Cerebral and mental symptoms in relation to somatic disease, anaesthetics and toxic agents, traumata and surgical procedures : with a review of the treatment of some cerebral and mental symptoms by operation ... / by James Christian Simpson.

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Cerebral and Mental Symptoms

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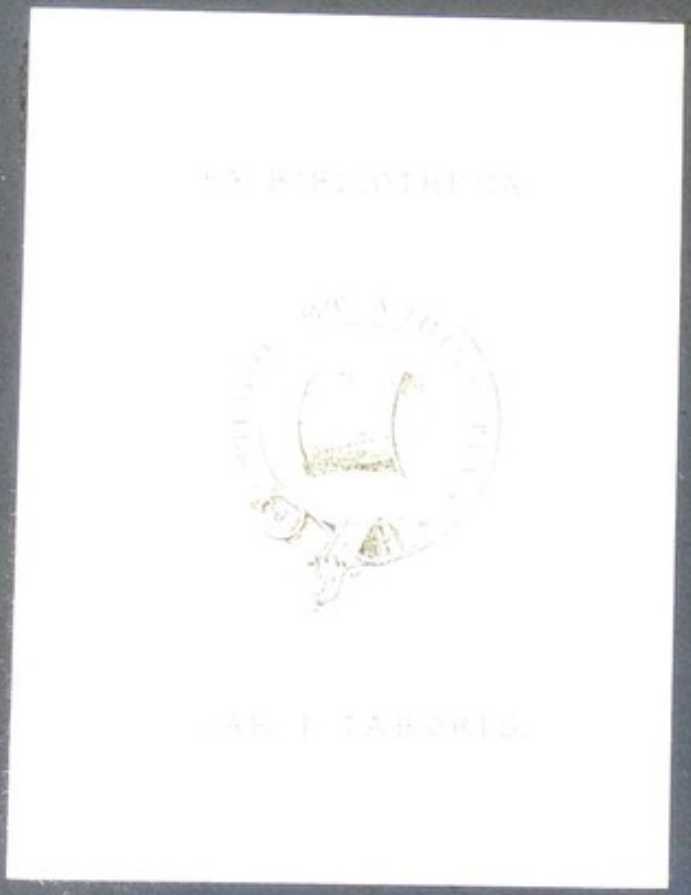

TO MY FORMER CHIEFS

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WITH THE GRATEFUL THANKS OF

THE AUTHOR.

Cerebral and Mental Symptoms

IN RELATION TO

SOMATIC DISEASE, ANÆSTHETICS AND TOXIC AGENTS, TRAUMATA AND SURGICAL PROCEDURES,

WITH A REVIEW OF THE TREATMENT OF SOME CEREBRAL AND MENTAL SYMPTOMS BY OPERATION.

A THESIS

PRESENTED FOR

The Degree of Doctor of Medicine of the University of Edinburgh, in 1895,

BY

JAMES CHRISTIAN SIMPSON, M.B., C.M., M.D.

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PREFACE.

THE subject matter of this book was presented as a Thesis for the degree of M.D. of the University of Edinburgh in 1895. It was "deemed worthy of competing for the Theses Gold Medals," and the Senatus Academicus granted permission for its publication. I have decided to do so, believing that such a collection of cases and facts may be of interest to others, and a reference to the bibliography, even though very incomplete, will show the reader that the Literature on the subject is extensive and scattered.

The delay in publication is partly due to the fact that Parts I. and. II. appeared in various numbers of the *Caledonian Medical Journal*, and are reprinted by kind permission of the Editor.

No alteration in the original Thesis has been made, though several very interesting papers have since appeared in connection with the subject, notably Dr. Macpherson's monograph on "Acute Primary Confusional Insanity," in vol. v. of the *Edinburgh Hospital Reports*. Other records of cases in various journals have also been duly noted for future use and reference.

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CEREBRAL AND MENTAL SYMPTOMS

IN RELATION TO

SOMATIC DISEASE, ANÆSTHETICS AND TOXIC AGENTS, TRAUMATA, AND SURGICAL PROCEDURES.

—o—

So wide and universal is the subject of cerebral and mental derangement in relation to the various bodily diseases, toxic agents, and surgical injuries of one sort or another, that it is only possible for a very brief review of the various conditions and their sequelæ to be included in a thesis such as this. It is more important to present the subject in its entirety than to confine the remarks to an elaborate dissertation on the nervous sequelæ of any one particular condition.

The more one works at such a subject, the more hopeless does it seem to put together, in an intelligent manner, and in such a way as to be of any practical utility, all the facts and cases known and recorded up to date. But by following a definite plan, the present collection of theories, facts, and short clinical records, both personal and derived from other sources, may be so arranged as to give some idea of the universal influence the brain has on the body, and, conversely, the influence of various morbid conditions of the body on the brain.

For this purpose we may at once put on one side all anatomical considerations, and only concern ourselves with the fact that this complex nervous mechanism may be likened to so many stages of a railway line which is worked on the block system. Each subsection or reflex arc performs its functions normally in obedience to influences generated in the various organs and tissues of the body, and each lower arc or complete nervous reflex is governed and inhibited by the next higher one, till the highest and most complex of all

is reached in the cerebral cortex. Here are found the cells by means of which psychic acts take place. It is the want of action of the higher centres that allows the lower ones to act, and this is expressed in the law which obtains throughout the whole nervous system—viz., "The higher controls the lower, and, uncontrolled, the lower passes into a state of increased action." Dr. Hill remarks "that the nervous molecules are never still, activity of any one part affects the movements of all the rest, the passage of one set of impulses is accompanied by the blocking of neighbouring routes." The various abnormal conditions which may be present, and some of which may co-exist or be otherwise combined, may be tabulated somewhat as follows:—

Stimuli.	Nerve Endings and Conductors.	Perception.
Abnormal.	Normal.	Normal.
Abnormal.	Abnormal.	Normal.
Normal.	Normal.	Abnormal.
Normal.	Abnormal.	Normal.
Normal.	Abnormal.	Abnormal.
Abnormal.	Normal.	Abnormal.
Abnormal.	Abnormal.	Abnormal.

Normal stimuli are those which are necessary to the proper carrying out of ordinary reflex movements and mental activity, and consist in the normal state of the fluids of the body, the various secretions and excretions, and also of certain sensory stimuli, both of the common and special variety.

Normal stimuli either produce no subjective sensations, or only pleasurable ones, and Meynert terms certain definite movements associated with these pleasant sensations, the result of normal stimuli, "movements of aggression." He presumes that these movements are "accompanied by a free transmission of nerve force, vasomotor dilatation, a functional hyperæmia of the nerve centres, and an apnœic phase in consequence of the increased tissue breathing of the nervous elements."

Abnormal stimuli may be divided into those applied from without—the result of disease, toxic agents, or traumata—and those generated within the body, a result of faulty physiological chemistry, or of an abnormal condition of the various tissues and organs of the body. These abnormal stimuli may, like some normal ones, produce no actual unpleasant subjective sensations, but, as a rule, they are associated with a feeling of ill-being, both bodily and mental. Clouston

assumes "that bodily pain covers and includes all subjective bodily sensations that are consciously disagreeable, and that all kinds of perverted sensations of the unpleasant sort are clinically associated with mental pain in cases of melancholia. The expression 'mental pain' covers the whole ground of normal and abnormal psychological conditions where there is a mental feeling of distress and ill-being. Where to consciousness there is unhappiness, there we have mental pain." The movements which may be associated with abnormal stimuli are termed by Meynert "movements of repulsion," in contradistinction to the "movements of aggression," the result of normal stimuli. They are attended by immediate inhibition of nerve conduction, increased arterial pressure and deoxygenation, as well as impaired nutrition of the nerve cells. These effects are recognised in the conscious condition as pain, but the radiation of any irritation has a great influence on the character of the painful sensation from the said irritation, and Meynert assumes that the grey matter acts as an inhibitor of, or as a physiological resistance to, the irradiation of any given irritation beyond the normal reflex. Thus, a slight prick with a pin is hardly felt as pain, for little inhibition is required to control the normal reflex; whereas an extensive burn requires a much greater inhibitory effort to prevent wide-spread muscular reflexes consequent thereon, and this intense inhibition of the grey matter in the cerebrum and spinal cord is recognised in the conscious state as pain. This is accompanied by a greater or lesser amount of constriction of the cerebral arteries, and the continuance of the conscious state depends on the amount of this constriction and consequent cerebral anæmia. Hence swooning results from intense peripheral irritation, and the sense of pain is, for the time being, lost, as no inhibition is required to control the muscular reflexes. What occurs in such acute cases is similar to what may occur in the course of any long-continued bodily disease or peripheral irritation which demands a constant inhibition by the grey matter, and this inhibition is necessarily accompanied by a reflex contraction of the arteries, which implies a deficiency of oxygen and normal nutriment to the nerve cells, with the resulting disagreeable sensation of pain. Here we have all the elements for the excitation of a much more serious cerebral state—namely, actual dissolution of the "centres of association" to some degree. Even without any great bodily pain, mental pain may be produced in a patient by means of constant intense thought concerning his ailment. "This intense thought inhibits emotion," as, according to Meynert,

"the functions of the fore brain (cortex) inhibit one another, according as one or the other happens to predominate at the time." As we have already seen, this inhibition of certain areas is accompanied by a corresponding change in the blood supply of the said area, for the cortex is a vasomotor centre for itself, and accurately gauges the amount of blood required for any given function which has to be carried on at any time. Thus, when there is this constant intense thought, there must be a constant change in the blood supply of certain areas, and in this way abnormal mentation may be produced. Hypochondriasis is a frequent example of this process, and the whole group of symptoms of an hypochondriac are looked upon by Clouston as "the result of an equal disturbance of both the mental and sensory portions of the brain," whereas in melancholia pure and simple, there is an unequal disturbance, the mental cells being more affected than the sensory ones.

It is thus evident that well known clinical facts may be so far satisfactorily explained by some such theoretical physiological consideration, and this may, at any rate, form a working basis for such facts to be built upon. The symptoms may be almost all analysed, and referred to one or other of the various pathological conditions which were noted as being possible to affect either the tissues, the nerve endings or conductors, or the perceptive centres.

Certain diseases are more frequent, and others seem to be decidedly less frequent, in the insane than in a sane population.

Thus there are really two considerations—(1) the relative frequency of bodily disease in the sane as compared with the insane; (2) what bodily diseases are particularly apt to attack the insane.

(1) The relative frequency of bodily disease in the sane, as compared with the insane, is a difficult point to work out, as the usual conditions of life are so different in the two classes of population. Thus, the sane, going about at their various occupations, are more apt to contract the various acute zymotic affections, which are rare in institutions for the reception of the insane, except as an accident or epidemic, as the recent influenza. The diseases which are decidedly more frequent in the insane will be noted later. Suffice it to say now, that as the mortality in the insane "is just four and a half times as great as that of the sane (90 per 1,000, against 20 per 1,000), therefore disease must be more common in the insane."

(2) As regards the second point, there seems to be no doubt that certain organs are more apt to be attacked in insane than in sane patients. Thus, as regards the respiratory

system, Mays says that phthisis is three times more common in the insane, and is more apt to occur in subjects of melancholia, diabetes, myxœdema, and idiocy. Phthisis and insanity usually occur between the years of 20 and 30, whereas tubercular meningitis reaches its maximum at 1 year, and its minimum after 3 years. Hysteria, chorea, and epilepsy often co-exist with phthisis. Phthisis is from eight to ten times more frequent in idiotic families, and idiots die of phthisis about ten years earlier than the average. In fact, Mays considers phthisis and insanity as one family group, the former being a vagus lesion. Clouston found a hereditary predisposition to insanity in 7 per cent more of the insane who were tubercular than of the insane generally, and that the last of the family is either insane or tubercular. There is a strong relation between the phthisical and the insane predisposition; and when phthisis and insanity contemporaneously develop, a special type of insanity may be made out in about one-fourth of the cases. Dr. M'Callum has shown that the deaths from phthisis in Scottish asylums during the period of eighteen years from 1871 to 1889 have materially decreased; and in dividing this period into three sub-periods of six years each, he arrived at this result: that while the percentage of male deaths from phthisis on the total number of male deaths fell from 13·3 to 12·5, the percentage of female deaths from phthisis on the total number of female deaths fell from 19 to 15·1. Taking the total phthisis death percentage, there is a fall from 16 to 13·8, the greater part of this improvement being due to the great decrease in the number of women dying of phthisis. A similar inquiry was made in seven English asylums chosen at hap-hazard. The available period was from 1880 to 1889, subdivided into two periods of five years. This showed that in these seven asylums the death-rate from phthisis, as compared with the total death-rate, is higher in the second period than in the first, and this increase is due entirely to the higher phthisical death-rate in women, which rose from 17·3 to 20·6. Northumberland Asylum actually showed an increase of 12 per cent; and when this is analysed, it is really an increase of 20·1 in the female death-rate from phthisis. In commenting on this, Dr. MacDowell said, in 1885, that the ventilation was at fault, the gauge covering the opening into the ventilators being choked with dirt, and some of the shafts opening directly outside having birds' nests in them. These defects were remedied, and next year there was an appreciable decrease in the phthisical death-rate; but Clouston has shown

that phthisis is four times as common in the insane as among the sane population of the same age.

As regards cardiac disease, Greenlees came to the following conclusions after an extensive study of the subject:—(1) Heart disease is more frequent among the insane. (2) This increase is in part regulated by the frequency of heart disease among the sane population in the vicinity of the asylum where the observations are made. (3) Heart disease is more frequent among the insane in the counties in which the ratio of the insane to the sane is greatest. (4) The distribution of heart disease among the sane is regulated by geographical position, dietetics, and other predisposing influences; and similar conditions appear to exercise an influence on the apparent frequency of heart disease in the insane. (5) Taken all over, the numerical difference between heart disease in the insane and the sane is not very great, being 8·72 in the latter and 9·36 in the former. (6) Both on admission and at death the age of the greatest number who had heart disease was between 60 and 70. (7) The arteries are frequently affected in the insane; but, with respect to age, atheromatous degeneration does not appear to occur earlier in the insane than in the sane, with the exception of general paralysis, in which the arterial degeneration is dependent rather on the duration of the disease than on the age of the patient.

Diseases of the nervous system are naturally more frequent in the insane than in the sane population, and this even when putting the mental state out of account. Thus the various forms of paralysis and organic changes are very frequent, and in many cases might be referred to vascular lesions, under the heading of cardiac or renal disease. But certain other gross lesions affect the nervous system independent of such abnormal vascular conditions, such as tumours, cysts, and the various forms of sclerosis and degenerations secondary to cerebral injury or vascular disease already alluded to.

When the occurrence of renal disease is considered, Bondurant says that 50 per cent of 1,100 patients in the Alabama Asylum were suffering from renal disease, and that nearly 60 per cent of recent admissions had albumen or casts, and that most of these showed other signs of Bright's disease; three-fourths of the *post-mortems* showed renal disease, though the percentage is less among the coloured population. Bennett, in the *Alienist and Neurologist*, also states the experience that renal disease is more frequent in the insane than is commonly supposed, and that uræmic poisoning is a most frequent cause of insanity, mostly

evidenced by mental pain, but passing through all the grades of dissolution. My own observations, though limited to 100 consecutive *post-mortems* in the Royal Asylum, Edinburgh, and 100 *post-mortem* records in the Royal Infirmary, Edinburgh, show a similar increased frequency of renal disease in the insane. In the Asylum records, 39 per cent had renal cirrhosis, and 13 others had adherent capsules; while in the Infirmary records, only 29 per cent had renal cirrhosis, and 3 adherent capsules. A most interesting point was this, that while the insane cirrhotic lives to an average age of 57, the sane patient dies at 43, when his kidneys are only ·02 oz. less than they should be at that age. There is no doubt that the careful treatment, regimen, and regular hours of an asylum all tend to prolong the lives of the patients, whereas the sane patient has to try and do his work under bad conditions, and he dies fourteen years sooner.

