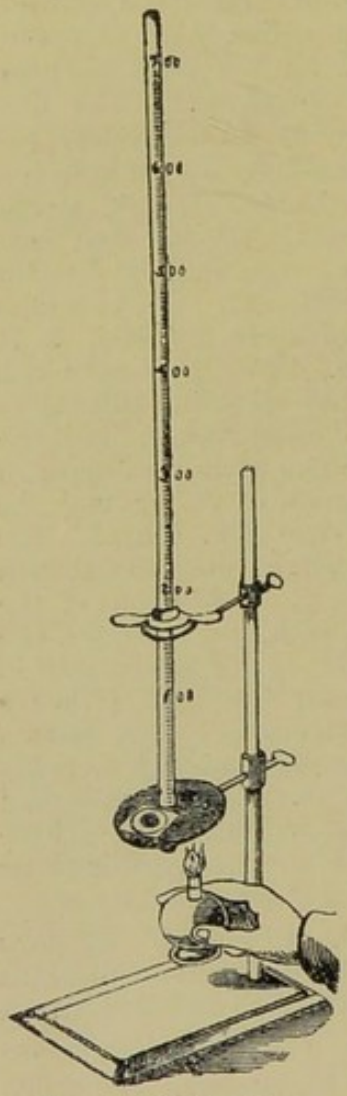

FIG. 33, Sublimation.—Apparatus for testing poisons (inorganic and organic) and noting the temperature at which change of form and colour and sublimation occurs, showing the spirit-lamp applied to the substance placed on the disc of copper, with hollow nipple, in which is received the thermometer.

Poppy capsules, *Post* (*Hind.*), are narcotic. Syrupus papaveris B. P. and I. P., prepared from the capsules freed from the seeds, is said to have a strength equal to about two grains of opium per fluid ounce. The B. P. and I. P. also contain an extract prepared from the same, the medicinal dose of which is two to five grains.

Poppy oil expressed from the seeds, *Kash-kash-ka tel* (Hind.), is used largely in India in food, and appears to be inert. Another oil met with in India under the name of poppy oil, unlike poppy-seed oil, is dark brown in colour, and has a strong odour of opium. It appears to be a vegetable oil which has been used for softening old opium ; it is employed as an anodyne application, but I have not been able to detect either morphia or meconic acid in the specimens I have examined.

Detection.

Meconic acid in solution gives, with ferric chloride solution, a blood-red colour, not destroyed by dilute hydrochloric acid (distinction from acetates), and not destroyed by mercuric chloride solution (distinction from sulphocyanic acid). **Morphia** in solution gives : (1) With strong nitric acid, an orange colour changing to yellow ; (2) With a mixture of bichromate of potassium solution and strong sulphuric acid, a green colour ; and (3) with a mixture of starch solution and solution of iodic acid, a blue colour. In solid form morphia

[1] Hughes' *Braithwaite's Retrosp.*, 1893, p. 5, and A. Powell, *Ind. Med. Gaz.*, 1902, p. 306. The latter observer found the pupil to be *widely dilated* in all of the last four fatal cases. This experience is opposed to Taylor's *dictum* that "usually in fatal cases there is contraction."

[2] Morphia is only very sparingly soluble in ether and chloroform.

sublimes at 330°F. without change of colour, it melts at 340° and darkens with deposit of carbon ; whereas **Strychnia** sublimes at 345°, melts at 430°, when it darkens from deposited carbon ; **Tartar Emetic** decrepitates at 380°, sublimes slowly at 480°, and chars at 550° ; whilst **Arsenious Anhydride, Calomel,** and **Corrosive Sublimate** sublime without change of form or colour at 260°, 240°, 200° respectively.

From organic mixtures, meconic acid and morphia may be separated as follows :—Digest solid matters cut up into small pieces (or fluid matters concentrated on a water bath to a syrup) with alcohol acidulated with acetic acid, strain through cloth, evaporate the alcoholic tincture nearly to dryness on a water bath, add a little water and a few drops of acetic acid, and filter. To the filtrate add excess of sub-acetate of lead solution and boil, filter again ; the filtrate will now contain the morphia as acetate, and the precipitate the meconic acid as meconate of lead. These are to be separately treated as follows :—(1) The precipitate is to be suspended in water, sulphuretted hydrogen passed through the liquid, the liquid filtered, evaporated to a small bulk, and tested for meconic acid : (2) The morphia filtrate ; sulphuretted hydrogen is passed through this until all the lead is thrown down, the liquid is then filtered and concentrated, and morphia extracted from it as in Stas' process (see p. 488), using amylic alcohol or acetic ether as a solvent. As an aid to diagnosis in a case of poisoning, the ferric chloride test for meconic acid may be applied directly to a small portion of the liquid removed by the stomach-pump. **Microscopically** on evaporating spontaneously the morphia extract with a drop of dilute sulphuric acid on a glass slide, crystals of morphia sulphate will be obtained as in fig. 34.

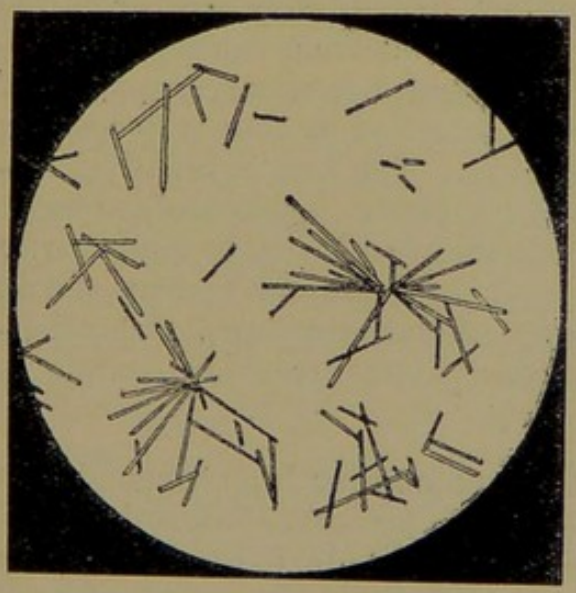

FIG. 34.—Morphia Sulphate ×100.
Obtained by evaporation spontaneously with dilute sulphuric acid.

Failure to detect, &c.—The detection of opium depends on the recognition of morphia and meconic acid, two substances which form only a fractional part of the crude drug. A very minute dose of opium, however, containing only an infinitesimal quantity of these substances will prove fatal to a young child. In such cases, analysis often fails to detect the presence of the poison. Cases also have often occurred, in which adults have died from the effects of a considerable dose of opium, and yet it has been found impossible to detect the poison after death in the viscera. Among other cases of this kind, Taylor mentions one of a young woman who died in nine hours from a dose of one and a half ounces of laudanum, and yet, in the contents of whose stomach after death, no trace either of meconic acid, or morphia, could be detected. On the other hand, opium has several times been detected in the contents of the stomach of persons poisoned by it, four months or more

after death. The explanation of these differences is probably something as follows. When an individual has lived for some time after swallowing the poison, especially in solution, such portion as has not been got rid of by vomiting, becomes absorbed, and distributed through the body, its constituents after absorption, either undergoing change, or becoming so very widely distributed that unless a very large portion of the body is submitted to analysis, a sufficient quantity of them for identification cannot be isolated. On the other hand, if the poison has been taken in the solid form, or death has been rapid, a portion of it, failing to undergo absorption before death, remains in the stomach, and, as opium has a considerable resisting power to putrefaction, its presence may still be detected even if this is far advanced. Finally, it may be pointed out, that the presence of realgar, as an adulterant in opium (see p. 453), might lead to complications of evidence in a case of opium-poisoning.

ALCOHOL.

Alcoholic poisoning is not very common in India except in the larger cities.

Alcohol.—Water-free or 'absolute' alcohol is seldom met with. *Rectified spirit*, the nearest approach to it in common use, contains 16 per cent. by weight of water. The quantity of real alcohol in liquors sold for potable use is approximately: in strong spirits, such as *brandy*, *whisky*, *rum*, *arrack*, &c., 37 to 45 per cent.; in strong wines, such as *port* and *sherry*, 15 to 22 per cent.; in light wines, *e.g.*, *claret* and *hock*, 6 to 9 per cent.; and, in *malt liquors*, such as porter and ale, 3 to 6½ per cent. *Proof spirit* (in terms of percentage of which the strength of alcoholic liquors is often stated) contains 49·24 per cent. by weight of absolute alcohol.

In acute alcoholic poisoning, which may arise from the inhalation of alcoholic vapours, as well as from swallowing alcoholic liquids, there is usually but not always a previous stage of excitement and delirium. This is followed by stupor deepening into coma with stertorous breathing. The face is usually flushed, the breath smells of alcohol, and the pupils are generally but not always dilated. As a rule the patient can be temporarily roused into partial sensibility by a loud noise or violent shock. Vomiting and convulsions are occasional symptoms. Occasionally also the symptoms remit, the patient recovers consciousness, but subsequently dies.

The diagnosis of alcoholic poisoning from concussion of the brain, apoplexy, and poisoning by other narcotics, *e.g.*, opium, is sometimes a difficult matter. In these the face is usually pale, and in opium poisoning the pupils are contracted. A smell of alcohol in the breath, it must be recollected, merely indicates the presence of alcohol in the stomach; accompanying narcotic symptoms may, or may not, be due to alcohol poisoning.

Fatal dose, &c.—In terms of absolute alcohol, the probable minimum fatal dose is:—For a child under twelve, 1 to 2

ounces; for an adult, 2½ to 5 ounces. Recovery has been recorded in an adult after swallowing a quart of whisky (probably equal to at least 9 ounces of absolute alcohol), and in a child of five after swallowing 3 ounces of rum (probably equal to 1 to 1½ ounces absolute alcohol). In alcohol poisoning, death obviously may occur as an indirect result, as for example from a fall or other accident brought about by intoxication. After coma has supervened, death may occur in a few minutes or not for days. Blyth states that death has occurred after coma of three, four, and even six days' duration.

Treatment.—The contents of the stomach should be at once evacuated, preferably by the stomach-pump; and endeavours should be made to restore sensibility by cold affusion, galvanism, ammonia to the nostrils, &c. Strong coffee may be administered as in opium poisoning. Acute alcoholism in robust and otherwise healthy subjects by large doses of digitalis, but the perils of this treatment are obvious and its value doubtful.

Post-mortem appearances.—The mucous membrane of the stomach generally but not always, shows signs of inflammation. These vary from patches of redness, to a condition similar to that found in poisoning by a powerful non-corrosive irritant. The brain is usually congested, so also frequently are the lungs; and the large vessels of the chest are usually found full of dark fluid blood. An odour of alcohol is usually present in the contents of the stomach, and may be noticeable also in other parts of the body.

Chronic alcoholic poisoning.—Long continued abuse of alcoholic liquors may, as is well known, give rise to disease of various organs, and to delirium tremens. Delirium tremens may be distinguished from intoxication by the history of the case, and the character of the delirium. This may be shortly described as a delirium of dread, accompanied by delusions most commonly connected with visual perception. The patient imagines he sees various objects lying around him, or crawling about, and is often violent, with a tendency to suicide, or less commonly to homicide. As a rule, he can be roused into temporary sanity when sharply spoken to. Legally, delirium tremens is unsoundness of mind,[1] not intoxication.

The criminal responsibility of individuals for acts done while in a state of alcoholic or other intoxication[2] is dealt with

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[1] For the criminal responsibility of persons of unsound mind, see *Insanity*, p. 411.

[2] The responsibility is the same, no matter what the *nature* of the intoxicating agent.

in *ss.* 85 and 86 of the *Indian Penal Code. S.* 86 is as follows: "In cases where an act done is not an offence unless done with a particular knowledge or intent, a person who does the act in a state of intoxication shall be liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated, unless the thing which intoxicated him was administered to him without his knowledge or against his will."

Mayne, in commenting on this section, writes: "Sometimes in determining the quality of an offence, evidence is necessary of a specific existing state of mind, which must be found as a fact, and cannot be assumed. For instance, supposing a fatal blow to be struck under circumstances of grievous provocation; it might be shown that, notwithstanding the provocation, the defendant had acted, not under its influence, but from a preconceived malicious resolve to kill. If so, the offence would be murder. But the mere fact of the deadly blow would not be sufficient evidence for that purpose. Given the provocation, the legal inference derivable from the character of the blow would be exhausted in making the act be culpable homicide not amounting to murder. Evidence of a different state of mind would be required to constitute the graver charge. In this state of things, intoxication might be an answer to the charge of murder."

Methyl alcohol, *wood spirit, wood naphtha,* or pyroxylic spirit, obtained by the destructive distillation of wood, has an action on the system similar to that of ethyl alcohol. It has a peculiarly disagreeable odour, and is used for fouling rectified spirit, so as to render it non-potable. Rectified spirit, mixed with ten per cent. of pyroxylic spirit, is sold under the name of '*methylated*' *spirit* for use in arts and manufactures.

Amyl alcohol, *fusel oil,* or potato spirit.—This is a higher alcohol of the same homologous series as the two alcohols mentioned above, but, unlike them, is not miscible with water. It is much less volatile than ethyl alcohol, and is found in the last portions of the distillates obtained from fermented potatoes and fermented grain. Like ethyl alcohol, it is a narcotic poison, but is much more powerful in its action, and more prone to cause convulsions. It appears to be more powerfully poisonous when inhaled in the form of vapour, than when swallowed in the liquid form. Carelessly distilled whisky and other spirits are apt to contain amyl alcohol, and, in consequence, to be more powerfully intoxicant and more injurious to health. When such spirits are kept, the amyl alcohol they contain gradually decomposes, fragrant ethers being formed, and the spirit, as a consequence, improves in flavour, and becomes less hurtful.

Detection.—All three alcohols are inflammable, and burn with a pale blue flame. All three, if added to a mixture of bichromate of potash solution and strong sulphuric acid, change the colour of the mixture from red to green. Methyl and ethyl alcohols are both miscible with water. Methyl alcohol has a peculiarly disagreeable odour. Ethyl alcohol has a pleasant odour, and, when heated with sulphuric acid and an acetate, gives off vapours of acetic ether, the odour of which is peculiar and characteristic. Amyl alcohol is not miscible with water; treated as above, it evolves amyl acetate, which has the characteristic odour of jargonelle pears. From organic mixtures, methyl and ethyl alcohols may be readily separated by distillation. The liquid to be distilled, if acid, should first be neutralized. Methyl alcohol, on account of its superior volatility, should be looked for in the first portions of the distillate. From the distillates the alcohols may be obtained, sufficiently free from water for recognition, by shaking with solid potassic carbonate. The liquid will then separate into two layers, of which the upper one

contains the alcohols. Amyl alcohol, the boiling-point of which is 132° C., will be found either in the last portions of the distillate, or in the residue in the retort. From the latter it may be removed by shaking with ether, in which it is soluble.

Ether, sulphuric ether, or ethyl oxide.—This, when swallowed, produces effects similar to those produced by alcohol. It appears to be more rapid and more powerful in its action than alcohol, but its effects pass off more quickly. Blyth estimates that one fluid-ounce swallowed would kill most adults. It is sometimes taken by spirit-drinkers, as a substitute for whisky, brandy, &c. Ether vapour, if inhaled, produces effects similar to those produced by inhalation of chloroform vapour, but is said to be less likely to cause arrest of the heart's action. Inhalation of ether vapour has, however, caused death. A given quantity of ether acts more powerfully, when inhaled in the form of vapour, than when swallowed in the liquid form.

Amyl nitrite.—Inhalation of the vapour of this is employed for the purpose of relaxing vascular spasm. When inhaled, its first effect is to cause flushing of the face, throbbing of the carotids, a quick full pulse, and giddiness. Experiments on animals show that large doses of the vapour cause convulsions, coma, and death.

CHLOROFORM.

Chloroform, when swallowed, produces effects very similar to those produced by alcohol, causing, if taken in sufficient quantity, coma with stertorous breathing and dilated pupils. As in alcohol poisoning, vomiting and convulsions are occasionally present. Taylor mentions a case in which an adult, who had swallowed three ounces, recovered sensibility in fourteen hours, but died of acute gastritis with collapse, twenty-nine hours after swallowing the poison. The smallest dose of liquid-chloroform which has proved fatal to an adult is 3·8 drachms ; a case of recovery, however, is reported after swallowing four ounces. One drachm proved fatal in three hours to a boy æt. four. A given quantity of chloroform acts very much more powerfully when inhaled in the form of vapour, than when swallowed in the liquid condition.

Inhalation of chloroform vapour causes (1) a stage of **excitement,** with flushing of the face and contracted **pupils** : in this stage, delirium is nearly always present, and sometimes the patient struggles violently. To this succeeds (2) a stage of **complete anæsthesia,** with relaxation of the muscles and suspension of reflex action. This is the stage in which surgical operations are performed ; it may be looked on as fully developed, when touching the conjunctiva fails to cause reflex closure of the eye-lids. If the inhalation of chloroform is continued, (3) a stage of **paralysis** sets in. Respiration becomes slower and more feeble, the heart's action becomes weaker, and death ensues from paralysis of respiration, or from arrest of the heart's action. Death, however, may occur during any stage of the inhalation, and may be due (*a*) to sudden stoppage of the action of the heart, liable, in exceptional cases, to occur at any stage ; or (*b*), to asphyxia, which may be brought about in various ways, *e.g.*, by closure of the glottis, owing to pressure of the tongue, or by blood or vomited matter finding its way into the air-passages. In more than one case, death has occurred within two minutes of the commencement of the inhalation. In one case, thirty drops, and in another fifteen to twenty drops, inhaled in vapour, caused death. A much larger quantity than this (about 3½ drachms) is commonly required to cause anæsthesia. The more concentrated the vapour, the more likely is danger to arise.

The death ratio from chloroform during operations is variously estimated at ·75 to 3·4 per 10,000 cases.

Cases occasionally occur in which an individual alleges, that he or she has been rendered insensible by chloroform, and while in that condition, robbed or raped. As bearing on the question of the truth or falsity of such charges, it may be noted : 1. That chloroform vapour does not cause immediate insensibility, and that it is difficult to administer chloroform to persons against their will, unless considerable force is employed. 2. That to successfully administer chloroform vapour during sleep requires the greatest skill and care, and even then can only be accomplished in a small proportion of cases ; and 3. That inhalation of chloroform may cause sexual excitement, accompanied by delusions, remembered after recovery of sensibility, and believed to be real events.[1]

Treatment.—If *liquid* chloroform has been swallowed, the stomach-pump should be used at once. In poisoning by the *vapour* it should first be pointed out that chloroform vapour should always be given greatly diluted with air, and on a nearly empty stomach ; and that its administration should be avoided in patients suffering from certain cardiac diseases. In cases of poisoning, the patient should be placed in a horizontal position, and cold affusion, artificial respiration, and galvanism employed. It should be seen that nothing mechanically impedes respiration, and that the tongue is well forward. It may be necessary to draw it forward with a pair of forceps. Turning the head on one side will often suffice, and will, at the same time, allow of the escape of vomited matters, &c.

Post-mortem appearances.—Not characteristic. The blood is usually dark-coloured and very fluid. After death from swallowing liquid chloroform, signs of inflammation of portions of the gastric mucous membrane have been found.

Detection.—Death from chloroform may occur, and analysis fail to detect the presence of poison in the viscera, owing to its having escaped by volatilisation, or its having become decomposed in the body. This last may be due to the action of alkalies, a formate of the alkali being formed according to the following equation : $CHCl_3 + 4KHO = KCHO_2 + 3KCl + 2H_2O$. From organic mixtures chloroform may be separated by distillation, and recognised in the distillate by its peculiar odour. Or the mixture, first neutralized if acid, may be distilled, and the vapours passed through a glass tube heated to redness. Under these circumstances, the chloroform is decomposed with formation of hydrochloric acid and free chlorine. The presence of the first is shown by the vapours reddening moistened blue litmus paper, and producing a white precipitate in silver nitrate solution ; and of the second, by the vapours causing a blue colour to appear on paper soaked in a mixture of starch and potassium iodide solutions.

Chloral.

This is used in medicine as a hypnotic in the form of *chloral hydrate*, and has in several cases caused death. It causes deep sleep, followed, if an overdose has been taken, by coma with motor paralysis ; and slowing, weakening, and ultimate arrest of the heart's action, and of the movements of respiration. These effects appear to be due to the action of the drug on the nerve-centres, and not on the nerves. The pupils are nearly

[1] Lauder Brunton's *Pharmacology*, p. 723.

always contracted. A skin eruption, in some cases resembling that of scarlatina, in others urticaria or purpura, has been observed. Possibly, in many cases the fatal result is attributable to the decomposition of chloral within the body into chloroform.[1] This may be effected by the action of alkalies, a formate of the alkali being at the same time formed thus: $C_2HCl_3O + KHO = KCHO_2 + CHCl_3$. Sometimes a single overdose of chloral causes sudden death by syncope.

Fatal dose.—The probable minimum fatal dose cannot be stated with certainty. In one case thirty grains, or not more than a full medicinal dose, caused the death in thirty-five hours of a woman æt. twenty. Persons, however, have recovered from doses of 150 and 160 grains. The syrup of chloral B. P. contains ten grains in each fluid drachm.

Post-mortem appearances.—Considerable congestion of the vessels of the brain and its membranes has been observed.

Treatment.—Evacuate the contents of the stomach, preferably by the stomach-pump; administer decoction of coffee freely, introducing it by the stomach-pump if necessary; keep the patient warm, and endeavour to restore respiration. Hypodermic injection of strychnia is strongly recommended by several authorities; its efficacy is denied by others. If used, two or three drops of the solution of strychnia B.P. or I.P., may be injected and very cautiously repeated at intervals of fifteen or twenty minutes.

Chronic poisoning by chloral.—The long-continued use of chloral in medicinal doses may give rise to skin eruptions of the character noted above, impairment of the cerebral functions, and partial paralysis of the limbs. In some cases, insanity has been attributed to chloral drinking.

Detection.—Organic mixtures containing chloral should be rendered alkaline by caustic potash, distilled, and the vapours tested for chloroform.

Bromal hydrate, the corresponding bromine compound, has a similar action on the system to chloral hydrate, but is a more powerful poison.

COCAINE.

Cocaine, an alkaloid derived from the leaves of *Erythroxylon coco*, is largely used as a local anæsthetic, and of late has begun to be used rather extensively as an intoxicant or stimulant by natives of India, and to counteract the soporific and prostrating effect of over-indulgence in opium.

It is sold now in most bazaars by the *pan* 'betel' sellers. *Locally* it paralyses the terminals of the sensory nerves, blanches mucous membranes and dilates the pupils. *Internally* it first stimulates and then paralyses the nerve centres of the brain and cord. The stimulation is of an exhilarating kind.

[1] From the experiments of Hammersten, it would appear that chloral ordinarily acts without undergoing decomposition into chloroform (see Lauder Brunton's *Pharmacology*, p. 715).

In poisonous doses it ultimately shows the heart, reduces the blood pressure and paralyses respiration, raising the temperature, and convulsions may occur. In *chronic* poisoning patient feels as if grains of sand or worms were under the skin—this is "Magnan's" symptom. For several cases of chronic poisoning see article by Dr. K. C. Bose in *Ind. Med. Gaz.*, 1902, p. 85.

Fatal dose.—About two-third of a grain injected subcutaneously caused death of a woman aged 71 in five hours; and ten grains of the hydrochlorate swallowed by a woman caused death in 40 or 50 minutes.[1]

Habituation establishes toleration of much larger doses.

Treatment.—If poison was swallowed use stomach-pump. If injected hypodermically, administer stimulants with inhalation of chloroform if the spasms hamper respiration. Artificial respiration may be necessary.

Detection of Cocaine.—Lett, in the *Quarterly Journal of Inebriety* for April, 1899, describes a method which he has devised which will detect this alkaloid in the urine of those who use the drug. Ten or twenty ounces of urine is taken, to which is added potassium or sodium carbonate until the mixture is alkaline. It is allowed to stand for half an hour and then filtered. The filtrate is agitated with two ounces of pure sulphuric ether. The ether is withdrawn, and to it is added one drachm of dilute hydrochloric acid of a strength of ten

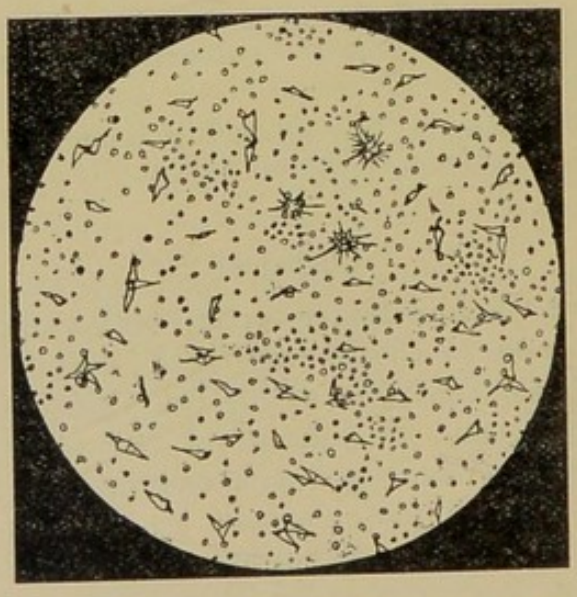

Fig. 35.—Cocaine Crystals.
As obtained by Myer's reagent under ⅛ objective, after Lett.

minims to the ounce. This is shaken with the ether and placed in an open dish from which the ether evaporates spontaneously, a gentle heat

[1] Dixon Mann, p. 607.

being applied to obtain a perfect solution of any alkaloid on the surface or adhering to the sides of the dish. The remaining liquid may now be tested for cocaine.

A solution of terchloride of gold is made by dissolving ten grains of the terchloride in one ounce of water. This added to the ethereal extract will give, if cocaine be present, a yellow or yellowish-white precipitate. The precipitate is dissolved by heat in the presence of a little free acid. Upon boiling, the vapour given off has the odour of benzoic acid. The author states that if benzoic acid is present, it can only come from the presence of cocaine.

The test by Myer's reagent is as follows: To a portion of the residue left from the ether evaporation add a few drops of this test reagent; a white precipitate will at once be formed if cocaine is present, which dissolves by heat, and upon cooling throws down yellow crystals, which under the microscope ($\frac{1}{6}$ objective) appear as depicted in Fig. 35. If there is an excess of the precipitate the undissolved portion will fuse into yellow gummy masses upon boiling. In following out the test with Myer's reagent, should the patient be taking quinine, it will first be necessary to precipitate this alkaloid from the solution to be tested by picric acid in excess, filter, and make the test with the filtrate thus obtained. The limit of Myer's reagent appears to be about one part of cocaine in 30,000 of water.

Coal-Tar Derivatives.

Of the countless coal-tar derivatives many are used by patients on their own responsibility to relieve headache or procure sleep, and hence poisoning is not unfrequent.

Antifebrin, antipyrin, phenacetin, pyrogallol, sulphonal, act as blood poisons disintegrating the red blood corpuscles and convert the liberated hæmoglobin into methæmoglobin.

Antifebrin or **Acetanilide**.—Five grains in an adult have frequently produced toxic symptoms with cyanosis and reduction of temperature.

It is contained in 'headache' or 'Daisy' powders.

Antipyrin produces similar symptoms occasionally.

Phenacetin has in two instances at least caused death with cyanosis. One, a girl, died in a few hours after taking fifteen grains of phenacetin; and a boy after taking a fifth dose of fifteen grains within three weeks.

Pyrogalloll or Pyragallic acid causes dyspnœa, reduction of temperature and sensibility, paralysis, cyanosis. Four fatal cases from external application for psoriasis. *Treatment.*—Evacuation of stomach, administration of stimulants and external warmth, and inhalation of oxygen.

Naphthalene may produce toxic effects even from external use, cyanosis and muscular twitchings.

Sulphonal used as a hypnotic produces ataxia and death in large doses. It is cumulative. Death has occurred in a man

aged 50 who took for four weeks doses of 7 to 22 grains, also in a woman aged 47 who took 15 to 22 grains almost daily till total reached over 2 ounces. The leading symptoms are staggering gait, thick speech, ataxia paralysis of facial muscles, convulsions, coma, &c., and death from heart failure and probably uræmia. Urine is claret coloured from hæmato-porphyrin as well as unchanged sulphonal. *Treatment.*—Empty stomach, give purgative and large enemata of warm water and alkalies.

Resorcin produces toxic symptoms like phenol, see p. 568.

Nitro-Glycerine.—This is a heavy, very explosive, oily liquid, almost insoluble in water, but soluble in alcohol, ether, and chloroform. Mixed with siliceous earth, it forms the explosive known as dynamite. Nitro-glycerine is a narcotic poison, acting more powerfully when inhaled in vapour, than when swallowed as a liquid. In some persons, even minute doses cause violent headache. Several cases of poisoning by nitro-glycerine have occurred in Sweeden, the symptoms being narcotic in character. In a case mentioned by Taylor, vomiting and purging were also present.

Benzene or Benzol, a liquid prepared by distillation from coal tar naphtha, used in the arts as a solvent, is a powerful narcotic poison. Inhalation of its vapour has caused narcotic effects with twitchings of the muscles and convulsions. Taylor[1] records a case of a boy who swallowed about three ounces of coal naphtha and died in three hours. The symptoms were delirium followed by coma with contracted pupils. There was complete loss of muscular power and great difficulty of breathing.

Nitro-Benzene, *artificial oil of bitter almonds or essence of mirbane,* obtained by the action of strong nitric acid on benzene, is a liquid possessing the same odour as hydrocyanic acid, and a powerful narcotic poison. The symptoms produced by it are exactly the same as in poisoning by hydrocyanic acid, but with one remarkable point of difference, *viz.*, that there is an interval generally of at least two hours, but sometimes longer, between swallowing or inhaling the poison, and first appearance of the symptoms. Several deaths have been reported from swallowing nitro-benzene. In one case quoted by Taylor,[2] a boy, æt. thirteen, swallowed a small quantity; no symptoms appeared for several (apparently eight) hours; he then suddenly became insensible, and died four hours after the attack, or twelve hours after swallowing the poison. Blyth considers it probable from recorded cases, that 15½ grains, or even less, would, if swallowed, prove fatal to an adult. Death also has occurred from inhalation of the vapour as in a case reported by Dr. Letheby,[3] in which a man, æt. forty-three, having accidentally spilt some nitro-benzene over his clothes, became comatose in four and died in nine hours. Bad effects even are said to have arisen from washing with soap scented with nitro-benzene, especially when hot water has been used.

Aniline or Phenylamine, obtained by the action of nascent hydrogen (which may be evolved by the action of acetic acid on iron) on nitro-benzene, is a powerful narcotic poison, acting similarly to hydrocyanic acid. It is remarkable that the sulphate of aniline appears to be almost inert to man. Symptoms of poisoning, however, have followed from external application of the hydrochlorate of aniline and the use of **brilliantly coloured clothing** dyed by aniline.

It has long been known that it can readily gain access to the circulation through the lungs, respiratory passages, and digestive organs, and much evidence is accumulating that it may enter the symptoms through the skin In the body it undergoes partial oxidation leading to the formation of ami-

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[1] *Poisons*, p. 656. [2] *Ib.*, p. 666. [3] Taylor, *Poisons*, p. 666.

dophenol or its derivatives (a similar result occurs after the ingestion of acetanilide or antifebrin) and these bodies are capable of producing destruction of the red blood corpuscles, cyanosis, and dangerous collapse.

Aniline dyes.—These, of various colours, are mostly prepared from rosaniline, a red colouring matter usually manufactured by the action of arsenic acid on aniline, and liable therefore to contain arsenic. There is some reason to believe that certain of these dyes, even if free from arsenic, may produce ill effects. Aniline dyes, therefore, should never be used for colouring articles of food. They have, however, been used to colour confectionery, and Chevers mentions the use by native females of red aniline dyes for painting the lips, and refers to a case of poisoning in a child from this practice. Essence of peppermint has been found coloured. MM. Landouzy and Brouardel in 1900 recorded in the *Bulletin de l'Académie de Médecine* ten instances in which the wearing of *yellow boots* by children had been followed by very grave symptoms. In every case the colour of the boots was due to their being stained with a liquid containing aniline. An infant, 17 months old, was taken out of doors for an airing. Under these circumstances it was accustomed to be very lively, but on this particular occasion its general demeanour underwent an extraordinary change, its face became pale and blue, it fell into a deep sleep, and shortly became quite insensible. After two hours of vigorous treatment the child, which had appeared to be dying, recovered. A few days elapsed, and then a brother, aged six, was taken out for a walk shod in a similar manner. Three hours later he returned apparently thoroughly chilled and looking very blue. The cyanosis passed off after a few hours, but his face did not regain its ordinary appearance until the following day. On a subsequent occasion a similar outing was followed by similar train of phenomena. Eventually it was discovered that the fluid which had been used for staining the boots contained aniline, and it was recognised that the cyanosis resembled that seen in aniline makers. Not long after these cases were reported it was ascertained that six out of seven children of one household had developed similar symptoms after wearing yellow boots. They suddenly became ill, complained of chilliness and exhibited pallor of the face with blueness of the lips and hands. Three of them remained unconscious for several hours; the heart's action became very feeble, and the urine contained a trace of albumen. In still another case the cyanosis was so profound that a diagnosis of morbus cæruleus was made and attributed to a sudden reopening of the foramen ovale. Analysis showed that the liquid used to give colour to the boots contained 90 per cent. of aniline. When it was injected subcutaneously into young guinea-pigs and rabbits they develop identical symptoms in from fifteen to thirty minutes. The same results occurred, but more slowly, when it was given by the mouth. Similar toxic symptoms appeared when a few drops of the liquid were placed on the nasal and buccal mucous membranes; also when the animals were made to inhale the vapour from the heated liquid, and after painting it over a considerable area of shaved skin. In the latter case some of the animals died within thirty-six hours. The red blood corpuscles decreased in number, and the spectroscope showed the characteristic absorption bands of methæmoglobin. Further experiments revealed the fact that absorption by the skin occurred with special facility in a moist and heated atmosphere. An instance was recently reported of an American girl who was poisoned by the ink used on *typewriter ribbons*. She stained her figures with the ink, and thus conveyed some of the latter to a sore on her upper lip. Acute toxic symptoms subsequently quickly developed, associated with great œdema and pain locally, and a fatal result shortly afterwards ensued.

Detection of the above.—Aniline (1) with sulphuric acid and manganese dioxide, or lead peroxide, gives a green colour changing to a persistent blue, and then to black; and (2), with solutions of hypochlorites, *e.g.*, chloride of lime gives a blue or violet colour, soon changing to brown. **Nitrobenzene** may be recognised by converting it into aniline and applying the above tests The conversion may be effected by dissolving the nitro-benzene in alcohol, and adding hydrochloric acid and zinc. From the acid liquid, after driving off

the alcohol aniline may be separated by neutralizing the liquid with carbonate of soda, and shaking the neutralized liquid with ether. The ether is then separated, allowed to evaporate, and the residue tested for aniline. **Benzene** is detected by converting it first into nitro-benzene, by treatment with nitric acid, and then into aniline as above. **From organic mixtures** benzene and nitro-benzene may be separated by distillation. If the matters to be distilled are first acidulated with sulphuric acid, aniline, if present, will be found in the residue left in the retort, and may be separated from it by Stas' process (see page 184), using ether as a solvent. Nitro-benzene may become changed in the body into aniline.

Carbolic acid.—*Phenic acid, Phenol, or Phenyl alcohol*, obtained from coal tar, is largely used as a disinfectant and is sometimes used for *suicide*. It is the active ingredient of many disinfecting powders, *e.g.*, *Calvert's*, which contains free carbolic acid mechanically mixed with siliceous matter, and separable from it by distillation; and *Macdougall's*, which contains carbolic acid in combination with lime, calcium sulphite being also present. From Macdougall's powder, carbolic acid may be separated by decomposition with dilute hydrochloric acid. Carbolic acid is a powerful poison, causing, when swallowed, burning pain in the mouth and throat, whitening and hardening of the lining membrane of the mouth, and occasionally vomiting. Insensibility speedily follows, passing into coma, with stertorous breathing and contracted pupils. The urine is suppressed or scanty, and of a dark or olive green tint.

Fatal Dose.—Death has occurred in ten minutes; the usual fatal period, however, is one to four hours. One and a half teaspoonfuls of the concentrated acid has caused death, and in four cases out of five, 15 grammes (231½ grains) proved fatal to adults. Half an ounce is almost always fatal. Dangerous symptoms may be caused by six or seven drops, and death has resulted from its external application with gangrene especially in lower extremities. **Resorcin,** a substance closely allied to carbolic acid, and like it used as an antiseptic, has a similar toxic action.

Detection.—(1) The odour of carbolic acid is characteristic, and may be recognised during life in the patient's breath, urine, or vomit, and after death in the tissues. (2) Slips of some kinds of pine wood moistened first with carbolic acid, and then with hydrochloric acid, acquire a blue colour. The pine wood used should always be tested first: (*a*) with hydrochloric acid only, and (*b*) with carbolic acid and hydrochloric acid, as some varieties give a blue colour with hydrochloric acid only, and others do not give a blue colour with carbolic acid and hydrochloric acid. (3) If to a solution of carbolic acid one-fourth of its volume of ammonia be added, and then a minute quantity of a hypochlorite, a blue colour is produced, turning red with acids; warming hastens the development of the blue tint.

Treatment.—Alcohol is alleged to be a chemical and physiological antidote.[1] Wash out stomach with Epsom salts, and give half-ounce doses of sulphate of magnesia and sulphate of soda. The soluble sulphates combine with the carbolic acid to form harmless sulpho-carbolates. Olive oil in large doses—*e.g.*, a couple of wine-glassfuls. The 1·50 grain of sulphate of atropine may be given hypodermically.

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[1] A. M. Phelps, in the *New York Medical Journal* of January 14, 1899, calls attention to the marked antagonism between alcohol and carbolic acid. He states that he has frequently seen Dr. Powell, at the Post-Graduate Hospital, pour upon his hands some pure carbolic acid and in a few minutes wash it away with alcohol, and no escharotic action followed. At the present time he frequently flushes abscess cavities by washing them out with pure carbolic acid, and a few minutes later with pure alcohol. Phelps is of the opinion that we have in alcohol a specific against the escharotic action of pure carbolic acid.

Picric or Carbazotic acid.—A yellow crystalline substance, having a bitter taste, and great calorific power ; and **Creosote,** a mixture of phenols (aromatic alcohols homologous with carbolic acid) obtained by distillation from wood tar.

Petroleum.—This is a mixture, occurring in nature, of hydrocarbons of the paraffin series. From it by fractional distillation are obtained various liquids. Of these the lighter are known under the names of gasoline, *benzoline*, *mineral naphtha*, and *petroleum ether* or spirit ; the intermediate portions from the *kerosene oil* of commerce used for lighting purposes, and the heavier portions are used for lubricating machinery. A few cases of poisoning by petroleum are recorded, the symptoms being those of narcotic poisoning, death occasionally resulting from cardiac failure (case below). In India the majority of the cases are in children under three crawling over the floor and drinking kerosene oil by mistake for water. Narcotic effects have also been produced by inhalation of the vapour.

Symptoms of kerosene poisoning.—Irritant vomiting followed by signs of collapse, chiefly circulatory. Odour of the breath markedly that of kerosene.

Treatment.—The stomach should be washed out with warm water. If in children an ordinary soft rubber male catheter being employed instead of the ordinary tube which is too large. Other treatment is mainly symptomatic. The child should be kept under observation for at least twelve hours, and the possibility of a sudden fatal issue never lost sight of.

Case CCLXV.—**Kerosene Oil Poisoning.**—(1) A. K., Hindu male, aged 18 months, brought to hospital at 4-40 P.M., on the 11th of April 1901, with the history that the child had drunk some kerosene oil an hour previously, and vomited several times. Child is somewhat collapsed. Extremities cold. Pulse 62, very feeble. Respirations 32, laboured. *Treatment.*—Stomach washed out with warm water and the child was then wrapped up in warm blankets. Later, warm milk was given. 7 P.M., child had thoroughly recovered. Pulse 132, respirations 35. Child discharged cured on morning of 12th.

(2) K. A., Hindu male, aged 20 months, brought to hospital about 5 P.M., on the 8th of July 1901, in an unconscious condition. Said to have drunk a quantity of kerosene oil from a lamp about two hours previously and to have vomited ten times at home. Patient is collapsed, unconscious. Pulse feeble, rapid, 150 ; respirations 54 ; abdomen distended. *Treatment.*—Stomach washed out with warm water. Washings clear and possessed distinct odour of kerosene. Patient recovered consciousness after this procedure. Stimulants were given freely and the general condition showed at 7 P.M., slight improvement. A small dose of castor-oil was then administered. Later in the night the child relapsed into a semi-conscious state ; the circulation continuing to be of the feeblest character despite stimulation. At 7 A.M., on the morning of the 9th the child was no better and treatment was continued. At 9-20 A.M., the child died very suddenly, having had an evacuation of the bowels a short time previously. The stomach washings contained no opium or any other substance. The *post-mortem* revealed no lesion which could have otherwise explained the condition and the death.—C. Robertson Milne, *Ind. Med. Gaz.*, 1902, p. 210.

Turpentine Oil or Spirits.—Several slightly differing varieties of oil of turpentine exist, all being terpenes, or hydrocarbons of the formula. A few cases of poisoning of children by oil of turpentine, two of them fatal, are recorded by Taylor, the symptoms being those of narcotic poisoning. In the two fatal cases the dose was about half an ounce ; the children were respectively three and five months old. Taylor also mentions a non-fatal case of poisoning in an adult by camphine, or rectified oil of turpentine, in which vomiting and purging were present. Turpentine, it may be noted, is excreted

by the kidneys and communicates to the urine a smell of violets; painful micturition and hæmaturia may result from its action on the urinary organs.

DELIRIANTS.

The majority of the more important of these are **'mydriatic deliriants'** belonging to the N. O. **Solanaceæ.**

DATURA OR 'THORN-APPLE.'

Datura poisoning is common in India, especially to facilitate theft. It is the poison used by the *Thugs*, the strangling poisoners. The seeds are usually employed; but a few cases of poisoning by the leaves have, however, been reported.

Datura fastuosa (Linn.) and variety *alba* (Nees) white-flowered (*safed dhattura*) and purple-flowered datura, *Kala dhattura* (Hindi) *Umattai* (Tam.), common in India; and Datura Stramonium, or Thorn-apple, indigenous in England, and officinal B. P. The seeds, leaves, and probably other portions of these plants, contain the poisonous alkaloid **daturia** or **daturine,** now regarded as identical with atropine.

In Bengal, &c., in the three years ending 1872, the seeds were administered in seventy-seven cases, affecting one

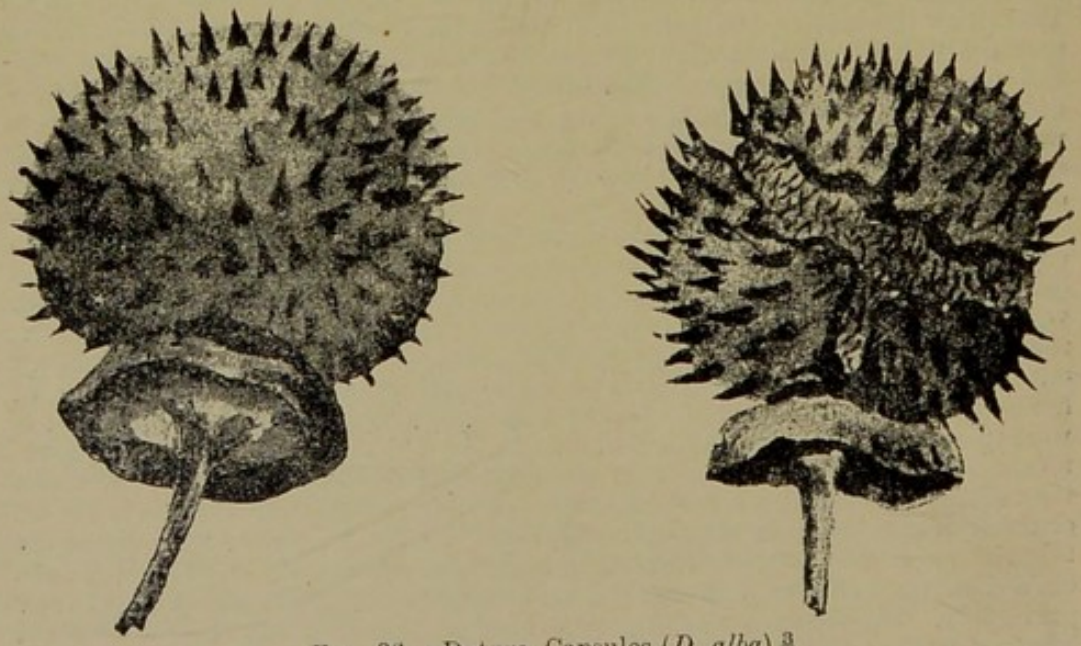

FIG. 36.—Datura Capsules (*D. alba*) ¾.

hundred and twenty-three persons; and the Bombay Analyser's reports for the ten years ending 1885, show that datura was detected during that period in seventy cases, affecting one hundred and thirty-eight individuals. In the great majority of cases of datura poisoning in India, the motive of administration is facilitation of theft (see *Cases CCLXV & CCLVI*). When, in fact, in India, an individual has been first drugged and then

robbed, it will usually be found that datura has been employed. Sometimes, however, arsenic or cannabis is used. A common form of theft by aid of datura is road robbery by professional highwaymen (see *Case CCLXV*) ; and in such cases a hollow pestle is sometimes used by the disguised robbers, the cavity of which contain datura or arsenic and the inversion of this while pounding grain, &c., with it, introduces the poison into the food without exciting suspicion.[1] Occasionally the motive of administration is other than aid to theft (see *Case CCLXVII*). It is of course possible that in some cases datura is given with homicidal intent. It rarely, however, happens that there is any ground for suspecting this ; in fact, there seems to be a widespread popular belief in India that datura is simply an intoxicant, and not a poison, and certainly many of the cases do recover. Road-poisoners sometimes partake with their victims of the drugged food, which they would hardly do if aware of the danger (see *Case CCLXV c*). Commonly, where datura is used for criminal purposes in India, the poison is mixed with sweetmeats or food, but in exceptional cases the poison seems to have been mixed with tobacco given to the victim to smoke. *Suicidal* poisoning by datura, if it occurs at all, is extremely rare. *Accidental* cases among children are sometimes met with. *Case CCLXVIII* is an exceptional case of this kind. Lastly, it may be mentioned that datura is said to be used in India by vendors of native liquor, for the purpose of conferring additional intoxicating power on their wares. A method said to be followed in Bombay, is to pour the liquor into a vessel which has been first filled with the smoke of burning datura seeds.[2]

Case CCLXVI.—**Datura poisoning ; Road robbery; Multiple homicide.**—(1) In 1899 the dead bodies of three Bengali men, evidently pilgrims, were found at a place near Buddha Gaya, and it was thought that they had died either of heat apoplexy or of cholera. The civil surgeon, who made the *post-mortem* examination on these bodies, found the brain, lungs and liver deeply congested and suspected poisoning, but he deferred giving any opinion as to the cause of death, pending the results of chemical analysis. Suspicion of foul play also arose from the fact that the deceased persons were seen in the company of another who had disappeared. Analysis revealed marked quantities of atropine in the viscera of each of these three persons.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(2) (*Bo. Chem. Analyser's Rept.*, 1878-79). Two merchants started with a tattoowalla, from Hubli in the Dharwar Collectorate, on an expedition to buy cotton in the neighbouring villages. As they were starting, a man and a woman offered themselves as guides, stating that they would show them where cotton was to be had. At a halt, food was

[1] Dr. W. Center, *Ind. Med. Gaz.* for 1874, p. 116.

[2] The occasional presence of datura in majun has been mentioned ; see Cannabis, p. 580).

prepared by the woman, of which the merchants and the tattoowalla partook ; all three became insensible, and were robbed. One of the three died.—(3) (McLeod's *Beng. Medl. Rept.*, 1868-69, p. 113). Three adults and a lad were on a pilgrimage from Bombay to the North-West. At Hurdah they were overtaken by a man who said he was going in the same direction. He contrived to make himself very agreeable, and they all travelled together until they reached a village called Bansa, a few miles from Dumoh. Here they halted under the shade of a few trees beyond the village. According to the statement of the lad, the only survivor of the four, the stranger used daily, while on the march, to prepare sherbet for the party. He did so at this last halt, and after drinking the sherbet he had prepared, all four became insensible, and were robbed by the stranger, who disappeared, but was aftewards arrested in company with another party of travellers.—(4) (Taylor, *Poisons*, p. 776). Dr. Irving, of Allahabad, mentions a case of robbery by aid of datura in which the poisoner, a man named Basowar Singh, in order to lull suspicion, partook of the poisoned food himself, and died from its effect, while his victims whom he had robbed, recovered.

Case CCLXVII.—**Datura poisoning; robbery.**—(1) In 1899 a Hindu prostitute in Calcutta was visited on the night of the 10th September by two men previously unknown to her. At about midnight, the men left, and the woman was afterwards found lying unconscious in the room and her house robbed. She was admitted into the Medical College Hospital next morning in an unconscious condition. Her stomach was washed, and the washings were forwarded for analysis. Atropine and alcohol were detected in the liquid. The woman recovered. The accused were afterwards traced by the police and tried at the Alipore Sessions Court, and were convicted and sentenced to long terms of imprisonment. During the trial it was found out that they had committed similar offences on several previous occasions with a view to robbery. L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(2) (Chevers, *Med. Jur*, p. 155). In 1852, two men Joogul and Pertab, went at night to the house of Pearee, a prostitute at Meerut. Joogul arranged to pass the night with Pearee, and, having paid her eight annas in advance, went away, but shortly afterwards returned with some sweetmeats, part of which he gave her. Pearee, soon after eating the sweetmeats, began to feel ill, and suspecting that she had been drugged, went to the door and informed a chowkeedar, who kept watch outside the house, and in the morning sent for the police. The police, on arrival, found Pearee insensible, and arrested Joogul in the house, and afterwards arrested Pertab. On the trial the prisoners confessed that they had arranged that Joogul should give the woman sweetmeats, with which datura had been mixed, so that they might rob the house while she was insensible.—(3) (*Bo. Chem. Analyser's Rept.*, 1883). The body of a man was found in a tank in Bombay. The feet were tied together, and the *post-mortem* appearances indicated death by drowning. Ornaments which deceased had been wearing a few hours before death were missing, and were subsequently traced to the possession of two men, in the company of whom deceased had been seen on the evening of his disappearance. On analysis, daturine was found in the contents of the stomach of the deceased, and one of the two accused is alleged to have stated that he had seen his companion put a powder into some liquor, which he gave to the deceased while in their company.—(4) *Bo. Chem. Analyser's Rept.*, 1877-78). Four children were minding sheep in a field, when some persons offered them sweetmeats, which they ate ; all became insensible, and the sheep disappeared. Two of the children died the same evening, and another on the third day ;

the fourth, who had vomited a good deal, recovered. Daturine was detected in the contents of the stomach in each of the three fatal cases.

Case CCLXVIII.—**Datura poisoning; motive other than theft.**—(1) (*Bo. Chem. Analyser's Rept.*, 1884). In a case from Amraoti a man and his mother, after eating some food prepared by the wife of the former, were attacked by symptoms of datura poisoning; both recovered on the third day. The wife was arrested, and confessed to having put datura into some cooked *bhaji* (vegetables), which she had given to her husband and his mother. A portion of the *bhaji*, sent for examination, was found to contain daturine. The accused also stated that she had put arsenic and aconite root into some bread, which she had given to the two sufferers. In neither case, however, were any symptoms of arsenic or aconite poisoning present, and no trace of either of these poisons could be found in a portion of the bread submitted for examination.—(2) (*Bo. Chem. Analyser's Rept.*, 1884). In a case from Bagevadi (Kaladgi District), daturine was found in some sweetmeat given by one man to another, who, after eating a portion, suffered from the usual symptoms of datura poisoning. The motive in this case was stated to be to make the victim "mad on account of kept women."—(3) In 1848, and again between 1866 and 1868, the Bombay Police used often to pick up in the streets of the city, on the same day, several persons suffering from datura poisoning. The affected individuals were mostly mendicants or others, apparently so poor as to make it unlikely that the motive of administration was facilitation of theft. Possibly, in these cases, the poison was given simply in order that the antics of the victims might afford amusement, or it may be that the motive for administration was connected with a belief, that the utterances of persons under the influence of datura are oracular, and may be depended upon as a guide to the success of undertakings, &c. As late as 1883, an apparently similar case was reported from Karachi, in which the victims were 18 in number, all Fakirs, who had been poisoned by datura, given to them in sweetmeat.

Case CCLXIX.—**Accidental poisoning by daturine** (*Bo. Chem. Analyser's Rept.*, 1876-77).—A child, two years old, got hold of a small pill-box, in which a small quantity of daturine was kept for use in ophthalmic practice by its father. Shortly afterwards the child became insensible and convulsed, the pupils became widely dilated, and death took place with well-marked symptoms of datura poisoning.

Case CCLXX.—**Fatal trial by Datura ordeal.**—In 1899, an old Hindu woman Radhika Goalin of the milkman caste, aged about 60, residing in Hario village of Monghyr district, was believed to be a witch, and her fellow-villagers deputed a professional exorcist (*ojha*) to find out whether or not this belief were true. The man gave her some prepared treacle to eat. Soon after taking this the poor woman developed narcotic symptoms, and died within twelve hours. The Civil Surgeon of Monghyr who made the *post-mortem* examination forwarded the viscera of the deceased for chemical analysis. Atropine was detected in the viscera. It is common superstition in the country that witches withstand the action of poisonous drugs.—L A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Symptoms.—These are in two stages, namely, delirium and then coma. The symptoms develop rapidly. If a decoction of the seeds has been swallowed, may appear almost immediately. Usually, however, there is an interval, com-

monly not more than half an hour, between swallowing the poison and first appearance of the symptoms. The first symptom noticed is dryness of the throat: this is followed by giddiness, staggering as if intoxicated, flushing of the face, and delirium with **widely dilated pupils.** The dryness of the throat increases and swallowing becomes difficult, the difficulty seeming to depend, at any rate partly, on spasm of the pharyngeal muscles. The voice becomes changed, articulation becomes indistinct, and in one case mentioned by Taylor (from *D. stramonium*) the power of speech was lost. The vision becomes indistinct or disordered. **The delirium is peculiar** in character. The patient is restless, often wanders about, talks incoherently, or mutters indistinctly, but at the same time is timid and easily controlled. He goes through various ludicrous movements, appears to grasp at imaginary objects, picks at his clothes or bedding, and often appears to be trying to pull imaginary threads out of the ends of his fingers. These symptoms either gradually disappear, or are succeeded by a **stage of sopor** with *subsultus tendinum*, deepening into coma sometimes accompanied by convulsions, followed by gradual failure of the heart's action and respiration, and death. Dr. Giraud, in two out of four cases of deep coma, found a remarkable tympanitic condition of the abdomen to be present. If the case tends towards recovery, the sopor passes away, and is succeeded by a stage of **secondary delirium** lasting about six to ten hours, and in character similar to the primary delirium of the first stage. The *pupils* are widely dilated throughout.

Fatal dose.—This cannot be stated with certainty. Waring, however, writing of the tincture of the seeds (strength 1 to 8), considers twenty drops to be equal in effect to one grain of opium.[1] On this basis, a minimum fatal dose of the seeds would be about ten to fifteen grains, and a case is reported in which a decoction of 125 *D. stramonium* seeds, equal to about sixteen grains, caused the death of an adult in seven hours.[2] The leaves are less active than the seeds. One hundred seeds of *D. alba* weigh about twenty-one grains; of *D. stramonium*, about twelve and a half grains, and of *D. fastuosa*, about ten grains.

Mortality.—Dr. Giraud (in 1848) met with only one death in fifty-one cases admitted into the Jamsetjee Jejeebhoy Hospital, Bombay; and in the ten years ending 1885, of

[1] *Pharmacopœia of India*, p. 176.
[2] Taylor, *Poisons*, p. 774.

fifty-nine cases admitted into the same hospital, only two died. This, however, is an exceptionally low death-rate. Dr. Brown, of Lahore, records twenty-one deaths in ninety-two cases. In one hundred and twenty-three Bengal cases, twenty deaths were reported; and of the Bo. Analyser's one hundred and thirty-eight cases, twenty-four died. These last three sets of figures give a total of sixty-five deaths in three hundred and fifty-two cases, or just under 18½ per cent.

Post-mortem appearances.—These are usually wide dilatation of the pupils; congestion of the brain and its membranes, and often also of the lungs and abdominal viscera. The mucous membrane of the stomach and intestines may be found congested, and patches of extravasated blood have been met with in the large intestine. Seeds, or fragments of the seeds (see *Detection*), may be found in the contents of the stomach or intestines.

Treatment.—Administer emetics, or use the stomach-pump; and treat the symptoms, as they arise, on general principles, *e.g.*, if the pulse is feeble, and the skin cold, give stimulants; if narcotism is present, use cold affusion, &c., as in opium poisoning; employ artificial respiration if necessary. Opium, or better morphia, hypodermically may be given if there is much excitement. Opium, however, is less efficient as an *antidote* in atropine poisoning, than atropine in opium poisoning. Lauder Brunton recommends the cautious administration of physostigma; and Ringer and others advise, in atropine or stramonium poisoning, administration of pilocarpine nitrate in quarter to half grain doses.

Detection.—Datura seeds are ear-shaped, with rounded thickened furrowed wavy margins strongly compressed laterally, from one-sixth of an inch to one-fifth of an inch broad and about one-twenty-fifth of an inch thick. **Datura alba** (*Nees*) of

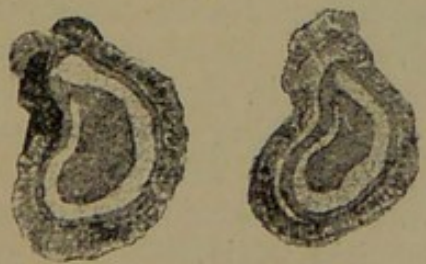

Fig. 37.—Sections of Datura Seeds (*enlarged*).

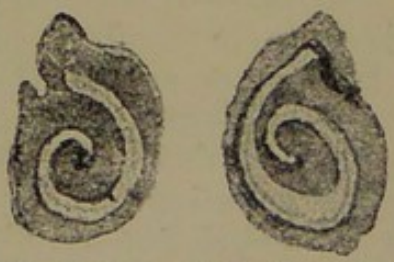

Fig. 38.—Sections of Capsicum Seeds (*enlarged*).

India, has rather small subglobular and sharply spinous capsules and irregular triangular yellowish-brown, roughish seeds, which are used like those of the preceding species. **Datura Metel**

(*Linné*), which grows in Africa and Southern Asia, has obliquely cordate, somewhat sinuate-toothed or nearly entire, soft-hairy leaves, and pendulous spiny capsules with brownish-yellow seeds, and to a certain extent **resemble capsicum** and **tomato seeds.** And as both capsicum and tomatoes are extensively used as food, their seeds may be found in vomit or in the contents of the alimentary canal. In all of these the testa is, under the microscope, seen to be covered with convoluted ridges. Whole seeds or large fragments may readily be differentiated as follows :—(1) Datura seeds are **double-edged** at the convex border ; capsicum seeds are not ; (2) Capsicum seeds have a sharp pungent taste ; datura seeds are feebly bitter, but **not pungent**; (3) If the seeds are laid on the flat, and divided horizontally, the **embryo** of a datura seed is seen to **differ in shape** from that of a capsicum seed (see Figs. 33 and 34) ; (4) A little solution of **iodine** applied to the section **gives** (if the seeds are tolerably fresh) **a blue tint** at a spot near the hilum of the seed, if it be a datura seed, but not if the seed is a capsicum seed. **From organic mixtures,** or the powdered seeds, the alkaloid may be separated by Stas' process, using ether as a solvent. It will be found when dissolved in a little very dilute acid (1) to respond to the group tests for alkaloids, and (2) when applied to the conjunctiva, to cause dilatation of the pupil. There are no special chemical tests for daturine (or atropine) ; the *physiological test* (action on the pupil) is, however, extremely delicate. In man, an atropine solution of 1 to 120 commences to act in six or seven minutes, and its effects continue more or less for several days. A solution even of 1 to 48,000 will slowly cause dilatation. Herbivora, and especially the rodents, are much less sensitive than man to the action of atropine.

BELLADONNA.

All parts of the *Atropa belladonna*, or deadly nightshade, indigenous in England, contain *atropine*. Cases of poisoning by belladonna are occasionally met with in England, and are usually accidental, arising either from eating the berries in ignorance of their poisonous nature, or from mistakes in dispensing or using medicinal preparations. Accidental cases of this last description have been reported in India.

Symptoms are similar to those of datura poisoning, all the secretions are lessened except the urine ; in several cases a scarlet rash on the skin has been observed. Recovery is frequent ; in over sixty cases of belladonna and atropine poisoning tabulated by Woodman and Tidy, there were only fourteen

deaths. Death has been caused by a few of the berries; and two of the berries, and three grains of the extract, have each caused bad symptoms. Death also has resulted from the application of atropine to a blistered surface.

Ordinary medicinal Doses are: of atropine, $\frac{1}{100}$th to one twenty-fifth part of a grain; of extract of belladonna, ¼ to one grain; and of the tincture (strength, one of leaves to twenty of proof spirit), 5 to 20 minims.

Post-mortem Appearances and Treatment are the same as in poisoning by datura.

Detection.—The flowers have a bell-shaped corolla about one inch in length, dull reddish purple in colour, and pale green at the base. The berries are rounded, about three-quarters of an inch in diameter, purple black and shining. The seeds are small, about one-tenth of an inch in diameter, and studded with projections. Organic mixtures may be subjected to Stas' process.

Scopolia lurida leaves and stalks were eaten by Gorkhas in the Black Mountain campaign in mistake for a Nepalese vegetable and caused poisoning symptoms like belladonna:—A. J. Macnab, *Ind. Med. Gaz.* 1903, p. 365.

Henbane or Hyoscyamus.

Three species of **Hyoscyamus** are found on the Northern borders of India, namely, **H. niger** in the temperate Western Himalaya, **H. pusillus** in Western Tibet, and **H. muticus** or **insanus** in the Western Panjab, Sindh and Baluchistan distributed to Kabul and Asia Minor, whence the Indian name for the seeds of the latter, *Khorasani-ajwan* (Hind.) or *Khorasani-owa* (Bom.). The latter species from its deliriant and intoxicating properties is known as *Koh-i-bhang* or mountain-hemp, from a fancied resemblance to Indian Hemp; and is said to be smoked in small quantities by debauched *fakirs* and to be used by evil disposed persons to injure those with whom they had a quarrel. It was described as causing dryness and constriction of the throat, and furious delirium.

In Sind, writes the Commissioner, in 1894, regarding **H. muticus**, Baluchis, who use it as an intoxicant, dry the leaves and flowers and

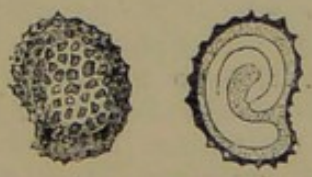

Fig. 39.—Hyoscyamus-seed and longitudinal section.
Magnified 7 diameters.

smoke the mixture exactly like *ganja*. But it is very powerful and makes them positively mad. Under its influence they strip themselves naked, and dance about like lunatics. It grows wild about the Khirtar Mountains where it flowers in March. I have ascertained that it is used in this way all along the Sind border. Baluchis and Sindhis (and especially those of mixed Sidi and Baluch breed, calling themselves Gaddos or Khaskelis, the descendants of slaves) are addicted to hemp drugs which are grown or manufactured in Sind on the Munchar Lake,

and the use of henbane is stimulated, by the sale of the hemp drugs being a monopoly and the drugs themselves more expensive.

All of these Indian species of hyoscyamus contain a poisonous alkaloid **hyoscyamine** resembling atropine in action, but weaker.[1] The leaves of **H niger** are officinal in both Indian and British Pharmacopœias. Ordinary medicinal doses are—of the extract (of the leaves) five to ten grains; and of the tincture (strength, one of the leaves to eight of proof spirit), half a drachm to a drachm. A few (not Indian) cases of poisoning by hyoscyamus have been reported. In one, a woman suffered severely, but recovered from a dose of eleven drachms of the tincture; and in another, six adults, of whom one died, were poisoned by eating the roots in mistake for parsnips. In a third, two boys, one of whom died, were poisoned by the seeds. **Treatment** as in datura poisoning.

Detection.—Dymock describes the bazar-seed as "reniform—laterally compressed, equal in size to that of *H. niger*[2] (see fig. 39), of a light brown or grey colour; the testa is finely reticulated. The albumen is oily. The embryo curved like the figure 9, the tail of the nine being represented by the radicle. The taste is oily, bitter, and acrid." Hyoscyamine applied to the conjunctiva dilates the pupil, and may be recognised, but not distinguished from atropine, by this property. It may be separated from organic mixtures by Stas' process as for atropine.

Solanine.

This is a poisonous narcotic alkaloid contained in the stalks and berries of the potatoes and other plants belonging to the genus solanum, N. O. *Solanaceæ*.[3] A few cases of poisoning by plants containing solanine are on record. In many of the cases there have been thirst, vomiting, and purging. Usually severe nervous symptoms are present, *e.g.*, convulsions, delirium, and coma. Dilatation of the pupils has also been reported, but, according to Lauder Brunton, solanine is entirely without action on the pupil. The following species may be specially mentioned:—

Solanum tuberosum, or *Potato.*—A fatal case in a girl æt. fourteen from eating the berries of the potato is reported; and another in which four persons, all of whom recovered, were poisoned by eating potatoes which had commenced to germinate. Mature potato tubers ordinarily contain only a trace of solanine, ·06 per cent., but occasionally contain more and so cause poisoning. Sixty-six soldiers at Pfuhls were poisoned by potatoes which contained ·38 per cent. of solanine when raw and 24 when cooked. They exhibit shining fair variety in severe jaundice, and in 1 case convulsion (*Med. Press & Cir.*, 5th June 1901).

Solanum dulcamara, bitter-sweet or *Woody nightshade.*—This, a common hedge plant in England, is officinal in the British and Indian Pharmacopœias. A child æt. four is said to have died from eating only

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[1] Dr. T. E. Stocks, I.M.S., in Hooker's *Jour. Bot.*, 1852, p. 1781.

[2] See Report by W. Dunstan in *Agricult.* Ledger, 1879, No. 5.

[3] About one-eighteenth of an inch in diameter, and weighing one hundred and twenty to the grain (Guy).

two of the berries. According to Dymock, the dried fruit is imported from Persia into Bombay, where it is known under the name of *Anab-es-salib.*

Solanum nigrum, or garden nightshade, *Makoi* (Hind.), *Kamuni, Ghati* (Bom.), *Manattak-kali* (Tam.), *Kakmachi* (Beng.)—This found in gardens in England, is common wild in India. Woodman and Tidy cite two cases (both in Europe) of poisoning of children by the berries; in one, two were poisoned and one died; in the other, three children, all of whom died, were poisoned. A case also recently occurred in Karachee in which three children, one of whom died, suffered from symptoms resembling those of datura poisoning, after eating food with which *solanum nigrum* berries had been mixed.

INDIAN HEMP.

Indian Hemp, or *Cannabis sativa*, N. O. *Urticaceæ* (see Fig. 40), when grown in India, differs so widely in medicinal

FIG. 40.—Indian Hemp. *Cannabis sativa.*

properties from the same plant grown in Europe, that it formerly was regarded as a distinct species, hence the old name *Cannabis Indica*. It is met with in the bazars of India in four forms, *viz.* :—(1) *Bhang*, *siddhí*, *sabzi*, or in pahariya *atar*, the dried leaves and small stalks ; (2) *Ganja*, the flowering tops ; (3) *Charas*, the resin which exudes from the leaves and branches—this is often adulterated : I have found thirty to fifty per cent. of mineral matter in specimens ; and (4) *Majun*, a sweetmeat prepared with hemp. In India, hemp appears to be seldom, if ever, used for homicidal purposes. Fatal, accidental or suicidal cases have, however, been reported. Cases also have been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. Thus Chevers mentions a case which occurred at Ahmednagar, in which a woman, having first drugged with *majun*, a child aged seven, afterwards murdered him for the sake of his ornaments.[1] *Charas* is used by road-poisoners at Amritsar, in order to facilitate theft.[2] A case also is reported by Dr. Cullen, of Hoshangabad, in which *majun* was given to a woman and her daughter, "not with the intention of causing death, but to effect a criminal purpose." In these two females, the symptoms present exactly resembled those of datura poisoning, and it would appear that datura is sometimes used as an ingredient of *majun*.[3] In a case sent by the Bombay police in 1883, some food, alleged to contain cannabis, and to have been used for drugging persons in order to facilitate theft, was found to contain a resinous substance, which, when separated and given to a dog, caused distinct narcotic symptoms.

Symptoms.—Hemp acts on the brain, causing usually excitement, followed by narcotism. During the stage of excitement, the individual is the subject of hallucinations, usually, but not invariably, of a pleasurable, and often of a sexual character. In this stage, the patient may show no outward indications of excitement, or he may be constantly laughing, singing, or talking, or furiously delirious. In animals, it shows itself by a swaying movement of head and body. This stage is followed by one of narcotism, usually with dilated pupils. Commonly, there is tingling and numbness of parts of, or over the whole body, or, in severe cases, general anæsthesia may be present.

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[1] *Med. Jur.*, p. 225. [2] *Beng. Med. Leg. Rept.*, 1870-72, p. 268.

[3] Ainslie speaks of datura as a usual constituent of Majun ; Honigberger says it is sometimes used as an adulterant of Majun.

Detection.—The active principle of cannabis is generally considered to be a resinoid body, *cannabin*. In addition, it contains a volatile oil, and from recent researches, apparently, also a volatile alkaloid in minute quantity. Authorities differ on the question of the action of these two last-mentioned substances. Warden and Waddell are of opinion, however, from the results of their experiments, that both the oil and a volatile, apparently alkaloidal, substance separable by distillation from an alcoholic extract of the plant, are inert. Cannabis cannot be identified by chemical tests. Its recognition, therefore, in a medico-legal inquiry must depend on the physical characters of the plant, and its physiological action. As regards the first, Dymock describes the leaves as deep-green in colour; they "have long petioles and are digitate, with linear-lanceolate, sharply-serrated leaflets, tapering to a long smooth point." The same author also states, "The flowers form erect clustered spikes, often six to eight inches long; in the drug (*ganja*) the spikes are compressed, flat, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour." As regards the second, portions of the drug, if available, may be administered to a dog; or food, sweetmeat, &c., supposed to contain cannabis, may be digested with alcohol, the alcoholic solution filtered and concentrated. The resin may be then precipitated by the addition of water, separated and administered to a dog.

Use of Cannabis as an intoxicant.—This is widely prevalent in India, the drug being either smoked (*ganja* smoking) or swallowed. Insanity in India is often attributed to indulgence in cannabis, see p. 330. Of 2,283 cases admitted in the Bengal lunatic asylums during the five years ending 1867, 8·8 or 38·4 per cent. were attributed to this cause. Apparently, however, many of these were simply cases of temporary intoxication from hemp. Chevers remarks that "it is a matter of popular notoriety, both in Bengal and the North-West Provinces, that persons intoxicated with *ganja* are liable to commit acts of homicidal violence." In some cases of homicide committed, or alleged to have been committed, while under the influence of cannabis, one person only has been attacked (see *Case CCLXX*). Usually, however, the victims are numerous, the case assuming the form known as *running amok* (see p. 349). Cases of running amok, however, have been reported, in which the criminal has been under the influence of an intoxicant other than cannabis (see *Case CCLVIII*), and also cases in which the criminal does not appear to have been under the influence of any intoxicant (see *Case CCLXXI*). In running-amok cases,

whether while under the influence of an intoxicant or not, usually the first individuals injured, are persons with whom the criminal is at enmity (see *Cases CCLVIII* and *CCLXXI*). This, however, is not always the case (see *Case* B 38 *a*). Commonly, when acts of homicidal violence are committed while under the influence of an intoxicant, some motive is traceable for the crime. In some cases the motive will, on inquiry, be found to have pre-existed the intoxication ; and when this is so, there often appears to be reason to suppose that the intoxicant is taken by the criminal with the object of nerving himself for the deed (see *Cases CCLVIII* and *CCLXX a*). In other cases, the motive, such as it is, apparently comes into existence subsequent to the commencement of the intoxication (see *Case CCLXXI b*). As already pointed out, the question of criminal responsibility for acts done while in a state of intoxication, is not affected by the nature of the intoxicating agent. Hence, *ss.* 85 and 86 of the *Indian Penal Code*, apply with the same force to cannabis intoxication, as they do to alcoholic intoxication. Indian Hemp is sometimes administered with criminal intent in tobacco, a pipe or 'huka' of which is offered to the victim.