The influence which bodily disease has over mental symptoms is often most marked, and, so far as the more chronic visceral affections are concerned, a fuller description will be given later. In connection with this general question, Stretch Dowse remarks that we know how some functional derangements produce certain definite conditions of temperament, and that certain constitutions are prone to functional derangements of certain glandular organs. This alters the quality of the blood, which reacts on the body and mind, either in the shape, say, of gout, or in the aforesaid change of temperament, varying from mania in some to epilepsy in others. Or, again, in those whose individual temperament and personality are different, depression or hypochondriasis may be the result. Co-existent with this action of the body on the mind is the action of the mind on the body, and thus even a previously healthy person may, by excessive mental strain, become functionally diseased, and the now enfeebled body reacts on the primarily disordered brain, which leads to the worst form of nervous disease. There is in the body a double circulation of nerve energy, as pointed out by Mercier. The one is from the sense organs and the skin to the brain, and from these back to the muscles. This is the more important current by which all the movements of the body are adapted to circumstances of the outside world. The other, or lesser current, is from the viscera and body at large to the brain, and from the brain back to the viscera and other organs. By this latter current, the activity of function is adapted to the body needs, and thus the action

of mind on body and body on mind are co-existent, and may be disordered in a great variety of ways, with results differing according as to whether the interference with the two currents is independent, primarily, or sequential, the one to the other. Some nervous states can undoubtedly be acquired independent of hereditary tendencies, but as no two persons are able to withstand equally the same amount of strain and worry, all are not to be made responsible for such acquired condition; though, on the other hand, all are blameable for acquired bad tendencies, but one may be less blameable than another, according to hereditary or personal circumstances. Laycock insisted on this twenty years ago, that it is the lower or animal appetites which crop up in hereditary insanity.

One has now to briefly allude to the occasional beneficial effect of acute bodily disease on previous mental symptoms. This is, unfortunately, usually but temporary. The most familiar instance met with in asylum practice is seen in cases of acute inflammatory chest affections, which are sometimes associated with a lucid period in the previous mental blank of a chronic case, but, unfortunately, after the crisis, the previous mental state reasserts itself as a rule. In cases of phthisical insanity, there is also sometimes a lucid period before death takes place. In rare cases the mental state appears to be cured by a sort of crisis, such as is sometimes met with in cases of puerperal and other post-febrile insanities, as variola, erysipelas; one case is reported of mania following erysipelas being cured by a second attack of erysipelas. Metz also reports an instance of a cure by an attack of acute influenza. The patient had been confined in an asylum on account of delirium of persecution in 1888. On 13th January, 1890, he contracted influenza, and on the 17th he wrote a rational and coherent letter, giving an account of all that had happened since he became insane, and he dated his recovery from the day of being attacked by the influenza. He was discharged cured on 9th February, 1890.

Leyden reports a curious series of cases where undoubtedly some obscure bodily sensations produced an overpowering desire to have surgical operations performed for their relief. A woman, aged 37, had seven operations performed on her between 1887 and 1893, some trivial, some laparotomies. Another case persisted in having gastro-enterostomy performed; a third, oöphorectomy; and in a fourth, exploratory laparotomy was done to satisfy the patient, but in six months she wanted another to see that nothing was left behind. One man had a laparotomy performed so that his stomach might

be examined, as he had had a feeling of pressure there for years; nothing was found, but, as the sensation still persisted, he wanted another operation a year after.

It is also well known that certain bodily diseases and symptoms alternate with insane states. Neuralgia and other abnormal sensory phenomena almost invariably precede melancholia, and when the mental pain is fully developed the bodily pain subsides, to reappear when the mental state is passing away, and, finally, to disappear when the general health is sufficiently good.

The most notable examples of bodily disease alternating with insanity are diabetes and gout as instanced by Savage, asthma as reported by Norman and Mays, and phthisis which is often more or less latent for considerable periods during the acute mental derangement. Eczema and furunculosis have also been known to alternate with insane states, and frequently give a basis on which to found delusions. The greater number of cases in which there is mental disease is not benefited by bodily disease; the mental symptoms are rather exaggerated either in the direction of mania or depression, mostly in accordance with the circumstances of the case, and very often a more rapid or profound dementia may result. This is the natural outcome of the inevitable nervous strain or exhaustion which a patient suffers from when attacked by acute disease, with its necessarily increased tissue waste and consequent increased malnutrition and poisoning of all the already too poorly nourished and unstable nervous system.

The chief examples of the effect of mental disease or even continual mental worry, or sudden emotion on somatic conditions, are to be found in the greatly modified symptoms which some diabetic and phthisical patients exhibit when the insanity is more or less active. In the former case there sometimes seems to be an actual suppression of the usual diabetic phenomena; likewise in many instances of phthisical insanity it is only a change in some of the insane symptoms which may lead to a more exhaustive physical examination, revealing active pulmonary disease which caused no cough to speak of nor the usual abundant expectoration.

It was noted by Murchison that Murat became rapidly jaundiced while reading an unsatisfactory despatch. Clifford Allbutt reports that in thirty-five cases of chronic renal disease, twenty-four had a history of acute mental distress for a considerable time previous to the appearance of the renal symptoms. Dickenson has also seen cases immediately sequential to trouble and without any other cause; he has no

doubt that lowered nervous tone predisposes to albuminuria; but, as Elwig remarks, few of us reach middle life without mental strain and anxiety, and that the amount of nervous tension is due rather to temperament and disposition than to the actual circumstances of the person's life. Roche reports five cases of herpes zoster, in all of which there was mental depression before the appearance of the eruption; and Bateman has noticed a similar occurrence after a fit of anger, while Schwartz had three cases after a similar outburst. Quite lately I had a patient who had had considerable worry, and who presented symmetrical herpetic eruption at the margins of symmetrical patches of alopecia areata in the course of the occipital nerves. The herpes improved, but the hair which grew in the bald places came in quite white.

There is often a marked absence of pain in many diseases, which in the sane are accompanied by considerable suffering. Thus the pain of acute pleurisy or peritonitis may never be felt. Extensive cellulitis and suppuration may be quite unattended by any suffering to all appearance, and free incisions may be made with absolute indifference on the part of the patient. As a rule, however, this anæsthesia does not seriously interfere with the success of an operation if such be required, or with the ultimate healing and cicatrisation of other cutaneous maladies, such as furuncles or Raynaud's disease.

Acute cerebral symptoms or actual insanity not infrequently occurs in the course of active bodily disease, either of an infective febrile or general constitutional nature, or in association with some more purely local disease of the viscera. This consideration opens up the whole question of the dissolution of the functions of the nervous system, which is much too complex a problem to attempt to unravel on this occasion, so that only the more probable theories will be shortly stated, and subsequently some cases will be quoted illustrating the general bearing of cerebral symptoms in the course of bodily disease of one kind or another.

Hughlings Jackson takes, as a working basis, the hypothesis that there are four depths of dissolution which may take place, and also four factors in relation to the insanity which results. It is impossible to fully appreciate the disordered mechanism of an insane case; it is so complicated, and no one case can be allocated to any one depth or to any one factor. But the consideration of these depths and factors *seriatim* is most helpful in aiding us to comprehend the fearful complexity of symptoms exhibited by an insane patient.

"In every insanity there is a morbid affection of more or less of the highest cerebral centres, the physical basis of consciousness. There may be discoverable disease destructive of the nervous elements, or there may be loss of function from some undiscovered pathological process, inferred from symptoms, and it matters little what the process is, and whether discoverable or not. It is present in every case, and produces dissolution of more or less of the highest centres at different rates. This 'loss of function' is 'the negative lesion,' and includes not only destruction, but also all other conditions of the nervous elements from which they function no longer," whether post-epileptic mania or normal sleep.

All forms of mental disease are negative, not positive, as they at first appear. Their essential existence consists in a deficiency of properties possessed by the healthy mind, and not in the superaddition of any quality, good or bad. MacPherson remarks that the mental disturbance, in the course of a fever or acute bodily disease, is the outcome of great exhaustion and the asthenic condition to which some patients are rapidly reduced. It is this exhaustion of the highest cerebral centres that is the dissolution, which allows the lower ones to superfunction and act uncontrolled, incapable of feeling the exhaustion which has been and is being produced by their own overaction. But, in disease, we rarely if ever meet with a dissolution which is the exact reverse of the process of evolution, though healthy senescence is the nearest approach to it. With the one exception of dementia, the dissolution and evolution go on side by side, and, in great measure, in inverse proportion as regards their respective depth and height. "The deeper the dissolution the lower the range of evolution remains, and hence correspondingly the greater the negative affection of mind or consciousness and the less elaborate the mentation remaining possible." Conversely, the shallower the dissolution, the higher the range of evolution.

Disease does not cause the symptoms of insanity, which are the result of the evolving portion of the brain, but it affects the highest cerebral centres to different depths of dissolution, and it is this negative element or defect of consciousness that allows of the evolution of the lower centres or positive element, which is more or less unaffected, to produce the symptoms in every insanity. Thus all the illusions, delusions, conduct, and emotions of an insane person signify evolution, or the action of the positive element, which physically is intact but uncontrolled, and, whenever there is this positive condition, it

necessarily implies a co-existing negative state; there is less perceptive power, less reasoning power, less adaptation to present surroundings, and an absence of the finest emotions, as compared with the former sane individual. The depths of dissolution are the first factor in insanity, and the second relates to the person who has undergone the dissolution. "It is obvious that when the dissolution is of but little depth, the insanity will vary according as the person is a child, an adult, or an old man—whether he is clever or stupid, intelligent or the reverse, educated (either to a trade or other manipulation) or uneducated." All these various points may be brought out in the evolution of the lower centres, provided the dissolution be not too deep. The question of heredity also comes into this factor. Jackson is of opinion that a person inherits a healthy brain, but one which has fewer functional elements in the highest ranges of his highest cerebral centres. In other words, he inherits a brain which will give out more easily under unfavourable circumstances than the brain of an average man. Griesenger remarks that "an individual who cannot partake of a relatively small quantity of spirit without committing extravagant, noisy, and foolish acts, though not being deeply intoxicated, and retaining fully his consciousness, may be truly considered as having a predisposition to mental disease."

The third factor is the rate at which dissolution is effected, or, in other words, the rate of removal of control from the ranges of evolution remaining. The more rapid the dissolution the greater the activity of the range of evolution remaining. Two extremes may be cited—one, the senile dement who undergoes dissolution very slowly, and is quiet; the other, the epileptic maniac who has undergone extremely rapid dissolution, and whose lower centres are very busy. The influence of local bodily states and of external circumstances constitute the fourth factor. Thus a healthy man may have muscæ volitantes, but during an attack of delirium tremens he sees mice, rats, and other animals. Likewise, in normal sleep, a cramp in a finger may be transformed into a dream about a cat biting it, and so on. What he was doing just before an epileptic fit may influence the patient's actions in the insanity after it.

Clinically, all these various depths and various factors are so complicated, and are associated in such a variety of ways, that it is quite impossible to consider any one separately from the other, and insanity may be defined as a "function of four variables;" but we must remember that, speaking broadly,

there are two factors in the physical processes corresponding to the mentation of healthy people. One man may have a highly developed brain, but not the full use of it on account of bad development or failure of vital systems, such as digestion or circulation, whereas another may have a more or less defective brain, which even fully developed vital systems cannot improve beyond a certain point. Another interesting point to determine clinically is the order in which the mental faculties are affected in insanity. These are the emotions, the intelligence, and the volition. In typical melancholia these disappear in the order just named; "in mania the volition is apt to be affected before the intelligence, whereas in delusional insanity the intelligence is first affected." In all cases there is probably first a general dissipation of nervous energy, and the particular mental faculty which gives in first is determined by the many factors in the individual case.

The dissolution which may accompany the acute bodily diseases is usually of a temporary character, and may be of varying depths, as is evidenced by the symptoms of melancholia, mania, delusional insanity, and acute temporary dementia or coma; but in some cases the insanity is of a more serious type, and becomes chronic, with terminal dementia. In the foregoing remarks it must be understood that trauma and toxic agents act in precisely the same way.

There is practically no system in the body which, when in a diseased state, may not be the exciting cause of some cerebral disturbance, varying greatly in character, degree, duration, and termination. But certain acute inflammatory affections are more prone to have such a complication, and, as a general rule, the cerebral disorder is of two varieties. First, and more frequent, is a nonvesanic delirium, which appears in all severe cases either at the commencement or at the crisis; and, secondly, more serious symptoms, which may appear either during the acute period of the disease, when the exhaustion and fever are greatest, or later, during the convalescent period, when the patient is still weak, and the nervous system breaks down on the cessation of the abnormal stimulus it received during the acute stage of the fever. The most frequent cerebral symptom which ushers in many acute diseases, or may accompany some reflex irritation, such as dentition or an overloaded stomach, is a sensori-motor disturbance. In a child this is manifested by the occurrence of a convulsion, while in the adult the cerebral organ is not so unstable, the stimulus is more inhibited; hence, instead of a

convulsion, we find, with few exceptions, that merely a rigor takes place. This superior inhibition is explained anatomically by the fact that, in the child, up to 3 months, only the lowest centres are fully developed, and it is only after that time that any of the higher centres become developed and connected with each other by medullated fibres. It is unnecessary to consider this minor subject more fully at the present time, as it is of greater importance to briefly note some instances of more serious symptoms which may follow (1) some of the acute infectious fevers; (2) some of the more prolonged constitutional affections.

The usual type of insanity which follows any of these febrile states is an acute confusional insanity, which Norman considers as an intermediate state between the acute mania and the acute dementia of older writers. It is mostly characterised by "the engagement of consciousness in the form of dream-like confusion, together with hallucinatory disturbances." In the younger cases no heart or kidney disease may be present, and this is the form mostly taken by phthisical and alcoholic insanities, and also by the insanity following general diseases and the climacteric.

In the case of infectious diseases, several causes are acting to a large extent conjointly. Thus there may be—(1) a direct action of the microbes on the nervous centres; (2) the products secreted or produced by the microbes may act on the centres, and auto-intoxication result from their imperfect elimination; (3) certain organic changes may be induced by thrombosis, embolism, or hæmorrhagic extravasation into the cerebral substance; (4) apparently a purely functional cerebral derangement may result from cardiac weakness and general nervous exhaustion. As a rule, the insanity which comes on in the active period of the affection is of the maniacal form, while that which appears during the period of convalescence is usually of the melancholic type.

Variola is frequently accompanied by insanity—either an attack of mania during the eruptive period or melancholia during convalescence. Similarly, typhoid fever may be associated with the occurrence of cerebral symptoms more or less severe. Nonvesanic delirium appears in all severe cases; but, according to some authorities, actual insanity is not exactly rare. Thus, Nasse reported 43 cases in 2,000; Schlager, 22 in 500; Christian, 11 in 2,000; which gives an average of 17 per 1,000. This is probably too large a percentage, and might be reduced if a larger number of cases were taken. The pre-typhic cases are rare, but the post-typhoid ones are more

frequent, and are usually of the melancholic or pseudo-demented type. Typhoid fever more frequently than any other fever may be accompanied by, or have as an occasional sequel, aphasia. Trousseau was the first to record instances of aphasia in connection with fevers; but the first special treatise was a monograph on aphasia in children, by Clarus, in 1874. Among others who have written on it are Kühn and Longuet, and the most recent is Wyllie. The other fevers in connection with which aphasia has been met are typhus, small-pox, measles, intermittent fever, and yellow fever; and Wyllie sums up the whole subject thus:—In any case aphasia may be functional or organic. (1) Functional cases are by far the more numerous, and appear usually in the later stages of a severe case after other nervous symptoms. It is not accompanied by hemiplegia, and is more frequent in children, specially boys. It usually passes off in a few days, though occasionally it has been prolonged throughout the whole period of convalescence, with ultimate recovery. Its occurrence during the fever is not a very bad omen; but if death occurs, nothing special is found in the brain. It is probably the result of cardiac weakness, anæmia, and general nervous exhaustion. As a rule, it is essentially purely amnesic, and the speech memories least deeply imprinted are the first to be wiped out. Thus Bateman reports a case as follows:—"Dr. Scandella, an Italian, who died in New York in 1789, was master of the Italian, English, and French languages. In the beginning of an attack of yellow fever, of which he died, he spoke English only; in the middle of the illness he spoke French only; but on the day of his death he spoke only the language of his native country." (2) Organic cases are usually the result of embolism, or, according to Kühn, of hæmorrhagic extravasation. It is always suddenly developed along with hemiplegia; and if the patient recover, both are apt to be permanent. It usually occurs during convalescence, when the heart is getting stronger, thus differing from the functional variety. The type is usually motor aphasia, though any type may occur, according to the exact site of the lesion; and it seems to be as frequent in adults as in children.

Wyllie also notes a form called "dysarthria," a purely motor disturbance and not properly aphasic. Westphal is also an authority on this articulatory defect. He describes a slow staccato utterance as being not infrequently met with in the course of small-pox. Slurring is perhaps the most common articulatory defect in any form of fever, and is of grave significance if extreme. Wyllie has met with such a case in

typhoid, in whom the slurring had become more and more marked during the last eight days of life, till her speech was almost wholly inarticulate, though evidently she was conscious.

In further illustration of these interesting sequelæ of typhoid, I quote the four following cases:—Ord put on record an instance of typhoid fever which was followed by cerebral weakness, imbecility, and protracted silence, loss of word memory, and a monotonous, slow, inarticulateness of speech. Phillips reports the case of a man who had a mild attack of typhoid, but whose heart was very weak. He had sudden pyrexial attacks during convalescence, evidently corresponding to embolism. The fourth, fifth, and sixth attacks were accompanied by acutely maniacal excitement, with a temperature of 106·1°. He was quite calm, and had a normal temperature in the intervals. This is an example of the rarer condition of mania due to organic, though temporary, lesion during convalescence. The third case, which I now put on record, was that of a woman who, during the convalescent stage of a mild attack of typhoid, was seized with a kind of "fit," which was repeated many times, and gradually developed into a condition of incomplete catalepsy, and still later into hystero-catalepsy. Mentally she was dull and obtuse, and presented dysarthria. This defect, as well as the hystero-cataleptic condition, has persisted for over twenty years. She was 28 years of age when she had the fever, and has had these attacks ever since, Sunday being always the worst day of the week.

Silva also reports a case, who died of an epileptic fit during the course of typhoid, in whose brain Eberth's bacillus was found in the cortex.

Cerebral or mental derangement following other infectious diseases, with the exception of influenza, are more of the nature of curiosities than of much practical importance, but it is well to record that Dawson Williams reported a case of measles in which, on the fourth day, convulsions occurred, and unconsciousness lasted for ten days, after which a condition of general paresis was left, with loss of speech, tremor, and inco-ordination. Gradual improvement took place ultimately, though the intellect has always been backward, and the lower limbs spastic. He considers it a case of pseudo-disseminated sclerosis.

Mercier also noted an epidemic of delirium among some boys on board the *Worcester*, who were suffering from scarlet fever. Some were isolated on 24th February, and others on 2nd and 13th March. Among the first batch two developed delirium after having had severe headache, and in a few days

three more became delirious. In all these cases there was a curious exacerbation at 9 at night; there was no albuminuria, and this mental condition continued intermittently for three weeks, after which time they all recovered.

Influenza is the most important infectious disease which has attracted attention, on account of the intimate relation between mental and cerebral derangements and its occurrence as an epidemic. There seems to be no tissue in the body which can escape its ravages. Of all the systems the nervous is most seriously and extensively affected, for every degree of pain and muscular atony, from a slight headache and feeling of malaise to the most excruciating cephalalgia and neuralgia of the fifth nerve, absolute prostration and loss of will power may be felt even in ordinary cases which do not have as a sequel a more serious dissolution of brain power, or actual lesion of the brain, cord, or peripheral nerves. The toxin of influenza seems, like other toxic agents, to have a special faculty of picking out and influencing malignly the weakest part of the individual, whether it be an overstrained brain, weakened lungs, heart, or alimentary system. Some such cases may be rapidly fatal, as in diabetes, where coma may be at once induced. In others a latent lesion is revealed, as is reported by Stretch Dowse in the following instances:—A lady, about 38 years of age, had writer's cramp, which was cured about two years before she was attacked by influenza. When the influenza subsided the cramp returned, and she was unable to write more than a few lines. Again, a gentleman, aged 53, had complete right hemiplegia at the age of 44; but at the time of contracting the influenza he was able to move his arm and leg with perfect freedom. After the influenza his grasping power with the right hand was very feeble, and he could not raise his hand to his head. Dowse remarks that the toxin finds the cells in the Rolandic area ever ready to develop derangement of their natural capacity when their normal nutrition has been interfered with, or when they are in a neurasthenic condition. When this condition occurs to the special mental or volitional cells, the patient is incapable of adapting himself to the ordinary surroundings of life, his powers of control, resistance, and proper appreciation are all defective, just as, when the motor cells are affected, there is manifest weakened muscular action and sense. This loss of will power is one of the most prominent symptoms of influenza, as any general dissipation of nervous energy is always accompanied by a decrease of will power, and this is always attended by a craving for stimulation in the widest sense of the term,

which temporarily repairs the waste of brain tissue and the concomitant dissolution of nerve force. But a time comes when the normal reserve force in the cells is exhausted, and there is a condition of neurasthenia. This neurasthenic condition, whether influenzal or from any other cause, has a most important bearing on the subsequent appearance of other more serious, and may be incurable, cases of insanity or cerebro-spinal disease, and it is possible that many of the cases may be prevented if the early neurasthenic stage be properly treated, as the longer it persists the more likely is it to become chronic or lead to some of the more serious results just alluded to.

The whole picture of a case of influenza may be described by the single word "toxæmia," for it is only by means of some universally distributed poison that so many different tissues, organs, and their functions can be either simultaneously or consecutively deranged or serious mental or bodily disease induced, which may last so long or actually terminate fatally sooner or later.

Althaus remarks that the psychoses of influenza are of such frequent occurrence that they differ from what really are curiosities when they are a sequel to measles and some other infective fevers.

The duration of the disease resembles rather that which may accompany rheumatism, intermittent or typhoid fever, or cholera; but the prognosis is not so favourable. Savage is of opinion that a neurosis is a rare sequel of influenza in a perfectly healthy patient, and that when it does occur the subjects of it are alcoholics, syphilitics, or neurotics, as all of his 54 cases were. In asylum admissions, mania is usually more frequent than melancholia; but Clouston's statistics during the epidemic of 1890 show a great preponderance of melancholic admissions. Hardly a single case of influenza occurs without a more or less acute feeling of depression and a sense of illbeing. When this is combined with actual mental pain, there is a condition of melancholia which is defined by Clouston as "a sense of illbeing with a feeling of mental pain." There is almost invariably some bodily pain—neuralgia, or headache, or more defined inflammatory troubles; and as a disagreeable stimulus always depresses the vitality when it is repeated too often or for a lengthened time, it becomes highly injurious to the cerebral centres. They become anæmic, lose their nervous energy, and finally are in a state of hyperæsthesia, less able than ever to receive the painful bodily impressions which are still being transmitted to them, and

mental depression or melancholia results. Fortunately the dissolution does not usually go beyond this degree; but under unfavourable circumstances this hyperæsthesia of the sensory centres is merely a prodrome of the anæsthesia or actual paralysis of the sensory centres, with its attendant morbid exaltation and maniacal excitement.

This is certainly a further depth of dissolution, and is a result of the total cessation of function of some parts of the sensory centres. Along with either this melancholic or maniacal condition, there may be also a special local dissolution of some of the very highest parts of the cerebral centres, those more particularly connected with intelligence; and when such is the case, a condition of delusional insanity is developed—either delusional melancholia or delusional mania, according to the degree of dissolution of the sensory centres. Recovery from delusional melancholia is more frequent than from delusional mania, as the paralysis of the highest centres is much more complete in the maniacal condition. Thus one may consider influenza to be accompanied, in certain cases, by—(1) A preliminary depression and sense of illbeing, which is almost universal, and which may not deepen into any further disorder unless there be some constitutional predisposition; but it may last during the whole attack, and during the convalescent period as well. (2) There may be, after this depression, a nonvesanic delirium corresponding to the height of the febrile state. (3) During convalescence a true psychosis may develop as a continuance of the former delirium or depression; this most frequently occurs in patients in the third decade of life, according to Althaus. Savage found that in 54 cases there were 33 men and 21 women. Melancholia was the state in 20 cases; acute mania of ordinary type in 13; delirious mania in 5; delusional insanity in 6; mental weakness of some sort in 6; general paralysis in 4. Of these, 3 died and three-fourths recovered, which is a higher percentage than Althaus gives.

It is thus seen that any form of insanity may be consequent on influenza, and also that many nervous symptoms, quite independent of insanity, may be produced, such as insomnia, neurasthenia, epilepsy, hypochondriasis, diabetes, and tachycardia. There seems, however, to be no actual relation between the severity of the influenza and the exact form of mental disturbance or neurosis.

The most important chronic infectious disease in the progress of which cerebral symptoms may appear is syphilis, which is regarded by many as a prolonged fever. There are various

classifications and divisions of the mental and nervous symptoms which may appear in the course of this disease, and the varieties, no doubt, are due to the inconstant way in which syphilis makes itself manifest, and to the careless way in which the subjects of it sometimes treat themselves. Ross considered that there were certain seats of election wherein the syphilitic poison chiefly deposited itself. One is the cortical area corresponding to the area of distribution of the middle cerebral artery; the other is at the interpeduncular space at the base of the brain. The other lesions which have an influence on the cerebral functions are syphilitic arteritis and a nuclear proliferation round the capillaries of the cortex which gradually become obliterated after intermediate stages of degeneration; and disease of the cranial bones, meninges, or neuroglia tissue. Thus every tissue may be invaded in, some way by the poison.

According to Blandford, "syphilophobia is not uncommon." "Patients who have or have had specific disease may become melancholic, and are possessed by the one idea that they will die of it in its most loathsome form. Even those who have not had the disease may conceive a delusion that they have it, and point to every little spot or pimple in proof thereof." Thus syphilis may also act as a moral cause of insanity.

Clouston classifies cerebral symptoms in relation to syphilis under four headings:—(1) A short delirium during the secondaries; (2) acute delirious mania from rapidly forming syphiloma on the cortex anteriorly, often ushered in by prolonged somnolence, and ending in a comatose state of short duration, the whole acute mental illness lasting about three weeks; (3) moral and impulsive insanity, no headache nor eye symptoms, but may be convulsions and paralysis, genuine apoplectic attacks, the result of syphilitic arteritis, all tending to dementia; (4) mental symptoms of all kinds, some like general paralysis, with frequent epileptiform attacks and nocturnal headaches and implication of cranial nerves, due to the capillary lesion, others commencing with irritation, then cerebral nerve paralysis, hemiplegia, then somnolence, and sometimes double hemiplegia and death when interpeduncular lesion is present. Various other cases may be the result of inflammation in the bones, secondary gummatous meningitis, and affections of the neuroglia.

Insanity in the course of leprosy is not very uncommon, although Bevan Rake was unable to trace the pathological relation between them. The following is an example which

he gives:—A negro, with insane heredity, had been the subject of leprosy for several years, but lately had had several violent maniacal attacks, which occurred mostly at night. He was alternately in the leper and the lunatic asylum, according to the predominence of either disease. Finally, in 1885, in the leper asylum, he became affected with gangrene of the fingers and toes; said he felt spirits running to his ears, which he rubbed so violently that they ulcerated; he was even tempted to put his head in an oven to try to dispel the spirits. One night he got up, fell and struck his head; a brawny hardness and carbuncle supervened, and he died septic. In 1886 there were two demented lepers in the asylum, and several others have occurred.

Insanity associated with intermittent fever was first described by Sydenham, but more recently by Lemaine. Three periods may be mentioned during which mental symptoms may appear:—(1) Psychical disorders of the febrile attack; (2) of convalescence; and (3) in the course of the chronic poisoning.

Hydrophobia is at first ushered in with insomnia, a feeling as if the head were in a vice, and a general excitement and disorder of the secretions, specially the salivary. Later, a maniacal condition develops, and lastly, depression, paralysis, and a typhoid state appears.

Snow has observed that cancer is rare in asylums, but that mental symptoms are sometimes secondary to malignant disease, and that delusions may be based on the existence of cancer before it is actually diagnosed, thus showing how careful a physical examination, specially of the abdominal viscera, should always be made when such delusions are present. Cancer is never found in congenital idiots.

Special mental symptoms or types are frequently associated with a morbid condition of certain viscera, either functional or organic. Maudsley says that "derangement of an internal organ acting on the brain may engender morbid feelings and their related ideas, which result in general or specific mental effects." Mickle also remarks that "the internal organs are not the agents of their special function only, but by reason of their intimate consent or sympathy of functions, they are essential constituents of our mental life. The mind sums up and comprehends the bodily life, and the question arises whether each of the internal organs has not also a special effect giving rise to particular feelings with their sympathetic ideas."

It is evident that to a certain extent such sympathetic and

special mental symptoms may be curable, if the visceral disease be curable; but, unfortunately, in most cases the somatic disease associated with such insanity is of a chronic nature, little amenable to treatment, though sometimes alleviated by it.

Hence such mental symptoms are most unsatisfactory from a prognostic and therapeutic point of view, with only one or two brilliant exceptions, which will be mentioned later. Batty Tuke is of opinion that a misconception is involved in speaking of insanity as a "mental disease." The cerebral convolutions should be regarded as an apparatus in which changes take place in consequence of the action of malign influences, and mental action is a function of connections, the grey matter being the field for the association of efferent sensory impulses, which are there placed in communication with the efferent tracts along which the impulses travel either at once or subsequently. One is justified in presuming that when the continuity of these connections is interrupted, modification of function must exist. The transformation of sensory stimuli into motor acts is not the sole function of the Rolandic area, which is also a store for, and transmittor of impressions, and when this area is affected mental symptoms are also produced. This is confirmed by the fact that in insane brains there are more naked eye morbid appearances over the Rolandic area than over the frontal lobes. At the same time, there may be no evident cerebral alteration when the symptoms are the result of an irritation starting from some visceral lesion or cutaneous nerve. It is very curious to note that each of the various mental symptoms may be caused by an alteration in the same part of the encaphalon so far as we are at present able to discover. It is also important to remember in connection with obscure predisposition to cerebral symptoms, after, say traumatism or operation, that every part of the cerebrum may be so altered that its functions must certainly cease, though there may be no symptoms at the time; but this is a latent lesion which only requires some more or less trivial or serious emotion or injury to light up, and thus symptoms be produced not only in relation to the seat of lesion, but also in connection with all the other centres which are in association with it. Experimentally this has been proved in the case of a dog, from which a small piece of the cortical area for the leg was removed; the leg was paralysed, but recovered. When an injection of morphia was given, the local paralysis was evident. Clinically, the following is an example of the same:—A man was admitted into Mr. Annandale's wards with a compound fracture of the

left parietal, seven pieces of which were removed, and the middle meningeal artery tied, as it was ruptured, and the dura lacerated. Next day aphasia appeared, but gradually improved, and he was discharged cured. About three weeks later he got drunk, had an attack of catarrhal pneumonia, and the aphasia returned. He recovered from the alcoholism and pneumonia, after which the aphasia again disappeared.

Crichton Browne has pointed out that while women are more attacked by insanity than men, they die rather from bodily disease which does not directly interfere with their brain, whereas men die rather from brain disease than from bodily affection. The male forebrain is better nourished than the corresponding area in the female, whose posterior brain is better nourished than the male. This accounts for the predominence of emotional, in contradistinction to more purely intellectual, disturbance in the female. In health we should be quite unconscious of the impressions made on the brain by the various organs in the body, but if an organ be diseased, a morbid impression is at once communicated to the brain, and may make itself felt. In this way a hypochondriac can never withdraw his attention from the morbid impression and sensation; his life gets wrapt up in it, and gradually his intellect wavers; his powers of discrimination between the real and the unreal are overpowered; hallucinations as to devils inside him take total possession of his thoughts—he is insane. As before remarked, Clouston regards hypochondriasis the "result of an equal disturbance of both the mental and sensory portions of the brain cortex," whereas in melancholia there is an unequal disturbance, the mental being more affected. This strikingly shows the direct influence on the cerebral functions of morbid visceral or peripheral stimuli in any form.