Case CCLXXI.—**Homicidal violence committed while under the influence of Cannabis** (Chevers, *ib.*, p. 790, *et seq.*)—(**a**) "One Madar Buksh, of Mirzapore, hacked his wife to pieces, inflicting twenty-two wounds with a sword, probably under the influence of jealousy. He confessed the crime, saying that he suspected the woman of infidelity, and that before his return home on the fatal night a man gave him a pill to eat ; it was majun, or bhang, and very powerful. The person named denied altogether that he had given the pill to the prisoner. The judge thought it not improbable that intoxication was resorted to, purposely to gain heart for the deed which was meditated."—(**b**) "One Kumla, a burkundauze of Bulandshahr, killed, without any evidence of sufficient provocation, two boatmen who were ferrying him across the river. The Sessions Judge believed that having been at a religious festival at Belown, the prisoner had probably indulged in bhang, or some intoxicating liquor, and being temporarily excited, was irritated by the slowness of the men. He was sentenced to death."—(**c**) Three Sepoys went over from Bhurtpur to witness the religious ceremonies at Gobardhan. Suddenly, and, as far as could be ascertained, without any provocation, one of them drew his sword, decapitated first one of his comrades, and then three women, entirely strangers to him His defence was that he had taken bhang, and was beside himself. Before the magistrate he had said that the man whom he had killed had threatened to strike him. At the time he committed the act he apparently showed no signs of intoxication.

Case CCLXXII.—**Running Amok**—(**a**) (Chevers, *M. J.*, p. 792).—A Muhammadan khalasie, excited by jealousy of his wife, apparently determined to revenge himself on mankind in general. He seized a sword rushed into the street, and attacked every one he met. Before he could be secured he had killed two children, and wounded, more or less

seriously, two other children, and seven adults—(**b**) (*ibid*, p. 791). A Havildar in the Kumaon battalion, while seated in the orderly room with other native officers of the regiment, suddenly rose and killed one Nardeb, an Acting Havildar, with a kukri. He then rushed about and wounded two Sepoys of the corps. It was alleged that deceased had debauched the prisoner's wife.

Wormseed.—The unexpanded flower-heads of *artemisia maritima*, and other species N. O. *Compositæ Kirmani-owa* (Bom.), used in medicine as a vermifuge, contain 1½ to 2 per cent. of *santonin*, a crystalline principle to which their activity is due. Santonin is the anhydride of santonic acid, and is administered medicinally in doses of two to five grains. Large doses of wormseed or of santonin give rise to symptoms of irritant poisoning, accompanied by delirium or convulsions, followed by stupor. The pupils are dilated, and a peculiar disturbance of vision, owing to which everything appears at first bluish, and afterwards yellow or greenish yellow, is a constant symptom. Taylor [1] quotes a case where 155 grains of wormseed proved fatal to a girl aged ten ; and Chevers [2] mentions two cases, in each of which three grains of santonin caused serious symptoms in children. Treatment, general as for cerebral poisons.

Detection.—From organic mixtures santonin may be extracted by a process similar to that employed for plumbagin (see p. 219), using chloroform instead of ether as a solvent. When dissolved in slightly diluted sulphuric acid, and the solution warmed, a red colour passing into purple, and finally into brown, is produced by the addition of ferric chloride solution.

Wormwood.—The leaves and tops of *Artemisia absinthium*, N. O. *Compositæ* and probably of other species of artemisia, contain a bitter principle (absinthin) and a volatile oil. The latter is a narcotic poison, causing stupor, convulsions, and dilated pupils. In one case half an ounce of the oil caused very severe symptoms in a male adult. *Absinthe*, a French liqueur, contains oil of wormwood, and when taken in excess gives rise to loss of intellect, paralysis, and epileptiform convulsions, combined with the usual effects of chronic alcoholic poisoning.

Tansy.—*Tansy*, *Tanacetum vulgare*, N. O. *Compositæ*, contains a volatile oil possessing apparently a similar action on the system to oil of wormwood. Woodman and Tidy [3] mention two cases of poisoning by tansy, taken with the object of causing abortion. In both cases coma supervened, but in neither was miscarriage produced. One of the two terminated fatally.

Coriaria myrtifolia.—A few cases of poisoning by the berries and leaves of this plant—a native of Europe—have been reported, the symptoms being coma, convulsions, and dilated pupils. In one case an adult died in twenty-four hours from eating fifteen of the berries. In another an adult died in four hours from swallowing an infusion of senna leaves that had been adulterated with the leaves of this plant ;[4] and Taylor[5] mentions a case where a whole family in France was poisoned by eating snails, that had been fed on the leaves and young shoots.

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[1] *Poisons*, p. 682. [2] *Med. Jur.*, p 283. [3] *For. Med.*, p. 451.
[4] Woodman and Tidy, *For. Med.*, p. 293.
[5] *Poisons*, p. 169.

Camphor—Common or officinal, **or Laurel Camphor,** *Kafar* (Hind.), *Karuppuram* (Tam.), *Kapur* (Bom.), *Karpur* (Beng.), is a volatile crystalline substance obtained from the *Cinnamomum Camphora* or *Laurus Camphora*, N. O. *Lauraceæ*. Its chemical composition is represented by the formula. Another variety, **Borneo Camphor** from the *Dryobalanops aromatica*, N. O. *Dipterocarpeæ*, has the composition. Camphor is administered medicinally in doses of one to ten grains. In large doses it acts as a poison, causing excitement and delirium, with dilated pupils and sometimes convulsions. Several cases of poisoning by camphor, nearly all of them non-fatal, are on record. In one case thirty grains caused furious delirium in an adult, and in another twenty grains, swallowed in solution by an adult, caused severe symptoms. Recovery has been reported from a dose of 160 grains, and in another case from a dose of 270 grains.

POISONOUS MUSHROOMS.

Certain species of mushrooms are non-poisonous and are used as articles of food. Others are poisonous, and cases of accidental poisoning occasionally occur, from one of the poisonous being mistaken for an edible variety. Poisonous mushrooms have the following characters :— Unlike non-poisonous mushrooms they have a bitter, astringent, acrid, or salt taste, and on section and exposure change colour, a brown, green or blue tint developing on the cut surface. The **symptoms** in mushroom poisoning may be those of irritant poisoning, or those of cerebral poisoning, or both sets of symptoms may be present. Prominent cerebral symptoms in mushroom poisoning are, excitement and intoxication, convulsions, delirium, and stupor, with dilated, or in some cases contracted pupils. Of the better known poisonous varieties, one, the *Amanita muscaria* or fly-blown agaric, appears to owe its activity partly to an undiscovered substance destroyed at the temperature of boiling water, and partly to an alkaloid called *muscarine*. Muscarine taken internally causes contraction of the pupils ;[1] hence this condition is present in cases of poisoning by Amanita muscaria.[2] Atropine appears to be to a great extent antagonistic in its action to muscarine, and is recommended as an antidote. A curious fact about poisoning by Amanita muscaria, is that it renders the urine intoxicating ; and in Kamschatka, where this fungus is used as an intoxicant, individuals are in the habit of drinking their urine so as to renew the intoxicant effect. Cases of poisoning have also been reported in Europe from the common *morelle*. The poison of this variety appears to be soluble in boiling water, and volatile, and to disappear when the morelles are cooked or dried. **Poisonous mushrooms** are to be met with **in India.** Chevers mentions a case of mushroom poisoning which occurred at Jessore in 1853, and Dr. Kirtikar states that, although the poisonous varieties growing in India are not many, he has been able to identify the following : *Agaricus procerus*, *A. albus*, *A. dryophilus Boletus atrofulvus*, and some varieties of **B. nitidus crocatus**, especially the variety growing on the peepul tree. Of these the first three, *viz*, *Agaricus procerus*, *albus* and *dryophilus* give rise to mixed irritant and cerebral symptoms. *Boletus atrofulvus* from a case observed by Dr. Kirtikar, seems to act chiefly as a cerebral poison, and he once met with a case in which the external

[1] Lauder Brunton's *Pharmacology*, p. 187.
[2] Woodman and Tidy, p. 306.

application of the peepul variety of *Boletus anitidus* as an anodyne was followed by a good deal of vesication of the skin, with eczematous inflammation in some places.

Dr. Paxton, of Chichester,[1] points out that examination under the microscope of portions of a suspected mushroom, or of the contents of the stomach in a case of suspected mushroom poisoning, may be employed in order to determine whether or no the mushroom concerned is poisonous. He considers that the discovery of pink irregular spores, or of rusty brown irregular spores, or of round white prickly spores, is strong evidence of the mushroom being poisonous; while plain round spores may belong to a poisonous or to a harmless variety.

Treatment.—Emetics followed by stimulants, warmth to the surface, and hypodermic injection of atropine in one-fiftieth grain doses

POISONOUS AND FOOD-GRAINS.

Various cereals affected with ergot and diseased maize **(pellagra)** become poisonous, as has been already mentioned. Cases of poisoning also have arisen through the eating of certain poor grains and jungle-peas, especially in times of famine, resulting in spastic spinal paraplegic affections which have been broadly classed as **Lathyrism** or "Bean paralysis" in Europe, so called after the particular genus of peas or vetches most commonly causing these symptoms, though similar disturbances result from eating certain grasses and other plants. Cases of this kind of poisoning are most common in the Central Provinces, including Chota Nagpur and in the outer Himalayas. When mixed with three-fourths of wheat and cooked as potage or bread it is apparently harmless, but cooked entirely itself it acts as a poison.[2] The poisoning may be in epidemic form.

Lolium temulentum, *Darnel or Bearded darnel, Mostaki* (Panj.), Mochni (N.W.P.).—A few cases of poisoning, mostly non-fatal, have occurred both in India and in Europe, due to the consumption of bread, &c., made from grain containing darnel seeds. The symptoms of darnel poisoning are chiefly giddiness with tremors of the muscles, and dilated pupils followed by stupor. Irritant symptoms may also be present. Christison mentions three European cases of mass poisoning by darnel affecting respectively eighty, seventy-four, and forty persons, all of whom seem to have recovered. Similar cases have been reported as occurring at hill-stations in the Panjab and N.-W. Provinces. The precise nature of the poisonous principle of darnel is unknown.

Identification.—According to Hassall, the starch granules of darnel are polygonal, like those of rice, but much smaller. The structure of the testa also, in the main resembles that of rice, differing, however, in the fact, that in darnel the outer coat consists of a single layer of broad cells disposed transversely, and not of narrow transverse fibres as in rice.

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[1] See Woodman and Tidy, *For. Med.*, p. 306.

[2] For an old account of its wide prevalence, see Colonel Sleeman's *Rambles*. Dr. Irving (vide *infra*) reported in 1857 that in one district of Allahabad division 6 per cent of the population were affected.

Lathyrus sativus, *Kessari Dal* or *Teori* (N. O. *Leguminosæ*).—This species of pea is a pulse used by the poorer classes in some parts of India as an article of food. Its continued consumption is said to give rise to a kind of chronic poisoning, characterised by rheumatic pains, followed by paralysis of the lower extremities and especially of the muscles below the knee, paralysis of the lower limbs, resulting from the use of *Kesari Dal* as an article of diet, is common in Sind,[1] also in Chota Nagpur and Central Provinces. In one district of Bengal nearly four per cent. of the population suffered from it in 1860.[2]

The toxic principle is believed to be to some extent destroyed on cooking, and is said to be absent on the small seeded form (*lakhori*) grown on rice-land in the Central Provinces; but the subject still requires investigation.[3]

Cantarri and Suchard find that the muscles of face, neck and trunk are not affected. Cutaneous sensibility is not always affected, even in the legs, reflexes unaffected. Abductors are less effected than abductors. *Post-mortem* examination showed no lesion of cord. In horses, in addition to paralysis of hind legs, death has followed from bilateral paralysis of the laryngeal nerves and consequent asphyxia. There is some resemblance between this disease and beri-beri.

Case CCLXXIII.—Lathyrism.—The onset of the paraplegia is usually sudden. Irving reports a typical case where a man "was working in the rice fields during the rains, and had sat down; he found he was unable to rise." In some cases, sudden pain in the loins is felt, and at the same time great difficulty in rising from a sitting posture. There is no fever. The cases which have recently occurred in Bengal show very much the same symptoms. The arms are unaffected, and the patients drag themselves along by means of leaning on a tall bamboo, which they fix on the ground in front of them, and use as a sort of pivot round which they twist themselves forward. They can squat on the ground easily, but arise with many contortions. There is considerable wasting of the muscles of both legs, but one side is usually affected rather more than the other. Sensation is not impaired, but the skin is harsh. The knee-jerks in recent cases are easily obtainable; if put in a constrained attitude for some time their stretched muscles quiver and jerk; there is no ankle clonus, but the Tendo Achillis is so rigid that the ankle cannot be flexed, and the patient can only get his toes to the ground. The sphincters are not affected. These advanced cases appear to be incurable; no doubt when the first symptoms occur, recovery would follow change of diet, especially if combined with warm clothing. Irving narrates of five cases which he took into the Government dispensary, that they improved a little with good food, but as soon as medicines were administered they all ran away."

Paspalum scrobiculatum, *Kodra* or *Harik.*[4]—Cases of poisoning are occasionally met with in India, arising from the consumption of this grain as an article of food. The symptoms of kodra poisoning are very similar to those of poisoning by darnel, namely, tremors and twitchings of the muscles, giddiness and seeming intoxication, with impaired vision followed by sopor, and accompanied in some cases by irritant symptoms. Kodra poisoning occasionally ends fatally: thus in a case

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[1] Dr. W. Kirk, *Ind An. Med. Sc.* VII, 145.
[2] Dr. Irving, *ib.*, 127; also VI and XII.
[3] See article by Capt. A. Buchanan, *Ind. Med. Gaz.*, September 1878.
[4] Dr. G. Watt, *Ind. Med. Gaz.*, 1895.

reported to the Bombay Chemical Analyser, from Godhra, in 1879-80, four persons, *viz.*, a man and three children, were poisoned by eating bread made from kodra flour, and one of the children died. Kodra appears to be only occasionally poisonous; according to popular belief, in fact, it is supposed that there are two varieties of the grain, a sweet and a bitter variety (*Goraharik* and *Majara harik*), of which the latter alone is poisonous. As is the case with darnel, the precise nature of the poisonous principle present in kodra is unknown. So like, however, are the symptoms of kodra to those of darnel poisoning, that it has been suggested that so-called kodra poisoning is really darnel poisoning, arising from accidental mixture of darnel with the grain.

Certain of the **poisons** already described under **Vegetable Irritants** act also on the brain. Thus stupor or insensibility with dilated pupils has been observed in poisoning by *Tylophora fasciculata*, *Daphne mezereum*, Laburnum, and Yew. Cerebral symptoms also present in cases of poisoning by *Cocculus indicus*, and the fruit of *Terminalia bellerica*. Lastly, it may be mentioned that cases have been met with in India (chiefly among children) which tend to show that the kernels of the fully-developed seeds of star-anise, *Illicium anisaeum*, possess a narcotic action.

CHAPTER XXVII.

Spinal Poisons.

Under this head may be grouped a few of the neurotic poisons, which act mainly on the spinal cord. This action may be stimulant in character or the reverse. If stimulant, the result may be production of muscular spasm as in strychnia poisoning ; if the reverse, paralysis, or loss of sensation results. Cerebral symptoms are, as a rule, either absent or slight, and death usually occurs by asphyxia, due to arrest of the movements of respiration. This arrest may, as in strychnia poisoning, be the result of spasm, but is more commonly due to paralysis, though calabar bean slows the action of the heart and so may cause death by syncope.

General indications of Treatment should be:—(1) Elimination, by giving emetics (see p. 405) or using the stomach-pump ; (2) prevention of action by administration of animal charcoal, or of gallic acid, or tannin or decoctions containing tannin ; (3) counteraction of effects, by treatment of the symptoms as they arise, *e.g.*, administration of stimulants to counteract depression, employment of artificial respiration, &c. Certain drugs more or less antagonise the action of some of the poisons of this order and are recommended for use as physiological antidotes ; thus, in strychnia poisoning, inhalation of chloroform is specially indicated.

Spinal poisons may conveniently be divided into (1) those which specially affect the cord, or central poisons, and (2) those which primarily affect the peripheral extremities or trunks of the nerves, or peripheral poisons. The central spinal poisons include *strychnia*, *calabar bean*, and *gelsemium ;* of these the first excites, and the other two paralyse the cord.

NUX VOMICA AND STRYCHNINE.

Strychnine or strychnia is one of the most deadly of known poisons. It is contained in several plants common in India belonging to the genus *Strychnos* of the N. O. *Loganiaceæ*, together with another poisonous alkaloid of similar action but milder in degree named **brucia**.

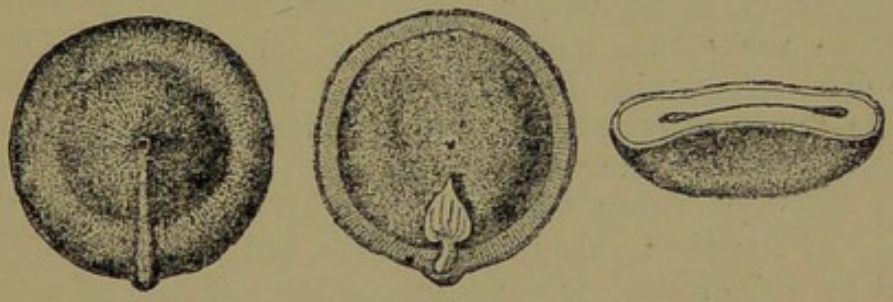
These two alkaloids are contained in *nux vomica*, in combination with **Strychnic** or **igasuric acid**, probably identical with malic acid. Strychnia and brucia have been found present in :—

1. **Strychnos Nux vomica**, *Kuchila* (Hind.), *Kajra* (Bom.). *Ettikkottai* (Tam.). The seeds of this, disc-shaped, are officinal, and the bark is met with in commerce under the name of "false angostura bark." All parts of the plant are bitter and poisonous.

2. **Strychnos Ignatii**, *Papita* (Hind.) and Bom.), *Kayappan-kottai* (Tam.). The seeds of this are known as *Faba amara* and St. Ignatius' beans.

3. **Strychnos colubrina**, *Snake-wood*, *Naga-musadi* (Tel.), *Modira-canuram* (Mal.), *Kuchila-lata* (Hind.), *Goagari-lakri* (Bom.) *Kajarwel* (Mar.)

4. **Strychnos Tieute**, the *Upas* tree of Java and a noted arrow-poison.



a. *b.* *c.*

FIG. 41.—Nux Vomica, $\frac{3}{4}$ths natural size.

a. Surface with raphe.
b. Longitudinal section showing albumen and embryo.
c. Transverse section showing central cavity.

Strychnos toxifera belonging to the same genus is believed to be the chief source of *curara* (which see p. 638).

Several species of strychnos are **non-poisonous** : of these the most important is the *Strychnos potatorum*, *Nirmali* (Hind), *Tetrankottai* (Tam.), *Nivali* (Mar.), the seeds of which are used under the name of clearing nuts, for clearing muddy water. They are subglobose, half or less the diameter of nux vomica, brownish grey in colour and not bitter.

In India, poisoning by Nux vomica is occasionally met with, the cases being generally suicidal or accidental.

Among the causes leading to accidental poisoning may be mentioned, (*a*) The practice of nux vomica eating, which to a certain extent prevails in some parts of India; and (*b*) The substitution of nux vomica or *kuchila* bark for other barks, notably for *kurchi* or *holarrhena antidysenterica* bark, a drug in common medicinal use in India as a tonic and antiperiodic for children, and as an astringent in dysentery. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of holarrhena bark being seized, about one-fourth of it was found to consist of nux vomica bark. Waddell suggests that this substitution may partly account for the great mortality among infants and children, yearly reported from tetanus in Calcutta.[1]

[1] *Ind. Med. Gaz.*, March 1885.

Poisoning by the alkaloid Strychnia, formerly rare in India, has of late years, become more frequent, owing to the greater ease with which the alkaloid can be obtained. It is usually accidental in the Bombay Presidency; strychnia powders have of late years been largely supplied to the police for the purpose of de troying dogs; and several cases of poisoning of human beings by strychnia have been reported, in which the poison was obtained from this source. Accidental poisoning has occurred through prescribing Liquor Strychnia along with its incompatible Liquor Arsenicalis when the alkaloid is thrown down forming a poisonous dose at the bottom of the bottle.

Action, Symptoms, &c.—Strychnia acts as a direct stimulant to the spinal cord, causing tetanic spasms, and death either from **asphyxia,** due to spasm of the muscles of respiration; or from **collapse,** occurring in the interval between the spasms. When swallowed (except when taken in the form of a pill) the first thing noticed is an intense bitter taste and dryness of tongue; this is frequently but not invariably succeeded by a feeling of suffocation and want of air. Twitchings and cramps follow, rapidly developing into intensely painful tetanic spasms, affecting nearly all the muscles of the body. During the spasms, the body frequently becomes rigid, and arched so as to rest only on the head and the heels (*opisthotonos*). During the fits of spasm also, the pupils are usually dilated, and the features drawn into a grin (*risus sardonicus*). The fits of tetanic spasm alternate with intervals of muscular relaxation, the relaxation being as a rule complete. As the case progresses towards a fatal termination, the intervals between the spasms become shorter and shorter in duration. The convulsions may be so severe as to simulate bruises, see *Case CCLXXVI.* There is no narcotism, but insensibility from exhaustion may occur before death.

Case CCLXXIV.—**Nux vomica poisoning, Homicidal.**—In Dinajpur in 1884, a Hindu man after eating some food given him by his unfaithful wife was seized with a burning sensation in mouth, throat and stomach and immediately commenced to vomit. He suspected his wife of poisoning him, and had the house of her paramour searched, and there were found two *Nux vomica* beans, but no poison was found in the vomited matter. The man recovered.—L. A. Waddell, *Beng. Ch. Ex. Rept.*, 1884, p. 15.

Case CCLXXV.—**Strychnine poisoning, Homicidal—Neill Cream tragedy.**—In October 1892 Neill Cream was convicted of the murder in London of Matilda Clover, and there was good evidence that he also murdered Marsh, Shrivell and another young prostitute and attempting the life of another to whom he gave on the street some pills to take, but she threw them away. The criminal had tea with Marsh and Shrivell on the night of April 11th, 1892, and gave them both "three long

pills." Half-an-hour after Cream left them they were found to be dying, and died within six hours. From Marsh's stomach seven grains and from Shrivell nearly two grains of strychnine were separated, so that each pill probably contained at least three grains of strychnine. The body of Clover exhumed six months after death contained the same poison.

Case CCLXXVI.—**Strychnine poisoning, Homicidal—Palmer case.**—Wm. Palmer, aged 31, a Surgeon, in Staffordshire, England, was charged in 1856 with the murder of John Cook. Palmer, who was deeply in debt through racing matters, was under suspicion of having poisoned both his wife and brother in 1854 and 1855, their lives having been heavily insured by him. He was also heavily in debt to Cook who was under his treatment for a sore-throat. Cook was attacked by vomiting, burning pain in stomach immediately after drinking coffee handed him by Palmer, and some of the soup given by Palmer was sipped by the chamber maid who also was seized with vomiting. A few days afterwards on the 19th, Palmer purchased three grains of strychnine, and gave Cook two pills at night and next day he purchased more strychnine and gave two more pills, after taking which Cook was seized with tetanic convulsions and died. At the *post-mortem* examination Palmer pushed against the surgeon who was placing the stomach in a jar and upset the contents; he also tried to make away with the jar and its contents and tried to bribe the driver to upset the carriage in which the jar was to be conveyed to the railway. Although no poison was found in the stomach, the circumstantial evidence was so strong that he was convicted and hanged.

Case CCLXXVII.—**Strychnia poisoning with Bruises by Convulsions**—In 1896, the Civil Surgeon of Cachar forwarded portions of the viscera of a man and his wife who were found dead in their hut, and the police reported that their death was suspicious and that there was no history of illness. The civil surgeon who held the autopsy was of opinion that death had been caused in both the cases by "shock to the system, probably from external violence," as he found extensive bruises on the upper part of the body, neck, chest, back, and head. A large and extensive bruise on the right side of the chest under the armpit. Large bruise on back, from neck to buttock.

The alkaline ethereal extract obtained from the viscera in each case by Stas' process was a white crystalline deposit, which had a bitter taste. It was first tested for aconitia, and the result being negative, was then applied to a cat's eye to ascertain whether it had any effect on the pupil. The cat developed all the symptoms of strychnia poisoning in half an hour, and died in three hours. The ethereal extract was then tested for strychnia, and found to give the chemical reaction of this alkaloid. The quantity of strychnine present in the portions of the viscera of the woman was estimated and found to amount to 2·7 grains.

This case is interesting from several points of view. The bruising of the bodies which had led the civil surgeon to suspect, death by violence was no doubt due to convulsions induced by the poison; the presence of the alkaloid in considerable quantity in the ethereal extract; and the fact that sufficient was absorbed through the mucous membrane of the cat's eye to bring about the death of the animal.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1896.

Fatal period, &c.—In poisoning by strychnia, the symptoms usually appear in five to twenty minutes; in poisoning by

nux vomica the appearance of the symptoms is less rapid, and in one fatal case their appearance was delayed for two hours.[1] Death may occur in ten minutes or be delayed for five or six hours. Of thirty-five cases collected by Woodman and Tidy,[2] nineteen died in an hour or less, and eleven more in one to three and a half hours.

Diagnosis from disease.—The chief points of distinction between strychnia poisoning and **tetanus,** the only disease likely to mistaken for it, are :

(1) In poisoning, the symptoms come on suddenly, rapidly become severe, and soon end in either death or recovery ; in tetanus as a rule, the reverse is the case. Chevers, however, mentions an exceptional case of sudden accession of tetanus, and death in the first spasm (see *Case CCLXXVII*). (2) In tetanus, the muscles of the lower jaw are early affected, stiffness of the lower jaw being often the first prominent symptom ; in poisoning, the muscles of the lower jaw are the last to be affected. (3) In poisoning, as a rule, the muscles during the intervals are completely relaxed : this is not so in tetanus.

Case CCLXXVIII.—**Sudden death in first spasm of tetanus**—Chevers (*Med. Jur.*, p. 248), under this heading, cites the following case :—"An apparently healthy boy, one of the pupils of the La Martinière School, Calcutta, was seated on his bed, having a small sore on his foot, dressed by the native doctor. Having applied the dressing, the native doctor was leaving. He walked straight to the door, but as he was passing out he heard a noise from the bed. Turning, he saw the boy supported on his occiput and heels, his body being arched up in opisthotonic spasm. He ran to the bed, the body sank, and death was immediate."

Treatment.—Administer emetics or use the stomach-pump, chloroforming the patient so as to allow of the introduction of the tube. Give animal charcoal or infusions containing tannin. Administer chloral, or still better, keep the patient under the influence of chloroform.

Post-mortem appearances.—Not characteristic ; as a rule, the body is relaxed at death, sometimes, however, it remains rigid, the rigidity continuing for a very long period. The brain, spinal cord, and lungs are usually found congested ; the heart may be empty or full. The convulsions may have been so severe as to bruise the body, see *Case CCLXXVII.*

Fatal dose, &c.—(*a*) **Of Strychnia.** A medicinal dose of this is one-thirtieth to one-twentieth of a grain. Taylor[3] estimates the fatal dose for an adult at half a grain to two grains. Some persons appear to be specially sensitive to the action of strychnia, and two cases are on record in which respectively one-twelfth, and one-sixth of a grain, caused alarming symptoms. In both these cases the subjects were adult females. The smallest quantities which have caused death,

[1] Taylor's *Manual*, p. 172. [2] *For. Med.*, p. 330.
[3] *Poisons*, p. 713.

are one-sixteenth of a grain in a child two to three years old, and half a grain of the sulphate in an adult.[1] Recovery has been recorded from doses of ten to twenty, and even forty grains of the alkaloid.[2]

(*b*) **nux vomica.** Nux vomica seeds contain about a quarter to half per cent. of strychnia, and St. Ignatius' beans about one and a half per cent.[3] The medicinal dose of powdered nux vomica seeds is two to three grains. In one case thirty grains of powdered nux vomica seeds (equal to about one full-sized seed), taken in two doses of fifteen grains each, caused the death of a girl aged ten; and in each of two cases death was caused by fifty grains.[4] It should be noted that, owing to the insolubility of the testa, **whole** nux vomica **seeds** may be swallowed, and pass through the body, without giving rise to symptoms of poisoning.

Influence of habit.—Many authorities state that in different parts of India, nux vomica is habitually eaten (like arsenic) as a stimulant and aphrodisiac. Baker, quoted by Chevers,[5] states that those who practise this habit, begin with one-eighth of a grain of the seed, gradually increasing the dose to about twenty grains. If this is so, the inference of course is, that habit tends to confer on the system a resisting power to the action of strychnia. It is, however, undoubtedly the case that small doses of strychnia repeated at short intervals tend to exert a cumulative effect. Lauder Brunton, in fact, states that strychnia is a cumulative poison, and points out that this effect is due to the slowness with which it is excreted, one effect produced by it being to contract the renal vessels, and thus interfere with its own elimination.

Unusual Cases.—Harley[6] records a case where an infant at the breast suffered from symptoms of strychnia poisoning, the result of the medicinal administration of strychnia to the mother, who remained unaffected. Dr. Chatterjee[7] met with a non-fatal case, resulting from the introduction, by a quack, of a pulp made from nux vomica seeds into a wound. Blyth[8] mentions a case of attempted suicide by a young woman, who took about one and a half grains of strychnia, and two ounces of laudanum. Severe symptoms of narcotic poisoning followed, but no symptoms of strychnia poisoning showed themselves until eight hours afterwards.

Preparations: (1) Officinal.—The following preparations of nux vomica are contained in the I.P.:—

—	Strength.	Medicinal Dose.
Infusion ...	1 to 48	½ oz. to 1 oz.
Tincture ...	2 ozs. to 1 pint	5 to 20 drops.
Extract ...	1½ oz. equals about 1 lb. of the seeds	¼ of a grain to 2 grains.

The I.P. also contains a solution of strychnia; strength four grains to one ounce, or about 1 to 109. With the exception of the infusion, the

[1] Case of Dr. Warner, *ib.*, p. 712.
[2] Woodman and Tidy, *For. Med.*, p. 330.
[3] *Pharmacographia*, pp. 430, 433.
[4] Taylor, *Poisons*, p. 695.
[5] *M. J.*, p. 241.
[6] Woodman and Tidy, *For. Med.*, p. 330.
[7] *Ind. Med. Gaz.*, 1872, p. 251.
[8] *Poisons*, p. 313.

above preparations are similar to those of the B.P. of 1867. The strength of the preparations of the new B.P. (of 1885) is defined as follows :—The extract is to be so made as to contain 15 per cent. of nux vomica alkaloids ; and the tincture, made from the extract, is to contain one grain of nux vomica alkaloids per ounce. The solution of strychnia (liquor strychninæ hydrochloratis) has a strength of about 1 to 100, instead of 1 to 109 as in the B.P. of 1867. (2) **Non-officinal.**—Various vermin-killers sold in England contain strychnia. Blyth mentions the following :—*Miller's rat powder*, a mixture of one ounce of nux vomica to one pound of oatmeal. *Battle's vermin-killer*, a mixture of strychnia with flour and Prussian blue, containing about 7·7 per cent. of strychnia, and *Butler's vermin-killer*, a mixture of strychnia with flour and soot, or sometimes Prussian blue, containing from about $3\frac{1}{3}$ to 5 per cent. of strychnia.

Identification.—**Nux vomica seeds** (see Fig. 39) are contained in a smooth orange coloured berry about 2 inches in diameter and containing about five seeds or 'nuts.' The seeds are in shape nearly circular discs, slightly concave on one side and convex on the other, about one inch in diameter, by about a quarter of an inch thick. In colour, they are light greyish, and have on the surface a silky appearance, due to their being thickly covered with short hairs. In the centre of the concave side is the *hilum* connected by a slightly elevated *raphe* with the *chalaza* which forms a small protuberance on the edge in the neighbourhood of the radicle, see Fig. 41. They are very tough and horny, and have an intensely bitter taste. **St. Ignatius' beans** are about one and one-fifth of an inch in length, ovoid, but presenting three to five flattened surfaces due to mutual pressure. "In the fresh state they are covered with silvery addressed hairs ; portions of a shaggy brown epidermis are here and there perceptible on those found in commerce, but in the majority the seed shows the dull grey granular surface of the albumen itself."[1] **Nux vomica bark occurs** in quilled twisted pieces, an inch or less in diameter, thin, light-brown in colour, and marked on the outer surface

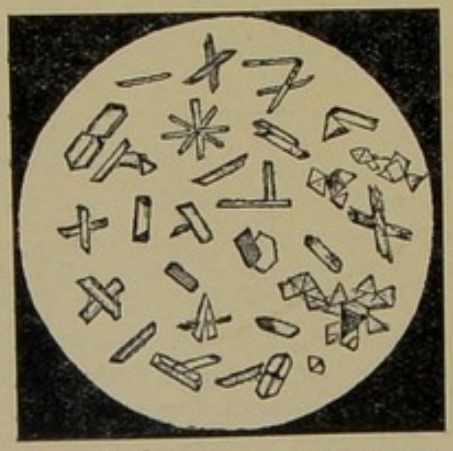


FIG. 42—Strychnia crystals × 120 obtained from an alcoholic solution.

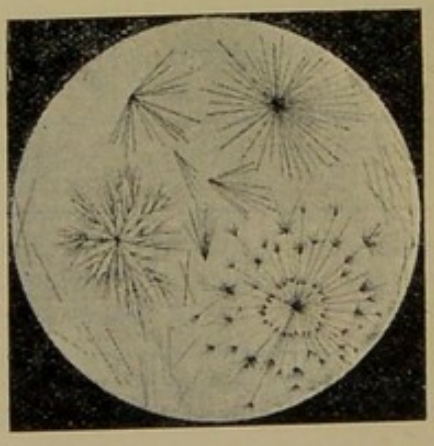


FIG. 43—Strychnia + potash or ammonia × 30.

by numerous small light-coloured elliptic corky warts. Its inner surface is turned red by nitric acid ;[2] this distinguishes it both from angostura

[1] *Pharmacographia*, p. 388. [2] Owing to the presence of brucia (see p. 595).

or cusparia bark, and from holarrhena antidysenterica bark ; the latter also is much thicker, and is marked on the external surface by scars of exfoliation.

Detection of Strychnia.—Strychnia occurs in commerce as a white powder, or in white rectangular prismatic crystals, but may be obtained in other crystalline forms, *e.g.*, hexagonal prisms, octahedra, or forms derived from the octahedron. It is freely soluble in chloroform (1 to 7 or 8), less soluble in alcohol (about 1 to 100), and still less soluble in ether. It is only very sparingly soluble in pure water (about 1 to 7000 of cold water), but readily dissolves in dilute acids. Its solution in faintly acidulated water has an intensely bitter taste, and is precipitated by the alkaloidal group reagents (see p. 185). It sublimes at 169°F. and condense in minute needles. The special tests for strychnia are :

1. Bitter taste.

2. The colour test.—This depends on the fact that a play of colours namely blue, rapidly changing to violet, and then slowly to purple, and lastly, to red—is produced when strychnia is subjected to the action of nascent oxygen. To apply the test, stir a minute quantity of strychnia with a drop or two of strong sulphuric acid ; the strychnia dissolves if pure without change of colour. Then cautiously add a minute quantity of manganese dioxide, or lead dioxide, when the play of colours appears. Potassium permanganate, or potassium dichromate, may be used instead of manganese or lead dioxide, but are not so suitable ; or the test as proposed by Letheby, may be conducted galvanically. In this modification, the strychnia dissolved in a drop or two of strong sulphuric acid, is placed on a piece of platinum foil connected with the positive pole of a galvanic battery ; on touching the liquid with the negative pole, the play of colours appears. It has been objected that various substances, *e.g.*, pyroxanthin, piperine, salicine bile, &c., become coloured when treated with strong sulphuric acid. With these substances, however, the colour appears directly the acid is added, while with strychnia no colour appears until after the addition of the manganese dioxide, or other oxygen yielding substance. Aniline salts, Woodman and Tidy point out, are not coloured by sulphuric acid only, but give a play of colours when manganese or lead dioxide is added ; with aniline salts, however, the colours are first "green, then a very persistent blue, then black."