There are many important mental symptoms which may be traced to a disorder of the organs constituting the alimentary system. Taking the organs from above, one has only to allude to the delusions of taste and smell which frequently occur, and though in delusions these two senses are not always associated, still many normal tastes are entirely dependent on the volatile elements which are only perceived by the olfactory nerves, and thence referred back to the taste centre. Delusions may accompany abnormal sensations in the œsophagus, leading to refusal of food, and sometimes in the case of either the œsophagus or stomach, these apparently insane delusions have an actual pathological basis, as may be found *post-mortem*, such as stricture of the œsophagus or

ulceration of it or of the stomach. It thus does not do to too lightly pass over some of these delusions without a searching physical examination of each patient. Dilatation of the stomach will be alluded to under the heading of Toxic Insanity, but the following case of fæcal impaction with delusions of taste and smell may now be quoted. Bridger reports that a lady aged 50 gradually developed, in the course of eight months, delusions of taste and smell, mostly at night; she thought her husband and children introduced poisonous fumes into the room to kill her, and left home for days to get rid of the persecution. She always had the bad smells, and after a time refused food and communicated with the police. On physical examination, a large elevated ridge was found stretching across the abdomen in the line of the transverse colon. This mass of fæces took several days to dislodge, and in six weeks time she was eating well and had no delusions.

Disease of the liver is a fruitful source of melancholia, specially of the hypochondriacal type, and this may be due either to organic hepatic disease, which, according to Trousseau, is rare in the insane, or more frequently to functional derangement, whereby the waste products are not efficiently removed or oxidised, or consolidate in the form of gall-stones. These concretions are found very much more frequently in the insane, though the symptoms which they usually give rise to are seldom such as can be recognised as due to an accumulation of gall-stones. Snell found in 1,000 *post-mortems* in Hildesheimer Asylum, gall-stones in 9·2 per cent of 500 males, and in 19·4 per cent of females, which is about twice as high as Halle's statistics for a sane population. The mental states associated with this condition were mostly dementia after melancholia, senile dementia, and epilepsy. The intimate relation between hepatic disorder and mental states is well illustrated by the facts already noted as having been recorded by Murchison, who instanced the case of Murat becoming jaundiced immediately after reading an unsatisfactory despatch. Similarly acute yellow atrophy occurs in a larger number of unmarried women during their first pregnancy, than in other patients, and though there are mental symptoms which are due to toxæmia, still a most important exciting cause may be, in many cases, the severe mental strain and emotional disturbance which the woman has to go through. At the same time, it has been reported in males, and also in children, two recent cases being aged 2½ and 6 years respectively. This subject of biliary toxæmia will be discussed more fully later. Suffice it to say now, that the usual mental type associated

with hepatic and other accessory alimentary glandular disease is melancholia, and that in some instances these symptoms may precede the possible diagnosis of some serious physical disease in the organ affected.

Duodenal catarrh, even in the sane, is usually associated with restlessness and irritability, and hypochondriasis or actual melancholia may be present for the time being.

Pancreatic disease is sometimes associated with mental symptoms. Ruggi reports a case of a woman aged 50 suffering from an abdominal swelling, with occasional severe pain; there was profound melancholia, which was really worse than the bodily pain. Laparotomy was performed, and an encephaloid mass involving the pancreas was removed, weighing 650 grammes. The mental depression entirely disappeared. This case will also be mentioned under the head of insanity cured by operation. In other cases published, where pancreatic disease had been diagnosed and operated on, mostly traumatic cysts, no mental symptoms have been recorded, so that the fact of this being a malignant tumour may have had some influence in the production of the depression in this instance.

Among functional disorders of the intestine, the most important by far in relation to mental derangement is constipation. At the present time merely the physical side of the question will be alluded to, as the toxic element will be considered when toxic insanity is treated. There is no doubt that the physical condition of a constipated person is not conducive to a healthy state of the intestine, and as it is absolutely impossible for an abnormal intestine to send normal stimuli to its corresponding nervous centres, so it must follow that mental disturbance of some sort occurs even in sane individuals. These are usually put down to the liver, but the cases which are relieved by large enemata, or which become amenable to dietetic and therapeutic regimen, show that probably the local intestinal condition had more to do with it, combined with the toxæmia which must accompany such a state, than a mere primary functional disorder of the liver. No doubt the liver suffers secondarily from constipation, but the first step in the treatment of such conditions is to clear the way for the biliary products, which will be gradually naturally secreted, not to stimulate the organ too soon. The fæcal masses act as an abnormal stimulus to the sensitive mucous membrane of the intestine, just as any other foreign matter does. Thus, nothing is more common than for convulsions to first intimate the probability of worms being present; in some subjects actual epilepsy may occur, and even insanity has been

cured by the evacuation of worms or the larvæ of flies from the intestine, hence it is only fair to presume that the worms or larvæ were the exciting cause of the mental condition. Esquirol found that 24 out of 144 patients in the Salpetrière had worms, and Vix, in a monograph, notes specially the occurrence of perversions of taste, marasmus, and sitiophobia, mostly in women, as being frequent in these cases. Krause reports a case of epilepsy which was cured when all the larvæ of two species of fly were removed from the stools; there were about 1,000 present, and were derived from the Musca vomitoria, and the Anthomyo canicularis. Slayter reports a case of delirium tremens from eating tea leaves to such an extent, that on the first occasion they formed a hard mass in the right iliac region, and after brisk purgation the leaves continued to be discharged for three weeks after; four years later the delirium recurred from a similar exciting cause, and subsided after the copious discharge of tea leaves. All these conditions illustrate the two clinical types and results of reflex action as defined by Brown Sequard.

1. Cessation of function may cause (*a*) diminution or loss of some intellectual faculties, (*b*) paralysis of one or several nerves of sense or (*c*) of general sensibility, (*d*) of volition, (*e*) of voluntary motor conductors, (*f*) of respiratory muscles, or (*g*) of vasomotor nerves.

2. Irritation of foreign bodies may cause (*a*) irritation of central terminations of voluntary motor, sensory and vasomotor nerves, (*b*) irritation of nerve fibres in the brain and other organs reflexly producing referred sensations, which differ from subinflammatory pain in that they are of a pricking formicating nature, or a feeling of heat or cold, not made worse by manipulation nor modified by movements, and may actually appear to be in a limb which is completely deprived of sensibility, or which even is not there.

It can thus be readily seen that a person who is constipated, or has other foreign bodies in the intestines, is suffering from a double source of irritation, for the gut has ceased to perform its normal functions for the time being, and is thus capable of producing some of the above mentioned reflexes, while at the same time the foreign bodies are a source of irritation with its own special train of reflexes which, being of a more active nature, mask to a certain extent the more negative reflexes of the former factor. In many instances not only is the colon sluggish in its action, abnormally distended and irritated by accumulations of fæces, and constantly absorbing toxins, but it is frequently in a condition of malposition called enteroptosis,

which must materially add to the abnormal stimuli which pass through the abdominal sympathetic to the cerebrum. This has been more particularly noted by Esquirol, Wickmann, Hesselbach, and Greding, while Moyer in America has frequently drawn attention to the diseases of the colon in the insane. In the case of a man at Morningside Asylum who had various delusions relating to his abdomen, it was found, *post-mortem*, that there was an old and extensive internal hernia through the mesentery to the extent of about twenty feet of small intestine. It is well known among surgeons that there often accompanies diseases of the rectum a despondency and depression out of all proportion to the severity of the actual disease. Piles, fissure, and fistula, the three most common simple diseases, and also the less frequent ulcerations, and chronic congested and pulsatile condition of the whole rectal mucous membrane, are all apt to be associated with a melancholic or hypochondriacal tone of mind. In the case of piles, and congested rectum, with or without impacted scybala, this is probably accomplished through the consequent portal congestion and hepatic derangement; but in the others, it is probably a purely reflex action coming from a sensitive and emotional area, for in the case of fissure there is the constant dread and fear of pain at or after each evacuation, which, when long continued, leads to a neurasthenic condition, while in tubercular or specific lesions, the general health is already impaired, and the nervous system ready to break down on the slightest provocation.

Bonet, Greding, and S. Pinet have remarked the occurrence of disease of the peritoneum as an exciting cause of mental symptoms, and Campbell reports a case of sitiophobia in whom chronic peritonitis was found after death. The greater frequency of insanity following abdominal operations, even though not strictly gynæcological—such as simple laparotomy, artificial anus, hernial cases, whether strangulated or not—points to the peritoneum as being an important sensory area, which may be able in certain cases to excite a reflex psychosis.

The influence of diseases of the circulatory system on the functions of the brain can very readily be understood on account of an equable and evenly balanced mechanism being necessary to supply the nutrient medium to it. This mechanism includes not merely the heart itself, but also the great blood-vessels and arteries, and arterioles at the base and in the substance of the brain. In many cases of cardiac disease compensation is so complete that little or no disturbance of the circulation is evident, or, at any rate, the disturbance and

secondary impairment of the blood is not sufficient to cause any definite cerebral symptoms. But when the heart becomes too weak to maintain an equable circulation, either from a primary weakness in its walls or secondary to atheroma or arteriosclerosis, whether of the normal senile variety or more strictly pathological, such as occurs in gout, renal cirrhosis, plumbism, or syphilis, then definite cerebral symptoms either become manifest for the first time; or, if the patient have been previously insane, a certain character, which is frequently an irresistible desire to be in motion, may be imprinted on his insanity, closely coincident with, and in fact due to, the altered state of his circulatory apparatus.

Mickle, who among others has devoted considerable study to this subject, subdivides the influence that heart disease may have in bringing about functional disorder of the brain, including insanity, as follows:—(1) It disturbs the balance of the general circulation; (2) it disorders the cerebral and cranial circulations, including the local vasomotor mechanisms; (3) the composition of the blood within the cranium is changed; (4) or that of the whole blood is altered; (5) pulmonary disorder is induced; (6) and the heart itself becomes a source of peripheral irritation which influences the cerebral functions, inhibiting some, deranging others.

When disease of the various factors of the system is studied seriatim, it is found that, roughly speaking, the mental symptoms attendant thereon are more or less definite, varying according to the lesion in the heart or vessels. Thus, mitral regurgitant disease is usually associated either with sombre emotional dejection and melancholy dread, with hallucinations and hypochondria, or there may be a more sullen and taciturn condition, with marked striking of attitudes, as in one subjected to annoyance or persecution. Mitral stenosis, on the other hand, is more frequently associated with an intense querulousness, as well as with delusions of persecution. Cases of general paralysis with these valvular lesions are usually of the depressed type, are more irritable, have annoying delusions, and are more apt to run into a rapid dementia after having had fewer expansive delusions than the ordinary type. If aortic stenosis exist before mental symptoms appear, they are apt to be characterised by sudden outbursts of excitement and violence, in addition to some depressed ideas as to adverse influences, and when aortic stenosis comes on in the course of an insanity, similar delusions and refusal of food have been noted. Aortic regurgitation, on the other hand, is mostly characterised by a mental condition of expansive and emotional

exaltation, rather a maniacal than a melancholic tendency; but when the aortic arch as well as the valves becomes diseased and dilated, a general mental deterioration and subsidence of the previous expansive and exalted condition supervenes. When mitral and aortic disease coexist, it is usually found in senile and organic dementia cases, and, on the whole, the symptoms are aortic in type; whereas, when the heart develops a condition of dilated hypertrophy, the symptoms are of the depressed and demented mitral type, and are very chronic. Thoracic and abdominal aneurysm may be merely indicated by false perception and interpretation of the inevitable pressure symptoms, but the nodulated aorta is most frequently found in general paralysis and other demented and syphilitic cases, often associated with patches of cerebral sclerosis and toughened meninges. These conclusions were arrived at after a study of 236 instances of disease, of which 163 were heart, and 73 aortic, cases; while, of 165 separate diseased individuals, 107 had heart, and 48 aortic disease.

Greenlees has also studied this relation between cardiac disease and mental symptoms and disease, and in 672 patients he found that almost 13 per cent had organic heart disease, while 44 per cent exhibited functional disorders of the heart. The organic diseases occurred with greatest frequency in cases of dementia and imbecility, being 22·3 per cent; then of general paralysis, in 15·3 per cent; of mania, in 12·2 per cent; and of melancholia, in 9·8 per cent. Functional heart disease was exhibited in an almost inverse order—viz., 50·8 per cent in melancholia, 43·5 per cent in general paralysis, 41·1 per cent in mania, and 40·2 per cent in dementia.

As regards arterial disease, 222 *post-mortems* showed thirteen cases of this affection, and when clinically compared in relation to the mental symptoms, it was found that it occurred as follows—viz., in general paralysis, 69·6 per cent; in dementia, 62·9 per cent; in melancholia, 57·5 per cent; and in mania, 51·02 per cent. This arterial degeneration does not appear, however, to occur at an earlier age in the insane, except in the case of general paralysis, where the arterial disease is dependent rather on the duration of the disease, than on the age of the patient. The influence of the blood pressure on mental symptoms, and the converse, may be better appreciated by giving the following conclusions, at which Greenlees arrived after an examination of many sphygmographic tracings in all forms of insanity:—1. In the various forms of insanity the influence of the nervous system on the heart and circulation is such that in nearly every case the

sphygmographic character of the pulse is altered in some way from the normal. 2. In acute mania, and in other forms of insanity associated with mental excitement, the nervous centres are congested, but the walls of the arteries being in a lax condition, there is lowered arterial tension, and the pulse tracing is dicrotic; as the case becomes chronic, the pulse more or less resumes its usual characters. 3. Mental depression, if recent and acute, produces a feeble cardiac systole, and an imperfect filling of the arteries; if, however, the depression is long continued, or if it is accompanied by mental hebetude or stupor, the systole becomes stronger, and the tracing indicates light arterial tension. 4. The arteries of epileptics are lax, and low arterial tension is the rule. During the status epilepticus, and during the unconscious stage of an epileptic fit, the ordinary character of the pulse tracing is lost and it becomes monocrotic or dicrotic, being "soft, frequent, small, running, similar to that found in coma and collapse from any acute disease." 5. In general paralysis the pulse varies according to the stage of the disease:—(*a*) in the first stage the systole is strong but sudden, the tension of the arteries is low, and the descent line is marked with numerous (4-8) undulations, probably the result of muscular tremors; (*b*) in the second stage the percussion impulse is moderately strong, and the apex presents either a rounded summit or else it is prolonged, indicating marked arterial tension; (*c*) in the last stage the ventricular systole is feeble, and the pulse tracing resembles somewhat that found in the first stage. 6. The pulse tracing in dementia indicates a feeble cardiac action, and a torpid circulation from imperfect distension of the vessels, probably due to slow evolution of nerve impulses along the vasomotor system. 7. Cases of congenital mental defect where it is inferred that there is an arrest in the development of the encephalon, as well as cases where it is evident that a certain amount of atrophy of the brain tissue exists, have tense arteries, and, as a rule, a strong cardiac systole, a condition in many respects similar to that found in fibroid degeneration of the kidneys, and in advanced aortic stenosis.

These original investigations by Greenlees were made with a Dudgeon's sphygmograph, and the amount of pressure used in each separate case was that with which the most characteristic tracing was obtained and was noted. Except when specially mentioned, cardiac and their physical diseases were eliminated so as to produce as true and scientific a record as possible, and it is evident that if such results are obtained from average physically normal insane patients, the introduc-

tion of either cardiac, arterial, or respiratory disease cannot fail to have a still more deleterious effect on the general and cerebral state of the patient.

The diseases of the hæmopoietic system, which may be accompanied by mental disturbance, will now be considered. (1) It has long been a moot point what is the exact ætiology of Graves' disease, but there is no doubt that whether it is primarily a sympathetic or a central disease, the nervous accompaniments are numerous and essential, and in some cases actual mental derangement supervenes on the one hand; while, on the other, exophthalmic goitre may appear in the course of mental disease. Russell Reynolds, in a series of forty-nine cases, found many nervous symptoms, sensory disturbances, and mental aberration, specially a "chorea of ideas."