3. The physiological test.—This consists in administering, preferably by subcutaneous injection, a little of the suspected alkaloid, to a small animal, *e.g.*, a frog, and observing whether or no tetanic symptoms are produced. Substances other than strychnia, however, induce tetanic symptoms : hence the physiological test is only useful as a negative test, to prove the absence of strychnia ; or, as a confirmatory test. If, however, definite chemical evidence of the presence of strychnia has been obtained, the physiological test is quite unnecessary.[1]

Brucia.—This alkaloid also has an intensely bitter taste. Its physiological action is the same as that of strychnia, but seven to ten times weaker. It is less soluble in ether, but more soluble in water, alcohol, and choloform, than strychnia. Un-

[1] Blyth, *Poisons*, p. 323.

like strychnia, it gives no play of colours with nascent oxygen. The special colour test for brucia, a test to which strychnia does not respond, is as follows :—Add a little strong nitric acid, a bright red colour is produced, which, on warming, becomes yellow. If, after warming, a trace of stannous chloride be added, the yellow changes to purple destroyed by excess of stannous chloride or of nitric acid.

From organic mixtures, strychnia and brucia may be separated by Stas' process, using chloroform, or a mixture of ether and chloroform, as a solvent. If both are present, the alkaloidal residue will respond both to the nitric acid test and the nascent oxygen test. The discovery of both, in a case of poisoning, indicates that probably portions of a plant containing the alkaloids, *e.g.*, nux vomica, has been employed.

Failure to detect Strychnia.—Strychnia is an extremely stable substance, not likely to be destroyed by putrefaction. Richter[1] found it in putrid tissues after eleven years' exposure to decomposition in open vessels. Elimination also of strychnia from the body is comparatively slow. Hence, given that the analysis has been properly conducted, and that a sufficient quantity of material has been submitted to analysis, failure to detect strychnia in the body is strong evidence against death from strychnia poisoning. It is not, however, absolutely conclusive evidence against this supposition, as it is just possible that if death has occurred from a minimum dose of strychnia, and the patient has lived for some time after its administration, complete elimination of the poison may take place before death.

Stimulation of the Spinal Cord is caused also by **Thebaia,** one of the opium alkaloid ; this, however, is less active even than brucia. It is also caused, according to Lauder Brunton, by **Calabarine,** one of the alkaloids of Calabar bean. Spasms, more or less tetanic in character, pointing to a stimulant action of the cord, have been observed in poisoning by **Nerium odorum.** Stimulation of the spinal cord resulting in the production of epileptiform convulsions, is one of the effects of **Picrotoxin,** the active principle of cocculus indicus ; and Blyth mentions as similar in its action to picrotoxin, the poison of **Illicium religiosum,** a plant growing in Japan. Venous blood, it may be here noted, irritates the nerve-centres ; hence in narcotic poisoning, and poisoning by drugs tending to cause death by asphyxia, convulsions may precede death, even when the poison itself has no irritant action on the nerve-centres.

Calabar Bean.—The seeds of *Physostigma venenosum*, N. O. *Leguminosæ*, a native of Western Africa, *Physostigmatis semina, Calabar beans*, are highly poisonous. A dose of twelve grains of the seeds taken for purposes of experiment, caused alarming symptoms in an adult. In 1864, a number of children were accidentally poisoned at

[1] Blyth, p. 321.

Liverpool, by eating the beans ; one who had eaten six beans died ; and two who had eaten the broken fragments of the kernel of one bean, suffered severely, but recovered. Calabar bean **paralyses the spinal cord,** slows the action of the heart, and causes death by paralysis of respiration. In experiments on animals, large doses have been found to at once arrest the heart's action, and cause death by syncope. In poisoning by Calabar bean, the prominent symptoms are gastric irritation, slight tremors followed by great weakness of the muscles, and slowness of the pulse and of respiration. The mental faculties are unaffected. The pupils are contracted, but the poison appears to act more powerfully on the pupils when locally applied, than when swallowed.

Three alkaloids have been described as present in Calabar bean, *viz.*, physostigmine, eserine, and calabarine. Of these, the first two are considered by many to be identical with one another, and are apparently the constituents to which the paralysing action of the poison is due. Calabarine, according to Lauder Brunton, causes convulsions like strychnia.

Treatment.—General, as for spinal poisons (p. 274). Both atropia and chloral, to a certain extent, antagonise the action of Calabar bean, and have been recommonded as physiological antidotes. The antagonism is in neither case complete, but appears to be greater in extent with chloral than with atropia.

Identification.—The beans are kidney-shaped, chocolate coloured externally ; and have a broad black furrow, with raised edges lighter in colour than the rest of the surface, running along the convex border. Dimensions about 1 to 1¼ by ¾ by ½ an inch ; weight about sixty-seven grains. Physostigmine may be extracted from organic mixtures by Stas' process, using benzene as the solvent, and identified by its action on the pupil, and by the red colour given by its sulphate with bromine water.

Gelsemium.—*Gelsemium nitidum* (syn. *G. sempervirens*), or yellow jasmine, N. O. *Loganiaceæ*. The dried rhizome and rootlets of this, officinal B.P. (1885), are used in medicine.[1] In overdoses, the drug paralyses the cord, and causes death by paralysis of respiration. Unlike Calabar bean, gelsemium has no very marked action on the heart.

Its active properties appear to be due to the alkaloid *gelsemine*. Wormley estimates that not more than one-sixth of a grain of gelsemine, was contained in a dose of the drug which proved fatal to an adult female. Five fatal cases of poisoning by gelsemine have been reported.[2] The prominent symptoms are muscular weakness, followed by giddiness, frontal headache, double vision, and squinting. The weakness deepens into paralysis, the eyelids drop, vision becomes indistinct, and the muscular power of speech is lost. Respiration becomes slow, and the surface cold. The mind remains unaffected. The pupil is usually contracted, but Ringer points out that gelsemine, when locally

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[1] According to the B.P. (1885), the medicinal dose of the dried root is five to thirty grains, and of the tincture—strength one to eight—five to twenty minims.

[2] Wharton and Stille (1884), vol. iii., p. 416.

applied, causes dilatation of the pupil, or a reverse effect to that produced by internal administration of the drug.

Detection.—Gelsemine may be extracted from organic mixtures by Stas' process, using chloroform as the solvent. The colour tests for it are : (1) with sulphuric acid and manganese dioxide it gives a damask red colour, changing to a rich green, most marked at the edges ; and (2) nitric acid strikes with it a brownish green, quickly changing to deep green.

Paralysis of the cord is also the special action of methylconia, a liquid volatile alkaloid allied to conia (see Conium) ; and *ulexine*, a powerfully poisonous alkaloid contained in gorse (*Ulex europœa*), is said to paralyse the motor tract of the cord, and the trunks of the motor nerves.

CHAPTER XXVIII.

CEREBRO-SPINAL-POISONS, CARDIAC, &c.

CARDIAC POISONS.

OF the poisons which act more or less directly on the heart, through a direct action on its nerve-supply, Tobacco and Lobelia are spinal as well as cardiac poisons, and cause death by asphyxia due to paralysis of the respiration, whilst Digitalis and Oleander appear to act directly on the cardiac muscle, thus tending to arrest the heart's action and cause death by syncope. Like spinal poisons, cardiac poisons leave no characteristic *post-mortem* appearances.

General treatment indicated in cardiac poisoning is to try to secure : (1) Elimination, by emetics (see p. 405) or the stomach-pump ; (2) Prevention of action, by giving decoctions containing tannin ; (3) Counteraction of effects, by the administration of stimulants, and the employment of physiological antidotal measures, such as keeping the patient in a recumbent position, keeping the surface warm, employing galvanism, and, if required, artificial respiration.

Tobacco.

Nicotiana tabacum, Tobacco, N. O. *Solanaceæ* ; '*Tambaku*' (Hind., Beng., and Bom.), *Pugaiilai* (Tam.).—The dried leaves of this plant are officinal B.P. and I. P., and form the ordinary tobacco used for smoking, &c. They contain a poisonous liquid volatile alkaloid, *nicotia* or *nicotine*, and also an unimportant volatile crystalline substance, nicotianin, or tobacco camphor. Cases of poisoning by nicotine are rare ; one celebrated case is however, on record, namely, the case of Count Bocarmé, convicted of poisoning his wife's brother, by forcible administration of nicotine. Cases of poisoning by tobacco, mostly accidental, are more common. Death has resulted from swallowing tobacco, from administration of a decoction of tobacco as an enema, and from swallowing tobacco juice such as collects in pipes ; and bad symptoms have been caused by the application of tobacco leaves to a wound, and even to the sound skin. Death has occurred from excessive smoking ; it is

doubtful, however, whether tobacco smoke contains nicotine ; probably its poisonous effects are due to pyridene bases, developed during the combustion of the tobacco.

Action, Symptoms, &c.—Tobacco first slows and afterwards quickens the pulse, acting on the heart through the vagus, which it first stimulates, and afterwards paralyses. It is also a spinal poison, and causes death by paralysing the respiration. The prominent symptoms of tobacco-poisoning, are giddiness, muscular weakness, faintness, and depression, abdominal pain, vomiting, sometimes purging, difficult respiration, and convulsions. The pulse is at first slowed, afterwards it becomes quick, weak, and irregular. Death usually occurs rapidly. In one case, fatal results followed the administration as an enema, of a decoction of half a drachm of the leaves.

Treatment.—Evacuate the contents of the stomach, give tannic acid and stimulants, keep the patient in a recumbent posture, and apply warmth to the surface. Blyth recommends cautious hypodermic injection of strychnia.

Post-mortem appearances.—Not characteristic : there may be congestion of the brain, lungs, and liver. In some cases, inflammation of the stomach and intestines has been found.

Detection.—Portions of tobacco-leaf may be found and recognised by their odour and physical characters Nicotine may be extracted from organic mixtures by Stas' process as for conium, and recognised by its odour and action on animals. There are no special colour tests for nicotine. Nicotine does not coagulate albumen, and gives a crystalline precipitate with mercuric chloride solution (distinction from conia)

Duboisia hopwoodii, or **pituri,** a small shrub or tree belonging to the N. O. Solanaceæ, indigenous in Australia, contains a liquid volatile alkaloid called piturie, which resembles nicotine in physiological action.

Lobelia.

Lobelia inflata, Indian tobacco, N. O *Lobeliacæ.*—The "dried flowering herb" of this plant, a native of North America, is officinal B.P. and I.P. It has long been known to contain a poisonous liquid volatile alkaloid, *lobelina* or *lobelin ;* and lately a solid alkaloid resembling apomorphia in emetic character, has been found to be also present in it. Several fatal cases of poisoning by lobelia, due to the administration of the drug by quacks, have been reported in England and the United States.

Action, Symptoms, &c.—Similar to those of poisoning by tobacco, except that there is more burning pain in the stomach, &c. As in poisoning by tobacco, death occurs by paralysis of the respiration. Ten to fifteen grains of the powdered leaves or seeds, will act as a strong emetic, and a drachm of the powdered leaves has caused death. The treatment should be the same as in poisoning by tobacco.

Post-mortem appearances.—Inflammation of the stomach and intestines, and congestion of the vessels of the brain.

Identification.—Lobelia is generally met with as a greenish coloured powder of disagreeable odour, and acrid burning taste. The powder consists of the chopped herb. In the powder the seeds may be found ; these are ovate-oblong, about one-fiftieth of an inch in length, are light brown in colour, and have a reticulated pitted surface. According to Guy, 3,176 of them weigh one grain.

Lobelia nicotianæfolia, vern. *Deonal, Bokenal, Dhaval.*—This lobelia, Dymock states, is found upon the mountain ranges of Ceylon and Southern and Western India. The upper portion of the stem is hollow, and is dried and used as a shepherd's pipe. The plant has recently been examined, and found to contain the same active constituents as L. inflata.

Identifications.—Dymock gives the following description of the plant: "The leaves resemble those of the tobacco; they are finely serrated and covered with simple hairs. The lower part of the stem is woody, an inch and a half or more in diameter, and almost solid; the upper portion is a hollow tube ending in a crowded head of flower spikes; the latter are about a foot in length, and when the plant is in fruit, are thickly set with globular capsules about the size of a pea, to which a portion of the dry flower is often adherent; the capsules are two-celled, each cell containing a fleshy placenta. The seeds are numerous and very small (one-fiftieth of an inch in length), oval, flattened, and marked with delicate lines. Several small tubercles surround the site of the placental attachment; their colour is light brown. The whole plant when dry is studded with small spots of resinous exudation, and is hot and acrid to the taste."

Digitalis.

Purple Foxglove, or *Digitalis purpurea*, N. O. *Scrophulariaceæ* (see

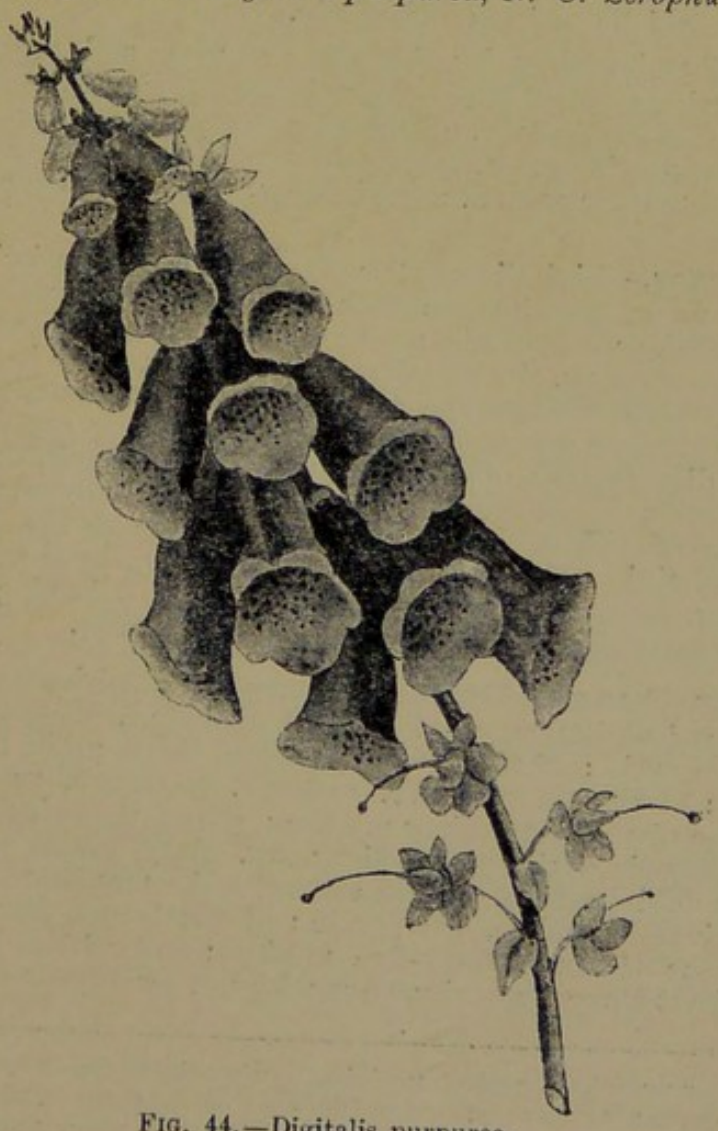

FIG. 44.—Digitalis purpurea.

(Fig. 44). This plant is a native of Europe; all parts of it are poisonous.

The leaves, probably the most poisonous portion of the plant, are officinal B.P. and I.P. Several active principles have been described as present in digitalis, of which the most important are *digitoxin*, *digitalin* (a glucoside) and *digitalein*.[1] Of these, the last is the only one soluble to any extent in water. All three are powerful heart poisons. They stimulate the cardiac muscle and prolong the contractions of the heart, subsequently rendering the heart's action irregular, and finally arresting it. Of the three, digitoxin is said to be five to ten times more powerful than either of the others. Blyth estimates that one-sixteenth of a grain of digitoxin would probably prove fatal to an adult. When boiled with dilute acids, digitoxin yields toxiresin and digitalin yields digitaliresin ; both these also are highly poisonous, but cause convulsions like picrotoxin.

Commercial Digitaline.—Formerly, the active principle of digitalis was stated to be digitaline. This was officinal in the B.P. of 1867, but has been omitted from the B.P. of 1885. Digitaline is still officinal I.P. Several varieties of digitaline have been prepared and sold, the chief being :—(1) Nativelle's crystallised digitaline, containing digitoxin, as its chief constituent. (2) Homolle's amorphous digitaline, containing digitalin as its chief constituent. This is the digitaline of the I.P. and old B P. ; and (3) Soluble digitaline, a large proportion of which consists of digitalein.

Cases of poisoning by digitalis are rare, and are chiefly due to accidents arising out of the medicinal use of the drug. One celebrated homicidal case is, however, on record, *viz.*, the case of Dr. De la Pommerais, a homœopathic practitioner, who was tried and convicted in Paris in 1864, of poisoning a woman named Pauw. The case was an assurance murder.

Symptoms.—Digitalis acts to a certain extent like an irritant poison, causing, no matter how introduced into the system, nausea, vomiting, and often diarrhœa. Its main action, however, is exerted on the heart : the pulse becomes slow, the heart's action irregular, there is pallor of the surface and tendency to syncope, and finally the heart's action stops, and death occurs. Other symptoms of digitalis poisoning are dilatation of the pupils, disturbances of vision, slowing of the respiration, and suppression of urine. Salivation is often present, and convulsions are occasionally seen. Usually the mind remains clear to the last. Sometimes the administration of a series of medicinal doses of digitalis, is followed by a sudden outbreak of symptoms of poisoning. Digitalis, therefore, is generally stated to be a cumulative poison.

Preparations and Dose.—Ordinary medicinal doses of the various preparations of digitalis are—of officinal digitaline, one-sixtieth to one-thirtieth of a grain ; of the powdered leaves, half a grain to one and a half grains ; of the tincture B.P. and I.P. (strength, two and a half ounces to one pint), ten to thirty minims ; and of the infusion (strength, B.P. 1885, fifty-six grains to one pint ; I.P. sixty grains to one pint), two to four fluid drachms. Blyth estimates the maximum safe dose to be—of officinal digitaline, 0·03 grain ; of the leaves, four and a half grains ; of the tincture, forty-five minims ; and of the infusion, one ounce, or about three times these quantities in twenty-four hours. The

[1] Another principle present in digitalis, *viz.*, digitonin, is readily soluble in water, and appears to have an action like that of saponin. This action is to a certain extent antagonistic to that of digitoxin, digitalein, and digitalin, its tendency being apparently to depress instead of stimulate the heart's muscle.

same authority considers that double these maximum safe doses would be likely to prove dangerous. A case, however, is recorded of recovery after taking one drachm of the powdered leaves, and another of recovery after swallowing two ounces of the tincture.

Fatal period.—Rarely less than twenty-two hours. In one case death occurred on the sixth day.

Treatment.—Evacuate the contents of the stomach. Give tannic acid and stimulants. Administer aconite cautiously, and keep the patient recumbent.

Post-mortem appearances.—Not characteristic. In some cases signs of inflammation of the mucous membrane of the stomach and intestines have been present.

Identification.—The flowers are purple and dotted, and bell-shaped. The seeds are minute (about 1,126 to the grain ; Guy), light brown, angular, and pitted. The leaves are four to twelve inches long, "with a winged petiole of varying length ; ovate or ovate lanceolate, subacute, crenate, or irregularly crenate-dentate, somewhat rugose, slightly hairy, and dull green above, densely pubescent, and paler beneath. Taste very bitter, unpleasant ; odour faint, agreeable, and tea-like" (B.P. 1885). Organic mixtures should be treated by the modification of Stas' process, referred to at p. 488, shaking the acid watery filtrate first with petroleum ether to remove impurities, and subsequently successively with benzene, which takes up digitalein, and chloroform, which takes up digitalin and digitoxin. The residues left after evaporation of the benzene and chloroform, must then be tested physiologically. The following colour-test may also be tried, but is not a very delicate one, and cannot be by itself relied on. With sulphuric acid and bromine, digitalin gives a red colour, becoming emerald green on dilution. Digitalein similarly treated, gives a violet colour, becoming light green on dilution.

WHITE OR PINK OLEANDER.

This sweet-scented Oleander[1] is the *Nerium odorum*, N. O. *Apocynaceæ*, vernacularly known as *Kaner* (Hind.), *Sweth karabi* (Beng.), *Alari* (Tam.) (see Fig. 45. The shrub grows wild over the greater part of India and is cultivated in gardens for its graceful flowers. All parts of the plant are poisonous ;[1] but cases of poisoning by it are not very often reported. It is also called the "true oleander" in contradistinction to the "bastard oleander" **Thevetia nerifolia** or **cerbera thevetia** (see p. 609).

During the fifteen years ending 1888, fourteen cases of Nerium poisoning were referred to the Chemical Examiner, Bombay, and eleven

[1] The goat feeds on the foliage with impunity, but Dr. Watt (*Econom. Diets.*) states that it is fatal to camels and other animals and poisonous also to insects. One of its Sanskrit names, as noted by Dr. C. L. Bose, is 'destroyer of horses,' *aswamarala*. Dr. Honigberger was of opinion that the wild hill plant was more poisonous than the cultivated variety, and he is supported in this opinion by M. Latour and Prof. E. Pelikan who found by careful analysis that the wild variety contained a larger quantity of the poisonous principle.—Dr. C. L. Bose, *Ind. Med. Gaz.*, 1901.

to the Chemical Examiner, Madras ; only two cases were dealt with by the Chemical Examiner, Bengal, during the same period. Of seventeen cases, nine were suicidal, two homicidal, two criminal abortions, and in four the poison was given medicinally.

For **suicidal** purposes the root is especially used by women in Western and Southern India and in the outer Himalayas ; whilst in Bengal the fruits of the yellow oleander (see p. 609) is more often used in this way.

FIG. 45.—Nerium Odorum, ½.

For homicidal purposes it is less frequently employed ; but the root is commonly used for procuring criminal abortion both locally and internally. The use of the root medicinally by ignorant persons for venereal disease has occasionally led to fatal poisoning.

The active principles of the plant have recently been investigated by Dr. Chuni Lal Bose,[1] who discovered that the

[1] *Ind. Med. Gaz.*, Aug. and Nov. 1901.

plant contains in addition to the *Neriodorin* and *Nerioderein* of greenish,[1] another actively toxic principle, which he has named *Karabin* after the vernacular name of the plant. Like *Neriodorin*[2] it is a powerful cardiac poison acting on the heart in a somewhat similar manner to digitalin, and it also acts on the spinal cord somewhat like strychnia.

Symptoms.—Vomiting and frothy salivation usually occurs, followed by restlessness. Pulse becomes slow and weak, respirations hurried, muscular twitchings, especially of upper extremities, deepening into tetanic spasms, which (unlike strychnia poisoning) affect one side more than another (thus, see *Cases CCLXXIX & CCLXXXI*, the muscles of right arms were chiefly affected, in one case and in another the left side). Lock-jaw is frequently present. Drowsiness passing into insensibility and collapse. Diarrhœa is usually absent.

Case CCLXXIX.— **White Oleander Poisoning—Accidental—Multiple.** In 1898 two men were admitted into the Medical College Hospital, Calcutta, three hours after taking a cupful of a decoction of the root of *Nerium odorum* which they had taken medicinally as an anodyne.

(A) Mahomedan male, aged about 50. Vomited several times before and after coming to the hospital ; vomited matter consisted of yellowish frothy fluid. At the time of admission he was quite conscious and able to speak and swallow ; complained of no pain in the stomach ; pulse small, soft, slow (about 60 per minute), but regular ; respirations normal ; eyes congested ; pupils unequal, the right one being contracted.

Two hours after admission, drowsiness and twitchings of the muscles of the hands were noticed. An hour after, spasms were noticed, most marked in the upper extremities and face but slight in the legs. There was no lockjaw but dysphagia was a marked symptom, and the patient was unable to speak, although he appeared to understand when spoken to and frequently smiled vacantly. Respirations were hurried, and the pulse slow and small, about 50 per minute.

Four hours after admission, he began to get tonic convulsions of all the muscles of the body, especially of the upper extremities ; no lockjaw. An hour after the whole body was found rigid, and there were lockjaw, twitchings of the fingers and bending of the neck towards the right ; froth coming out from the mouth. The pulse was frequent (about 100 per minute), and the respirations hurried (about 70 per minute).

About 12 hours after admission, the upper extremities were found still rigid, but the lower extremities were flaccid ; breathing was hurried and stertorous, and the pulse was frequent and small. Rigidity of the muscles began to disappear gradually, but the general condition of the patient became worse. The pulse began to fail, the breathing continued stertorous, and the conjunctival reflex was lost. The patient died about 26 hours after the ingestion of the poison.

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[1] *Pharm. Jour.*, 1881, p. 873.

[2] The third principle *Neriodorein* is shown by Dr. C. L. Bose to be a saponin, with little toxic properties, so may be disregarded.

Post-mortem appearances.—Dr. Gibbons held a *post-mortem* examination about four hours after death and recorded the following conditions :—" Rigor mortis well marked ; body still warm to the touch. Right pupil a little smaller than the left. Thumbs resting against fingers. *Lungs*, adherent behind and very congested with fluid blood. *Heart*, right side full with blood, left side nearly empty ; spots of subendocardial hæmorrhage on front wall and towards apex on both walls. *Liver*, *spleen*, and *kidneys* congested. *Stomach* contents, about 1½ oz. of greenish-yellow fluid and much mucus, no smell ; stomach in folds with tops congested, mucous membrane congested, specially along the lesser curvature. *Small intestine* contents, yellow mucus, slight congestion of upper part of duodenum and a few scattered spots of congestion. *Large intestine* healthy contained liquid fæces. *Brain* healthy. *Trachea* congested, and frothy liquid in the bronchi.

(B) Muhammadan male, about 28 years of age. The symptoms in this case were similar to those in the first case, excepting that they were apparently of a comparatively mild nature : there were vomiting, slow and feeble pulse, hurried respirations, twitchings of the muscles of the upper extremities, which, however, developed about twelve hours after the ingestion of the poison as against five hours in the first case ; unequal dilatation of the pupils ; bending of the head towards the right ; general tonic convulsions of the whole body, opisthotonos ; lockjaw. A movement of the head from side to side was noticed, and there was a slight rise of temperature on the second day of poisoning. Under treatment he began to improve steadily, but remained in a debilitated condition for about three weeks, after which he was discharged from the hospital cured.

The treatment in both the cases consisted in giving emetics and alcoholic and diffusible stimulants, mustard plasters over the heart and hypodermic injections of sulphuric ether.

The viscera of the deceased man and the vomited matter of both the men were sent to the Chemical Examiner for analysis. A *narcotico-irritant* principle was detected both in the viscera and in the vomited matter which produced vomitting, weakness of the heart, general uneasiness and drowsiness in a cat, but not twitchings or convulsions. The poisonous principle could not be identified by chemical tests.—Asst.-Surgn. Kalimohun Sen, *Ind. Med. Gaz.*, 1899, p. 118.

Case CCLXXX.—**Nerium Poisoning—Suicidal.**—(*a*) A man, aged 35, after a quarrel with his wife, attempted suicide by swallowing rather more than an ounce of expressed oleander juice. After swallowing the poison, he is stated to have almost immediately fallen down insensible, and when admitted was insensible with flushed face and stertorous breathing. There were violent spasmodic contractions of the muscles of the entire body, more developed in the upper than in the lower extremities, and on the left more than the right side. " During the intervals of spasm the patient lay evenly on his back ; and when action commenced, the superior contractions of the left side threw him over on his right." After some hours the spasms decreased, the pulse sank to a thread, and the extremities became cold. Insensibility lasted about 36 hours. Under active treatment, however, the patient ultimately recovered.—Dr. Broughton, *Koldpur*, 1858, Chevers, *M.*, 256.—(*b*) A Hindu woman Sundari Rawe in Calcutta in 1884 ate some of the bark of *Nerium odorum* to commit suicide. She was attacked by convulsions and became unconscious, but recovered after a time.—L. A. Waddell, *Beng. Ch. Ex. Rept.*, 1884, p. 16.

Cases CCLXXXI.—**Nerium Poisoning—Suicidal.**—A man in Sitapur, aged about 50, took some Nerium root mixed with mustard oil to destroy himself on account of a domestic quarrel. He was brought to the hospital about an hour and a half after the ingestion of the poison in an apparently insensible condition. The principal symptoms noticed in the case were—*Vomiting; preternaturally slow but regular pulse and insensibility.*

The man was making favourable progress when, after making certain exertions, he suddenly died, probably from heart failure, about twenty-four hours after he had taken the poison. He never complained of any pain in the abdomen.

At the *post-mortem* examination small patches of congestion with red points were discovered near both the pyloric and cardiac ends of the stomach posteriorly; there were also two slight abrasions on the mucous membrane of the stomach. The cavities of the heart, particularly the ventricles, were filled with black fluid blood. Other organs were found healthy. Dr. Greig, 1840.

Case CCLXXXII.—**Nerium Poisoning—Suicidal.**—A man, aged 35, drank a strained watery decoction of 4 ounces of the root and was attacked soon afterwards with vomiting and cramps. Insensibility came on in two or three hours. Eight hours after swallowing the poison he is described as becoming insensible, skin cold and clammy, pulse weak and thready; muscles of the jaws stiff; eyes turned up, whites only visible; hands pretty open, but fingers rigid, thumbs turned inwards. During the night had frequent convulsive spasms, and had not recovered sensibility when taken away from hospital by his friends 48 hours after swallowing the poison, and died on the 5th day.—Dr. Murray, *Ind. Med. Gaz.*, 1877, p. 319.

Case CCLXXXIII.—**Nerium Poisoning—Accidental.**—In 1889 at Cawnpore, a Hindu woman, aged 39, was brought to hospital in an apparently dying condition with the history that being advised to take *anar ke châla* (pomegranate bark) for worms she had taken by mistake *kaner ke chala* (the bark of *nerium odorum*), of which she drank the decoction of about an ounce of the bark at 10 A.M. An hour after she complained of excessive thirst, an intense heat all over, and severe pains in the stomach. Vomiting of a severe and persistent character set in. She become unconscious gradually, and remained in that state. Vomiting ceasing, the body appeared to be rigid, the extremities trembling, especially the fingers. The breathing was deep, and frothy sputum collected in great quantities about her mouth, the teeth were clenched, with the lips parted, the eyes remaining open.

When admitted to hospital at 11 P.M., the body was rigid and inclined to "opisthotonos," extremities in tonic spasm, fingers twitching, heat of surface much above the normal, skin moist; pupils, left, widely dilated; right, less so; eyes, staring and fixed, sensitive to touch, very much congested; teeth clenched; corners of lower lip, drawn down; profuse amount of frothy foam about mouth, the whole giving the face a sinister and painful expression. Respiration 36, stertorous, pulse 109', barely perceptible. *Treatment.*—After great difficulty the teeth forced apart sufficiently to admit gag. Stomach pump tube inserted, and mustard and tepid water thrown into stomach for some time, until it was thoroughly cleansed. Four ounces of carbonate of ammonia stimulating mixture injected also, and the tube withdrawn. Nine minims of 1 in 10 solution of morphia, injected hypodermically into right arm, enemæ of turpentine, soap and tepid water.

12-30 P.M.—Much the same, except that the spasms appear less, the hand can be raised with little difficulty, but the fingers are still tremulous, and shew a tendency to clutch. Respiration is still stertorous, but not so embarrassed, powers of deglutition completely lost, pulse of slightly better volume.

2 A.M.—Respiration sighing, pulse improving, spasms not so rigid, pupils contracting (vomited a short time ago). She kept in about this condition till 5 A.M., when a decided improvement was observed in her case, the spasms becoming clonic, and the twitching of fingers almost ceasing. Some milk was swallowed, and the eyelids shew a tendency to droop, the respiration, though laboured, is calmer. The features are gaining their lost expression, and the mouth can be opened with very little difficulty.

11 A.M.—Patient much improved, little or no rigidity present, but on the least noise or touch, sudden spasms are induced, which last at intervals, from 1 to 3 minutes. The eyes shift uneasily about, and the patient is restless. *Treatment.*—Sinapism to nape of neck, cold to head, bromide of potassium and chloral hydrate, of each 20 grains every 4 hours.

2 P.M.—Has regained consciousness entirely, called to her husband for a drink of water, the muscles all over have relaxed, but the fingers, when extended, have the D. T. tremor. Complains of a severe headache.

After a good night's rest, she appeared quite well and requested her discharge. The only remaining symptoms are the markedly congested eyes, and the quivering fingers. Discharged on the 2nd day in every way well.—P. Fitzpatrick, *Ind. Med. Gaz.*, 1889, p. 307.

Post-mortem appearances.—Patches of congestion in the stomach and upper portion of the small intestine ; congestion of the liver, lungs and kidneys ; engorgement of the general venous system ; both sides of the heart full of blood, but see cases above.

Treatment.—The general treatment for digitalis and strychnia poisoning. Injections of ether and morphia seem to be beneficial, see especially *cases* pp. 606 and 607.

Identification.—A shrub about six to ten feet high with linear lanceolate leaves and white or pinkish flowers (see Fig. 45, p. 604). The root is "crooked," bark thick, soft, external surface grey corky ; or young roots the corky layer is very thin and the interior yellow colour of bark is seen through it, inner surface yellow. The bark when cut or wounded exudes a pale yellow latex which is resinous and very sticky. Odour somewhat acrid, like that of a raw potato. Taste acrid and bitter.

Tests.—The following tests are prescribed by Dr. C. L. Bose and for the separation and identification of *Karabin* and *Neriodorin* in cases of poisoning by this plant.

Separation and identification of the poison in viscera, &c.—Extract obtained by Stas' process should be treated with water acidulated with a few drops of diluted sulphuric acid and then agitated successively with ether and chloroform ; the former will take up any *Karabin* and the latter *Neriodorin* which may be identified (1) by their producing the peculiar acrid

pricking sensation on the tongue followed by numbness ; (2) by their behaviour with concentrated sulphuric acid and fumes of nitric acid ; and with concentrated hydrochloric acid and heat ; and (3) by the previously described toxic symptoms produced on animals.

Behaviour with Chemical reagents.

	Neriodorein.	Neriodorin.	Karabin.
Conc. H_2SO_4 ...	Maroon brown passing to violet. On exposure to the fumes of HNO_3 or Bromine, no change was noticed.	Yellowish brown ; on exposure to the fumes of HNO_3 or Br., it immediately changes to a beautiful mauve-violet.	Light brown ; on exposure to the fumes of HNO_3 or Br., a faint violet-brown colour develops after some time.
Conc. H_2SO_4 + KNO_3.	No change ...	Reddish violet colour.	No reddish violet colour.
Conc. HCl + heat.	No change ...	Dissolves to a yellowish solution ; no separation of flocks.	Partly becomes soluble, forming a greenish yellow solution with separation of flocks of a dark greenish-blue colour.
Fehling's solution + heat.	No reduction ...	Reduction.	No reduction.
Boiled for 3 hours with 2 per cent. HCl, neutralised with KOH, and then heated with Fehling's solution.	Reduction ...	Reduction.	No reduction.