Toulouse remarks the frequent and divers mental troubles which in many cases border on true psychoses, instead of being merely emotional manifestations, and several other French authorities are of a similar opinion; but Boeteau, after having studied twenty-four cases, many of which are unpublished, thinks that the mental troubles are independent of the exophthalmic goitre, and refers them rather to a hereditary influence or predisposition. He divides them into two groups:—(1) Psychic troubles apparently connected with the neurasthenia which is frequently associated with Graves' disease; (2) more definite psychoses, delirious melancholia, mania, alcoholism, systematised delusions of persecution, and even general paralysis. As to the first, it is difficult to differentiate those which are purely neurasthenic from those the result of the Graves' disease; and the second class do not appear to have any special type, and may occur in those not subject to exophthalmic goitre. Hence Boeteau concludes that there is no psychosis proper to or dependent on exophthalmic goitre, and Raymond and Serieux, though admitting that the delirium of degeneration may occur, can trace no pathogenic relation between it and the goitre, their impression being that a primary instability of the nervous system is the cause of both maladies. Toulouse contends, however, that though seductive, this theory cannot be applied to all its aspects. Exophthalmic goitre is a general malady whose most constant symptom in all patients is emotion, indicating considerable nervous disturbance and perturbation of the intellectual faculties. Doubtless the altered functions of the thyroid gland are able to exercise an influence on the appearance of cerebral symptoms, hence the disease is able to determine

psychic troubles which would not have resulted at that particular time, just as a patient would not have suffered from puerperal insanity if she had not been recently confined. The purely predisposition hypothesis is too sweeping and general. There are many points which require elucidation, such as whether the psychic symptoms are present at all periods of the illness in different degrees or only at certain times; whether the paroxysms of delirium are synchronous with exacerbations of the physical state; and, if so, whether the physical state is a cause or result of the mental symptoms; and, again, whether the general progress of one of those symptoms depends on the evolution of the other.

As before mentioned, there are two points of view from which these cases have to be looked at—(1) the occurrence of mental symptoms in the course of an ordinary exophthalmic goitre; (2) the occurrence of one or all of the symptoms of the goitre in the course of mental disease. As to the first, there is usually a feeling of morbid self-consciousness with subsequent delusions of persecution, mostly due to the altered personal appearance; the general mental state subsequently is one of maniacal excitement, usually periodic, with exacerbations or remissions of the goitre, and in these recurrent cases all the symptoms of the goitre are usually present.

On the other hand, exophthalmic goitre may appear in the course of pre-existing mental disease. It is closely allied to the neuroses, is more common in neurotic families, and, according to Savage, is not uncommon in the insane. It may be seen in melancholia, periodic mania, as reported in two cases by Emminghaus, or in general paralysis. In these cases there is usually only an individual symptom of the goitrous condition prominent at one time, as distinguished from the former class of cases, when all the symptoms of the goitre are usually present, and are associated with recurrent mental disturbance.

The most probable lesion is a vasomotor disturbance in the medulla, and as one centre of the brain must and always reflexly acts on others more or less dependent on it, or in association with it, it is readily understood how the varying bodily and mental symptoms varying so much in different cases may be produced. Whether the mental symptoms, if they occur sufficiently severely to be termed insanity, take the form of mania which is most frequently of the acutely delirious or choreic type or more or less depression, which is much rarer, will probably depend on the stage of the disease, the state of malnutrition of the brain and body when the

symptoms appear, and also on any hereditary tendency to an excited or depressed state of mind. It will be seen later that the mental symptoms of exophthalmic goitre and of myxœdema are almost exactly the reverse, for in the latter melancholia is more frequent, with occasional maniacal outbursts, whereas just the opposite has been noted in the former. Such facts are strongly in favour of a great influence by the thyroid gland itself being exerted on the nutrition of the brain through the medium of the blood and lymph.

Myxœdema is one of the most striking maladies of this generation, and the practice of its treatment has opened up a vast area for both clinical and experimental investigation. Not only does the thyroid gland treatment seem to have an almost specific effect on the purely myxœdematous state, but sundry other conditions seem to be beneficially acted on, though at first sight there is no apparent relation between them. For this reason it is almost certain that the thyroid gland does not merely serve one function, nor secrete merely one substance whose presence in the blood is an absolute necessity for the preservation of health. The fact that some cases of eczema, psoriasis, and lupus are benefited by the thyroid treatment, as reported by Bramwell and others, seems at once to establish this multiple function. Though many cases are reported by various asylum physicians, it seems that mental symptoms sufficiently serious to require asylum treatment are not so common as one at first might be led to suppose. Thus Greenfield reports that only two out of seventeen cases he had observed were actually insane. Stalker, of Dundee, says he knows of twenty-one cases personally in that town of 153,000 inhabitants, and it is presumed that none of them are in the asylum. Some districts in Edinburgh are particularly affected, but Clouston has had only nine cases in the Royal Asylum.

The previous history is usually one of depressing circumstances, mostly in women, some married and too frequently pregnant, others single with perhaps illegitimate children; others are barren, some have a family history of phthisis in a previous generation, some more decidedly neurotic, one case reported having two sons subjects of Graves' disease. During the course of the disease Greenfield noted a marked tendency to tuberculosis. Only a small percentage occurs in males. The age at which the first appearance of symptoms is manifest varies considerably, usually between thirty and fifty. At first the cerebral symptoms consist of marked occipito-vertical headache, which is most persistent during the whole course

of the mental aberration. The memory becomes defective, thought, perception, motion, sensation, and reflex actions are all slowed and dulled, and co-ordination somewhat interfered with. A progressive somnolence, torpor, hebetude, and perfect apathy, which gradually proceeds to dementia, supervenes, and the case ends by convulsions, coma, and death.

During the whole course of the disease, the entire tissue metabolism is interfered with, blocked and perverted. In many cases definite delusions arising from hallucinations of the special senses are marked, and they are usually of a melancholic type, though sometimes of the excited variety, and sometimes mania may also develop and vary from simple general exaltation with some grandiose delusions to delirious incoherence. These attacks of mania are more or less temporary and intercurrent, and are often the actual cause of the patient requiring asylum treatment. Of Clouston's nine cases, seven were maniacal on admission, though all had begun with the usual typical mental lethargy.

The usual history of cases before 1891 was that they gradually died in a more or less completely demented condition, and no drugs, regimen, nor treatment of any kind had the slightest permanent effect. Since the thyroid treatment came into more general use the results in these cases have been most satisfactory. In the comparatively short period of a few months the patient has undergone a complete physical and mental change. Physically, the loss of body-weight is one of the most striking features, and gradually the whole system becomes more supple and less encumbered by the myxœdematous deposition and infiltration. The number of blood corpuscles increases, and the hæmaglobin percentage likewise improves in value. Menstruation, which is usually suppressed, reappears if the patient has not yet passed the climacteric; the bowels and stomach, and, in fact, every organ, seems free, and at liberty to perform its normal functions. Mentally, the change is no less gratifying: from the state of apathy, melancholia (simple, restless, or suicidal), or mania with delusions, we gradually see lucid intervals appearing. Thoughts and actions are not so slow and sluggish; the excitement quiets down, or the depression is less profound; the patient begins to take some interest in herself and her surroundings, may do some needlework or write a coherent letter to her relations, the first for years. This improvement is generally sustained, and they are able to be discharged cured. Relapses may, however, occur, and have to be treated in the same way.

Clouston's conclusions are (1) that the mental functions are always affected; (2) that a large proportion are insane; (3) when they remain sane they remain in much the same condition, but when once over the sane line the insanity is very marked; (4) all the common and special senses are affected; (5) there is first a period of acute mental disturbance, then dementia with delusions, mostly of suspicion; (6) the thyroid treatment by one-sixteenth of a gland is best.

Affleck has reported a curious case in which there is a reversal of the usual sequence of events. In this case there was a cerebral hæmorrhage, with subsequent softening and mental deterioration, which necessitated her confinement in an asylum. She recovered, and some time after developed the myxœdematous habit of body.

Cretinism is also in many instances markedly relieved by a course of thyroid treatment, and though very much improvement cannot be expected in some of the very old standing cases, still the results, as communicated by Bramwell and Thompson, in which cretins of a more youthful age have been treated in this way, are most satisfactory and encouraging; it may be the means of permitting many such cases to live at home, instead of dying at an early age or drifting to swell the already too great accumulation of incurables in our asylums. Cretinism sometimes appears as a sort of small epidemic, or rather endemic, and Bell reports that such was the case a few years ago in the valley of the Tay, there being six or eight cases, all within a short time, known to himself.

Functional and other nervous and psychic troubles are often due to changes in the blood, either as regards (*a*) its quantity or (*b*) its quality.

(*a*) Whenever the quantity of the blood is diminished below a certain standard—which, however, varies in different individuals and with the degree of rapidity with which the diminution has been brought about—certain cerebral and spinal symptoms never fail to manifest themselves. A "faint" is the most common and familiar evidence of interference with the cerebral circulation. This may occur in one of two ways—either the result of a general sudden depletion, such as from actual hæmorrhage or profuse diarrhœa in an already weakened patient; or there may be no actual loss of blood or flux so far as the body is concerned, but a serious diminution as regards the cerebral circulation, a reflex result of shock, pain, emotion, or sudden erect attitude after prolonged recumbency. In both instances the syncope is a beneficial provision of nature, for in the first case it allows of a chance

of the hæmorrhage stopping from the heart's lessened action, and in the second place the whole system is saved the full bad effect of the shock, pain, or emotion by quietly lapsing into a beautiful unconscious condition. The general nervous tone and condition of the patient has, of course, a marked influence in determining the amount of blood or flux which is able to be withstood, or the amount of shock which the nervous system is able to combat. The chief factor, however, is the rapidity with which the loss occurs. The total amount of blood is, in a very rapid loss, not nearly so large as could be permitted if it were to occur in a more slow or intermittent manner, as can be readily understood by comparing a post-partum flooding and a case of continuous menorrhagia lasting some hours or days. The result of the first is that there is a sudden fall of general and cerebral blood pressure, which can at once be remedied by transfusion; but in the latter instance, over and above the lessened amount of blood, there is also a serious interference with its quality, which is more marked and persistent than in the first case. The patient is in a state of chronic atony and anæmia; but this atony, which is really a provision of nature, allows of a more rapid circulation of the blood, which to a certain extent makes up for the diminished quantity and faulty quality thereof. When acute anæmia is not arrested by syncope, further cerebral and spinal changes become manifest. The arms are reflexly moved in all directions, and a general muscular restlessness rapidly becomes evident. Sighing and yawning take the place of the previous rapid and shallow respirations; these bodily movements are reflexes, endeavours to urge on the blood to the heart and brain; and the involuntary respiratory acts are also reflexes, as by the different expansion of the chest the blood in the dilated abdominal veins has more *vis a fronte* than by the ordinary respiratory acts. Later, convulsions may supervene, and coma and death from general anæmia. That the nervous tissue is sometimes actually affected by even an apparently simple anæmia or chlorosis is evidenced by those cases in which more or less marked retinal changes have been noted, and in whom other causes of such a condition, such as albuminuria or uræmia, have been excluded. In some cases of pernicious anæmia, actual hæmorrhages may be seen in the fundus of one or both eyes, and it is natural to suppose that similar extravasations on or in the brain substance may be an exciting cause either of the mental disturbance which may accompany these cases, or of the various irregular rises in temperature which

might be the result of a cortical lesion of this nature. In a case under Dr. Affleck's care, in which the lowest record was 950,000 red cells and 22 per cent of hæmoglobin, the temperature continued pyrexial until the red cells were over 1,450,000 and the hæmoglobin 30 per cent; after this stage all the symptoms improved *pari passu* with the increased percentage of red cells and hæmoglobin till she was discharged cured.

(*b*) The quality of the blood is very often altered in the insane, and this may result in two ways—either from intrinsic or extrinsic causes. Intrinsic causes, as from diabetes, uræmia, cholæmia, and respiratory changes, will be considered when toxic insanity is treated of. Extrinsic causes of alteration of the blood include mostly the fevers, cholera, diphtheria, syphilis, and tuberculosis. Physiological chemistry, bacteriological investigation, and spectral analysis may thus in some obscure cases be able to clear up a doubtful diagnosis, as has been shown by Müller. The chief results of either of these causes are changes in the number of corpuscles, in the total amount of hæmoglobin, in the hæmoglobin in each cell, and in the diminution of mineral salts in the blood-plasma, which is the universal carrier of the toxins which are being developed or of drugs introduced for various reasons or accidentally taken.

Amongst others, Macphail has particularly studied the changes in the blood in certain mental conditions, independent as far as possible of marked bodily disease. In mania, he found that both the corpuscular and hæmoglobin percentage was equal to, sometimes higher than, normal. During individual attacks of maniacal excitement there is a diminution of the red cells and also of the hæmoglobin, but more granules were present than in the quiescent condition. In melancholia, the blood is deteriorated in 50 per cent of the cases he observed, and mostly so in women, both as to red cells and hæmoglobin, but in several the red cells were normal, and only the hæmoglobin was deficient. In dementia the red cells diminish with the age of the individual, but the hæmoglobin, which is also deficient, does not seem to be influenced by the age; masturbational cases were worst. Imbeciles usually had fewer red cells and hæmoglobin. The blood, in cases of general paralysis, varies somewhat with the stage of the disease, and he could corroborate Seppilli's observations. In the first stage, in 25 per cent of the cases there is a leucocythæmic condition, worse in males, while in 33 per cent of the cases, mostly women, there is a fall in the red cells, though the hæmoglobin is fairly normal. The red cells deteriorate in

quantity and quality according to the progress of the disease, and the increase of the white cells is also in accordance with the stage of the disease. The hæmoglobin is low or normal at first, increases in the quiescent stages, but falls in the third or paralytic condition. As a rule there is marked absence of rouleaux formation, and the condition of the blood probably explains the frequent occurrence of pachymeningitis hæmorrhagica interna during the course of the case. In idiopathic epilepsy, in 100 cases the red cells were lower in 37 per cent and higher in 40 per cent, and, on the whole, both red cells and hæmoglobin were better than in dements of the same age, and were also better while under treatment by bromide of potash. Bevan Lewis reports five cases of puerperal insanity, in all of which the hæmoglobin was lowered by from 20 to 78 per cent, though the red cells were nearly normal in uncomplicated cases, but the hæmoglobin equivalent was invariably low, and in one case the red cells themselves were only 40 per cent. Pellagrous insanity is unknown in Great Britain, but in Italy it comprises 20 per cent of the admissions into asylums. The red cells are subnormal, markedly so in some women, and the white cells were increased in 10 per cent of the cases. The hæmoglobin was also lower than normal—mostly in women—and even more so than the diminution of the red cells.

A physiological property of the blood—viz., clotting—sometimes has as a result cerebral derangement. The pathological causes of this may be (1) a hyper-rhinotic condition of the blood such as occurs in certain conditions, notably in acute rheumatism, pneumonia, and some puerperal and septic conditions; or (2) to an abnormal condition of the endothelium of the heart, arteries, and even veins, of the nature of acute endocarditis or endarteritis, or of a more chronic degeneration—atheroma. The arteritis of the middle coat and periarteritis which occurs in syphilis, renal cirrhosis, and chronic plumbism may also act by causing a gradual occlusion or obliteration of the full calibre of the vessel, or in other cases aneurysmal dilatations may occur with or without subsequent rupture. The gradual extension of a cerebral tumour will also cause a corresponding obliteration and consequent thrombosis of many vessels in its immediate neighbourhood, which often accounts for the premonitory symptoms. The most frequent instances of these conditions may be briefly exemplified by noting cases of cerebral embolism occurring during the course of acute rheumatism. The exact symptoms vary according (1) to the site of the

lesion and corresponding cerebral area which is rendered functionless, and (2) to the composition of the clot, whether soft and more or less easily broken down, when perhaps little ultimate gross lesion is left; or more fibrinous, when it practically constitutes a permanent lesion; or septic, with resulting acute inflammatory changes. A similar state of affairs may arise from a hæmorrhage, which, if slight, may be soon absorbed without any serious consequences except the latent weak spot, or it may have ruptured so many fibres that complete repair is impossible, and permanent paralysis with or without actual mental symptoms is the sequel.

I have seen a case of aphasia in a healthy young man resulting from embolism in the course of acute pneumonia without cardiac lesion. Wyllie has also reported a case of left hemiplegia from a similar cause, remarking on the good fortune that it was left-sided. Another case of pneumonia, in a young woman, died with cerebral symptoms under the care of Professor Grainger Stewart in 1886. The *post-mortem* revealed extensive thrombosis affecting not only the right subclavian vessels, but also the right jugular and meningeal veins. Handford also reports a case of empyema dying with cerebral symptoms, probably from the same cause. Dr. Affleck had under his care a pale, anæmic girl of nineteen suffering from right hemiplegia, some hemianæsthesia, and aphasia. The diagnosis lay for some time between a hysterical and an organic lesion, but the permanency of the condition and the marked normal hemiplegic gait seemed to favour the latter conclusion.