Fatal dose *for an adult human being* —Half a grain of *Karabin* nearly proved fatal to a cat. Two grains of *Neriodorin* killed a cat in 15 minutes. One grain of either of these substances may, therefore, be considered to be the fatal dose for an adult cat. From an analogy of the action of other vegetable poisons on cat and man, it will be within the mark if the fatal dose of either of these principles for the latter be fixed at five times that for a cat. In the case No. 4 about 180 grains of the root produced alarming symptoms, but did not prove fatal. As the root contains about one per cent. of *Karabin*, and probably an equal amount of *Neriodorin*, 250 grains (about ½ ounce) of the root (which would yield 5 grains of the two active principles), may be taken as the average fatal dose for an adult human being. The *Neriodorein* of Mr. Greenish which is a *Saponin* only, may be neglected as its toxic properties are of a much milder character than those of either *Karabin* or *Neriodorin*.

YELLOW OLEANDER.

Cerbera Thevetia, or Thevetia neriifolia, **Yellow** or **Exile** or 'Bastard' **Oleander** ; N. O. *Apocynaceæ*, *Pila-kanir* (Hind. and Bo.) ; *Kolkiphul* or 'yellow flower,' and *China Karab*

or 'Chinese oleander' (Beng.); *Pach-chai-alari* (*Tam.*); (see Fig. 46).—This plant, a native of the West Indies, but domes-

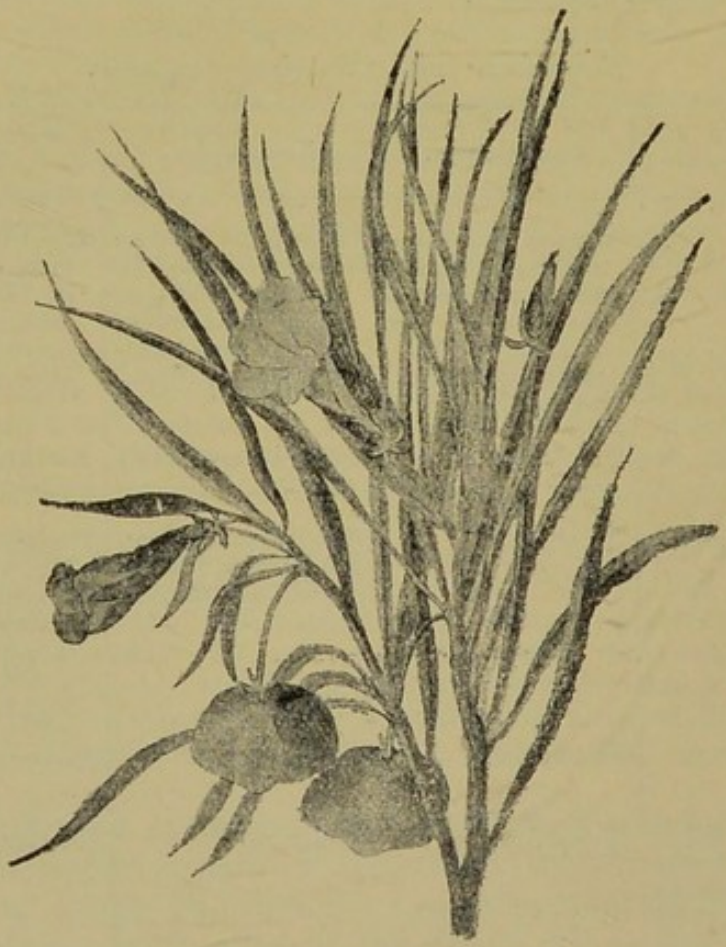

Fig. 46.—Cerbera Thevetia $\times\frac{1}{3}$.

ticated in India, is highly poisonous. It contains a glucoside, *thevetin*, a powerful heart-poison, acting similarly to digitalin.

In India it is chiefly used as a poison for suicide or by women who take it as an abortifacient. In Bengal it is especially used in Midnapur and Orissa. Of late years, the seeds have come into somewhat extensive use in some parts of the Bombay Presidency as a cattle-poison.

Symptoms.—The more prominent of these are a burning sensation in mouth with tingling of tongue and dryness of the throat, vomiting and purging, with drowsiness and dilated pupils, and depression of the heart's action somewhat resembling digitalis, like which its symptoms may be divided into the stages of (1) excitation, (2) depression, and (3) paralysis. In one case a child, æt. three, died with symptoms of tetanus after eating one seed, and in another case eight to ten of the seeds proved fatal to an adult female. A tincture of the bark has been used in

medicine as an antiperiodic ; thirty to sixty drops of a tincture, strength one to five, acts as a purgative and emetic.

Case CCLXXXIV.—**Yellow Oleander Poisoning—Suicidal.**—A Hindu woman in the Contai District of Lower Bengal in 1884 committed suicide by eating the seeds, some of which, together with the flowering tops, were sent for identification.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 16.

Case CCLXXXV.—**Suicidal Cases :—**

(*a*) Surju Bewah, a young Hindu widow, resident of village Jhowa, under the jurisdiction of Contai Thana, rubbed two seeds of yellow oleander with treacle on a mortar and swallowed them down on the 5th of June 1897, to procure abortion. Almost immediately after taking the poison, she felt a burning pain in the throat, vomited and purged several times, became much prostrated, and had several fainting fits. She was brought to hospital by the police on the following day when her pulse was found to be very soft, compressible, and slow. 52 in a minute ; the pupils were normal and acted on by the stimulus of light ; mind clear, skin soft and perspiring ; she felt giddiness in the head, felt thirsty and was much troubled with a dragging sensation in the tongue. These symptoms gradually disappeared with the exception of slowness of the pulse, and giddiness in the head, which lasted till the 9th of June, when she gave birth to a healthy male child The Chemical Examiner detected the presence of the active principle of the poison in the deposit on the stone on which the seeds were rubbed with treacle. (Report No. 1024B, 11th August 1897) She was tried by the Sessions Judge of Midnapore and was sentenced to six months' imprisonment

(*b*) Wedennissa Bibi, a Mahomedan female of Jalakhabad, a village close to Contai, took two seeds on the 18th September 1897, to commit suicide. She was admitted into hospital on the following day, suffering from purging, vomiting, pain in the throat with severe headache and fainting fits alternating with drowsiness ; pupils normal and acted on by light ; her heart-sounds were weak, and her pulse was soft, feeble and compressible, 36 in a minute. It remained so for three days ; the headache and giddiness gradually disappeared with the rise in the tone and frequency of the pulse. She was tried by the Subdivisional Magistrate of Contai and sentenced to three days' imprisonment.

(*c*) Dainu Bewah, a Hindu widow of village Aori, under the jurisdiction of Contai Thana, took two seeds on the 12th February 1898 after a quarrel with her sister-in-law. She was admitted into hospital with purging, vomiting, headache and giddiness in the head ; her heart-sounds were very weak and pulse was 140 in a minute, soft, irregular, compressible, was much troubled with a griping pain about the navel. The improvement in the pulse commenced with the abatement of headache and giddiness. She was tried by the Subdivisional Magistrate of Contai and sentenced to one week's imprisonment.

(*d*) On the 24th November 1893, Kumar Jana, fell ill with purging, vomiting, giddness in the head and fainting fits after taking a meal of stale rice, left in an open pot by his wife, with whom he was on good terms. He was brought to me for examination by the police on the night of the 27th November, when I found his pulse soft, compressible and slow, 52 in a minute ; he looked dull and walked with a slow and unsteady gait I gave my opinion that he was convalescing from *korobi* poisoning, which police on inquiry found to be correct. From the above cases it appears that this poison is used by women, not only to

commit suicide and to procure abortion, but also for homicidal purposes. The poison is a virulent cardiac sedative ; it causes death by the failure of the action of the heart. I treated first three of my cases with brandy, and was satisfied with the result ; I was afraid to try the hypodermic injection of strychnia. In case (c) I was obliged to inject ether hypodermically.—Asst.-Surgn. Jadub Kisto Sen, *Ind. Med. Gaz.*, 1901, p. 412.

Identification.—A tree about 12 feet high, with large yellow bell-shaped flower 3 inches in length, and linear lanceolate leaves about 5 inches long by ¼ inch wide. All parts of

FIG. 47.—Cerbera Thevetia nuts. (*Nat. size.*)

the plant abound in milky juice. The fruits are globular, light-green, about 1½ to 2 inches in diameter, and contain a single nut, light-brown in colour, and of a peculiar triangular shape (see Fig. 47), with a deep groove along the edge corresponding to the base of the triangle ; each nut contains two pale yellow seeds.

Tests.

The seeds and the inner layer of the bark give, when boiled with hydrochloric acid, a deep blue or bluish-green colour. Fragments of the seeds may be recognised as follows:—Exhaust with alcohol, filter, and evaporate the tincture to dryness. The residue may then be washed with ether, and the washed residue tested as follows : (1) A portion warmed with hydrochloric acid gives a deep bluish-green colour, destroyed by permanganate of potash soluiton. (2) A portion treated with strong sulphuric acid gives a brown colour, changing slowly into a rich crimson, which, on exposure, becomes deep green at the edges.

For the following chemical and physiological tests, we are indebted to Dr. Chuni Lal Bose :—Besides the deep-bluish green colour which the fresh bark or seed gives with warm hydrochloric acid (a test discovered by the late Dr. C. J. H. Warden), the seeds yield to the ethereal extract by Stas' process a white crystalline deposit (not an *alkaloid*, but more probably a *glucoside*) which, when applied to the tongue, produces a burning sensation accompanied by tingling, which often extends to the lips. There is also dryness of the throat. This sensation generally lasts from half an hour to one hour, though the tip of the tongue

may remain benumbed with a rawish feeling for a longer time. This sensation is not likely to be mistaken for that produced by *Aconitine* on the tongue, which lasts for more than six hours, and is of a less burning and more tingling character.

Cerbera Odallam (see Fig. 48).—This plant, closely allied botanically to the last, probably contains the same poisonous principle. Like the plant last described it also abounds in milky juice, and this and the seeds when heated with hydrochloric acid give a deep blue or bluish-green colour, similar to that given by *Cerbera Thevetia*. The flowers are jasmine-shaped, white, about 1 inch in length; the leaves

FIG. 48.—Cerbera Odallam.

are dark green, fleshy, and lanceolate, about 4 to 5 inches long, by 2 inches in greatest breadth. Fruits nearly globular, dark green, and contain in a cavity in the centre a single oval white seed.

ACONITE.

Aconite is one of the most virulent poisons known. All the aconites (N. O. *Ranunculaceæ*) are poisonous and some so extremely so that the general Indian vernacular name for them is *Bish* or *Bikh*, meaning '*the* poison.' The most poisonous species are *A. ferox* and *A. napellus*, which Hooker was inclined to think were merely varieties of the same species. All parts of these plants are poisonous.

A. ferox (see Fig. 49) is a native of the Himalayas, and its root forms most of the aconite-root of the Indian bazaars. It is believed to be even more actively poisonous than *A. napellus*, to which it is generally similar in appearance.

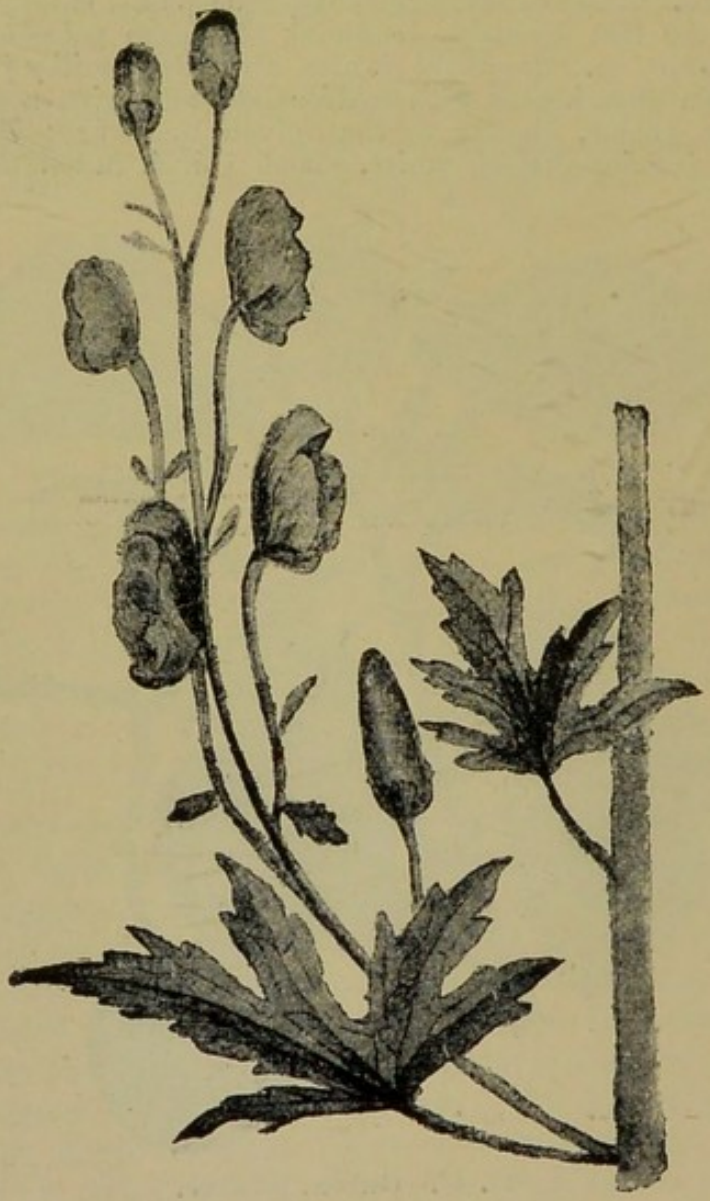

Fig. 49.—Aconitum ferox × ⅓.

A. napellus or 'monk's hood,' 'wolf's-bane' or 'blue-rocket,' is a common plant in England and grows also in the Himalayas. Its root and leaves are officinal It is perennial, two to three feet in height, with dark-green digitate leaves and an erect terminal spike of blue helmet-shaped (hence called 'monk's hood') flowers. Other extremely poisonous species are *A. luridume* from Sikhim, and *A. lycoctonum* from Kashmir to Kumaon.

Less poisonous species of aconite are :—*A. palmatum* in the eastern temperate Himalayas from Garhwal to Mishmi Hills in Assam and *A. heterophyllum* in the North-Western Himalayas. The root of the former is known in the vernacular as *Bikhma*, *Bishma* (Hindi), *Wakhma*

or Vakhma (Bombay), and of the latter as *Atis* (Hindi), *Ativisha* (Maratha), *Ativadayam* (Tamil), *Atavakha-in-kali* (Gujerati). The roots of these are smaller than those of the stronger species. They are used in native medicine as tonics and antiperiodics. Their alkaloids differ from aconitia.

The **root**, sold in the Indian bazaars, is mostly derived from *A. ferox* and is known under the names of *Bish*, *Bikh*, or *Bash-nag* (or snake-bite-preserver), *Mitha-bish* (sweet-poison), or *Mitha-teliya* (Hindi), *Bach-nab* (Bo.), *Vashnavi* (Tamil).

FIG. 50.—Aconite root (*Aconitum ferox*), natural size.

It is met with in two forms :—(1) Conical roots, see Fig. 50, three to four inches long, and half to one and three-quarters inches in greatest diameter, shrivelled with longitudinal wrinkles, and often flattened and arched. Externally they are blackish-brown ; internally, from being dried over a fire,

they are generally hard, horny, and brittle and on section darkening slightly on exposure to the air. (2) The same roots, after subjection to some soaking process, generally stated to be soaking in oil (hence called *teliya*) and cows' urine. These are black, plump, conical tubers, cylindrical in section, tough and moist, and staining the fingers brown when fresh. When dry, they are hard and brittle, and have a reddish-brown resinous fracture. They have a strong offensive odour.

Atis tubers are smaller, and *Bikhma* tubers about the same size as those of *A. ferox*, but branched. Both are externally much lighter in colour than the tubers of *A. ferox*. Both taste simply bitter, without the tingling and numbness.

The root of *A. napellus* is carrot-shaped, two to four inches long, by half an inch to an inch thick at the top, dark-brown externally, and whitish within. The fresh root has numerous long thin curling rootlets attached to it. The dry root is shrivelled longitudinally and breaks with a short fracture. Chewed, it causes tingling and numbness of the lips, &c. It may be distinguished from **Horse-radish root** which is cylindrical, longer than aconite root, and externally of a light-buff colour. Rootlets attached to it are straight ; chewed, it has a pungent taste, but does not cause tingling and numbness like aconite root.

A. ferox is extensively collected for commerce from Sandukphu, a mountain near Darjiling.[1]

The chief **active principle** of *A. napellus* is *aconitine*, while *A. ferox* owes its activity mainly to *pseudo-aconitine* which, although differing somewhat in composition and chemical properties, has the same physiological action as aconitine.

Other less active alkaloids, some of which are not poisonous, are contained in both species, two of which *aconine* and *pseudo-aconine* are obtained by the action of heat from aconitine and pseudo-aconitine respectively.

Aconitine is one of the most active poisons known, if not, the most active. It crystallizes with difficulty, so is usually met with as a white amorphous powder. The various kinds of commercial aconitine differ considerably in activity owing to more or less admixture with the other relatively inert alkaloids in the root or their derivatives.[2] English aconitine (Morson's) is more active than the German and is not bitter, but slightly soluble in water, but not very freely soluble in alcohol and ether, while the German alkaloid is soluble in all three and is bitter ; this is owing to its containing a considerable

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[1] *Among the Himalayas*, by L. A. Waddell, pp. 324-326. The name of this mountain means as Colonel Waddell pointed out "the hill of the aconite-plant."

[2] See Blyth's *Poisons*, 352 ; and Allen's *Commercial Analysis*, iii, Pt. II, for petails.

proportion of the less active alkaloids, namely, *aconine*, which is 2,000 times less active than aconitine and *benzaconin* which is 200 times less toxic.[1]

The activity of Morson's aconitine seems similar to that of the French. Dr. Harley found that $\frac{1}{1000}$ of a grain of Morson's aconitine nearly killed a cat weighing 3lbs., whilst two other cats weighing 3lbs. each died in 7½ hours and ¾ of an hour respectively from a subcutaneous dose of $\frac{1}{500}$ grain which is equivalent to ·092 mgrm. per kilo of body weight for cats. But man is much more sensitive as 1·6 mgrm. of French (Petits') aconitine nearly proved fatal, whilst 4 mgrms. by the mouth was rapidly fatal, and it is probable that 1·5 mgrm., if injected subcutaneously, would prove fatal. The medicinal dose of the B.P. tincture, 5 to 15 minims, equals approximately ·005 to ·015 grain of aconitine ; and 2 mgrm. of aconitine = ·030 grains of the alkaloid or about 30 minims of the B. P. tincture.[2]

Poisoning by the Root.—In India the root is extensively used by the wilder tribes of the Himalayas from Assam to Kashmir to poison arrows for the chase as well as for inter-tribal conflicts. In our military expeditions on the North-Eastern Frontier in Sikhim, Bhutan and Assam several of the sepoys have been mortally wounded by these poisoned arrows.

Several of these poisoned arrows used against our troops in the Aka expedition of 1884, were sent to Lieutenant-Colonel Waddell for examination and analysis, and the arrows were found to be smeared over with a paste containing aconite.[3] Septic blood is said to be mixed with the pounded root to increase its lethal effects.

The Lepchas of Sikhim have a saying that aconite is "useful to hunters for destroying tigers and elephants, useful to the rich for putting troublesome relatives out of the way, and useful to jealous husbands for destroying faithless wives." The Lepchas poisoned with aconite root the water-supply of a detachment of British troops during the expedition of 1887. Similarly the Burmese during their retreat before the British in 1842 threw bruised aconite root into a tank in the hope of poisoning the troops pursuing them ;[4] and the Gorkhas did the same in the wells in the Saran tarai against General Ochterlony's troops in the Gorkha War of 1814-16.

Accidental poisoning by aconite is occasionally met with as a result of its common occurrence in bazaars and its use as the drug by native quacks in the treatment of fever, &c. (see *Cases*

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[1] J. T. Cush in *B. M. J.*, October 8th, 1898.
[2] Blyth, *Poisons*, 357.
[3] See *Beng. Chem. Ex. Rept.*, 1885.
[4] Wallich, quoted by Chevers, *M. J.*, 136.

CCLXXXVIX a to *e*) ; also from native alcoholic liquor to which it is added occasionally (like datura) for the purpose of conferring additional intoxicating power[1] sometimes with fatal results (see *Cases CCLXXXVII a* and *b*). **Homicidal** and **suicidal** cases are not unfrequently reported (see *Cases CCLXXXVI* and *CCLXXXVIII a* to *e*), but are not so frequent as one might expect, considering how readily the drug can be obtained, and how well known are its poisonous properties. It is sometimes administered to the victim with betel-pepper,[2] so as to disguise its tingling taste.

In 1898 in Madras aconite accounted for the largest number of deaths from poisoning with any organic poison, 14 persons having died out of 22 affected in 7 cases (*Mad. Chem. Ex. Rept.* 1898) ; and Burton Brown records only nineteen cases in the Panjab in the years 1861-73. In Bengal, &c., for the three years ending 1872, only ten certain cases were recorded (five of them homicidal), and five doubtful cases ; but of late it has increased (see Appendix VIII). The Bombay Analyser's Reports for the ten years ending 1884 show only six cases, three of them accidental.

In Europe, aconite is rarely used for criminal purposes. According to Blyth, in the ten years ending 1882-83, eighty-seven cases of aconite poisoning were recorded in European medical literature, of which two were homicidal, seven suicidal, and seventy-seven accidental. It should be noted that in Europe, accidental cases sometimes arise from aconite root being eaten in mistake for horse-radish.

Action.—Aconitine or aconite root first stimulates the sensory nerves producing tingling, and then paralyses the sensory nerve-terminals causing numbness. It produces similar effects on the motor nerves and centres of the medulla and cord, while the higher cerebral centres are little affected. The motor ganglia of the heart are paralysed, the respiratory centre is slowed, death being usually due to arrest of respiration. The temperature sinks from the outset.

Symptoms.—Aconite causes tingling followed by numbness ; first, of the parts with which the poison has been in contact, *e.g.*, the lips and tongue, and subsequently in all parts of the body. This tingling, followed by numbness, is a characteristic symptom of aconite poisoning. Irritation of the stomach is also caused ; hence vomiting, sometimes violent, is

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[1] It may be mentioned here that a non-poisonous bark, namely, that of *Acacia leucophlæa*, *Hewur* (Mar.) is used in the South Concan in distilling liquor. It contains much tannin, and precipitates albuminous matters present in the juices from which the liquor is distilled : hence its employment.

[2] L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 13.

generally a constant feature. There may be diarrhœa. From its paralysing action on the motor nerves (or centres), and on the heart, other symptoms of aconite poisoning are :— great muscular weakness ; the patient staggers if he attempts to walk ; the respiration becomes slow and weak, and the pulse slow, weak, and irregular. Death may occur from shock or syncope, but usually occurs from asphyxia due to paralysis of the respiration. Convulsions may precede death. The pupil in the early stage of the case, alternately contracts and dilates, but becomes widely dilated in the later stage. The mind is usually quite unaffected, but in exceptional cases delirium has been observed. *Case CCLXXXVI* well illustrates the symptoms of aconite poisoning.

Case CCLXXXVI.—**Typical Aconite Poisoning—Homicidal.** In 1902, Monorath, a shopkeeper in the Terai was charged at Almora with murdering a fellow villager by poison. The evidence showed that the accused gave refreshment of tea to several of the villagers, including the deceased, with which latter person, the accused was at enmity. After helping all the others, accused asked deceased to bring some water from the river, and prepared, during deceased's absence, another cup of the tea, which he gave to deceased, who immediately remarked that it caused a tingling and 'pricking' of his lips and mouth, and a 'burning' of throat with nausea and a 'twisting pain' in the stomach, whereupon he taxed the accused with having poisoned him. The tingling of the lips and mouth was soon followed by numbness, and a free flow of saliva and vomiting occurred. Within less than half an hour the tingling and numbness extended to his arms, legs, and whole body, which had darting pains as if being 'torn,' he had dimness of vision, giddiness, staggering and unable to walk without assistance. He then lost power over his legs and remained lying prostrate, complaining of intense faintness. His pulse became feeble, respirations jerky and laboured, and limbs grew cold and moist to the touch. He grew gradually weaker and drowsy, and died within two hours of taking the poison. The *post-mortem* examination showed that the stomach lining was bright red and contained some bile, the small intestines contained a large amount of solid fæces which negatived cholera which with its cramps in the limbs had been put forward by the defence as the cause of death ; the brain and venous system generally were darkly congested. In the contents of the stomach an alkaloid was found possessing the properties of aconitine.—L. A. Waddell 1902.

Case CCLXXXVII.—**Homicidal Aconite poisoning by Liquor drugged with aconite.**—(**a**) (Chevers, *Med. Jur.*, p. 138). In 1834 about 70 men, 18 of whom died, were poisoned at Benares by drinking Mowa liquor obtained at a particular liquor shop. One of the servants at the liquor shop afterwards confessed to having put aconite root into the liquor —(**b**) (*Bo. Chem. Analyser's Rept.*, 1884). In a case from Morsi (Hyderabad Assigned Districts), a small bundle, taken out of the receiver of a country liquor still, was on examination found to contain a quantity of fragments of aconite root Of eleven persons, who had drunk liquor bought at the shop of the owner of the still, ten, it was stated, suffered from slight symptoms of aconite poisoning ; the eleventh, who had drunk about a quart of the liquor, died.

Case CCLXXXVIII.—**Homicidal Aconite poisoning by Food.**—(**a**) In 1899 a Muhammadan, Adibuddi of Patuakhali in Bengal, was given some poison mixed with food by his wife Moina Bibi. He vomited and purged soon after, but ultimately recovered. Aconite was detected in the vomited matter. The wife confessed to the police that she had mixed some powder with the food of her husband in order to poison him. A portion of this powder was also sent for examination, and it was found to contain aconite.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.—(**b**) (*Beng. Medico-legal Rept.*, p. 277). In a case reported from Gujranwala by Mr. R. C. Bose, a woman confessed to having killed her son-in-law, æt. 30, by administering to him half a tola (90 grains) of aconite root. "She said that, about half an hour after the imbibition of the poison, the man began to complain of pain in the stomach, numbness, tickling sensation in the throat, and subsequently of severe vomiting, followed by coldness of the extremities, collapse and rigidity of the hands and fingers. Death took place in seven hours."—(**c**) In Dinapur in Northern Bengal in 1884, a young Muhammadan, aged 19, was reported to have died by purging and vomiting after taking milk given to him by his step-mother who was suspected of deliberately poisoning him. Aconite was detected in the stomach, liver and vomited matter.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p 12.—(**d**) A Gorkha sepoy, at Dibrugarh in Assam, in 1884, had poison placed in his food by his wife between 7 P.M. and 8 P.M. On admission to hospital immediately after, he complained of tingling and numbness of lips and tongue, and pain in stomach. Latterly giddiness supervened, the tingling and numbness extended to his arms and legs, and he vomited. Skin became cold and moist, pulse small and thready, difficulty in breathing set in, and he died at 8·30 P.M. He was sensible up to time of death. The *post-mortem* examination held sixteen hours after death showed pupils widely dilated, brain much congested and its substance studded with minute points of ecchymosis, lungs much congested, heart normal, stomach distended somewhat with food, mucous lining injected, small intestine congested. Aconite was found in the stomach contents.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 13. (**e**) (Chevers, *Med. Jur.*, p. 140). "In 1854 one Anunchunder Roy, having incurred the censure of his family by his dissipated and extravagant mode of life, conceived the idea of murdering them all. For this purpose he purchased about an ounce of aconite root. He was seen pounding some of the root on a brick, and was proved to have deposited the powder in a utensil, containing a vegetable broth at his brother's house. The brother and three women partook of the broth." The brother "was taken ill almost immediately, complaining of a burning sensation in his throat and stomach, vomited once, and expired during the night." The three women suffered from similar symptoms but recovered.

Case CCLXXXIX.—**Accidental Aconite poisoning.**—(**a**) (*Bo. Chem. Analyser's Rept.*, 1875-76). In a case from Coompta a woman, after taking medicine, given to her by a quack for menorrhagia, suffered from "restlessness, depressed and irregular heart's action, coldness of the surface, numbness and tingling of the lips, tongue, and extremities, spasm of the diaphragm, and difficult respiration." The woman recovered under treatment; aconitia was detected in the vomit.—(**b**) (*ib.*, 1877-78). A man was admitted into the Jamsetjee Jejeebhoy Hospital, Bombay, suffering from symptoms of aconite poisoning. On inquiry, it turned out that he had been taking pills supplied to him by

a native hakim. Some of these pills, on examination, were found to contain cinnabar and aconite.—(**c**) (*ib.*, 1879-80). At Mahad, in the Colaba district, a man, the servant of a native Hakim, swallowed some of the preparation of aconite root he was making for his master ; death resulted, and on analysis, aconitia was found in deceased's viscera.—**(d) A typical case.** (Chevers, *Med. Jur.* p. 144.) A man, aged 35, was admitted into hospital, having about half an hour previously eaten by mistake a small portion of aconite root. "Immediately after chewing it, he felt a sweetish taste, which was soon followed by tingling of the lips and tongue, numbness of the face, and severe vomiting." On admission "he was extremely restless, tossing his limbs about in all directions, and constantly changing his position. He complained of a burning sensation in the stomach, and a tingling and numbness all over the body excepting the legs. The tingling was specially marked in the face and tongue, so much so that he was constantly moving the latter to and fro, in order to scratch it against the teeth. Retching and vomiting occurred almost incessantly, and he constantly placed his hand over the cardiac region. His face was anxious, the eyes suffused, the lips pale and exsanguine, the eyelids swollen, pupils moderately dilated and insensible to the stimulus of light. Respiration laboured, 64 a minute ; pulse, small and feeble, 66." There was inability to walk, but the man was perfectly conscious. $3\frac{3}{4}$ hours after admission, the symptoms had increased in severity, the pulse was intermittent, the tongue red and swollen, the tingling and numbness had extended to the legs. The points of a pair of scissors, four inches apart, applied to the skin of the arms and forearms, were felt as one. Applied to the thighs and legs, the two points were felt distinctly until the distance between them was reduced to less than $2\frac{3}{4}$ inches. About 9 hours after admission he began to improve, gradually recovered, and was discharged well in a few days.—(**e**) A Tibetan, a Buddhist priest at Jalpaiguri in 1884, bought several articles of food which he cooked and partook of with his friend at 9 A.M., and within an hour was attacked with a burning pain in the stomach and raging thirst, and died at 4 P.M. the same day. His friend who had eaten less, was seized with similar though less severe symptoms. He complained of tingling in the mouth and throat, numbness in limbs, dimness of vision and giddiness, and after a time became unconscious. In the afternoon he recovered consciousness, and on admission to hospital had dilated pupils, incessant thirst and vomiting, pulse weak and irregular. He ultimately recovered. In the fatal case the *post-mortem* examination showed :—Pupils dilated, internal organs generally congested, stomach highly congested and coated with bile. The stomach and its contents with portion of the liver were sent for analysis, and aconite was found in them,—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 11.

Fatal period.—Shortest recorded, twenty minutes ; longest, twenty hours ; usual, within three or four hours.

Fatal dose.—Of **the Root,** one drachm (presumably of the root of *A. Napellus*) has caused death. Chevers,[1] however, mentions a case in which fifteen grains of Indian aconite root

[1] *Med. Jur.*, p. 143

gave rise to severe symptoms, and bad symptoms have been produced by inhaling the dust arising whilst powdering the root.[1] The **Tincture of Aconite,** B.P. and I.P., is prepared from the root of A. Napellus, strength two and a half ounces to one pint. The medicinal dose of it is five to fifteen minims. Taylor[2] mentions two cases in which one drachm of the tincture caused death, and a case is reported in which fifteen minims of the tincture caused severe symptoms. In these three cases, the tincture was probably that of the old London Pharmacopœia, which was three times as strong as that of the B.P. Another tincture of aconite, known as **Fleming's Tincture,** is three to four times as strong as the B.P. tincture.[3] A case is reported in which death is believed to have occurred from the too frequent external application of **Neuraline,** a preparation containing Fleming's tincture. Another officinal preparation of the root, is the **Liniment**—strength I.P. one to one,—B.P. two to three. Lastly the B.P. and I.P. both contain an **alcoholic extract** of the leaves (of *A. napellus*), medicinal dose one-sixth of a grain gradually increased. Two grains of the extract has caused death.

One-fiftieth to one-fortieth of a grain of **aconitine** has caused alarming symptoms. Probably one-twentieth to one-sixteenth of a grain given by the mouth would usually cause death in an adult. Blyth considers that the minimum fatal dose, when given by the mouth, is even less than this, and that probably about one-fortieth of a grain subcutaneously injected would cause death. The only officinal preparation of aconitine is an ointment, strength eight grains to the ounce.

Case CCXC.—**Homicidal Aconite poisoning—Multiple.**—On 6th May 1891, three coolies of the *chamar* caste were found lying dead in the Dharamtola market; two others were unconscious, but subsequently recovered. The investigation showed that all five men had been poisoned with aconite mixed in their food by one Jitu Chamar at the instigation of Sanu Chamar. All concerned were fellow-countrymen and had been friends up to the time of the act, the cause for which apparently consisted in the fact that one of the murdered men had a quarrel with Jitu Chamar who thereupon introduced poison into the common meal of five individuals *with four of whom he was not in any way at variance.* No example could be more striking of the recklessness of the poisoner on the one hand or on the other of the small provocation required in some instances to induce the act.—C. L. Bose, *Proc. Med. Cong.*, 1894.

Case CCXCa.— **Homicidal Aconitine poisoning—Lamson Case.** George Lamson, aged 29, a Surgeon, was committed in London in

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[1] Woodman and Tidy. *For. Med.*, p. 394.

[2] *Poisons*, p. 756.

[3] Blyth, *Poisons*, p. 334.

1882 for the murder of his brother-in-law Percy John, aged 19, a cripple, who had property which would, on his death, revert to Lamson's wife, John's sister. On November 24th, 1880, Lamson having purchased two grains of aconitine, on December 3rd went to the school where the lad was, and during an interview gave him a capsule which he filled at the time with a white powder alleged to be sugar. Lamson then left and within 15 minutes John became ill, violent vomiting set in with pain in stomach, constriction of throat, and he died within three hours and three-quarters after swallowing the capsule. The viscera, vomit, &c., were analysed by Dr Stevenson of Guy's Hospital, who found aconite present in the viscera, contents of stomach and urine, and he considered that the vomit contained a quarter of a grain of aconitine. Sentence of death was passed. An attempt was afterwards made to get him off on the ground of insanity. It was urged that he had long been very eccentric, was in the habit of using enormous doses of morphia and opium as hypodermic injections, and had for a long time had a morbid habit of prescribing dangerously large doses of aconite for almost every disease. The Home Secretary refused to interfere, and he was executed.

Treatment.—Evacuate contents of the stomach, administer animal charcoal and stimulants. Keep the patient in a recumbent posture, apply friction to the surface and keep up artificial respiration. Blyth recommends hypodermic injection of **atropine** (4 drops of B. P. solution) repeated from time to time, and if tendency to syncope, tincture of digitalis in half drachm doses by the mouth or ten-drop doses subcutaneously, —see following case.

Case CCXCI.—**Aconite poisoning treated by digitalis—Recovery.**—(Apothecary Jas Forsyth, Kasauli; *Ind Med. Gaz.*, December, 1882.)—In this case the patient, who had been given aconite root by a hakim as a cure for fever, was brought to hospital in an almost moribund condition, but recovered under the following treatment:—On admission 20 minims of tincture of digitalis was subcutaneously injected, and 15 minims more a quarter of an hour afterwards. A draught, containing brandy, carbonate of ammonia, and 1 drachm of tincture of digitalis, was given about one hour after the injection, and another drachm of tincture of digitalis in three doses during the next 2½ hours.

Post-mortem appearances.—General venous congestion, congestion of the brain and its membranes, and frequently, if the poison has been taken by the mouth, some signs of gastro-intestinal irritation.

Detection and Tests—Aconitia (or pseudo-aconitia) **may be extracted from organic mixtures** by Stas' process, p. 488, conducting the evaporation at as low a temperature as possible, and using a mixture of chloroform and ether as a solvent. There are no reliable special colour tests for these alkaloids. They may, however, be identified by physiological tests, namely, by the tingling and numbing sensation produced by a cautious application of a solution of the alkaloid to the tongue or lip, and by the effects produced by administration of the alkaloid to small animals.