Collier published the case of a woman who, sixteen days after her confinement, had general convulsions more on the right side. These recurred for four days, then became less intense and merged into a semi-conscious state, which increased, and she died eight days after the onset of the convulsions. The *post-mortem* showed the pia mater ecchymosed and the veins thrombosed, including all the sinuses; the ecchymosis extended into the cerebral substance; the ears were healthy; and no septic focus was found. I saw a similar case after a four months' abortion, in whom, a fortnight later, cerebral symptoms developed, general fibrillary twitching, gradual coma, and death with hyerpyrexia in a week after the onset.

Dr. Dawson reported a case of ecchymoses following insane excitement. She suffered in 1890 and since from melancholia with delusions of suspicion, and fortnightly exacerbations of indignant grief in which she was very noisy and abusive. During the first two years, these outbursts were sometimes

accompanied by erythematous eruptions, but last April purpuric spots appeared after a fit of excitement, and continued to do so, the spots varying in size and appearing at varying times in every region of the body. Once some blood was evacuated from the mouth, and once a small spot appeared on the tongue; there was no rise of temperature, but the heart was weak. Only one similar case is reported by Drs. Savage and Price Smith, and, from recent pathological investigations, the cause may be stated as follows:—Arterial dilatation due to the mental excitement, and predisposed to by diathesis and time of life, this woman being aged fifty; sluggishness of venous return from cardiac weakness; and, lastly, an undetermined variety of vascular degeneration, which it is necessary to assume to account for the interval between the occurrence of the mental disorder and the ecchymotic symptoms.

Benedikt reports a curious case of a boy, aged 15 years, who had rigors every eight days, the temperature varying from 39° C. to 41° C., accompanied by severe headache, and on one occasion he was unconscious. He recovered, and in a week or two the same thing recurred, temperature rising to 42·5° C., with a sudden crisis to 36° C. He lost consciousness when the temperature rose above 42° C., had a staring expression, and muttered the word "robber." These attacks lasted from ten to fifteen minutes; the pulse never rose over 104. He had visual hallucinations for a short time. The attacks never occurred at night nor during sleep, but often at meals. There were no cerebral symptoms between the attacks. There were splenic enlargement, increase of white corpuscles, and disintegration of red cells and slight albuminuria. Quinine and arsenic failed, but some improvement followed the use of the cautery, not mentioned where, and the administration of iodide of sodium.

Disease of the suprarenal capsules has been observed by Griesinger to be sometimes accompanied by extreme and profound depression, and Macphail reports a case of melancholia with great anxiety and emotional attacks of religious exaltation. Food was refused later, and the patient died of marasmus.

There are many affections of the nervous system which are occasionally associated with mental symptoms; these, however, are in some cases more of the nature of an accident than an essential feature or result of the nervous affection. The nervous disease which has most relation to mental disorder is epilepsy, whether one regards it as being concomitant with the already existing disease, or a most powerful, exciting, and

predisposing cause of insanity. Hughlings Jackson "does not entertain the hypothesis, held by many medical men, that there is any relation of community of character between epilepsy proper and insanity. There is, in his opinion, no such relation between the pathological and physiological state of the brain in epilepsy and the pathological and physiological state of it in insanity. There is a relation of sequence often enough, not rarely there is temporary mania after a fit, and sometimes chronic mental failure occurs in epileptics, but that relation of sequence is quite a diffierent thing from a relation by community of character." There is no doubt that epilepsy may be present and still no mental symptoms of any serious import follow or be assiocated with it. In fact, it is one of those curious anomalies of the nervous system that epilepsy is in some cases associated with marked intellectual ability or genius in one direction, but in the next generation this may not by any means be the dominant feature of the nervous system or intellect. As a rule, the subject of epilepsy, more especially of the "petit mal" type, according to some, runs a great risk of mental deterioration, and also of sudden impulsive acts, which may be considered as an intellectual convulsion in the place of a sensori-motor attack.

Actual insanity in connection with the fits may be subdivided into (1) a preliminary excitement or depression which lasts for a varying period before the fit; (2) in place of the fit, the sudden impulses above mentioned may occur; (3) post-epileptic mania is the most frequent and dangerous form of insanity related to epilepsy, and it may last for some days. In other cases, stupor, great prostration, immobility and terrifying delusions with depression may occur. Sooner or later a large number of cases terminate in dementia, but before this stage supervenes fully the condition is one usually characterised by ideas of persecution and irresistible impulses. The insanity often accompanied by epileptiform attacks resulting from traumatism will be considered under that heading.

Diabetes, as distinguished from glycosuria, has also some very curious associations both with certain other bodily diseases and with insanity. Cristiani made a series of experiments on the subject of glycosuria, and found that lesion of the solar plexus may produce glycosuria, acetonuria, and albuminuria. He considers the vaso-paralytic diarrhœa in mental patients a result of solar plexus lesion, and the urine of 10 such patients was examined, with the result that in all glycosuria and albuminuria were present, though in 30 control patients, 15 suffering from simple intestinal catarrh and 15

with no diarrhœa, no glycosuria nor albuminuria was found. He is of opinion that glycosuria and albuminuria are rarely present in the insane, unless with nervous diarrhœa, and that acetonuria, though present in experimental cases, was entirely absent in these clinical cases.

The relation between diabetes and insanity is well illustrated by statistics of Savage, who reports that in Bethlem 40 patients had diabetic relations, of whom 10 were parents or grandparents, 14 were brothers or sisters, 12 were aunts or uncles, and 3 were cousins. Besides these 40, 12 others had relations insane as well as subjects of diabetes, and 10 were themselves insane diabetics. Nearly all were melancholic, and in many there is a sort of alternation in the diseases, and the diabetic symptoms are frequently conspicuous by their absence. Thus it is seen that diabetes and insanity run in the same families, and may alternate either in the individual or in different generations, and may be associated with certain other maladies. I have had a patient whose father was diabetic, and whose mother died of malignant disease. He is in a state of advanced paralysis agitans, with considerable mental infirmity, fixed delusions, and depression; he also has frequent attacks of gout, and other arthritic pains and contractures. He was very subject to paroxysmal sneezing at one time, and his son is likewise subject to this sneezing, and has occasional attacks of "petite mal" and "grand mal." The conclusions that Savage arrives at are:—(1) That diabetes may arise from local brain disease or injury, and that similar conditions may induce insanity; (2) similar bodily conditions may induce either diabetes or insanity; (3) in certain states, some diabetic symptoms may follow on brain changes, without diabetes as a whole being developed; (4) in insanity proper diabetes is uncommon; (5) diabetes and insanity run together in the same families like epilepsy, the two conditions sometimes alternating; (6) when diabetes and insanity coincide, the usual type of the latter is melancholia, though sometimes there is comparative optimism, in which case there may be some phthisical disease; polyuria and great thirst are often absent. Phillips reports that acute mania cases may have great glycosuria, and Roberts is of opinion that though cerebral injuries may produce glycosuria, diabetes never follows them. That actual changes in the nervous tissue may and do take place in the course of diabetes is evidenced by the appearances of the retina, which have been summarised by Saundby as consisting—(1) Retinitis centralis punctata diabetica, bright spots often coalescing in the centre of the

retina, and often with hæmorrhages; (2) retinitis hæmorrhagica diabetica, hæmorrhage followed by inflammatory and degenerative changes; (3) mixed cases. These nervous lesions are only found in cases in middle and advanced life, which makes one doubt their being always cases of true diabetes. The first variety is never accompanied by optic papillitis, and the second is clearly due to vascular degenerative changes.

The conditions of diabetic coma and dyspnœa will be further noted when toxic insanity is considered.

In the case of most of the other nervous diseases the occurrence of insanity is an epiphenomenon, such as in chorea either of the acute or the senile form, cerebral tumours, and paralytic cases. One may more particularly note, however, that in locomotor ataxia there is usually some modification of intellect or character, the patient becomes irritable, distrustful and depressed, sometimes with a suicidal tendency; but there may be genuine insanity, and there are several ways in which locomotor ataxia and insanity are related. Pierret and Rougier usually found melancholy with vague ideas of persecution, confused hallucinations, suspicions, and hypochondriasis; but other cases had the ambitious delusions of of general paralysis, and in a definite percentage of cases locomotor ataxia is either a causal concomitant or a sequel of the general paralytic condition.

In disseminated sclerosis there are often similar minor alterations of the mental state, and in one case I saw, an old woman of 72, there was an intercurrent attack of acute delirium, which necessitated her removal to the special ward.

Paralysis agitans has already been alluded to, and cases of congenital spastic paraplegia, athetosis, and other birth palsies will be considered when we come to traumatic insanity.

One other condition may be noted here, viz., the trophic changes which may occur in the course of insanity, more especially in relation to the osseous system. Wiglesworth found that (1) the ribs of lunatics are healthy in only a minority of cases; (2) there is a slight change in the majority of cases, such as thinning of the external layer of compact bone, and enlargement of the Haversian canals, due to malnutrition; (3) in about 10 per cent there is a special lesion, osteoporosis, there being apparently some direct causal connection with insanity, specially general paralysis and tabes, as that is a much higher proportion than in the sane; (4) ribs often fracture from slight causes or from muscular exertion, as in an epileptic fit, and there is rarely osseous union. Shaw

found, after a similar investigation, that the weight of the ribs on different sides of the body varied, as did also their breaking weight; the lighter rib often bore the greater weight. Cardiac cases bore less strain, while in advanced phthisis the weight borne may be above the average. Apparently there is no relation between the individual strength and the rib strength, and it was only in degenerated heart cases that the ribs were more brittle.

The influence which any defect in the renal system has on the cerebral functions is one of the most marked kind, for not only are the kidneys themselves very frequently diseased, but almost every system and tissue in the living body are more or less affected secondarily to or coincidently with the renal affection. The connection between renal cirrhosis and cardiac hypertrophy and dilatation has long been known, but it is only more recently that arterio-capillary fibrosis has been also recognised, either as a result of the renal disease or as a general and progressively fatal disease, the particular form of chronic renal affection being merely a local manifestation of it. Balfour says that this arterio-capillary condition "cannot be differentiated during lifetime, if at all, from senile loss of arterial elasticity." Gull and Sutton, who first clearly defined this disease, were of opinion that it primarily affects the vascular system, and only invades other organs such as the heart, kidneys, lungs, and nervous system, not simultaneously nor in any sequential manner, but, as it were, casually as part of a wide-spread cachexia which has its basis in the vascular system. They deny that there is any direct causal relation between renal cirrhosis and hypertrophy of the left ventricle of the heart, and Balfour is also of opinion "that the heart found connected with the cirrhotic kidney is always in the state of dilated hypertrophy usual in the senile heart, varying in degree in each individual case." So long as either senile or other arterial degeneration is able to be compensated by the hypertrophied heart, no brain symptoms of malnutrition appear, but so soon as either more extensive arterial degeneration or cardiac failure takes place, the brain is instantly affected, and symptoms of a character varying according to the locality of the malnutrition appear. Thus, "brain failure is not a necessary characteristic of old age," but is merely an indication of local malnutrition for which the cardiac failure, arterial degeneration, and probably an actual change in the composition in the blood are mostly to blame. Degenerations were divided by Parkes into two great groups:—(1) Those simply the result of old age—that is, of the peculiar force

which first builds up, then maintains, and finally dies, leaving behind it a tissue worn out, effete, and useless; (2) degenerations, the slow result of some excessively slight but constant failure in nutrition, fibroid, fatty and atheromatous changes and wastings, especially of muscular fibres but also of gland cells, mucous membranes, and nerves. These conditions come in to complicate the acute maladies, and largely increase their mortality. Thus the chance of degeneration being present in patients of middle age is a source of great embarrassment in prognosis, and the means of detecting many of these changes, and a recognition of how to avoid them, are points which require elucidation.

The opinion expressed by Gull and Sutton seems to be markedly corroborated by some facts which I was able to gather from the study of 100 consecutive *post-mortem* records in the Royal Asylum, Edinburgh, dating from 1887 backwards. I found that in these 100 cases there were thirty-nine instances of actual renal cirrhosis, thirteen other subjects had adherent renal capsules and were probably merely early cases of cirrhosis; in the total number only fourteen kidneys were normal. The average age at death of the thirty-nine cirrhotics was 57·2 years, and the average weight of the kidney was 3·9 oz. as compared with 4·4 oz., which is the correct average weight of the kidney at the age of 57, thus showing that a very material shrinkage of the kidney substance had taken place during the disease, and the consequent renal inadequacy must have been by no means trivial. When looked at from a psychological point of view, it was seen that there were forty-five mania cases, thirty-two melancholics, sixteen general paralytics, and the balance various dementiæ. Of these forty-five mania cases, 33·3 per cent had renal cirrhosis; of the thirty-two melancholia cases, 40·6 per cent had renal cirrhosis; while of the sixteen general paralytic cases, 50 per cent had renal cirrhosis.

Complementary to this enquiry into the frequency of renal cirrhosis and its accompanying mental manifestations, the condition of the dura and pia mater was also noted, and it was found that it was no mere coincidence to have renal cirrhosis and abnormal meninges with a special type of mental disease. In the first place, the dura mater was found to be adherent or abnormally thickened from any cause in 52 per cent of all the cases; but only one of the thirty-nine undoubted cases of renal cirrhosis had a normal dura mater, and in 74·3 per cent of these cases it was said to be abnormally adherent. Clinically considered, it is seen that disease of the

dura mater has an interesting distribution, and still more so when associated with renal cirrhosis. Of the general paralytics 37·5 had adherent dura mater, the percentage of these with renal cirrhosis was not noted, unfortunately; of the melancholics 43·7 had adherent dura mater, and 69 per cent of these had also renal cirrhosis; while of the mania cases 60 per cent had adherent dura mater, and 86·6 per cent of these had renal cirrhosis.

The pia mater was found thickened or adherent to the brain in 35 per cent; but, when renal cirrhosis was combined with abnormal pia mater in any respect, the percentage rose to 71·7, of which 30·7 per cent had adherent pia, 38·4 per cent had non-adherent but thickened and opaque pia, while in 3 no note was made. Clinically these results were distributed as follows:—87·5 per cent of the general paralytics had adherent pia mater, and 100 per cent had abnormal pia and renal cirrhosis; 31 per cent of the melancholia cases had adherent pia, but only 10 per cent had both this and renal cirrhosis; and 24 per cent of the mania cases had adherent pia mater, though of these 45 per cent had this and renal cirrhosis combined. This is an interesting inversion as compared with the former table referring to the clinical occurrence of abnormal dura mater, and it must have considerable significance from an etiological point of view, when the physiological and pathological structure and functions of the affected membranes and the subjacent cortex are studied. It is undoubted that renal disease has a most important influence in the determination both of the incidence of insanity and of its type if previously manifested, not only on account of the primary renal and consequent excretory changes and their results, but also, and most especially, when diseases of the meninges are so marked in such a large proportion of the cases.

The frequency of dura matral disease is an important factor in determining the mental aberration, as it certainly can act as a source of intense peripheral though almost central irritation, and thereby produce most marked reflex, mental, and other cerebral symptoms. But the functions of the pia mater are somewhat different, and hence it is found that there is little correspondence in the class of cases where the most marked disease of either membrane is present. It is through the medium of the pia mater that so many changes and variations in the cerebral circulation take place, for not only does it act as a delicate basis wherein the capillaries are distributed, but it also fulfils the function of a distensible

reservoir along with its ependymal extensions in the ventricles, thus allowing of considerable relief to the cerebral cortex as occasion requires. It is by means of the potential arachnoid space that the lymphatic circulation of the cranium is carried on; and this is perhaps of equal, if not of more, clinical importance pathologically than the mere condition of the capillaries. It is thus evident that, when the pia is thickened in various degrees up to absolute opacity, it is unfit to perform the function of a distensible reservoir for the blood, and at the same time the lymphatic circulation comes to be seriously impeded, and collection of arachnoid fluid is the result, with more or less pressure as a sequential symptom. Again, when the pia is actually adherent to the cerebral cortex, there is an absolute and total interference with anything approaching the normal lymphatic or vascular circulation, and the result is only too forcibly expressed by the whole train of symptoms exhibited by a typical general paralytic. When there is combined with this abnormal condition of the pia, a state of the kidneys which is detrimental to the efficient elimination of waste products from the blood, it can be at once recognised how serious a physical state such a patient is in, and how hopeless any treatment is likely to be as regards any permanent benefit. The importance of this combination can hardly be better appreciated than by remembering that, though only 87·5 per cent of the general paralytics had adherent pia mater, 100 per cent of those who had renal cirrhosis had an abnormal pia mater; and again, though only 24 per cent of the mania cases had an adherent pia mater, 45 per cent who had renal cirrhosis had an abnormal pia mater. It is also strikingly shown that the condition of the pia, specially when combined with renal cirrhosis, must have a very considerable influence in the production of excitement, motor and mental, for though a slightly larger percentage of melancholics than maniacs suffer from renal cirrhosis, still when the condition of abnormal pia is taken into account the difference is most marked; for while 45 per cent of the mania cases had combined renal cirrhosis and abnormal pia, only 10 per cent of the melancholics had a similar association, and though I have not the opportunity to state it as a fact, it is highly probable that these 10 per cent were of the excited variety.

Still more recently Dr. Bond has given some statistics which bear out many of the points which mine showed, even more forcibly, for he was able to take a larger number of cases—viz., 154 in Banstead Asylum. He found that 48 per

cent were subjects of renal cirrhosis, excluding all fatty, tubercular, or waxy cases. Like me he also obtained statistics from a general hospital, St. Bartholomew's; and it was found that in 422 cases only 26 per cent presented chronic renal changes. This is a greater difference than I was able to show between the insane and the sane;[1] but, if the 13 cases of adherent capsules be added to the 39 of marked cirrhosis in my series, we find that in my 100 cases there were 52 per cent insane compared with 32 per cent of sane renal cirrhotics, and thus there is really only a difference of 2 per cent. Dr. Bond desires to make alcoholic indulgence almost wholly responsible for this renal condition; and if this renal condition were taken as an indication of an alcoholic etiology of insanity, it would make alcohol a direct cause of 32·2 per cent of admissions. Taking my cases from a clinical point of view, this would make out that while only 33·3 per cent of mania cases were alcoholic, 40·6 per cent of melancholia cases owed their origin to alcoholism, and 50 per cent of general paralytic cases.

Dr. Auld considers this change in the vessels of the pia mater to consist "of a hyaline fibroid thickening of the outer vessel coat, not an exudation, nor a deposition of foreign nor a transformation of existing structure. This outer coat thickening is due to a proliferation of connective tissue corpuscles embedded therein, leading to new formation of tissue forming a slow progressive peri-arteritis, which is probably general through the whole tissue of the pia, and is accompanied at first by a hypertrophic, latterly by a degenerative, change in the muscular and inner layers of the coats of the vessels." Such being the pathological state of the pia, it is not surprising to find that clinically the cerebral circulation must at various times during this process be seriously interfered with, and that the brain cannot by any chance escape from an alteration in its normal functions, when on the one hand its circulation is interfered with, and on the other the blood and serum it does get is of an impure and noxious quality. That the brain tissue is directly influenced by these various conditions is found both pathologically and during life by means of the ophthalmoscope, which reveals the various stages and changes in the retina.

Renal disease may be associated with insanity in two ways:—(1) An acute transient delirious mania, really an acute toxæmia which will be noted later, in the course of active bodily disease; (2) true renal insanity, or the insanity of

[1] Page 6.

Bright's disease. The chronic renal disease may act as a primary cause, in which case a mild quiet delirium closely allied to dementia may be excited, and may continue so long as the albuminuria is present; but it may disappear if the renal disease should happen to sufficiently improve. But the renal disease may have a great influence on the mental state of a person already predisposed to insanity, and in these cases it is usually through the various vascular and other organic changes which have been alluded to, that the serious mental impairment and terminal dementia is produced, not a more or less pure toxæmia as in the first class of cases or the first subdivision of the second class.

The question of renal disease or inadequacy is most important when operations, more especially on any part of the genito-urinary tract, are necessary; for in these cases even a trivial operation may be sufficient to rapidly induce suppression and uræmia, which may be fatal; and even in other cases where a fatal termination does not ensue partial suppression and uræmic symptoms, more or less grave, add a most serious complication to an otherwise easy recovery.

Insanity occurring in relation to diseases of the reproductive system is very largely confined to the female sex, and in considering it, the first point to attract our attention is that insanity is often decidedly periodic or cyclical in its occurrence or recurrence, and this quite independent of the sex, or any actual gross lesion in the organs constituting the reproductive system. At every epoch in our lives, if we happen to have any predisposition, known or unknown, cerebral or nervous phenomena are apt to occur. Thus the convulsions of infancy attendant on the first dentition are the most common example of this. Actual insanity before puberty is very rare except where there is strong heredity, in which case terrors, nightmares, and nocturnal delirium, sometimes with visual hallucinations and impulses, may appear. At the second dentition, from about the seventh to the fourteenth year, other changes may take place, varying in degree from a certain marked backwardness, stolidity, and stupidity, often associated with naso-pharyngeal adenoid growths and consequent mouth breathing, and the various morbid conditions of the palate indicative of a neurotic diathesis, to the strangely sad cases of developmental general paralysis. Sometimes such cases have been attributed to an injury to the head, and as such will be considered later, but in others the reserve force in the brain seems to have been exhausted, and they devolute just when they should evolute. Puberty in both sexes is the

next trial to the nervous system, more especially in girls, and now there are to be observed, according to Maudsley, cases of quasi-hysterical melancholia or acute recurrent mania. In all these cases delusions are rare, there being rather a moral than an intellectual instability. This results from the prolonged strain and the altered physiological chemistry which takes place in the body at this time, notably the increase of uric acid in the blood, and the consequent anæmia which is almost universal at one time or another of a girl's life. The insanity of puberty occurs in ·2 per cent male and ·4 per cent female admissions into all the asylums and registered houses in England and Wales.

In the case of a man after he has got over his first 21 years, he has not so much to fear from his natural bodily condition as from the life he leads up the climacteric, which in him is later than in woman. At this time he has again to pass through a crisis, and many obscure and ill-defined symptoms may now take definite shape at or before this period of his life. But in the case of a woman we have to deal not so much with her artificial existence, though that is very important, as with the ever recurring changes which are the essential elements and factors of her period of sexual activity. No sooner has the body recovered from one menstruation than it has sooner or later to prepare for the next, and there are many instances of recurrent epilepsy and mania which are in abeyance in the intervals and only appear at these stated times. The minor complaints, where headache, pain, sickness, irritability and capriciousness are similarly periodic, are usually taken by most women as a part of their lot, and are never enquired into unless specially bad. In such cases there is either some local disease or malformation, such as a congenital anteflexion, or they may be considered a mild type of epileptiform disorder or explosion when no gross local lesion can be discovered. In other cases the cerebral symptoms take a more tragic form during the menstrual epoch. Barnes records "that Professor Costi was enabled to collect in the Musée de College de France a fine series of uteri and ovaries taken from women of all ages who had committed suicide during the menstrual epoch," but this collection is now scattered. No commentary is needed to impress the gravity of this period in many women, and how often perhaps many of their actions, strange, unaccountable, or actually criminal, might be sometimes proved to have been performed during their period of nervous instability. Love and marriage are also trials, and in relation with the latter a word on consanguinity may be noted. In

the island of St. Kilda there is necessarily much intermarriage and consanguinity, but the natives have no mental tension to strain their nervous system, and Macdonald found no cases of deaf-mutism, insanity, or idiocy, and imbecility was extremely rare. That either race or consanguinity in other circumstances has a powerful influence for evil, is shown by the fact that the number of insane German Jews in Prussian asylums has quadrupled in the last sixteen years and now reaches the figure 398 per 100,000, whereas the Protestants and Catholics are insane only in the proportion of 241 and 237 per 100,000 respectively.

The minor psychical disturbances which occur in women at various times have been studied by Dr. H. Campbell in over 200 cases of slum women; in none of these did actual insanity develop, but many were on the borderland, though those with a marked insane diathesis or apparently hysterical were excluded as far as possible. The chief symptoms were depression of varying degree, and two-thirds of the cases were worse in the morning and felt quite well by night; others were irritable either as regards sensory or emotional manifestations, and such conditions sometimes alternated with the depression. In other cases fear was readily excited, and there was a feeling of impending insanity, with vertical headache, loss of memory and power of attention, specially at the climacteric; hallucinations were rare, but terrifying dreams were not uncommon. In many instances these symptoms might be accounted for by the presence of intrinsic toxic agents, as they vanished when the blood plasma was freed by therapeutic means. More grave than the above are the cases of actual insanity which occasionally occur during gestation, labour, or the puerperium. The following is an example of homicidal mania during pregnancy which occurred in America:—A woman had four children, and when the tragedy was committed was about three months pregnant with the fifth. One child took ill in October, the second about a fortnight later, and a third in about another fortnight; these three died. The mother's disposition was noted to have changed—she seemed to be indifferent as to the welfare of her children. The fourth child took ill and died, and she blamed the doctor, so a *post-mortem* was held, and all were found to have been poisoned with arsenic. The mother had a hereditary predisposition, and in each previous pregnancy had been peculiar and hysterical.

Norman reports a curious case of insanity in the course of pregnancy, during which the woman suffered from a perpetual

questioning of all near her, and desired to read every scrap of paper; she had been subject to much mental and domestic worry and previous overlactation, but recovered in time. The usual type, however, in these cases is melancholia, sometimes suicidal, or merely a morbid craving which may gradually slide into puerperal insanity. During actual labour women may have a sort of frenzy or delirium, which most frequently happens when the cervix is fully stretched, or at the end of the second stage when the perineum is distended to its full. There is no doubt that in such a condition they are not accountable for their actions, especially if labour should come on when they are alone. As a rule, such a condition is ephemeral, and has no particular significance as to the probable occurrence of the more grave puerperal insanity. The following, however, is an instance of deliberate suicide during labour:—The woman had had seven children and was in labour with the eighth. She had a doctor in attendance, and asked him to leave the room on an apparently innocent pretext, when, during his short absence, she cut her throat and stabbed herself twice in the heart and twice in the abdomen with a pocket-knife. There was insanity in the family, which may account for the determined attempt. The insanity of pregnancy occurs in ·5 per cent of the total admissions to all asylums and registered houses in England and Wales.

Puerperal insanity has probably a more complex origin, as there are at least two, if not three, factors which may all be acting in one case—(1) In every case there is the traumatism, and in many some obstetrical operation has been performed; (2) there is in some cases undoubted septic infection; and (3) in others, difficult to distinguish from (2) and perhaps coincident with it, there may be auto-intoxication. The consideration of this insanity will therefore be resumed when traumatic and toxic insanities are discussed.

The psychoses of lactation are practically merely the results of anæmia, and hence do not usually appear till after several months' suckling or after weaning. Toulouse recorded twenty-five cases; eleven were melancholia, eleven mania, and three partial delirium. There were two deaths. The prodromata are usually excessive pallor, palpitation, insomnia, and indigestion, which latter may be a source of some toxins. Then some slight shock or a change of diet after the weaning may serve as an exciting cause, and the more definite symptoms appear, often ushered in by a slight delirium. As a rule, the recovery-rate is good, a strictly tonic regimen with ferruginous drugs

being the line of treatment. Lactational insanity occurs in 1·1 per cent of the total admissions to all the asylums and registered houses in England and Wales.

The climacteric is the last physiological epoch of the reproductive system which has attendant neuroses and psychoses; they form 4 per cent of female admissions and 2 per cent of the total admissions. In some cases during the whole period of sexual activity each menstruation has had as an accompaniment attacks of epilepsy or acute mania. These at first may not have seriously interfered with the mental condition in the intervals, but sooner or later failure of brain power is the result, dementia becomes more and more marked, and the mania, at first acute and intermittent, has now become chronic and constant. Unfortunately no hope of any improvement can be held out in these cases when the climacteric comes, as by that time they are hopelessly and irretrievably demented, or if not so advanced, Savage states that the climacteric rarely relieves those suffering from previous mental disorder, and that recurrent menstrual insanity merely assumes a more melancholic type. In all women there is a tendency to depression more often than to excitement, but sometimes hysterical manifestations, irritability of temper, sexual excitement, and a craving for stimulants are met with. The most incurable form which is characteristic of this period is a progressive deafness with delusions of suspicion. Another peculiar condition which is mostly found at the climacteric is known as "pseudocyesis." The patient is hysterical and has been sterile, but now imagines that she is pregnant, or feigns to be so; they not infrequently become hysterically insane on the subject. Besides these more purely mental troubles, other nervous derangements are not uncommon, such as functional derangements of the heart and the whole area of distribution of the vagi nerves; these conditions may be combined with epileptoid or hystero-epileptic seizures. The following case at present under my care is a good example of this state:—

Mrs. D., æt. 42, has an unimportant family history and her relations are long lived. She always enjoyed good health till three years ago; she always lived well, and has taken wine. There is a mitral regurgitant murmur which is quite satisfactorily compensated. Menorrhagia comes on every four weeks, and she always feels better after it—calls it "her safety valve." About two and a half years ago she first began to have attacks of dyspnœa, which were ascribed to the heart and treated as such. In February, 1894, I saw her for the first time, and found her suffering from repeated attacks of typical

hystero-epilepsy. She performed all the grand movements over and over, was to a large extent unconscious, but performed many acts apparently automatically. The chief subjective symptom was an intense air hunger, which caused her to loll out of a window and gasp for breath though she was breathing freely all the time; all the other windows and doors must be opened, and a draught play around her, to satisfy in even a small degree this craving. The face and eyes were suffused, and she complained of intense pain in the præcordial region, which was greatly relieved by very firm pressure on it. After repeated doses of hydrobromic acid and chloral, she gradually became more sensible, the attacks were less frequent, and she now had an intense craving for food and persisted in eating largely of cold minced meat; thirst was also a distressing symptom, and the amount of fluid consumed at times is extraordinary. There is considerable pain and feeling of numbness all down the left arm to the fingers, and there is frequently acute angio-neurotic œdema of this limb which especially occurs during or after dinner however simple, and it is of such extent that the sleeve of her dress is only closed by bows so that it can be at once opened out as required. This series of phenomena was frequently repeated during the next few months. Medicines seemed to have little effect in warding them off, dry cupping over the painful præcordial region was of only some benefit, and, apparently, firm pressure with the fist was as good. At night, when not in these attacks, sleep was prevented by great muscular restlessness, and she has frequent dreams of bloody sights. There is no albumen nor sugar in the urine, which is occasionally almost hysterically suppressed. The bowels move freely every day. Sometimes the attacks are ushered in by a feeling of blindness. The exciting cause is almost invariably some emotional disturbance, or unhappy train of thought or over exertion of body. Latterly the motor symptoms have somewhat changed, for she becomes far more rigid than formerly, and does not go through so many of the striking attitudes. Notwithstanding this, however, the vagus storms still come on, though less frequently and with a longer interval than formerly. There are also marked flushings with an absence of perspiration, and more or less defined left hemi-anæsthesia and feeling of painful cramps in the arm. There is usually a very free secretion of saliva, she sometimes having to use from twelve to fifteen handkerchiefs a day. Capsules of nitrite of amyl did good at one time, but she has now to have several 8 minim doses before there is much effect.

Normal senility is not usually nor necessarily accompanied

by actual insanity, though it more closely resembles a reversion of normal evolution than any abnormal dissolution in insanity. At the same time, Crichton Browne remarks that actual senile insanity is becoming more common and appears earlier than formerly. A mild melancholia falling short of insanity is very common at the climacteric even in men, and suicides are increasing mostly after the age of 45, but specially between 45 and 65. When mental dissolution occurs before the age of 60, Savage has observed that approximately the following order is usual:—(1) Loss of power of acquisition (2) or retention of recent impressions; (3) defective co-ordination, and (4) loss of control and judgment. Thus, the judgment may be impaired only long after the memory is sensibly weakened, and control is defective. Regis, of Bordeaux, considers senile insanity under three headings—(1) Simple senile psychoses, mostly melancholia, in an anxious type of man with a hereditary predisposition; no marked intellectual enfeeblement, but it usually becomes chronic. A less frequent form is a maniacal attack which is entirely curable. (2) Senile psychoses with simple dementia, usually in the form of subacute melancholia, with delusions of persecution which are absurd and puerile, and accompanied by constant sleeplessness and noise. (3) Senile psychoses with cerebral dementia due to organic or apoplectic disease.