The importance of sending in every case of suspected poisoning, the vomited matter as well as the viscera from fatal cases is illustrated in the following cases :—

Case CCXCII.—**Detection of Aconite poisoning in the Vomit and not in the Stomach.**—(a) A resident of Dinajpur prepared one morning his usual curry, one half of which he ate and the other half he reserved for his evening meal. On return from his day's work he mixed this curry with his freshly cooked rice, and whilst eating it was attacked by vomiting and purging and died next morning. The *post-mortem* examination showed :—throat and gullet to cardiac end of stomach in a highly congested state. The medical officer forwarded for analysis (1) the stomach and its contents ; (2) two pieces of the liver ; (3) matter vomited by deceased ; and (4) some of the food of which deceased was partaking when attacked. On chemical examination no poison was found in the stomach and its contents, nor in the liver ; but aconite was found both in the vomited matter and in the food. Hence had only the stomach and its contents and liver been sent for examination, the poison could not have been detected.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 5.—(b) In Lakhimpur in Assam in 1884, a Hindu named Sukla, was reported to have been poisoned by a vegetable curry given him to eat. The man exhibited the symptoms of aconite poisoning. The *post-mortem* examination showed the stomach to be intensely congested internally in patches and contained bloody and flaky mucus. Intestines irritated in patches ; kidneys intensely congested ; also lungs ; heart relaxed. Aconite was not detected in the stomach and contents, but only in the vomited matter.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 5.

It has been already mentioned that veratria (see p. 490) has a similar action to aconitia on the sensory nerves. In addition, Quebracho bark, the bark of *Aspidospermo quebracho*, N. O. *Apocynaceæ*, used in medicine to allay dyspnœa in asthma, &c., and containing several alkaloids, among them aspidospermine and quebrachine, has a paralysing action on voluntary movement and respiration, and appears, therefore, to be a spinal poison. Tobacco and lobelia, also, are spinal as well as cardiac poisons (see pp. 599 and 600).

The **Colchicums** which exert an asthenic action on the heart have already been described amongst the Irritant Vegetable Poisons, see p. 491.

HYDROCYANIC or PRUSSIC ACID.

Poisoning by hydrocyanic acid, common in England, was some years ago almost unknown in India. Of late years, however, a few suicidal cases have been reported by the acid and by cyanide of potassium, see *Case* p. 629.

Pure undiluted hydrocyanic acid rapidly decomposes, and is not met with in commerce. Dilute hydrocyanic acid, the form in which the acid is used as a poison, is officinal in the Pharmacopœias. The dilute acid of the British and Indian Pharmacopœias contains 2 per cent. of anhydrous hydrocyanic acid ; that of various foreign Pharmacopœias ranges from this strength to 10½ per cent. (Paris Pharmacopœia) or

even more. An acid met with in commerce called Scheele's acid, contains 5 per cent.

Certain portions of many plants contain hydrocyanic acid, or yield it under appropriate treatment, owing to the decomposition of amygdalin, or substances allied to amygdalin (see *Essential oil of bitter almonds*). Hydrocyanic acid swallowed, inhaled in the form of vapour, or otherwise introduced into the system, paralyses both the brain and spinal cord, causing insensibility and loss of muscular power. Death, from large doses, occurs rapidly by syncope, due to arrest of the heart's action ; or from smaller doses, less rapidly by asphyxia, due to paralysis of respiration.

Symptoms.—These vary to a certain extent with the dose. **Small poisonous doses** cause a hot bitter taste, giddiness, pains in the head, and confusion of intellect, followed by insensibility and loss of muscular power. The eyes are bright and prominent, the face pale, and salivation with ulceration of the mouth is frequently present. The breathing often becomes stertorous, the breath smells of hydrocyanic acid, and in a very short time (see *Fatal period*) death takes place by asphyxia. Lock-jaw and tetanic convulsions, and involuntary expulsion of urine and fæces, often precede death. Vomiting has been observed, but is not a common symptom. **Large poisonous doses** cause almost immediate insensibility and rapid death from syncope. In rapidly fatal cases convulsions are not usually present, but there may be involuntary expulsion of urine and fæces. In cases of this class, death usually takes place with a forcible expiration, which may or may not be accompanied by a shriek. Some of the more important medico-legal questions which may arise in case of poisoning by hydrocyanic acid, are as follows :—

1. **Interval between swallowing the poison and insensibility.**—Large doses given to animals cause almost immediate insensibility. In man, the action of the poison appears to be less rapid ; insensibility may, however, come on in a few seconds, and is rarely, if a full dose has been taken, delayed beyond the second minute. Still, however, even when a full dose has been swallowed, considerable power of volition and locomotion may remain, and various acts may be performed in the short interval between swallowing the poison and supervention of insensibility. Hence finding the bottle, out of which the poison has been taken, corked, or even placed on a shelf or table close to, but out of reach of the body, is consistent with a supposition of suicide.

2. **As to the shriek.**—This is not nearly so frequent a symptom of hydrocyanic acid poisoning in man, as it is in the lower animals. What may be called the true hydrocyanic acid shriek accompanies the

last forcible expiration ; after such a shriek power of speech, &c., no longer remains.

3. **Presence of hydrocyanic acid in various articles of food.**—*Amygdalin*, yielding hydrocyanic acid by its decomposition, is contained in the seeds, leaves, and flowers, and sometimes the bark, of most species of the sub-orders *Amygdalæ* and *Pomeæ* of the N. O. *Rosaceæ*. Its presence in the following may be specially noted :—in bitter (but not in sweet) almonds, in apple and pear pips ; in plum, damson, cherry, peach, apricot, and quince kernels ; and also (apparently) in *loquat* seeds. The presence of hydrocyanic acid ready formed, in the root of the jatropha manihot, has already been mentioned (p. 512). It is estimated that 240 grains of bitter almond pulp, 333 grains of cherry kernels, and from about 1,200 to 2,200 grains of apple pips, are required to yield a quantity of hydrocyanic acid equal to 30 minims of the B.P. dilute acid.[1] *Kirschwasser*, a brandy distilled from wild cherries, contains hydrocyanic acid to the extent, it is said, of 1 to 4 grains in a pint. Hydrocyanic acid is also contained in chlorodyne (see p. 555).

Fatal period and dose.—Large doses have been found to kill the lower animals almost instantaneously. In man death occurs less rapidly, but has occurred as early as the second minute, and as late as one and a half hours after swallowing the poison. When the dose is 1½ drachms or more of the B.P. acid, the average fatal period is two to ten minutes. The smallest dose which has proved fatal to an adult is 0·9 grains of anhydrous acid, death occurring in twenty minutes ; recovery has, however, taken place from 2·4 grains. One grain of the anhydrous acid may, but will not necessarily, prove fatal. In estimating the amount taken, it is important to recollect that drops and minims are not necessarily the same. Woodman and Tidy state that 10 drops of hydrocyanic acid equal on an average 20 minims.[2] It may be further noted that dilution seems to make no difference to the action of the poison, but exhaustion from any cause, such as fatigue, favours its action ; also that, although it has been asserted that hydrocyanic acid may act as a cumulative poison, the weight of evidence is greatly against its so acting.

Treatment.—The best antidote is a mixture of a ferrous and ferric salt, with a little caustic soda or potash, or, if caustic alkali is not obtainable, with carbonate of soda. Inhalation of chlorine, *e.g.*, from a mixture of chloride of lime and dilute acid held near the nostrils, is also useful. The other indications are to promote vomiting, to endeavour to restore

[1] Peach kernels contain rather less amygdalin than cherry kernels ; plum kernels contain rather more amygdalin than apple pips.

[2] According to the same authorities, ten drops of chloroform or of tincture of opium equal five to six minims, and ten drops of the following tinctures equal six to eight minims :—aconite, digitalis, and hyoscyamus.

sensibility by cold affusion and inhalation of weak ammonia, and to employ artificial respiration.

Post-mortem appearances.—These may be nil, but are generally similar to those of death from asphyxia. The odour of hydrocyanic acid is often, but not always, perceptible in the body, in the brain and muscles, as well as in the stomach. The smell of hydrocyanic acid has been detected in the stomach seven or eight days after death.

Detection.—Hydrocyanic acid gives (1) with silver nitrate solution a white crystalline precipitate soluble in ammonia and in hot strong, but not in dilute nitric acid. The dried precipitate is decomposed by heat with evolution of an inflammable gas (cyanogen), metallic silver being left. (2) On adding caustic potash solution, followed by a mixture of a ferrous and ferric salt, and then by dilute hydrochloric acid in quantity sufficient to dissolve the precipitated oxides of iron, a blue precipitate (Prussian blue) will subside. (3) If mixed with a little yellow ammonium sulphide, and the mixture evaporated to dryness, the residue will be found to give a blood-red colour with ferric chloride solution, discharged by solution of mercuric chloride, but not by dilute hydrochloric acid. **In organic mixtures** hydrocyanic acid may be detected by distillation on a salt-water bath, and testing the distillate as above. Or the matters may be warmed and the tests applied to the vapour, receiving this in watch-glasses containing a drop of fluid, and inverted over the mouth of the vessel containing the matters under examination. The fluid in which the vapour is received should be silver nitrate solution for test (1), caustic potash solution for test (2), and yellow ammonium sulphide for test (3). If the fluid is alkaline, it must be first acidulated with dilute sulphuric acid, so as to liberate the hydrocyanic acid. The **quantity** present may be estimated in the distillate by precipitation as cyanide of silver; long-continued distillation may be required in order to separate the whole of the poison.

If the result of the analysis is non-detection, death may nevertheless have been due to poisoning by hydrocyanic acid. A case is recorded of death from hydrocyanic poisoning, in which analysis twenty-six hours after death failed to detect the poison. On the other hand, it has been detected by analysis seventeen, twenty-one, and even twenty-three days after death, and may be detected even if no odour of the acid is perceptible.

If the result of the analysis is detection, it may possibly be objected that the poison found (*a*) has been yielded by apple pips, cherry kernels, or the like, hence the contents of the stomach, vomited matters, &c., should always be carefully searched for such bodies, which, if found, should be separated before proceeding with the analysis; (*b*) has been yielded by the decomposition of sulphocyanide of potassium present in the saliva; this theory may account for the discovery of a minute trace of hydrocyanic acid, but not for more; (*c*) has been formed as the result of putrefaction; hydrocyanic acid, however has never been known to be formed in this way; or (*d*) has been produced by the action on organic matters of the heat employed in distillation. A high temperature, much higher than that of a salt-water bath, would be required, however, to produce even traces in this way.

Essential oil of bitter almonds, *Benzyl hydride*, or *Benzoic aldehyde*, is obtained by distillation of an emulsion of the cake left after expression of the fixed oil from bitter almonds. It is formed by

the fermentative action of emulsin, present both in sweet and bitter almonds, on amygdalin, a glucoside present in the bitter, but not in the sweet variety. During the decomposition hydrocyanic acid is also produced, which, if not removed, renders the oil poisonous. Essential oil of bitter almonds unpurified, as generally sold, contains 8 to 15 per cent. of hydrocyanic acid. Seventeen drops of the unpurified oil has caused death in an adult, and probably less would prove fatal. Essential oil of bitter almonds is also sold under the name of peach-nut oil, and a fatal case is reported, arising from its having been sold by mistake for beechnut oil. Diluted with four to eight parts of rectified spirit, it forms the almond flavour or essence of the shops, sold for the purpose of flavouring confectionery. Bitter almond water, another preparation, contains hydrocyanic acid to the extent of 0·25 to 1·0 per cent. A fatal case of poisoning by **bitter almonds** in an adult female is also reported. The quantity taken was estimated at about 1,200 grains. The symptoms, treatment, &c., in poisoning by essential oil of bitter almonds, are the same as in poisoning by hydrocyanic acid. Hydrocyanic acid may be detected in it by the vapour tests, or by applying the tests for the acid, to water which has been shaken with the oil. The purified oil—from experiments on animals—acts as an intoxicant, but is very much less poisonous than the crude oil.

Waters distilled from the following also contain hydrocyanic acid, derived from decomposition of amygdalin, or a substance allied to it:—the leaves of the **cherry laurel** (*Prunus laurocerasus*); the flowers, bark, seeds, and leaves of the **mountain ash** (*Sorbus aucuparia*); and the bark, seeds, and leaves of the **cluster cherry** (*Prunus padus*). One ounce of cherry laurel water has proved fatal to an adult, and in a celebrated case (murder of Sir T. Broughton, 1781) two ounces proved fatal in half an hour. The **blossoms of the peach** also have, from a similar cause, in two cases caused death.

Cyanides of Potassium, Sodium, and Ammonium are all intensely poisonous. Cyanide of potassium, more commonly met with than the others, contains cyanogen equal to about 40 per cent. of hydrocyanic acid. It is largely used for various purposes in the arts, *e.g.*, in cleaning gold and silver lace, plate, &c.; by photographers for removing silver stains; and by electro-platers, the ordinary electro-plating solution being silver cyanide dissolved in cyanide of potassium solution. Fatal cases have been reported from swallowing this solution as well as from swallowing cyanide of potassium; and serious symptoms have arisen from the absorption, through abrasions on the skin, of cyanide of potassium, employed for the purpose of removing silver stains from the hands. 2½ grains of pure potassium cyanide may be regarded as a minimum fatal dose. The commercial salt is, however, generally impure from the presence of potassium carbonate, produced by the action of the carbon dioxide of the air on the cyanide. In an exceptional case recovery took place after swallowing more than half an ounce of the commercial salt. The symptoms, &c., are the

same as in poisoning by hydrocyanic acid. Probably, however, after death more evidence of irritation will be found.

Case CCXCIII.—**Cyanide Poisoning—Corrosive action.**—A case, remarkable for the corrosive effects of the crude drug owing to contamination with carbonate and caustic potash, is reported by Dr. A. Powell. The angles of the lips, the mucosa of the tongue, cheeks, pharynx and œsophagus were whitened feeling soapy to the touch. The mucosa of the stomach was dissolved, leaving a red raw surface. On section the epithelum was found to have disappeared except from the bottom of a few follicles. The autopsy was made four hours after death. Several witnesses deposed that death took between seven and twelve minutes after swallowing the poison.—*Ind. Med. Gaz.*, 1902, p. 306.

Case CCXCIV.—**Prussic acid poisoning by Cyanides—Suicidal.**—(*a*) A respectable-looking Bengali Hindu, aged about 23 years was found dead on a bench in the Eden Gardens, Calcutta, on the 11th July 1899. A bottle containing cyanide of potassium was found tied in his chaddar. In his right hand were found three lumps of potassium cyanide; a reddish froth was issuing from his mouth. In the pocket of his coat was found a tram ticket for the Chitpore car. Some prepared betel, a knife and a slice of ripe mango were found close to the dead body. The body could not be identified. The viscera were forwarded for chemical examination, and prussic acid was discovered in them. It is evident that the man went to the Eden Gardens to commit suicide by taking cyanide of potassium. Cyanide of potassium is freely sold in shops in the bazar without any restrictions.

(*b*) In another fatal case, in 1899, a gilder committed suicide by drinking some silverising solution (cyanide of silver dissolved in cyanide of potassium).—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case CCXCV.—**Homicidal Cyanide poisoning with John Hunter as a medical witness.**—G. V. Poore, in the *Clinical Journal* of August 23, 1899, discusses cyanide poisoning and cites the case of the King *vs.* Donellan. The case is especially interesting, as the celebrated John Hunter made his appearance upon the witness-stand in that case. In 1780 Captain Donellan was put upon trial for the murder of his brother-in-law, Sir Theodosius Boughton. Donellan and Boughton lived in the same house, and it was known that the former would benefit pecuniarily by the death of the latter. An apothecary had prescribed for Boughton, and the draught, which was supposed to be a purge, was administered by the mother of the deceased, though she noticed when administering it that it smelled of bitter almonds. Boughton died half an hour after taking it in convulsions. Donellan emptied and rinsed out the bowl which had contained the draught. Captain Donellan had a chemical "still" in his room, which he had given to a servant to clean a few days previously, it having been recently used. The medicine which had been administered by the apothecary contained no oil of bitter almonds.

The body of Boughton was exhumed and evidences of congestion were found. Hunter was called as a witness. He testified that the *post-mortem* signs were all due to putrefaction, and that death might have been due to apoplexy; the head not having been opened, it was impossible to say whether this was so or not. Being asked in cross-examination whether the fact of a man in perfect health, dying in convulsions immediately after swallowing a draught, did not point to poison, he replied: "If I knew the draught were poison, I should say

most probably that the symptoms arose from that; but when I do not know that the draught was poison—when I consider that a number of other things might occasion his death—I cannot answer positively to it." Hunter admitted that it was not very probably that Sir Theodosius Boughton died of apoplexy. The final question asked by the Court was: "Give me your opinion in the best way you can, one way or the other, whether, upon the whole of the symptoms described, death proceeded from that medicine or from any other cause;" to which Hunter answered: "I do not mean to equivocate, but when I tell the sentiments of my own mind—what I feel at the time—I can give nothing decisive." The judge made the following comment on the testimony of Mr. Hunter: "For the prisoner you have had one gentleman called; he is likewise of the faculty, and a very able man. I can hardly say what his opinion is, for he does not seem to have formed any opinion at all of the matter. He, at first, said he could not form an opinion whether the death was or was not occasioned by the poison, because he could conceive that it might be ascribed to other causes. I wished very much to have got a direct answer from Mr. Hunter, if I could, what upon the whole was the result of his attention and application to the subject, and what was his present opinion, but he says he could say nothing decisive. So that, upon this point, if you are to determine upon the evidence of the gentlemen who are skilled in the faculty only, you have the very positive opinion of four or five gentlemen of the faculty that the deceased died of poison. On the other hand, you have what I really cannot myself call more than the doubt of another; for it was agreed by Mr. Hunter that the laurel-water would produce the symptoms which are described. He says an epilepsy or an apoplexy would produce the same symptoms, but as to apoplexy, it is not likely to attack so young and so thin a man as Sir Theodosius was; and as to epilepsy, the other witnesses tell you that they do not think the symptoms which have been spoken of do show that Sir Theodosius had any epilepsy at the time." The jury brought in a verdict of guilty, and Captain Donellan was executed a few days thereafter.

A remarkable circumstance which came to light afterwards was that a still that had been recently used was discovered on the premises. Donellan was so bad a chemist that on being asked for what purpose he had procured this machine, he replied: "I used it to make lime-water to kill flies." In his laboratory there was found a single number of the *Philosophical Transactions*, and of this volume the leaves had been cut in only one place, which opened to an account of the mode for making laurel-water by distillation.

John Hunter, in the opinion of Poore, made a phenomenally bad witness, yet he says that one cannot help agreeing with many of the doubts that Hunter raised in this case.

Mercuric Cyanide.—This, already mentioned as a poisonous mercuric salt, according to some authorities, acts like hydrocyanic acid. **Silver Cyanide** also, from experiments on animals, appears to act like hydrocyanic acid, but is much weaker; it contains cyanogen equal to about $\frac{1}{8}$th of its weight of hydrocyanic acid. A case of attempted suicide by swallowing cyanide of silver, in which recovery took place under prompt treatment, recently occurred near Poona.

Case CCXCVI.—**Homicidal Cyanide poisoning by post.**—Several cases of cyanide poisoning by post occurred in New York in 1888. In one of these H. C. Barnet, whose death was deliberately planned

did not die until after ten days' illness.—(*Medicine*, February 1889), p. 174.

Potassium Ferrocyanide.—Yellow prussiate of potash, under ordinary circumstances, is either not poisonous, or only very feebly poisonous. When acted on by acids, however, it yields HCy. In one case, death resulted from swallowing a dose of this salt followed by one of tartaric acid; and in another, from swallowing a dose of the salt, followed by a mixture of nitric and hydrochloric acids. Other ferrocyanides probably act similarly to potassium ferrocyanide.

Potassium Sulphocyanide is poisonous, but not very active. The **Cyanates** (from cyanic acid, HCNO) are asserted to be non-poisonous. **Cyanuric acid**, however, Blyth states, causes symptoms and effects similar to those produced by hydrocyanic acid.

Other Cardiac poisons.—In addition to the foregoing, the following vegetable irritants already described appear to possess an action on the heart similar to that possessed by digitalin:—**Scillitin,** the active principle of squill, and probably also Superbine, from *Gloriosa superba*. **Helleborein,** from Helleborus niger and H. viride. **Anemonin,** from Anemone pulsatilla, &c., and **Adonidin,** from Adonis vernalis.

An action on the heart similar to that of digitalin appears also to be possessed by the following:—**Antiarin,** a glucoside contained in *Antiaris toxicaria*, a native of Java, where the milky juice of the plant is used as an arrow poison. **Strophantin,** a poisonous principle contained in *Strophantus hispidus*, N. O. *Apocynaceæ*. **Apocynin,** a poisonous principle contained in the root of *Apocynum cannabinum*. **Erythrophleine,** an alkaloid obtained from the bark of *Erythrophlœum guineense*, a native of West Africa. **Euonymin,** a glucoside contained in *Euonymus atropurpureus:* and by **Tanghinia venenifera,** or Madagascar ordeal poison.

Saponin and several vegetable irritants, appear to possess an action on the heart similar to that possessed by digitonin.

ASPHYXIANTS.

Carbon dioxide, Carbonic Acid Gas.—This gas is a product of respiration, combustion, and fermentation, and of the decomposition of organic matter. It is also evolved during the decomposition of carbonates by heat, as in lime-burning; or by acids, as in the chemical preparation of the gas. Poisoning by carbon dioxide is usually accidental. In some countries, however, *e.g.*, France, exposure to the fumes arising from a pan of burning charcoal placed in a room, the door, windows, &c., of which have been tightly closed, is a favourite method of committing suicide. (See also Carbon monoxide.)

Accidental cases may arise from carbon dioxide disengaged in any of the ways mentioned above; for example, from carbon dioxide evolved as a product of (1) **Respiration,** as when they occur in consequence of a number of persons sleeping in a small, badly-ventilated

room. (2) **Combustion,** in a similar way to the suicidal cases mentioned above. Accidental cases of this kind have occurred in India. (See *Case CCXCVII*). Under this head also, come cases of poisoning by "choke damp," or carbon dioxide, formed as a product of a coal mine explosion. (3) **Fermentation** ; carbon dioxide evolved in this way is liable to accumulate in vats in which fermentation has been conducted, *e.g.*, brewers' vats, rendering descent into the vat, in order to clean it, dangerous to life. (4) **Decomposition of organic matter.** Carbon dioxide thus produced is liable to collect in old wells, pits, vaults, &c., and to give rise to accidents. Descending into pits used for storing grain, which have been closed for some time, may result in death from carbon dioxide poisoning. A case of this kind occurred in 1888, in the hold at a ship of Calcutta. (See *Case CCXCVIIa*). (5) **Decomposition of carbonates.** Persons sleeping close to a lime-kiln have died of carbon dioxide poisoning ; and Taylor mentions a case of accidental poisoning, arising from the use of chalk to neutralize a quantity of nitric acid which by accident had leaked into a room.

Case CCXCVII.—**Accidental poisoning by Carbon dioxide.**—(*a*) Dr. Moffatt reports that four men were brought one morning to the dispensary at Naini Tal in a state of insensibility. They had been found in a closed room 6 × 8 × 7 feet, with a pan of charcoal between them. The previous night had been a very cold one. Of the four one never recovered sensibility, and died shortly after admission. The other three are described as being, soon after admission, in a drowsy semi-conscious state ; when shaken and spoken loudly to, they could be made to sit up and answer questions. Their eyes had a filmy look, the pupils were dilated, the pulse small and weak. Two of the three recovered completely ; the third was attacked with œdematous erysipelas, and died four days after admission. (*Ind. Med. Gaz.*, 1877, p. 184). (*b*) A very similar case, in which five persons were poisoned, of whom one died, occurred at Nowshera (see *ib.*, March, 1885).

Case CCXCVII a.—**Poisoning by gases from decomposing grain.**—In 1888 thirteen men were poisoned by gas in the hold of the Steamer *Clan McIntosh* at Calcutta. A few days before the catastrophe a lot of fodder (hay) which had been kept on deck in one of the sheep-pens was, owing to heavy weather, put into the lower store-room, which also contained some bags of grain, paddy, gram, barley, &c. This fodder may have got wet before it was removed below ; but there was no evidence to show whether these articles had actually become damp, because the lower store-room was flooded with water after the bodies had been recovered. There was no leak into the store-room, but a leak was discovered close by, and one of the witnesses thought it possible that leakage may have taken place into the room.

An unpleasant smell was observed about the place for a few days previous to the accident, and this was traced to the ventilators of the upper store-room. The steward had been down the previous day with a disinfectant. The smell was described as a smell of bilge and was plainly perceived coming through the hatchways when the bodies were being hauled up, and one of the survivors, who had been into the lower room, stated that it became stronger and more unpleasant as he descended. It was probably this smell that induced the chief steward, accompanied by three firemen, to visit the lower store-room. They were observed to fall down, and several of the officers and crew promptly descended into the hatchway for the purpose of bringing them up. The light which they carried went out, and they speedily became insensible.

Of thirteen persons who entered the lower store-room eight revived on being brought on deck. The remaining five bodies were not recovered for two hours and a half, and when they were, life was extinct. The Surgeon of the ship, Mr. Thomas Gibbard, M.R.C.S., was in attendance, and rendered every aid in his power. He deposed that the five men died of asphyxia, and that the eight who recovered suffered from symptoms of asphyxia. He thought this was due to a mixture of carburetted hydrogen gas and carbonic oxide. Mr. Pedler, Professor of Chemistry in the Presidency College, was examined as an expert, and stated it as his opinion that wet hay or rice or grain might, under a high temperature, undergo fermentation and produce carbonic acid gas, and that this gas would gravitate and remain in an unventilated chamber.

(*b*) (*Ind. Med. Gaz.* for 1874, p. 295).—Dr. Gardner, of Saharunpore, reports a case in which three men died shortly after descending into a pit used for the purpose of storing grain. The pit had just been opened, but instead of, as is customary, leaving it open for some time before allowing any one to descend, the owner being afraid of rain, sent his servants, four in number, down at once. The fourth man was also attacked, but recovered. The *post-mortem* appearances in the three fatal cases were those of death from apnœa, with numerous sub-pleural ecchymoses, of a dark purple colour.

Symptoms.—When pure, carbon dioxide causes spasm of the glottis and death from apnœa ; diluted, it appears to act as a narcotic poison,[1] causing narcotism, followed by coma and death. The more the gas is diluted, the more gradually it produces its effects. If much diluted, there is at first headache, giddiness, and singing in the ears, gradual loss of muscular power. Usually the face is livid, and there is palpitation, and hurried respiration. Gradually narcotism supervenes, deepening into coma with stertorous breathing. Sometimes vomiting and convulsions are present.

Toxic percentage.—Considerable difference of opinion exists on the question, what percentage of carbon dioxide present in air may be considered to render it poisonous. When carbon dioxide is simply **added to air** containing its normal percentage of oxygen, probably eight to ten per cent.—some say more—would be required. When developed at the expense of the oxygen of the air by **respiration**, probably five per cent. would suffice ; very much less than this would probably cause distress in most persons, and two per cent., it is stated, occasions severe suffering. When developed at the expense of the oxygen of the air by **combustion,** carbon monoxide is usually at the same time formed, which being more poisonous than carbon dioxide, augments the toxic action of air vitiated in this way. It is very important to note that a candle will continue to burn in air containing a poisonous percentage of carbon dioxide.

[1] It is alleged by some that carbon dioxide is not poisonous, and that its apparently poisonous action on animals is simply due to their being deprived of oxygen.

Post-mortem appearances.—The face may be pale, or livid and swollen. The tongue is often protruded and grasped by the teeth; sometimes there is froth at the mouth and nostrils. Internally, the appearances are similar to those of death by apnœa. Usually there is much congestion of the brain and its membranes, and of the abdominal viscera.

Treatment.—Remove the patient at once into pure air. Endeavour to restore sensibility by cold affusion and galvanism. Employ artificial respiration, and if there is much congestion, moderate bleeding may be resorted to. Obviously, if a person on descending into a pit or vat is seen to fall immediately insensible from poisoning by carbon dioxide, to allow others to descend to his rescue is apt to lead only to a useless waste of life. Taylor cites a case where two men lost their lives in this way in attempting to rescue a boy who had fallen into a brewer's vat. Before persons are allowed to descend, the carbon dioxide should be chased out by driving fresh air into the pit or vat; or lime may be thrown down to absorb the gas.

Quantitative estimation.—This may be effected by filling a large narrow-necked vessel of known capacity with the air to be examined, and adding a measured quantity of lime-water, the alkalinity of which has been first ascertained by a standard solution of oxalic acid. The vessel is then tightly closed, well shaken, and allowed to remain at rest for twenty-four hours. After this, the bottle is opened, the fluid poured out, a measured quantity (say equal to half the volume of the fluid originally poured into the bottle) separated; and the loss of alkalinity ascertained by titration as before, with standard oxalic acid solution. The loss of alkalinity of the whole fluid corresponds to the amount of lime converted into carbonate by the carbon dioxide contained in a quantity of the air under examination, equal to the capacity of the vessel, minus the volume of lime-water used.

The quantity of carbon dioxide likely to be present in an enclosed space, *e.g.*, a room, in which the air has been vitiated by respiration or combustion, may be approximately estimated from the following data. Normal air contains on an average four volumes of carbon dioxide per 10,000 of air. Each adult may be considered to give out from a half to six-tenths of a cubic foot of carbon dioxide per hour.[1] A candle or small lamp gives off about half a cubic foot per hour. If charcoal has been burnt in the room, the amount of carbon dioxide[2] evolved may be approximately inferred from the weight of the residual ash. Roughly, one pound of charcoal corresponds to twenty-nine cubic feet of carbon dioxide, and leaves about half an ounce of ash.

Carbon dioxide is about half as heavy again as air of the same temperature. Like other gases, it expands and becomes lighter as the temperature rises. Gases, however, diffuse into one another, even

[1] As the air gets vitiated the amount given out per hour decreases a little.

[2] A portion of the carbon, however, will probably have become converted into carbon monoxide, which is more poisonous than carbon dioxide.

against gravity. Hence, for a certain time after it has been evolved, hot carbon dioxide will be found in greatest quantity in the upper, and cold carbon dioxide in the lower strata, of a confined portion of air. After a time, however, the gas will have become uniformly distributed by diffusion. After this has taken place, separation by gravity does not occur.

Carbon monoxide, or Carbonic oxide.—*Carbon monoxide* is obtainable by passing carbon dioxide over red-hot charcoal. A certain quantity of it is always formed during the combustion, under ordinary conditions, of charcoal or other carbonaceous fuel, the amount being greatest when the combustion is least active, and *vice versâ*. It is a powerful narcotic poison, much more powerful than carbon dioxide. Death from inhalation of the products of combustion, *e.g.*, the fumes of burning charcoal, is probably in many cases due to carbon monoxide poisoning.

After death from poisoning by carbon monoxide, the blood is found bright-red in colour, not darkened, as in carbon dioxide poisoning. This is held to be due to the carbon monoxide forming, with the hæmoglobin of the blood, a compound of a red colour (carbonic oxide hæmoglobin). It is asserted by some that this compound is so stable that it cannot be broken up by simple exposure to air or oxygen; and hence, that in poisoning by carbon monoxide, artificial respiration is useless, and transfusion of arterial blood the only remedy. Others deny this, and hold that the compound does break up on exposure of the blood to air.

Coal gas.—The escape of this gas into badly ventilated rooms has frequently given rise to narcotic poisoning. The chief (according to some, the only) poisonous constituent of coal gas is carbon monoxide. The quantity of carbon monoxide present varies in different specimens. Usually the amount present is 5 to 11 per cent., but as much as 22 per cent. has, it is stated, been found. The constituent usually present in largest quantity in coal gas is methane or light carburetted hydrogen (40 to 45 per cent or more). Methane, even when present in air in quantity sufficient to form an explosive mixture ($5\frac{1}{2}$ per cent. or over) appears to exert little or no toxic action. Its presence in air, however, is a source of danger to life from the risk of an explosion, which may cause mechanical injury or result in poisoning by carbon dioxide.

Sulphuretted Hydrogen, H_2S.—The decomposition of organic matter may result in the production of this gas, directly, when the matter undergoing decomposition contains sulphur indirectly, when the decomposition takes place in presence of a soluble sulphate. In the latter case the sulphate yields a sulphide which, when acted on by carbonic or other acids, evolves H_2S. Accidental poisoning by sulphuretted hydrogen is liable, therefore, to occur from exposure to the emanations from decomposing organic matter, *e.g.*, in cesspools or sewers. This liability is increased, if an acid liquid finds its way into the sewer. It was to this that Dr. Letheby attributed the accident in the Fleet Lane sewer in February, 1861. Agitation also, of the liquid in the sewer, &c., favours the evolution of the gas.

Symptoms.—When concentrated, it causes immediate death. When dilute, it gives rise to nausea and the usual symptoms of narcotic poisoning, *e.g.*, headache, giddiness, and laboured respiration, followed by coma. Sometimes delirium and tetanic convulsions are present.

When very much diluted, the symptoms are chiefly nausea and abdominal pain, with febrile disturbance.

Post-mortem appearances.—The body exhales an offensive odour, putrefaction is rapid, and the blood is fluid and dark-coloured; there is general congestion of the viscera, and engorgement of the right side of the heart. Woodman and Tidy lay stress on the presence of a dirty brown deposit smeared over the lining membrane of the bronchial tubes, as characteristic of death from sulphuretted hydrogen.

Treatment.—Immediate removal into pure air, cold affusions, stimulants, and inhalation as an antidote, of dilute chlorine, as in hydrocyanic poisoning.

Detection.—Free sulphuretted hydrogen is readily recognised by its characteristic odour of rotten eggs, and by its blackening paper moistened with solution of lead acetate. Sulphides—those of the heavy metals excepted—are decomposed by dilute acids, sulphuretted hydrogen being set free.

Sewer gas may contain, in place of sulphuretted hydrogen, the vapour of hydrosulphide of ammonium, which appears to be equally poisonous. Or again, sewer gas may only contain sulphuretted hydrogen in small quantity, and but little carbon dioxide but still produce asphyxia in those breathing it, owing to its consisting almost wholly of nitrogen, *i.e.*, of deoxidised air.

Nitrous oxide or Laughing gas.—This is used as an anæsthetic instead of chloroform, and has caused several deaths. Death from inhalation of laughing gas appears to be due to asphyxia; indeed, it has been asserted that the anæsthetic effect of the gas is due to the production of temporary asphyxia, owing to the circulation of non-oxygenated blood, the blood having no power to separate the oxygen contained in this gas.[1]

Carbon disulphide, Bisulphide of carbon, CS_2.—This liquid, owing to its solvent action on sulphur, caoutchouc, ordinary phosphorus, and other substances, is largely used in certain industries. The vapour of carbon disulphide, from experiments on animals, has been shown to be a narcotic poison, acting very similarly to chloroform. Cases of chronic poisoning by carbon disulphide vapour, have been observed among the work people in factories where the liquid is largely used. The symptoms observed in these cases have been a stage of excitement, followed by one of depression. The first stage begins with headache, indigestion and nausea, and creeping sensations, followed by irritability and excitement of the nervous system, which may terminate in mania. In the second stage there is anæsthesia of the skin and mucous membranes, mental debility, and muscular weakness which may culminate in paralysis.

PERIPHERAL POISONS.

These especially act on the motor nerve terminals end-plates. There is no recorded instance of poisoning by them in India except by cocaine, see p. 563.

Conium—*Conium maculatum*, or Spotted Hemlock, N. O. *Umbelliferæ*; *Showkran* (Arab.), *Kirdamana* (Bo.)—This is a common plant

[1] Joylet and Blanche, quoted by Taylor, *Manual*, p. 445.

in Europe and temperate Asia. The whole plant has a 'mousey' fœtid odour and is poisonous, the leaves and fruit are officinal B.P. and I.P. It was the Athenian State-poison by which Socrates died. Cases of poisoning by conium are somewhat rare. Falck[1] found seventeen recorded in medical literature, of which fourteen were accidental, chiefly from the plant being mistaken for parsley or some other harmless herb. One case is recorded of a child, who died poisoned by conium, from blowing whistles made of conium twigs.

Conium contains a poisonous liquid alkaloid, *conia*, and a less poisonous crystalline alkaloid, *conhydrine*. These are similar in action, paralysing first the peripheral extremities of the motor nerves, and subsequently their trunks. In addition, commercial conia has been found to contain a variable quantity of methyl-conia, a liquid volatile alkaloid, which paralyses the cord. The prominent symptoms of conium poisoning are muscular weakness with loss of power to swallow, the weakness deepening into complete paralysis, affecting the extremities first, and afterwards the trunk. The pupils are dilated, there is ptosis, and sometimes convulsive twitchings. Consciousness remains until asphyxia sets in. Death occurs rapidly, by asphyxia due to paralysis of respiration, usually in one to four hours. The medicinal dose of the powdered leaves is two to eight grains, and of the tincture of the fruit — strength 1 to 8—20 to 60 minims. According to Woodman and Tidy, one drop of the alkaloid conia may be regarded as a poisonous dose.

Treatment.—General, as for spinal poisons.

Post-mortem appearances.—Those of death by apnœa.

Identification.—The stem of the plant is described by Guy as tall, smooth, glossy green, and dotted with brownish purple spots. The root is tapering, and in shape something like a parsnip, for which it has been mistaken. The leaves are deep green, and have often been mistaken for parsley leaves, from which, however, they differ greatly in shape.

According to the Pharmacographia, the fruit, as met with in the shops, "consists of the separated mericarps, which are about one-eighth of an inch long. The dorsal surface of these have five prominent longitudinal ridges, the edges of which are marked with little protuberances giving them a jagged or crenate outline. . . . The furrows are glabrous, but slightly wrinkled longitudinally; they are devoid of vittæ." The absence of vittæ distinguishes hemlock fruits from other fruits of the same N. O. All parts of the plant, when bruised and moistened with potassic hydrate solution, give out a peculiar mousey odour.

Conia may be separated from organic mixtures by Stas' process, using petroleum ether as a solvent, and conducting all evaporations, &c., at a low temperature. It is recognised by its peculiar mousey-like odour and its action on animals. Schwarzenbach[2] gives the following colour test for conia: "If dropped into a solution of alloxan, the latter is coloured after a few minutes, an intense purple red, and white needle-shaped crystals are separated, which dissolve in cold potash-lye into a beautiful purple blue." Conia coagulates albumen, and gives an amorphous precipitate with mercuric chloride solution: these characters distinguish it chemically from nicotine (see p. 600).

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[1] Blyth, *Poisons*, p. 253.

[2] Blyth, *Poisons*, p. 251.

Curara, or Wourali.—This substance also called *Urari* or *Tikunas* is a black resinoid mass, almost wholly soluble in water, used by the South American Indians as an arrow poison. It is believed to be an extract from a species of *Strychnos*, probably *S. toxifera*, mixed with other matters. When swallowed, it usually causes no symptoms of poisoning. Introduced into a wound, it acts like conia, paralysing the motor nerves, and causing death by paralysis of respiration. It contains an alkaloid curarine, sparingly soluble in chloroform, and giving a purple colour with strong nitric acid.

The following **alkaloids** are **similar** in **action** to conia and curara :— **Sparteine,** a liquid volatile alkaloid, contained in common broom (see p. 492). **Staphisagrine,** one of the alkaloids contained in stavesacre (see p. 490), and **Methyl-strychnia, Methyl-brucia,** and **Methyl-thebaia,** alkaloids obtained from respectively strychnia, brucia, and thebaia, by the substitution of methyl for hydrogen. It may be noted that this substitution, in the case of the alkaloids just mentioned, converts central into peripheral spinal poisons. In the case of conia, a similar substitution converts a peripheral into a central spinal poison (see Methyl-conia, pp. 637 & 598).

The Somalis on the East Coast of Africa prepare for hunting and war a paralysing arrow-poison from the extract of the root of 'Oubain,' a tree allied to the *Carissa schimperi*; though the term would seem to be used perhaps in a general sense, for one form of Oubain brought from the Harmassia country by Dr. Macpherson consisted of an extract from the wood and leaves of *Acokanthera schimperi*, and proved to be a most virulent paralysing poison of the motor nerve-terminals.

APPENDICES.

I.

The Bengal "Tichborne" Case.

CASE OF DISPUTED IDENTITY.

The case of Pratap Chandra, the claimant to the Burdwan Raj, resembled in many respects the Tichborne case (p. 47). It was tried in 1838 at Hooghly. The *rāja* of Burdwan at the beginning of last century had an only son, Pratap Chandra, who died in 1820-1821 during the lifetime of his father. Fifteen years afterwards in 1835 a pretender appeared calling himself Pratap Chandra and claiming the Burdwan estate. He came in the garb of a *sanyasi*, and declared that he had not died as was alleged, but had been living in secret retirement and had now returned. His story gained considerable credence, and some of his adherents created a breach of the peace for which he was imprisoned for six months. On release from jail he was provided with funds by some of those who believed in him and went in royal state with a large following to take forcible possession of the palace, causing a disturbance in the quelling of which three persons were shot by the military. He was indicted for fraudulently assuming the name and title of the deceased *rāja*. The death of the real Pratap Chandra was testified to by the native doctors who treated him, and other persons who saw him die of fever and who were with the corpse until it was cremated, also the priests who performed the *sradh* ceremonies. The face of the corpse was uncovered and then touched with fire three or more times, and the fire having burned the corpse to ashes in the presence of two or three thousand spectators, it was impossible that the body could escape. The identity of the claimant was rejected by Mr. H. T. Prinsep, Secretary to the Government of India, and several others who had known the Pratap Chandra. Whilst General Allard, Major Marshall, Dr. Scott, Civil Surgeon of Burdwan, Dr. Halliday and others believed he was the real Pratap. The prosecution alleged that he was Kristo Lal, son of a priest, formerly resident of Burdwan. Several witnesses testified to the claimant being the latter person, also the prisoner's voice and manner were quite different from those of Pratap, but his features, especially in the shape of the nose and the colour of the eyes, resembled a picture of Pratap. Major Marshall identified him as Pratap by certain marks, though the nose of the young *rāja*, 20 years before, was "rather fuller and smoother and the outline not so distinct" to the prisoner's at present. The Danish Governor of Chinsurrah, who was well acquainted with Pratap, identified prisoner as the real prince by certain scars, namely, a slight mark behind the right ear occasioned by the glazed string of a kite. A mark

between the shoulders caused by the bite of a vicious horse, a mark on the knee and a scald mark, the size of an eight-anna piece, on left hand. *The prisoner possessed all these marks.* The judge held that the case was proved against prisoner and recommended that he be sentenced to three to five years' imprisonment. The High Court (Nizamat) sentenced him to a fine of Rs. 1,000 for having assumed the name of Pratap Chandra. He died in obscurity in 1856. (Abridged from *Celebrated Trials* by J. Goshal, 1902.)

II.

Legal Definitions of an "Offence," and its Entailed Punishment.

In India, offences are defined, and the punishment awardable for each offence limited, by the **Indian Penal Code** (Act XLV of 1860), certain general provisions of which may be here considered.

A. Acts are not offences if they come under certain **general exceptions** laid down in the Code. The principal of these are, that acts are not offences if done—

I. By a child under the age of seven. (*S.* 82).

II. By a child between the ages of seven and twelve (not as in England between the ages of seven and fourteen), "who has not attained sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion." (*S.* 83).

III. By a person of unsound mind, "if by reason of unsoundness of mind the doer of the act is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." (*S.* 84).[1]

IV. By an intoxicated person, but only, provided,

(1) "the thing which intoxicated him was administered to him without his knowledge or against his will;" and

(2) when by reason of the intoxication so induced, the intoxicated person is "incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." (*S.* 85).

V. In good faith, and for the benefit of the person on whose body the act is done (under this exception come surgical operations), provided certain conditions are complied with, the chief of which are—

1. That the act must not be intended to cause death. (*S.* 88).

2. That the act must not of itself be an offence independently of any harm it may cause to the person on whose body the act is done; *e.g.*, causing miscarriage, except for the purpose of saving the life of the mother. (*S.* 91).[2]

3. That the act is done with the **consent of the sufferer**, such consent—

a. Not being known to the doer of the act to have been given under fear of injury or misconception of fact:

b. Not having been given by a person under twelve years of age;

c. Not having been given by a person who by reason of unsoundness of mind or intoxication is unable to understand the nature and consequence of that to which he gives his consent. (*S.* 90).

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[1] See also Insanity, p. 360. [2] See also Causing Miscarriage, p. 292.

Consent of the sufferer may, however, be dispensed with, if—

a. He is of unsound mind or under the age of twelve, if the consent of the person having lawful charge of him has been obtained (*S.* 89); or

b. The circumstances are such that it is impossible for him to signify his consent, and he has no person in lawful charge of him from whom it is possible to obtain consent in time for the thing to be done with benefit. (*S.* 92.)

But in those cases **where consent is dispensed with,** an act which is known to be likely to cause death or grievous hurt,[1] may only be done for the purpose of preventing death or grievous hurt, or for the curing of any grievous disease or infirmity. (*S.* 89.)

B. An offence may be committed by illegal omission (*s.* 32); thus, a woman may commit murder by intentionally omitting to supply her infant with food.[2]

C. Attempts to commit offences are, in some cases, punishable under special sections of the Code, *e.g.*, an attempt to commit murder (*s.* 307), or culpable homicide not amounting to murder (*s.* 308), or suicide (*s.* 309). Attempts not punishable under special sections of the Code, are dealt with by *s.* 511: "Whoever attempts to commit an offence punishable by this Code with transportation or imprisonment, or to cause such an offence to be committed, and in such attempt does any act towards the commission of the offence, shall, where no express provision is made by this Code for the punishment of such attempt, be punished with transportation or imprisonment of any description provided for the offence, for a term of transportation or imprisonment which may extend to one-half of the longest term provided for that offence, or with such fine as is provided for the offence, or with both."[3]

D. The punishments awardable for offences are defined by *s.* 53 of the *Penal Code* to be: 1, Death. 2, Transportation. 3, Penal servitude. 4, Imprisonment, which may be either (*a*) Rigorous, that is, with hard labour; or (*b*) Simple, that is, without hard labour. 5, Forfeiture of property. 6, Fine. And under Act VI of 1864, whipping may be awarded for certain offences. The chief medico-legal points in connection with these punishments are:—

I. Death.—This (see *s.* 368 of Act X of 1882, the Code of Criminal Procedure) must be by hanging. Pregnancy may be pleaded in bar of execution: "If a woman sentenced to death be found to be pregnant, the High Court shall order the execution of the sentence to be postponed, and may commute the sentence to transportation for life." (*C. P. C.*, *s.* 382.). In India the question by whom the existence or otherwise of pregnancy is to be determined appears to be left to the discretion of the Court. In England, according to an old rule of law, in such cases a jury of twelve matrons is empanelled and sworn, to try whether the "prisoner be with child, of a quick child."[4]

II. Hard Labour.—A medical man may be called on to determine whether a prisoner is in a fit state of health or not to perform

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[1] See Wounds, p. 117.
[2] See also Causing Miscarriage, p. 292.
[3] See Infanticide, p. 303.
[4] See Pregnancy, p. 264.

certain descriptions of labour; in such a case, the chief points for inquiry would be as to—

1. The prisoner's general health.
2. His freedom or otherwise from cardiac disease, aneurism, or grave disease of the respiratory organs.
3. The nature of the labour (if any) he has previously been engaged on, and whether he has been gaining or losing weight.
4. The proportion borne by the labour it is proposed to exact, to the weight of the individual, 2 foot-tons per 1 lb. of body-weight being an ordinary, and 3 foot-tons per 1 lb. of body-weight a very hard day's work. In many cases labour to be performed may be reduced to foot-tons by Haughton's formula, which may be stated as follows:—Add together the body-weight of the individual (in pounds), and the weight (in pounds) carried by him; multiply this by the height (in feet) ascended, plus one-twentieth of the horizontal distance (in feet — 1 mile = 5,280 feet) travelled, and divide the product by 2,240.[1]

III. Whipping.—Here the principal points are—

1. All females, and all males over forty-five years of age, are exempted. (*C. P. C.*, *s.* 393.)
2. A medical man may be called upon to certify whether or no an offender is in a fit state of health to undergo this punishment. (*C. P. C.*, *s.* 394.)
3. A medical man may, during the execution of a sentence of whipping, be called upon to certify as to the fitness, or otherwise, of the offender to undergo the remainder of the sentence, and should he certify that the offender is not in a fit state of health to undergo the remainder of the sentence, the whipping must be finally stopped, *i.e.*, the remainder of the sentence cannot at some future period be inflicted. (*C. P. C.*, *s.* 394.)

III.

Forms of Report for Forwarding Stained and other Articles to the Government Chemical Examiner for Medico-legal Examination.

As so much of the valuable medico-legal material and experience of India is utterly lost every year, owing to the want of any systematic attempt at preserving it, Dr. L. A. Waddell represented to Government on several occasions, in 1884, 1897 and 1899, the desirability of procuring its easy and permanent record through the agency of civil surgeons, on a uniform plan, for which purpose he drew up and submitted the necessary forms of report. As, however, no action whatever was taken in this important matter, and this invaluable source of information for the detection of crime in India is still neglected, one set of his proposed forms is here reproduced[2]

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[1] See also Starvation, p. 229. 2,240lbs. = 1 ton.

[2] It embodies several valuable suggestions by Dr. Chuni Lal Bose, the Additional Chemical Examiner of Bengal.

in order to show what kind of information is most needed to settle many doubtful medico-legal points and to complete that body of Medical Jurisprudence on which may hang the life and liberty of individuals in India. The information thus required, it will be noticed, is of two kinds, namely, that (*a*) to be noted in the first instance or sent along with the articles which are forwarded for expert examination, and that (*b*) to be sent on the conclusion of the trial ; and it is extra to the ordinary report (No. I or II, see pp. 645, 647) in forwarding viscera or other substances to the Chemical Examiner.

A.

I.—In Human Poisoning Cases.

1. Name of the victim.
2. Age ,,
3. Sex ,,
4. Caste ,,
5. Religion ,,
6. Occupation ,,
7. Place of residence (district and village).
8. When was the poison administered ?
9. How was the poison administered (with food or in any other way) ?
10. How long after administration did the symptoms develop ?
11. What interval was there between the last eating or drinking and the first appearance of symptoms of poisoning ?
12. What were the first symptoms of poisoning ?
13. Were any of the following symptoms present ; if so, state which :—

(*a*) (1) Vomiting, (2) purging, and (3) pain in the abdomen.
(*b*) Deep sleep from which the patient could not be roused.
(*c*) Tingling and numbness of the tongue, lips, throat and skin.
(*d*) Convulsions and twitchings of the muscles
(*e*) Delirium and clutching at imaginary objects and dilatation of the pupils.

14. Specify any other symptoms noticed.
15. Did any other person partake of the food or drink, and did they also suffer from similar or other symptoms ?
16. What was the interval between the first appearance of symptoms and death, if this occurred ?
17. Was he treated by anybody ?
18. If so, what were the principal medicines given to the patient ?
19. Any history of alcoholic drinking ?
20. Was the poison self-administered ?
21. If not, who is suspected of administering it ?

(*a*) Name of accused ; (*b*) age ; (*c*) sex ; (*d*) caste ; (*e*) religion ; (*f*) occupation ; (*g*) residence.

22. Nature of preservatives added to the exhibits.
23. Any other available facts of medico-legal importance ?

II.—In Animal Poisoning Cases.

1. Kind of animal poisoned (cow, calf, bullock, horse, buffalo, goat, fowl, dog, &c.).
2. What symptoms were noticed ?
3. How long after administration of poison did death take place ?
4. How was the poison administered (with food or in any other way) ?
5. Name, age, sex, caste, religion, occupation and place of residence of the accused.

III.—In Wound Cases.

1. Name, age, sex, caste, religion, occupation, place of residence of the wounded person.
2. Nature of the wound.
3. Nature of weapon.
4. Whether the wounds were self-inflicted or inflicted by other persons.
5. Name, age, sex, caste, religion, occupation, place of residence of the suspected person who inflicted the wound.
6. Motive for the infliction of the wound, if known.
7. In what way are the exhibits, forwarded for examination, connected with the case ? (Here specify which clothes are from the accused or wounded person's body respectively, and which from other suspected sources.)
8. Did the case end fatally or not ?

IV.—In Rape and Unnatural Offence Cases.

1. Name, age, sex, caste, religion, occupation, place of residence of the victim.

(In bestiality cases the kind of animal to be noted only.)

2. Nature of injuries found on the private part and on other parts of the body.
3. Was there much bleeding (with reference to washing away of semen) ?
4. Place of occurrence ?
5. Name, age, caste, religion, place of residence, occupation of the accused.
6. His relation to the victim.
7. Injuries found on the private part, and other parts of the body of the accused.
8. In what way are the exhibits, forwarded for examination, connected with the victim or the accused ? (Here specify which clothes are from the accused or outraged person's body respectively, and which from other suspected sources.)

Name.....

Designation.....

Dated.....190 . *Forwarding Officer.*

B.

TO BE SUBMITTED ON CONCLUSION OF THE TRIAL IN CONNECTION WITH EVERY SUBSTANCE SENT TO THE CHEMICAL EXAMINER.

1. A short history of the case, noting especially those points reported 'unknown' in the previous reports.
2. The result of the trial.

Name.....

Designation .....

Dated . ...190 . *Forwarding Officer.*

From such data the necessary particulars could be compiled for permanent record in regard to the cases which come before the Chemical Examiner, and also for those cases which are not referred to him.

The existing forms of medico-legal reports which are sent to the Indian Chemical Examiners are as follows :—

I.

FORM IN WHICH TO REPORT POST-MORTEM EXAMINATIONS, TO BE USED WHEN FORWARDING VISCERA TO THE CHEMICAL EXAMINER

FROM THE

TO THE

Dated.....189.....

Description of viscera forwarded for examination.

Mode of packing. Copy of label attached to bottle.

Impression of seal

Weight of parcel.

Mode of despatch | Date of despatch. | Date of receipt in Chemical Examiner's Office.

Information furnished by Police, or *précis* of case.

Name ... . Sex..... Age... .....
Caste..... ...of thana or village..... ....
History of case—*continued.*

Date and hour of despatch of body. | Date and hour of autopsy. | Name of officer by whom examination was actually made.

Date of receipt.

Appearance of body—

Muscularity
Stout
Emaciated

Special marks—

Scars
Tattooing
Amount of hair, &c.

Signs of decomposition—

Wounds and bruises—

a.—Position
b.—Character
c.—Size

State of natural orifices—

Eyes
Ears
Nostrils
Mouth
Vagina
Anus
Urethra.

State of limbs, &c.—

Rigor mortis
Position
Contents of hands, if clenched
Features ... { Relaxed / Contracted
Eyelids
Pupils
Contents of mouth
Position of tongue
State of teeth

Thorax—

Ribs
Cartilages
Pleura
Pericardium

Heart .. { Shape and appearance / Cavities / Clots, *ante* or *post-mortem* / Muscular structure

Vessels ... { Clots / Aneurism / Atheroma, &c.

Lungs ... { Appearance / Colour / Consistence / Adhesions

Larynx, trachea, and bronchi for foreign bodies or disease

Abdomen—

Peritoneum
Peritoneal cavity contents
Liver and gall-bladder—form and size, disease or injury
Pancreas, disease or injury
Spleen, ditto ditto
Kidneys, ditto ditto

Stomach ... { Size and general appearance / Appearance of coats / Contents, appearance, odour, and quantity

Intestines ... { General appearance and contents / Appearance of coats

Generative organs—

Bladder and contents
Uterus, appearance, size and contents
Vagina, contents

Head—

Scalp
Bones, disease or injury
Membranes
Brain substance and ventricles
Base of skull fractures, caries, extravasation, &c, &c.

The spinal canal need not be examined, unless any indication of disease or injury exist.

Fractures and dislocations—

More detailed description of injury or disease

OPINION AS TO CAUSE OF DEATH.

Station.. .....

Dated.....

Civil Surgeon or Medical Officer of.....

II.

FORM OF REPORT USED WHEN FORWARDING SUBSTANCES, OTHER THAN VISCERA, TO THE CHEMICAL EXAMINER

No.....

FROM ....

TO THE CHEMICAL EXAMINER TO GOVERNMENT,

....

Dated.....190 .

FORWARDING the articles mentioned below for examination for .....in connection with the case of.....

DESCRIPTION OF ARTICLES.

Mode of packing and weight of parcel.	Copy of label and impression of seal.
Mode of despatch Date	Date of receipt in Chemical Examiner's Office.

FACTS of MEDICO-LEGAL IMPORTANCE IN CONNECTION WITH THE CASE.

Signed

Certificate to be signed by a Magistrate or other Judicial Officer and forwarded with Blood or Seminal Stained Exhibits.

(For without this certificate no tests can be applied.)

CERTIFIED that a Chemical Examiner to Government has permission of the Court to remove, if necessary, portions of the exhibits connected with the case of Emperor *versus*..... ..... for the purpose of applying chemical tests.

Signed

Magistrate or Deputy Magistrate.

NOTE.—This certificate must be signed by a Magistrate or other Judicial Officer, and is to be appended by the Chemical Examiner to his report on the case and filed with the records.

IV.

Suicide Statistics for Calcutta. 1896—1900.[1]

(Compare these with tables on pp. 108 and 112).

Method of Suicide, per 1,000 *Suicides of each Sex in Calcutta Town*, 1896—1900.

Method.	
Males—	
Hanging	179
Drowning	127
Poison	547
Cuts, stabs, &c. ...	59
Gunshot	37
Otherwise	51
Females—	
Hanging	346
Drowning	54
Poison	562
Cuts, stabs, &c. ...	16
Gunshot	...
Otherwise	22

Details of Poisons, &c., used by Suicides in Calcutta (1896—1900).

	Hindus.		Mahomedans.		Others.		Total.		
	Male.	Female.	Male.	Female.	Male.	Female.	Male	Female.	Total.
Poisoning by Morphia ...	2	...	...	...	2	...	4	...	4
Drowning ...	..	...	...	...	2	...	2		2
Poisoning by Opium ...	52	42	5	4	6	2	63	48	111
,, Arsenic ...	3	13	3	3	...	..	6	16	22
,, Alcohol ...		2		...	..	...	..	2	2
,, Carbolic Acid ...	1	1	...		1	...	2	1	3
,, Prussic Acid ...	2	1	..	1	1	1	3	3	6
,, Nitric Acid ...	...	1	...	...	...	...	...	1	1
,, Corrosive Acid	1	1		...	...	...	1	1	2
,, Hydrochloric Acid	1	...	...	...	...	...	1	...	1
,, Strychnine ...	1	...	...	...	1	...	2	...	2
,, Cyanide of Potassium ..	1	...	...	...	2	...	3	...	3
,, Some unknown poison ...	...	1	...	...	...	..	...	1	1
Carried over.	64	62	8	8	15	3	87	73	160

[1] C. R. M. Green in *Ind. Med. Gaz.*, 1902, p. 301. The "Open Verdict" deaths are included as Suicides as they "were nearly all cases of Suicide."

Details of Poisons, &c., used by Suicides in Calcutta 1896 – 1900—(concld.)

	Hindus.		Mahomedans.		Others.		Total.		
	Male.	Female.	Male.	Female.	Male	Female.	Male.	Female.	Total.
Brought forward.	64	62	8	8	15	3	87	73	160
Hanging ...	30	58	6	4	1	..	37	62	99
Wounds, Cuts, Stabs, &c. ...	6	...	1	.	3	2	10	2	12
,, Gunshot ...	1	...	1	...	6	...	8	...	8
Other Methods ...	1	..	...	...	...	..	1	..	1
Falls	...	...	...	...	...	1	...	1	1
Hanging ...	1	2	...	...	...	..	1	2	3
Drowning ...	5	2	5	4	15	4	25	10	35
Poisoning by Opium ...	16	17	3	...	5	1	24	18	42
,, Dhatura ...	1	...	...	...	...	...	1	...	1
,, Strychnine ...	...	1	...	...	...	...	...	1	1
,, Morphia ...	..	1	...	..	...	...	...	1	1
,, Aconite ...	2	1	...	...	...	...	2	1	3
,, Arsenic ...	2	3	...	2	...	2	2	7	9
,, Nitric Acid ...	1	...	1	1	...	...	2	1	3
,, Prussic Acid ...	...	1	..	...	...	...	...	1	1
,, Sulphate of Copper ...	..	...	...	...	...	1	...	1	1
Wounds ...	1	1	1	...	...	...	2	1	3
Suffocation	...	...	...	...	1	...	1	...	1
Unknown cause	1	...	...	1	.	...	1	1	2
Other causes	2	1	1	...	...	...	3	1	4
Falls	3	1	1	...	1	....	5	1	6
Total ...	137	151	28	20	47	14	212	185	397

Frequency of Suicide per million per annum in Calcutta.

	Male.	*Female.*	*Total.*
Hindus ...	56 482	126·120	91·301
Mahomedans ...	18 37	31 653	25·011
Others ...	183·10	62·858	122·976

V.

Digestion Chart.

Showing approximate time required for digestion of food based on Beaumont's experiments with Alexis St. Martin.

	Hours.
Wheaten Bread	3 to 4
Milk, raw	2½
,, boiled	2
Cucumber	4¾
Melons	3
Nuts	4
Oranges	2¾
Pears (ripe)	2
Pineapple	2¾
Bananas (*Kela*)	1¾

DIGESTION CHART—*concld.*

	Hours.
Fish (white) boiled	2 to 3
Mackerel	4
Sardines	3½
Soles	2
Shrimps	3¾
Lobster and Crabs	4
Beef, boiled	3
,, roasted	3 to 4
Lamb	2½
Mutton, boiled	3
,, roasted	3 to 3½
Pork, roasted	5
Poultry, boiled or roasted	2½ to 4
Tripe	1
Veal (as prepared in the British Isles)	4½
Eggs, raw	1½
,, fried, or boiled hard	3 to 3½
Cheese	3 to 4
Apples	3 to 4
Cabbage	3½ to 4
Cauliflower	2
Carrots	3 to 3½
Potatoes	2½ to 3½
Turnips	3½ to 4
Rice (if completely cooked)	1 to 2
Sago (if completely cooked)	1 to 2
Tapioca (if completely cooked)	1 to 2
Tomatoes	2¼
Peas (green)	2½
Spinach	1½
Radishes	4

Indian Observations on Digestion Times.

Undertaken by Asst.-Surgeon Purno Chander Singh at the suggestion of Major F. P. Maynard, I.M.S.

The people of Bengal and Behar ordinarily take two or three meals a day, consisting of rice, *dâl* (pulses), wheaten flour, vegetables, fish or meat, the latter two are luxuries amongst the poorer classes. Rice forms the bulk of their food. The quantity of boiled rice taken by an adult in each meal varies from 24 ounces to 48 ounces (the weight of a given quantity of raw rice becomes about three times greater when cooked), of cooked *dâl* 12 to 18 ounces, of vegetable curries 6 to 8 ounces. They drink a good quantity of cold water during or immediately after meals, which averages at least 16 ounces, except during hot weather when it is more. The length of time requisite for digestion in the stomach of such an Indian diet and for complete emptying of the stomach, has not been ascertained by observation, or on any authoritative basis. The average period required for the digestion of an ordinary European meal was estimated at from three to four hours from observations made by Dr. Beaumont in the case of Alexis St. Martin. But European and Indian diet differ greatly in quantity and quality, the former consisting mainly of nitrogenous substances, and the latter in a majority of cases almost entirely farinaceous. The solvent powers of the gastric juice are chiefly exerted upon nitrogenous substances and its action is comparatively slight upon starchy and saccharine matters. The rapidity of digestion varies according to the quantity of food taken and the amount of fluids drunk. The Indians generally consume a large quantity of farinaceous food and drink largely of cold water, which, by lowering the temperature of the stomach and diluting the gastric juice, is prejudicial to digestion. Hence the time required for complete gastric digestion of Indian diet may exceed that for European diet. It may be contended that starchy food requires less time for digestion than the nitrogenous. This may be true when the quantity of it is small as in European diet. An idea of the time necessary for *complete* digestion (gastric) of an ordinary Indian diet may be

formed from the following observations made after death in some cases, and during life in others :—

A.—Presence of food in the stomach noted during post-mortem examinations.

(1) A healthy man, aged 35 years, took his morning meal (stale rice and *dâl*) between 7 and 8 A.M., and went out to work in his rice-field. There he quarrelled with another man who gave him blows and kicks at about 10 A.M on 3rd February 1902. He died the same day at about 2 P.M. from rupture of the spleen. *Post-mortem* examination held on the next day disclosed the presence in the stomach of a large mass of undigested and partially digested rice and *dâl*, and in the duodenum thick, white, glairy fluid and several bits of rice. The man was alive for about six hours after taking his meal and four hours after rupture of the spleen. The process of digestion might have been suspended or retarded by internal hæmorrhage, but his farinaceous food was not digested in less time than that required for digestion of European diet, *i.e.*, in two hours after his meals and before he met with violence.

(2) A Hindu male, aged 22, after his usual evening meal between 8 and 9 P.M., took some opium to commit suicide. He died next morning between 5 and 6 A.M. *Post-mortem* examination was held the same day. The stomach was full of undigested rice, *i.e.*, about nine hours after food.

Digestion was in this case probably in abeyance during coma.

(3) A Mahomedan male, aged 28, a lunatic, took his meal between 10 and 11 o'clock A.M., on 22nd January 1902, which consisted of rice, *dâl* and vegetable. He got an epileptic fit at about 2 P.M. the same day, and was unconscious till he died between 5 and 6 o'clock P.M. on 23rd January 1902. During the period of unconsciousness he could not swallow medicines or liquid nourishment. *Post-mortem* examination showed that the stomach contained a large mass of partially digested and undigested rice and *dâl* mixed with mucus. (More than half of the cavity of the stomach was full.)

The food remained in the stomach for nearly 30 hours without undergoing digestion. The digestion was in suspension owing to insensibility. His food was not even digested in four hours before the attack of the epileptic fit.

(4) A stout, healthy, Hindu male, took his evening meal at about 10 P.M. and was beaten to death between 5 and 6 o'clock in the morning of 30th May 1901. The stomach contained, as disclosed by *post-mortem* examination, a small mass of undigested rice, about one ounce in weight, and a few bits of potato rind.

The food was not *completely* digested in seven hours.

B.—Observations on the washings of the stomach of healthy men a few hours after their meals.

(1) A Hindu male, aged 25 years, a cook by profession, took his meals consisting of boiled rice 48 oz., cooked *dâl*, including the water in which *dâl* was boiled, 16 oz., and vegetables 4 oz. at 12-15 P.M. on 15th January 1902. His stomach was washed out with an India-rubber œsophageal tube at 3-15 P.M., *i.e.*, three hours after meal. About half an ounce of undigested rice was withdrawn. The openings of the tube were blocked up with particles of undigested rice. The tube was not reintroduced. On 18th January 1902, at 11-10 A.M. he took rice 48 oz., *dâl* 12 oz., vegetables 8 oz., and drank 16 oz. of water. The stomach tube was passed at 3-15 P.M., *i.e.*, 4 hours and 5 minutes after. About an ounce of undigested rice was brought out. The tube was twice introduced. On 20th January 1902, he was fed at 11-32 A.M., with 48 oz. rice, 8 oz. *dâl*, 8 oz. vegetables, and 16 oz. water. The stomach was washed out at 4-45 P.M., *i.e.*, 5 hours and 13 minutes after meal. Entire and broken rice grains, numbering 250, flowed out with the washings. The openings in the tube were blocked up with rice. He consumed on 24th January 1900 at 10-50 A.M., 48 oz. rice, 8 oz. *dâl*, vegetables 4 oz., and water 16 oz. The tube was used at 5-15 P.M., *i.e.*, 5 hours 25 minutes after. Undigested rice grains, about 200 in number, flowed out with the water. The openings of the tube were filled with rice. The tube was not passed a second time. On 25th January 1902, at 9-25 A.M., the man took the same quantity of food as on the previous day. At 4-50 P.M., *i.e.*, 7 hours 25 minutes after, the stomach was washed out. A few entire and broken grains of rice and a soft pulpy mass of it mixed with mucus flowed out. The tube openings were blocked up.

(2) A tall, stout, Hindu male, 32 years old, was fed at 11-32 A.M., on 20th January 1902, with rice 48 oz., *dâl* 8 oz., vegetables 8 oz., and water 16 oz. At 4-34 P.M., *i.e.*, 5 hours 2 minutes after, entire and broken rice, about 200 in number, was found in the washings of the stomach. The openings of the tube were blocked up with particles of rice. The tube was not reintroduced.

(3) A healthy, Hindu male, a mason, took his food at 12 A.M., on 30th January 1902, consisting of rice 2lbs. 2 oz., *dâl* 9 oz., vegetables 4 oz., and water 12 oz. The stomach was washed out at 3-20 P.M., *i.e.*, 3 hours and 20 minutes after. About an ounce of undigested rice was found in the washings. He was fed at 11 A.M., on 3rd February 1902, with rice 34 oz., *dâl* 9 oz., vegetables 4 oz., and water 16 oz. At 5-5 P.M., *i.e.*, 6 hours 5 minutes after, the stomach washings contained about 2 drachms of undigested rice. On 12th February 1902, at 10-30 A.M., he took *chappattis* made of 16 oz. *attah* (coarse wheaten flour), *dâl* 9 oz., vegetables 5 oz., and water 16 oz. At 5-5 P.M., *i.e.*, 6 hours 35 minutes after, his stomach was washed out. Soft bits of vegetables, and a small, soft lump of semi-digested *chappatti* came out with water. He took at 10-30 A.M., on 19th February 1902, rice 35 oz., *dâl* 9 oz., vegetables 4 oz., and water 16 oz. The tube was used at 4-45 P.M., *i.e.*, 6 hours and 15 minutes after. A few bits of entire and broken rice flowed out with water.

(4) A healthy Hindu male, aged 25, took, at 12 A.M., on 30th January 1902, rice 2lbs. 2 oz., *dâl* 9 oz., vegetables 4 oz., and water 16 oz. The stomach was washed out 3 hours and 25 minutes after. During introduction of the tube the man vomited and brought up about two ounces of undigested rice. The same quantity of food was given to him on 3rd February 1902 at 11 A.M. The washing was commenced at 5-10 P.M., *i.e.*, 6 hours and 10 minutes after meal. Two drachms of undigested rice were found. The openings in the tube were blocked up. During its reintroduction he vomited and brought up 3 drachms of rice.

(5) A Hindu male, aged 22, took on 12th February 1902, at 10-30 A.M., *chappattis* made of 16 oz. *attah*, *dâl* 9 oz., vegetables 5 oz., and water 16 oz. The stomach was washed out 6 hours and 40 minutes after meal. Four small bits of semi-digested *chappatti* flowed out. The man vomited a few bits. When the tube was withdrawn its openings were found blocked up.

(6) A Hindu male, 20 years old, was fed with *chappattis* of 16 oz. of *attah*, *dâl* 4 oz., vegetables 4 oz., and water 12 oz., at 11-45 A.M. on 7th February 1902. The stomach was washed out at 4-15 P.M., *i.e.*, 4 hours 30 minutes after. Two large and a few small soft lumps of *chappatti* and water came out.

(7) A Mahomedan male, aged 20 years, took at 10-30 A.M., on 19th February 1902, 35 oz. rice, 9 oz. *dâl*, 4 oz. vegetables, and 16 oz. water. The tube was passed at 4-52 P.M., *i.e.*, 6 hours and 22 minutes after. A few entire grains of rice, about one drachm, flowed out. The openings of the tube were found blocked up when it was withdrawn.

Remarks.—The men did not take any food between the hours of their meals and that of the washing of their stomachs. In all cases a little more than a pint of warm water was passed into the stomach. When the tube was withdrawn its openings were seen blocked up with particles of food. This evidently showed that more food existed in the stomach than what was withdrawn. The blocking up of the tube with food-grains no doubt prevented their further exit. The appearance of even a small quantity of undigested food in the washings of the stomach *seven hours and twenty-five minutes after meals* was sufficient to demonstrate that food was not *completely* digested, and the stomach was *not* empty, in that period.—(*Ind. Med. Gaz.*, 1902, p. 235, &c.)

VI.

Punishment for Criminal Abortion.

24 & 25 Vict., c. 100, *ss.* 58 & 59.

58. "Every woman being with child who, with intent to procure her own miscarriage, shall unlawfully administer to herself any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever with like intent, and whosoever, with intent to procure the miscarriage of any woman, whether she be or be not with child, shall unlawfully administer, &c., shall be guilty of felony."

59. "Whosoever shall unlawfully supply or procure any poison or other noxious thing, or any instrument or thing whatsoever, knowing that the same is intended to be unlawfully used or employed with intent to procure the miscarriage of any woman, whether she be or be not

with child, shall be guilty of misdemeanour, and being convicted thereof, shall be liable, at the descretion of the Court, to be kept in penal servitude for the term of three years, or to be imprisoned for any term not exceeding two years."

N.B.—By 27 & 28 Vict., c. 47, *s.* 2, the minimum term of penal servitude awardable is increased to five years.

VII.

Lunacy Certificates.

Schedule, Act No. 36 of 1858.

FORM A.

Certificate of Medical Officer.—(*See Sections IV and VIII*).

I, the undersigned (*here enter name and official designation*), hereby certify that I, on the day of at , personally examined (*here enter name and residence of lunatic*), and that the said is a lunatic (*or an idiot, or a person of unsound mind*) and a proper person to be taken charge of, and detained under care and treatment, and that I have formed this opinion on the following grounds, namely :—

1. Facts indicating insanity observed by myself (*here state the facts*).
2. Other facts (if any) indicating insanity communicated to me by others (*here state the information and from whom*).

Signed

FORM B.

Order for the Reception of a Private Patient.—(*See Section VII*).

I, the undersigned, hereby request you to receive A. B., a lunatic (*or an idiot, or a person of unsound mind*), as a patient into your asylum. Subjoined is a statement respecting the said A. B.

(Signed) name.
Occupation (if any).
Place of abode.

Degree of relationship (if any), or other circumstance of connection with the patient.

Dated this day of one thousand eight hundred and
To Superintendent of the Asylum at (*describing the asylum*).

N.B.—To guard against objectionable use of this certificate it is ordered (Government of India, Home Department Resolution 699, dated 31st May 1902) that "while it is desirable to maintain the procedure by which a Government medical officer in conjunction with another medical man can give a certificate which would justify the admission of a lunatic to, and his retention in, an asylum in a Presidency-town, precautions should at the same time be taken to prevent this certificate being given to some ostensible relation or friend of the lunatic in such sort that he may use it elsewhere than in the place where it is given. To meet this requirement the Government of India are pleased to direct that the Government physician or surgeon who signs a joint certificate of lunacy under *s.* 7 of the Indian Lunatic Asylums Act, 1858 (XXXVI of 1858), shall send the original document direct to the officer in charge of the asylum in which it is proposed to confine the lunatic. The officer in charge of the asylum shall not part with such original certificate, but, if the lunatic is not eventually placed in the asylum within a period of fourteen days, the certificate shall be returned to the Government medical officer and destroyed by him."

VIII.

Statistics of Poisoning in India.

The relative frequency of poisoning in the Province of Bengal is shown in the following table :—

Frequency of poisons found in human viscera *in Bengal during ten years ending 1893 in percentages.*[1]

Poisons.	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893
Opium (including Morphia)	63·73	57·96	48·23	60·6	59·7	63·35	46·73	53·52	62·65	61·37
Arsenic	26·48	31·84	42·46	34·54	28·96	31·2	33·15	25·74	24·53	24·8
Aconite	4·81	3·72	·87	·95	Nil.	Nil.	4·32	8·07	4·6	5·87
Indigenous vegetable poi-ons, *e.g.*, Nux Vomica, Datura, &c. ..	2·40	3·73	4·38	·95	2·01	1·96	3·27	8·07	3·32	3·72
Other poisons, *e.g.*, Hydrocyanic Acid, Alcohol, Mercury, &c.	2·58	2·75	4·06	2·86	9·23	3·49	12·53	4·6	4·9	4·24

In the case of *Opium* at least the actual frequency of the poison is much greater than shown in the table as the smell and naked eye appearances of opium are so characteristic that in many cases of poisoning by opium, the presence of this poison is so obvious that the cases are not sent to the Chemical Examiner.

Thus, out of 44 cases of Suicide by Opium examined by the Police Surgeon of Calcutta in 1893—94, in only 18 cases were the viscera sent for analysis, as in the other 26 the presence of opium was sufficiently obvious without chemical analysis.

In other provinces of India the relative frequency of these special poisons varies considerably in the viscera and vomit sent for analysis in poisoning cases :—

Poison detected in Viscera or Vomit in poisoning cases in 1884.

Province.	Arsenic	Opium.	Datura.	Other.	Total.
Bengal	22	53	...	8	83
Madras	19	4	...	8	31
Bombay	22	9	1	3	35
Panjab	45	18	1	1	65
N.-W Provinces	29	17	1	1	48
Total	137	101	3	21	262
Per cent. of deaths from poison ...	52·3	38·5	1 2	8 0	100·0

[1] From Drs. Evans and C. L. Bose, *loc. cit.*

For other provinces the relative frequency of poisons found in fatal human cases over a series of years is here tabulated[1]:—

For Madras Presidency :—

Poisons.	1885	1886	1887	1888	1889
Opium	5	6	1	6	7
Arsenic	35	46	37	28	33
Aconite	1	...	4	5	8
Datura	3	4	...	3	4
Mercury	7	4	9	5	10
Other metals	3	8	5	8	2
Other vegetable poisons	10	6	6	18	22

For Bombay Presidency :—

Poisons.	1885	1886	1887	1888	1889	1894	1895	1896	1897	1898
Opium	20	12	14	15	20	7	16	7	3	6
Arsenic	51	47	42	41	33	25	21	19	29	33
Aconite	1	...	...	..	...	...	..	...	...	...
Datura	5	4	5	5	3	2	3	...	...	...
Mercury	4	4	1	5	3		...	...	...	...
Other metals	8	14.	14	11	5	} 7	7	3	1	6
Other vegetable poisons ...	9	6	8	7	2					

The *relative frequency of poisons found in fatal cases in Bombay Presidency* during the five years ending 1898 is thus :—

Poisons.	1894	1895	1896	1897	1898
Arsenic	50·0	50·0	73·0	50·0	66·0
Opium	63·6	59·2	63·6	25·0	54·5
Datura	66·6	100·0	...	...	...
Other poisons	35·0	31·6	33·3	5·5	33·5

[1] For other provinces it is not specified whether the cases in which poison was detected in the vomit were fatal cases.

Poisons detected during the ten years ending 1884 in Bombay Presidency :—

	Cases.
Arsenic[1]	... 507
Opium	... 151
Datura	... 74
Copper	... 50
Mercury	... 29
Lead	... 19
Other metals	... 5
Pounded glass	... 31
Strychnia	.. 17
Oleanders	... 8
Aconite	... 6
Plumbago	... 6
Alcohol	... 6
Cucurbitaceous tubers	... 5
Oxalic acid	... 4
Acid and alkaline corrosives	... 3
Cyanides	... 3
Other poisons	... 23
Total ...	... 947

Persons poisoned and deaths from poison in Bombay Presidency during the ten years ending 1884 as reported to Chemical Examiner :—

—	Persons Poisoned.	Deaths from Poison.
Arsenic	652	305
Opium	142	131
Datura	146	22
Other poisons	155	42[2]
Total ...	1095	500

For Punjab.—Poison detected in human *viscera* only :—

Poisons.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Arsenic ...	72	70	46	68	70	74	89	105	70	72	363
Opium ...	34	42	36	93	49	20	46	51	53	36	98
Datura ..	8	6	6	8	11	6	4	17	9	11	27
Aconite ...	...	1	1	2	...	3	4	5	2	3	...
Other poisons ...	6	12	12	12	7	11	10	18	17	13	20

[1] In 450 arsenious oxide only, in 13 mixed arsenious oxide and sulphides, in 34 sulphides only, and in 10 arsenites of copper.

[2] Eight of these from strychnia and four from oxalic acid.

The percentage of frequency of poisons detected in human viscera in the Punjab was :—

	1897	1898	1899
Arsenic found in	53·57	46·36	53·33
Opium	27·04	35·10	26·66
Datura	8·67	5·96	8·15
Alcohol	1·53	2·65	3·70
Mercury	1·02	1·99	1·48
Indian hemp	2·04	2·21	2·22
Aconite	2·55	1·32	2·22
Strychnia	1·02	0·66	0·74
Nerium odorum	1·53	0·66	0·74

For United Provinces, including Central Provinces :—

Poisons.	1896.	1897.	1898.	1899.	1900.	1901.
Arsenic	42	64	49	42	45	44
Opium	30	14	17	16	41	18
Datura	41	20	22	9	3	6
Other poisons	21	27	27	18	9	8

For Burma :—

Poisons.	1896.	1897.	1898.	1899.	1900.
Arsenic	19	16	15	14	58
Opium and Morphia	7	2	2	7	14
Datura	4	2	2	...	1
Other poisons	3	5	5	10	6

A better index of the actual forms of poison ordinarily employed is perhaps to be found in the cases brought for treatment to the hospitals. The cases brought to the Medical College Hospital, Calcutta, in 1901 are here tabulated :—

Drug.	No. of cases.	Sex.		Age.		Race.				Mortality.	Remarks.
		M.	F.	Below 12.	Above 12.	Hindu.	Mahomedan.	European.	Other races.		
Opium ...	86	53	33	7	79	68	4	11	3	34	
Alcohol ...	22	20	2	...	22	16	1	5	...	..	
Kerosene oil ...	9	7	2	9	...	6	2	1	...	1	
Carried over ...	117	80	37	16	101	90	7	17	3	35	

Drug.	No. of cases.	Sex.		Age.		Race.				Mortality.	Remarks.
		M.	F.	Below 12.	Above 12.	Hindu.	Mahomedan.	European.	Other races.		
Brought forward	117	80	37	16	101	90	7	17	3	35	
Carbon monoxide	1	1	...	...	1	1	...	...	...	...	
Sulphuric acid ...	1	1	..	...	1	...	...	...	1	...	
Camphor ...	2	1	1	1	1	2	...	...	...	...	A Parsi.
Nitric acid ..	1	1	...		1	1	...	...	..	1	
Datura ...	3	2	1	1	2	2	1	...	...	...	
Aconite ...	3	3		..	3	3	...	...	...	...	
Ptomaine ...	1	1	...	1	..	...	...	1	...	...	
Arsenic ...	4	2	2	1	3	3	1	...	...	1	
Irritant (?)[1] ..	2	2	...	...	2	...	2	...	...	...	Nature not found.
Sewer gas ..	2	2	...	...	2	2	...	...	...	...	
Carbolic acid ...	2	2	...	2	...	2	...	...	...	...	
Belladonna ...	2	1	1	...	2	1	...	1	.	..	
Cannabis Indica ...	2	2	...	..	2	2	...	...	...	...	
Chloroform ...	1	...	1	...	1	1	...	...	...	...	
Iodine ..	1	1	...	1	...	1	...	...	..	...	
Total ...	145	102	43	23	122	111	11	19	4	37	

IX.

TREATMENT AND ANTIDOTES IN POISONING.

For diagnosis of the particular kind of poison taken the following suggestive list is abstracted from Murrell's admirable handbook "What to do in Cases of Poisoning"

1. **You find the Patient dead.**—Prussic Acid, Cyanide of Potassium, Strong Ammonia, Carbonic Acid Gas, Carbonic Oxide, Oxalic Acid and other active poison given in a large dose.
2. **Patient is Comatose.**—Opium and Morphia, Alcohol, Chloral, Chloroform, Camphor.
3. **Is Collapsed.**—Strong acids, Alkalies, Aconite, Antimony Arsenic, Tobacco, Antipyrin, Antifebrin and last stage of most poisons.
4. **Is Cyanosed.**—Aniline, Antifebrin.
5. **Is Delirious.**—Cannabis Indica, Datura, Belladonna (noisy), Hyoscyami, Alcohol, Camphor.
6. **Is Tetanized.**—Nux Vomica and Strychnine, Arsenic, Antimony, excessive pain also approaches this condition.
7. **Is paralysed.**—Aconite, Arsenic, Lead, Conium.

[1] Capt. C. J. Robertson Milne, *Ind. Med. Gaz.*, 1902, 207.

8. **Pupils Dilated.**—Datura, Belladonna, and Hyoscyamus, in early stage ; Opium and Aconite in last stage, Chloroform, Alcohol.
9. **Pupils Contracted.**—Opium, Physostigmine, Chloral.
10. **Skin is Dry.**—Datura, Belladonna, Hyoscyamus.
11. **Skin is Moist.**—Opium, Aconite, Antimony, Alcohol, Tobacco and other poisons in stage of collapse.
12. **Mouth is Bleached.**—Carbolic Acid, Corrosive Sublimate, and Caustic Acids and Alkalies.
13. **Is Vomiting.**—Arsenic (Brown with blood), Antimony (White), Digitalis (Green), Aconite, Ammonia, Phosphorus, &c.

TABULAR RESUME OF ANTIDOTES.

FOR THE MORE COMMON POISONS.

Abbreviations.

SP=Stomach pump.
E=Emetic preferably apomorphine $\frac{1}{10}$ gr., or common salt or mustard at once, followed by bitter emetic, Ipecacuanha, Zinc-Sulphate, &c.
D=Demulcents, milk, white of egg, barley water, olive oil, $\frac{1}{4}$ to 1 of water, flour paste.
ST=Stimulants, *e.g.*, Brandy, Ether, Sal-volatile, hot water bottles to feet and arms.
UA=Universal antidote.[1]

	Poisons.	Treatment and Antidotes.
Acids.	Mineral Acids Strong.	Do not use SP. or E. ; but neutralize by Alkalies, *e.g.*, Chalk, Scrapings from white-washed wall, mortar, soda, soap and water, or UA. Then D. Opium or Morphia $\frac{1}{3}$gr. for pain and shock.
	Oxalic Acid ...	Do not use SP. or E , but give Lime followed by Castor-oil.
	Carbolic Acid ...	Wash out stomach till washing cease to smell. Then fill stomach with solution Sulphate magnesia $\frac{1}{4}$oz. to pint. D. and St. Artificial respiration if necessary.
	Hydrocyanic Acid & Cyanides.	In open air, cold douche dashed over head and neck from height SP. or E., Sulphate of Iron and Liquor Perchloride of Iron. St. and Ether hypodermically.

[1] The Universal Antidote of Murrell is (*a*) Saturated solution of Ferrous sulphate 100 parts. (*b*) Calcined Magnesia 88 parts, Charcoal 40, Water 100. Mix these two solutions at the moment of using. Murrell states that it is a perfect antidote for Arsenic, Zinc and Digitalis and Acids, useful for Mercury, Morphia and Strychnine, but of no use for Alkalies, Lead, Antimony or Hydrocyanic Acid.

	Poisons.	Treatment and Antidotes.
Alkalies.	Caustic Alkalies ...	Do not use SP. or E, but neutralize by dilute Acids, Vinegar, Lime Juice. Then D, and for pain Morphia Sulphate $\frac{1}{3}$gr.
Metallic Salts.	Arsenic ...	SP. or E; complete removal of contents is important. UA or Ferric Hydrate or Dialysed Iron in frequently repeated tablespoonfuls followed by a little salt in water as emetic. D. and St. Ice for thirst. During recovery Morphia $\frac{1}{3}$gr.
	Antimony Salts ...	Its own emetic, if not SP. or E. Strong Tea or other Tannin repeated. D. St; and for pain Morphia.
	Mercuric Chloride ...	Do not empty stomach till give white of egg mixed with milk and water. Then SP. or E. to get rid of the precipitate. UA. Tincture of Opium for pain or purging. St. if depression.
	Copper	If no vomiting egg and milk before emptying stomach D. and Opium.
	Lead	SP. or E. Sulphates of Magnesia or Soda or dilute Sulphuric Acid. D. Opium or Morphia for pain.
	Silver Salts ...	Common salt. Emetic to remove Silver Chloride and D.
	Opium and Morphia.	SP or in mild cases E. Hot Coffee. Potassium Permanganate (see p. 553).....by mouth and for washing stomach, or charcoal, UA. especially for Morphia. Rouse and dash cold water on face. Warm extremities. Artificial respiration for some hours if necessary and Strychnia $\frac{1}{30}$ gr. or Liquor 5 mins. and Atropine ($\frac{1}{30}$ gr.) hypodermically.
	Aconite ...	SP or E. Digitalis (20 m.) or Digitalin $\frac{1}{100}$ gr. hypodermically. St. and warmth to extremities. Keep recumbent position. Artificial Respiration and Friction. Strychnine $\frac{1}{60}$ gr.
	Datura ...	SP or E. Morphia ($\frac{1}{3}$ gr.) or Pilocarpine ($\frac{1}{2}$ gr.). St. and Hot Coffee. Artificial Respiration.

	Poisons.	Treatment and Antidotes.
Organic Poisons.	Strychnine and Nux Vomica.	SP or E. Potassium Bromide 2 drams, UA. or Tannin 30 grs., Iodine Tincture ½ dram in water followed by E or SP Chloroform inhalation in convulsions. Artificial Respiration.
	Digitalis ...	SP or E. UA., Tannin or Strong Tea or Coffee, St. and Warmth, Recumbent position and Aconite.
	Alcohol (acute) ...	Ammonium Carbonate 30 grs in water. SP. or E. Rouse by cold affusion, Battery, Hot Coffee. Artificial Respiration. Warmth to extremities.
	Chloral and Chloroform.	SP. or E. Strychnine, Warmth, Friction, and Hot Coffee. St. Ether hypodermically, Artificial Respiration.
	Aniline Derivatives, Antipyrine, Antifebrin, Phenacetin, Pyrogallol.	E. St. Warm extremities. Recumbent position. Strychnia $\frac{1}{20}$ gr. Artificial Respiration.
	Cocaine .	SP. St. and inhale Ammonia, Amyl Nitrite. Morphia. Artificial Respiration.
	Croton Oil ..	SP. or E. Wash out stomach with Milk or Sweet Oil and water. D. St. Opium or Morphia for pain.
	Fungi and Food, Poisonous.	SP. or E. Purgatives. St. and Warmth. Opium or Morphia for pain.

X.

Precautions in Sending Substances to Chemical Examiner.

So that no poisoners may escape justice, Government has ruled that in every case in which there is the slightest suspicion of poison having been administered, the Vomit or Viscera must forthwith be sent to the Government Chemical Examiner for analysis. In this way a large number of viscera of persons who have died from natural causes, of vagrants dying from exposure on roadside, or otherwise than from poisoning necessarily come to be sent for chemical examination, also in those cases where human viscera are sent as 'Suspected' in order to disprove false charges of criminal poisoning.

What frequently happens is this:—A member of a particular household dies of natural causes, it may be more or less suddenly. Thereupon some person who entertains a spite against that family and wishing to get it into trouble writes anonymously to the District Superintendent of Police expressing the belief that the deceased was poisoned, and the Superintendent of Police then feels called on to treat the case as one of suspected poisoning, even when the attending physician certifies the death to have been from natural causes. The police subordinates too

there is reason to believe use the threat of a medico-legal examination as a means of extorting money from the relatives of the deceased, and failing to get satisfaction send the viscera for examination for poison.

Rules for the Guidance of Medical Officers forwarding Articles for Analysis in Cases of Suspected Poisoning.[1]

1. In all cases of death from presumed poisoning, the stomach should be tied at both ends and removed from the body, so that its contents may be retained ; after removal it should be opened, the contents received into a perfectly clean bottle, and the mucous surface of the stomach carefully examined, its appearance noted, and any suspicious particles found adherent thereto should be picked off with a pair of forceps and placed in a separate small phial for transmission.

2. In all cases of death from presumed poisoning, the mucous membrane of the mouth, pharynx, and œsophagus, should be examined, and any unusual appearance, or marks of corrosion thereon, carefully noted.

3. The following articles should be forwarded for analysis, each in a separate bottle, in cases of death from presumed poisoning :—

A. The stomach.

B. The contents of the stomach.

C. Suspicious particles (if any have been found) removed from the mucous membrane of the stomach.

D. A portion of the liver, not less than sixteen ounces in weight, or the whole liver if the organ weighs less than sixteen ounces, and one kidney—these may be sent in the same bottle.

E. The vomited matter, if any ; and in cases where it is suspected that death has been caused by the administration of datura or other vegetable poison :—

F. The contents of the small intestines.

4. Strong methylated spirit should in all cases be added,[2] as laid down in the rules for the transmission by post of articles for analysis (see below) to the contents of bottles *A*, *D*, and *F*, and also to the contents of bottles *B* and *E*, unless it is suspected that alcoholic poisoning has been the cause of death. No spirit need be added to the contents of bottle *C*.

5. All bottles should be carefully sealed by the Medical Officer, and closed in such a manner that they cannot be opened without destroying the seal. The seal used should be the same throughout, and a private seal ; each bottle should be labelled, and the labels signed by the Medical Officer.

6. After having made a *post-mortem* examination in a case of suspected poisoning, the Medical Officer should report the results thereof to the police, and on receipt of an order from a Magistrate or from a superintendent or Assistant-Superintendent of Police, but not before, forward the viscera, &c., of the deceased to the Chemical Analyser to Government for examination. In cases where no death has occurred,

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[1] For Bombay Presidency, but these are almost identical with those in the other provinces of India.

[2] In some cases where spirit is not available a saturated solution of common salt may be used. Formalin may also be used as a preservative, as it does not in any way interfere with any toxicological researches that may subsequently have to be made.

but where it is suspected that poison has been administered, the Medical Officer should similarly report the case to the police, and on receipt of an order from a Magistrate, Superintendent, or Assistant-Superintendent of Police, forward the vomited matter—or contents of the stomach removed by the stomach pump—of the affected individual, or other matters requiring analysis, to the Chemical Analyser to Government.

7. When, on receipt of the necessary order, a Medical Officer forwards articles to the Chemical Analyser for examination, he should address at the same time a letter to the Chemical Analyser advising their despatch. This letter should contain—

a. An impression of the seal used in closing the bottles, and a description thereof.

b. A list of the articles forwarded, and a statement as to how the articles have been forwarded.

c. The name of the officer from whom the order has been received to forward the articles, and the number and date of such order.

d. A detailed account of the *post-mortem* appearances observed.

e. If he has seen the case during life, an account of the symptoms observed, and a statement of the treatment, if any, adopted.

8. When articles are forwarded by post to the Chemical Analyser to Government, each package should be franked externally with the name and address of the Medical Officer forwarding the articles, and the rules for the transmission of such articles by post (see below) should be attended to.

Rules for the Transmission by Post of Articles for Analyses.

(1.) The suspected viscus, or other portion of the body to be sent for examination, should be enclosed in a glass bottle or jar, fitted with a stopper or sound cork.

(2.) If liable to decomposition it should be immersed in methylated spirits of wine, which should be used in the proportion of one-third of the bulk of the material.

N.B.—The use of spirits of wine in packing viscera should be invariable, whether the season is hot or cold, and care should be taken that common bazar spirit is not used.

(3.) The stopper or cork should be carefully tied down with bladder or leather, and sealed. To ascertain that it has been securely closed, the bottle or jar should be placed for some minutes with its mouth down.

(4) The glass bottle or jar should then be placed in a strong wooden or tin box, which should be large enough to allow of a layer of raw cotton, at least three-fourths of an inch thick, being put between the bottle or the jar and the box.

(5.) The box itself should be encased in common garah cloth, which should be sealed in accordance with the usual rules of the Post Office as to parcels.

(6) Despatching officers will be held personally responsible that these instructions are carefully followed. Whenever practicable, such parcels should be packed under the immediate supervision of the district civil surgeon.

(7) At all stations where there is a district civil surgeon the parcels should invariably be sent to the Post Office by that officer, and not by a subordinate officer ; but where there is no civil surgeon they may be sent through the sub-divisional officer.

(8) A declaration of contents to the officials of the postal dapartment is unnecessary, and should not be made.

1. Magistrates, superintendents, and assistant superintendents of police, on instructing Medical Officers to forward articles for analyses to the chemical analyser to Government, should at the same time address the latter officer, quoting the number and date of their order to the medical officer, and should furnish the Chemical Analyser with a brief summary of the history of the case.

2. The principal points on which magistrates, &c., in cases of suspected poisoning, should furnish information to the chemical analyser, are as follows :—

a. What interval was there between the last eating or drinking and the first appearance of symptoms of poisoning.
b. What interval was there between the last eating or drinking and death (if this occurred).
c. What were the first symptoms.
d. Were any of the following symptoms present? If so, state which :—
  a. Vomiting and purging.
  b. Deep sleep.
  c. Tingling of the skin and throat.
  d. Convulsions or twitchings of the muscles.
  e. Delirium and clutching at imaginary object.
e. Were any other symptoms noticed?
f. Did any other persons partake of the suspected food or drink and did they also suffer from similar or other symptoms of poisoning?

3. Any other information available, likely to prove serviceable as a guide to the class of poison administered, should at the same time be furnished.

4. Any articles in the possession of the police, of which an analysis may be required, may at the same time be forwarded to the chemical analyser, strong methylated spirits of wine being added to such as are likely to undergo rapid decomposition.

5. In forwarding such articles the precautions laid down in Rules 5, 7 *a* and *b*, and 8, for the guidance of medical officers, should be attended to.

XI.

Cattle Poisoning.

The poisoning of cattle is very prevalent in India. In 1884 the following number of cases were referred to the Chemical Examiners :—

Bengal	41
Madras	38
Bombay	1
Panjab	147
N.-W. Provinces	11
Total	288

In all of these except four Arsenic was the poison employed. It has many advantages over other poisons. It is tasteless, certain in its action and the dose required is small. Further the hides of animals poisoned with arsenic are more easily preserved. The method of administration is as follows :—A small quantity of white Arsenic is made into a paste with flour, oil or oil cake and then wrapped up in plantain or other leaves and thrown before cattle grazing in a field or introduced into the manger among the fodder. The seeds of Abrus Precatorius, Croton and Yellow Oleander as well as Aconite and Nux Vomica are also used as cattle poisons though but rarely. The seeds of Abrus Precatorius are made 'into a needle or *sui*' (see p. 527) which is forcibly thrust through the skin of the animal. In the Panjab "*suis*" are prepared with Arsenic instead of Abrus Precatorius seeds.

Cattle *poisons detected* in ten years ending 1884 in Bombay Presidency :—

Arsenious oxide	696[1]
,, ,, with sulphides ...	9
,, ,, with oxides of lead ...	9
Sulphides of arsenic only	11
Oxides of lead only	6
Sulphate of copper	6
Nux vomica	1
Cocculus indicus	3
Mercury	1
Sulphate of iron	1
Total	743[2]

Symptoms of Cattle-poisoning.

Inspecting Vety.-Surgeon W. Lamb, in a letter to the Government of Bombay, dated 5th December, 1872, gives the following summary of the symptoms likely to be observed in different cases of cattle poisoning :—

1st. Poisoning with arsenic, or other irritant mineral poisons.

The animal evinces soon, or almost immediately after the poison is given, violent abdominal pain, trembles, writhes, rolls about in agony, groans, foams at the mouth, and dies speedily. In more protracted cases, from less poison being given, or from its being absorbed more slowly, the abdomen swells, acute diarrhœa or dysentery supervenes, great thirst prevails, and death ensues from exhaustion.

Rinderpest, hoven and dysentery are the diseases whose symptoms most nearly resemble those of arsenical poisoning. The following are the most obvious distinguishing marks :—

(*a*) In rinderpest there is trembling with nervous or spasmodic twitches, but accompanied at first by dulness instead of agony. The access of the disease is by comparison gradual, for irritant poison produces violent symptoms suddenly.

(*b*) In hoven distension of the abdomen precedes and causes pain ; in poisoning by arsenic, pain precedes distension ; it is also more acute, violent, and agonizing.

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[1] Mixed in three cases with pounded glass, in two with compounds of mercury, and in one with sulphate of copper.

[2] Altogether 677 animals died from poison in the ten years.

(*c*) In acute dysentery, violent bloody slimy purging is the prominent symptom ; abdominal pain is subsidiary. In arsenical poisoning pain is the chief and primary symptom ; purging may come after.

2*nd*. *Aconite*—I have not myself seen cattle suffering from this poison, nor am I aware that the symptoms thereof have anywhere been recorded ; but they may be expected to be the same as, or similar to, those that occur in horses under such circumstances. Of these, the most characteristic are trembling, nausea, eructations, retchings causing discharge of mucus, partial convulsions, early inability to stand, paralysis, stupor, pulse and breathing slow, coma, death.

3*rd*. *Nux vomica*, in poisonous doses, causes spasms of the voluntary muscles, and all the symptoms of acute tetanus, such as jaws fixed, the haws projected over the eyes, ears erect, body rigid and often contorted, tail extended and quivering, death being caused by suffocation from the diaphragm and other muscles of respiration being affected, or by the beating of the heart being stopped by spasmodic contraction.

Tetanus might be mistaken for this form of poisoning ; but it is a rare disease among horned cattle, and is hardly ever caused in them except by wounds, and is never so sudden and violent in its attack, nor so rapidly fatal, as the poison of nux vomica.

The following rules for the guidance of officers forwarding articles for analysis in cases of suspected cattle poisoning, were published by the Government of Bombay on the 24th December, 1872 :—

"The whole of the contents of the stomach and upper portion of the intestines should, in the first place, be emptied out into a suitable clean vessel ; a portion of the same, say about as much as would fill a 12-oz. bottle, should then be removed and placed in a clean glass bottle, and the remainder, if any, washed out with water, and carefully searched for any mineral masses, fragments of roots, suspicious-looking seeds, &c.; any such substances being discovered, should be placed in a separate paper packet.

"2. A portion of the stomach, a portion of the liver, and a portion of one kidney, enough, when taken, to fill, say a 20-oz wide-mouthed bottle, should then be cut off, and placed together in one such bottle, along with some spirits of wine, or strong country spirit.

"3. Both bottles, *viz.*, that containing the portion of the contents of the stomach, and the other containing the portions of the solid organs, as mentioned above, are to be labelled, corked, and sealed with a private seal. The packet containing the mineral masses, portions of root, &c , is also to be labelled and sealed with the same seal ; and the two bottles and packet are then to be made up into a parcel, and forwarded to the Chemical Analyser to Government, Bombay.

"4. The letter advising the despatch of the parcel should contain a full account of the case, giving the symptoms observed, any unusual *post-mortem* appearances noted, &c., &c. Attached to the letter should be an impression of the private seal used in securing the bottles and packet."

XII.

Permanganate of Potassium Poisoning—Case CCXCVIII.

A woman, aged 47, after drinking heavily, took a "handful" of crystals of permanganate of potassium and throwing them into a

teacupful of beer drank the mixture. She was immediately taken to St. Thomas's Hospital. On the way she was said to have vomited. When seen she was pale, conscious, but was unable to speak. Her lips, chin, fingers, and the front of the right forearm were stained dark-brown. The tongue was much swollen and almost black. The breath smelled strongly of stale beer. The skin was dry; the pulse was moderately rapid and of fair tension. After a few moments she struggled into a sitting posture and her breathing became slightly stridulous. Preparations were made for tracheotomy, but before anything could be done she fell back pulseless and the respiration stopped. By the stethoscope the heart could still be heard beating faintly and very slowly, although no pulse was perceptible at the wrist. Artificial respiration induced one or two respiratory movements. The heart sounds ceased altogether a few moments later. Death occurred 35 minutes after taking the poison.

A necropsy was made 13½ hours after death. The chin, lips and interior of the mouth were stained a deep brown. The front part of the tongue was swollen and almost black, the back part was of a deep mahogany colour. The epiglottis was blackened, the glottis was œdematous. The stomach was moderately distended and showed no signs of inflammation externally. It contained about two pints of fluid with which was mingled a black insoluble powder and some parchment-like masses—probably portions of food. The mucosa was coated with a black granular powder, closely adherent which could not be washed off. On scraping away the incrustation, the mucous membrane was found to be intensely hyperæmic, presenting a bright pink blush. The destructive action of the salt was evidently very superficial. A little of the black deposit had escaped into the duodenum. The mucous membrane here was also hyperæmic, but there was no incrustation. The liver was enlarged and appeared fatty. The portion of the spleen near the stomach was soft and pultaceous; the rest of the organ was normal.

Remarks.—Fatal poisoning by permanganate of potassium appears to be very rare. Little or no reference is made in the current text-books on toxicology and forensic medicine to the poisonous action of permanganate of potassium. The writers are only aware of one recorded case where death resulted from it. Several, however, have called attention to toxic symptoms following its use, and in the experience of one of the writers local sloughing followed subcutaneous injection in watery solution as an antidote for opium poisoning. Thomson (*Petersburger Med. Woch.*, 1895) records a case in which a large dose of solid permanganate of potassium caused corrosion of the pharynx and death in five hours from cardiac paralysis, which is quoted by Dixon Mann ("Forensic Medicine") *Apropos* of the use of solutions of permanganate in the treatment of poisoning by opium. Bidwell (*Boston Med. and Surg. Jour.*, Vol. cxv., p. 141) quotes instances where serious symptoms followed the administration of permanganate of potassium. The sufferers were young unmarried females who were under treatment for amenorrhœa. In one case two consecutive doses of two grains were followed by intense burning pain from the throat to the pit of the stomach and serious collapse. In another a dose of one grain of the solid salt was followed by similar symptoms. In some correspondence (*Brit. Med. Jour.*, Vol i., 1895) on the possible dangers attending the use of this drug allusion is made to ulceration of the mouth attributed to local action of permanganate, and a case of abdominal pain and collapse following the administration is quoted by H. Powell. The actual

quantity taken in the latter case is not clear. In another instance severe vomiting and collapse occurred after three two-grain doses had been taken at interval. Judging from the condition of the coats of the stomach in their case no local mischief would have been inflicted by the use of the soft stomach-tube.—Dr. C. R. Fox in *Lancet*, p. 411, 1899.

Cocaine Eating.—Case CCXCIX.

At the Kamatipura Morgue, Bombay, Mr. P. Byrne, Coroner, conducted an inquest relative to the death of Mithoo Ramji, a Brahmin, aged 20, who lived with his aunt Anandibai in De Souza street. It seems that Mithoo returned home from work one evening and complained to his aunt of suffering from headache and fever. Some household remedies were applied, and the aunt left to attend a sick relative in Bhandari street during the night. On her return home in the morning she found her nephew in a dying condition. He was in the habit of eating cocaine in betel leaves. Dr. Arthur Powell, Coroner's Surgeon, who made a *post-mortem* examination was of opinion that clotting of blood in the heart was the cause of death, and such clotting could be due to some narcotic poison such as cocaine. The verdict returned by the jury was that death was due to narcotic poisoning, but under what circumstances it was administered there was no evidence to show. —*Pioneer*, Feb. 21st, 1902.

Medical Testimony *vs.* Confession—Case CCC.

At Poona, before Mr. Beaman, District and Sessions Judge, a woman named Vithai Luxumon was charged with murdering her newly-born infant by stuffing a rag into its mouth and then throwing the body into a canal. The accused woman confessed her crime before the second Class Magistrate, and again before the City Magistrate ; and on being charged before the Sessions Judge she for the third time ackowledged her guilt. Her statement was borne out by a neighbour who attended at the birth of the child and by accused's own son, a lad nine years of age. But the medical evidence, went directly against this theory and attributed death to concussion of the brain caused by an injury to the back of the head. In his charge to the jury the judge said that there could not be the slightest doubt but that the accused had meant to kill her newly-born infant, that she had taken measures to kill it by suffocation. Believing that she had killed it in that way, she threw the body into the canal. But the medical evidence proved conclusively that death was not caused by suffocation at all. According to the medical evidence the fracture of the skull which caused death might have been the result of an accident during birth, and this theory was corroborated by the midwife who said that the child fell on the floor. After this the child might have lived for a short time in a moribund condition. Therefore, although the woman meant and tried to kill the child, yet the death was the result of the accident with which accused had nothing to do. The accused was acquitted.—*Pioneer*,—Feb. 14th, 1903.

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