When we come to consider the mental symptoms more especially associated with actual gross lesion of the reproductive organs, we find that these are of comparatively frequent occurrence. Thus Drs. Cleaves and Gander state that in the State Lunacy Hospital at Harrisburg, out of 85 admissions in a year, 29 had some utero-ovarian disease, and that all improved mentally after local treatment, though many only up to a certain point, as the disease was probably of too long standing to benefit much. More Madden found that of 2,445 patients, 30 per cent had nervous disorder varying from trivial hysteria to the gravest forms of mental disturbance. Wiglesworth, in 1885, examined 109 *post-mortem* records, and found 42 were healthy and had no apparent lesion, while 67 had more or less serious alterations. In 22 there seemed to be no particular connection between the visceral disease and the insanity, while in 45 the conditions found were as follows:—1 had no uterus; 4 had conical cervix and pinhole os uteri; 4 had retroversion; 5 retroflexion; 1 both these displacements; 1 had prolapse; 6 had subinvolution; 6 had fibroma; 6 had chronic peritonitis; 1 a hypertrophied cervix; 1 cancer; and 9 had diseased ovaries and tubes. He remarks that most uterine affections are

capable of engendering sympathetic mental disease, but no one seems to have more special influence than another. Sometimes the uterine disease may get better and the mental disorder persist; at others the intellectual troubles disappear though the local disease is stationary; while in some cases removal of the local irritation either ameliorates or may cure the insanity.

The disorders or delayed appearance of menstruation may have considerable influence on the nervous system. Thus a case is reported in which there was dementia up to puberty, and so far no sign of menstruation had taken place; but suddenly one day it appeared, and the patient cried out, "Mother I am well." Again, a girl had been bedridden with hysterical paralysis for two years; menstruation appeared for the first time at the end of this period, when she was 19, and she recovered shortly afterwards. The reappearance of menstruation is the final symptom of a satisfactory cure in cases of puerperal and myxœdematous insanity. Hysterical trance, too, is frequently associated with menstrual derangements.

Uterine displacements are also frequent exciting causes of a more or less neurasthenic condition, gradually progressing in some cases to melancholia or other mental disorder, and that a displacement can be the exciting cause is clearly proved by the well-authenticated cases of cure after replacement, as reported by Barnes, Bennet, Bennington, Schrœder van der Kolk, Flemming, and others. More Madden records a case where a lady, aged 46, in an asylum, was irritable and excitable alternately with religious despondency and suicidal tendency. After two years she had profuse leucorrhœa, and a tender left ovary, elongated cervix, and deep cartilaginous erosion were then discovered. After suitable local treatment the mental symptoms improved and she finally recovered. Nymphomania may occur as a symptom of local disease, but may also be quite independent of it, and may occur in cases of puerperal, epileptic and senile mania. Abnormal sexual feelings and sometimes ovarian tumours are often associated with delusions of the sense of smell, which is probably merely a perversion of what occurs as a normal instinctive reflex in most lower animals. Like other diseased viscera, these organs may serve as a starting point for delusions, such as in one woman, who tried to tear herself in vain attempts to deliver a litter of monstrosities, when in fact she had a labial abscess; or, again, in a case lately under my care in which a woman thought she was full of devils, but gradually lost them as the local condition, an acute pelvic cellulitis, cleared up.

Perhaps of all the organs of reproduction the ovaries have most laid to their account, but whether this is always true is a matter of great doubt. That many cases of hysteria and other reflex neuroses are due to ovarian irritation can be proved by the cures which take place after the irritation is either relieved or removed by operation; but there are other cases where the operation of removal does not result so favourably—either the same nervous condition is unrelieved or an aggravation of it or a new one may follow in occasional cases. Hence it must follow that either gynæcologists have not exactly defined the condition of the ovary which the patient is the better of having removed, or neurologists have not clearly defined the previous nervous symptoms and predisposition, which will probably not benefit by the operation. In either case the operation is probably performed in many instances too late for an entirely satisfactory immediate nervous recovery; the patient has already developed a neurasthenic habit of mind and body, which it is very difficult to overcome by the operation, though it undoubtedly does great good, and, in fact, is the only hope of cure in certain selected cases. That hysteria and neurasthenia of a marked type may be absolutely without gross lesion is highly improbable, and in all such cases a hidden lesion should be diligently sought for. Lately I saw a woman over 30 years of age very hysterical, with anorexia, nausea, and violent attacks of palpitation. This had continued for some years, during which time she must have consumed pints of assafœtida, valerian, and digitalis. She had one child, now 9 years of age, but has had no conception since. Apparently neither she nor her husband was aware of any abnormality, and she had always been treated as an inveterate hysterical patient by previous doctors. However, they had omitted to examine her locally, and when that was done by me for the first time since her confinement, it was found that the only entrance into the vagina was a small aperture which just allowed of the passage of a sound. This aperture was just below the urethral orifice, and the rest of the ostium vaginæ was closed by a complete diaphragm of mucous membrane, which could not fail to prevent proper coitus. Rectal examination revealed a retroversion of the uterus. These local conditions were evidently at the root of the nervous state, but she absolutely refused to undergo any plastic operation for their relief.

In the male, cases are met with which have all the appearance of hysteria and disordered moral equilibrium. They are mostly associated with irritation at the neck of the bladder and prostate,

cystitis, or retention of urine from some cause. The mental anxiety and worry which a slight prostatic discharge or an old-standing gleet may occasion are wonderful; vague ideas of impotence are engendered, and the patient is in a condition of actual mental pain. Varicocele is a frequent cause of this melancholic and depressed condition, and to a man with an introspective tendency, the fact of one testicle hanging a little lower than the other is sometimes cruel. A curious relation has sometimes been noticed between an atrophied testicle and an orchidian tuft of white hair on the same side of the moustache. Reflex insanity has also been known to be due to a phimosis, and no doubt much masturbation is primarily the result of this condition, just as irritation about the labiæ of the female may induce a similar habit. It is also probable that many cases of hysteria in the female are due to a varicose state of the ovarian veins. The iliac and back pains are similar to those complained of by the male; both sexes are worse during the upright position, and are relieved by the recumbent attitude. Fortunately in man they can be alleviated or cured after a very simple diagnosis, whereas in women the actual diagnosis is not absolutely certain, and so far ovarian varices, if not amenable to electrolysis, necessitate ablation of the organ to be cured.

In the respiratory system the chief chronic diseases with which insanity may be associated are phthisis, bronchitis, and emphysema, with or without cardiac complications. The occasional alternation of insanity with attacks of asthma has already been noted, as also the occasional way in which acute pneumonia or pleurisy may temporarily elucidate the mental state of a previously insane patient; while delirium occurring in the course of such acute affections has likewise been treated of. But it may be well to again refer to the delirium in pneumonia. In the *Reports of the Royal Infirmary of Edinburgh for 1892* it was found that delirium was more marked in alcoholic than in influenzal cases, being 62·9 and 14·2 per cent respectively. The site of the consolidation has an influence; in those in which the apex alone was affected, 25 per cent were delirious, where the apex and other parts were involved the percentage was 21·7, while basal pneumonia was accompanied by delirium in no less than 31·8 per cent of the cases. This is contrary to the usual teaching on the subject of delirium in pneumonia, but statistics of a large number of cases in *St. Thomas' Hospital Report for 1889* confirm those of Edinburgh.

So well defined is the mental condition of many patients who have become insane either after tubercular symptoms

have manifested themselves in the lungs or elsewhere, or who become tubercular during the course of chronic insanity, that Clouston has described a type of phthisical insanity, and Mickle, amongst others, has also paid particular attention to this association and reaction of diseases. The most striking symptom in the majority of these cases is the depression and suspicion which is so markedly shown at one time or another, though in some cases there are also attacks of mania and excitement. There are three ways in which phthisis and insanity have to be considered:—(1) Phthisis as a cause; (2) phthisis and insanity appearing simultaneously; (3) phthisis supervening on insanity.

1. (*a*) In advanced phthisis there are often quasi-delirious symptoms and hallucinations due to the general cerebral malnutrition and disturbed circulation, the hectic febrile condition, and toxæmia. There is also the spes phthisica, which is a frequent symptom up to the very last, and is due to an abnormal perception or interpretation of abnormal peripheral stimuli from the lungs and body. (*b*) In about one-third of the cases, however, there are despondent, almost suicidal, symptoms, with worrying hallucinations and illusions, chiefly associated with the sensory organs of taste and smell, though occasionally with hearing and sight. They think the food is bad or poisoned, and hence refuse it, or imagine that noxious gases are being engendered in the room to poison or persecute them. (*c*) Others become morose, with angry outbursts of mania and delusions of injury or persecution, but systematised. (*d*) Some cases are almost purely monomaniacal, the subject being some persecutory one or querulousness. (*e*) An imbecile who previously has been able to be taken care of at home may become so demented that regular asylum treatment and accommodation is neccessary. Such usually occur between the age of 18 and 25 years.

2. When phthisis and insanity appear simultaneously there is often emotional depression, grief, and a feeling of being abused, which may even develop into a suicidal tendency. At other times the patient may be quite apathetic.

3. When phthisis supervenes on existing insanity there are again several considerations which it is convenient to note clinically, as any form of insanity may develop phthisis. (*a*) Monomania of persecution or of expansive ideas. (*b*) In other cases, where the delusions of persecution have been unsystematised, they become fixed and systematised when phthisis supervenes. (*c*) More marked intellectual perversion after acute mania or melancholia may appear if phthisis

develop. (*d*) Simple or melancholic stupor may be induced by the phthisical infection.

Tuberculosis also seems to give a special characteristic to some idiots, and is often a complication in cases of diabetes and myxœdema. On the whole, in two-thirds of the cases in which phthisis supervenes on insanity, a modification of the pre-existing insanity occurs as a more or less direct consequence, either in the way of new symptoms developing, usually of a depressing character, or a simple exaggeration or systemisation of delusions, or an amelioration of some other symptoms which were prominent before the phthisis developed; sometimes they become more manageable and are less dominated by their delusions, and even a stuporose case has been known to speak and refer to some adverse influences operating on him.

In the instance of chronic bronchitis and emphysema there is nothing very special to note, as these cases are most frequently associated with chronic cardiac disease, and to a large extent partake of the symptoms of a mitral case. They will also be alluded to under the heading of the altered condition of the blood and toxæmiæ.

Part II.

The subject of toxic insanity is one that is growing in importance year by year, for each year analyses and chemical researches are able to be conducted more elaborately and exactly, and likewise large numbers of toxic agents are being introduced into our daily life, whether in ordinary eating or drinking, or in our occupations, or medicinal agents. The active carrier of these various toxic agents is, of course, the blood and lymph streams, and we have already noted some changes in the quality and quantity of the blood which are able to produce important cerebral and nervous symptoms.

Certain mental symptoms are common to all poisons, and, according to Legrain, no intellectual disorder is more pathognomonic of one than of another poison, as the artificial insanity produced is nothing but a dissolution of nervous energy which takes place more or less rapidly, and affects different parts to a different depth in the same individual, and also in other persons subjected to the same poison. Hence there are many different details in the symptoms of toxic insanity in different persons from the same poison, though one, a form of intoxication, is to a large extent common to them all, and shows itself as an excitation of the organ of thought, incoherence in ideas and actions, which is only a functional or quantitative modification of psychical expression, whereas in an organic derangement there is a qualitative alteration.

According to Regis, there can be distinguished three types of this intoxication:—(1) Certain poisons, such as alcohol and the toxins of some pyrexiæ, produce a general disturbance of the intellect and disorder of all the faculties, which may go the length of actual insanity. If such occur, it is incoherent and inconsistent mania with hallucinations, which, however, do not permanently influence the course of ideas, but only

modify, in a transient manner, the ideation going on at the moment they appear. (2) Other poisons, such as camphor or musk, do not cause such intense disorder, but only disturb the ensemble of the faculties to a lesser degree; in fact, it is a pure intoxication, in contradistinction to the further stage of dissolution, severe enough to produce actual insanity. It is usually only a partial dissolution of the parts affected, and sometimes there is a persistency of consciousness throughout. (3) Still another series of poisons produce a temporary intoxication which is more localised in its site, sometimes affecting ideation or voluntary movements, or loss of sense of space such as occurs with haschisch, or variation in the sentiments with consequent instinctive impulses, erotic passion, and hallucinations of the sensory centres, as occur in belladonna poisoning. In all cases the symptoms may vary, according to what part happens to be most affected.

In any case there are usually some general symptoms which may be classed under the head of excitement or depression. The depression may result from the further or continued use of a drug, which, in the first instance, produces excitement, as is seen every day in the case of alcohol or opium. In some cases, as in the belladonna group, a period of excitement reappears before the subject finally returns to his normal condition. The excitement affects all the cerebral functions, and thus insomnia and great resistance to fatigue, irritability of character, more rapid ideation, though certainly more superficial and of less coherence than normal, more vivid imagination, vivacity and increased animal passions, and a motor restlessness, are the general and more prominent symptoms of this stage before insanity is actually reached. The subsequent stage is characterised by a corresponding depression, which may vary from simple tranquillity to complete torpor. Narcosis is most conspicuous, and may be evidenced by a mere tendency to sleep, or actual sleep and apparent annihilation of cerebral life, or by an absolutely irresistible somnolence, or by a craving for sleep. All of these types depend on the exciting cause, and they vary in their duration, may be followed by an absolutely amnesic condition, or one of fair recollection of the dreams which were excited. The memory is variously altered after the various intoxications. If there be no actual narcosis there is less depression, but also less mental power, moral energy, volition, and more apathy and indifference. Actual toxic insanity is a secondary insanity characterised by a deviation and perversion of the normal mental processes with loss of consciousness, as distinguished

from a mere intoxication with simple disturbance of the normal mental processes with consciousness remaining intact. It is a general insanity, with sometimes one predominant symptom, such as incoherence, polymorphism, hallucinations. The insane ideas are mostly painful, and the visual hallucinations frightful. Prolonged abuse of the poison produces definite anatomical lesions, progressive mental weakening, and terminal dementia. It is almost always accompanied by some extra-cerebral pathological condition and idiosyncrasy, which help to modify the clinical picture of a typical toxic insanity, and to diminish its clinical value as a morbid entity.

Toxic insanities may, however, be divided into certain clinical groups. That which includes the largest number of cases—all febrile affections and auto-intoxications—consists of (1) mania or incoherence, with general derangement; (2) mania of the depressed and painful type is the usual form in alcoholism, bisulphide of carbon, datura, absinthe, and atropine poisoning; (3) expansive mania, eroticism, mysticism, or self-satisfaction is more characteristic of such poisons as benzine, nitrous oxide, cannabis indica, cantharides; (4) the melancholic type is not so well defined, and is always temporary; (5) mixed forms also occur in which depression alternates with excitement; and lastly there are (6) certain vesanic conditions or attacks of insanity provoked by poisons in strongly predisposed persons, the result of (*a*) disordered ideation, (*b*) sensory illusions, (*c*) special hallucinations, or (*d*) annihilation or obscuration of consciousness.

One notable symptom—viz., aphasia—may be produced by a variety of toxic agents. Wyllie does not know any poison which produces loss of speech without loss of consciousness as one of its constant and characteristic effects, but there are many poisons, either extrinsic or intrinsic, which may produce loss of speech either occasionally or frequently. All such poisons act as brain depressors. The chief vegetable drugs that are known to have this special effect are those belonging to the natural order *atropaceæ*. Tobacco smoking has often caused temporary aphasia, and so do poisonous doses of belladonna and stramonium. Other natural orders contain plants which have a similar action, such as cannabis indica and opium. Alcohol is well known as a producer of slurring speech, and it also produces dulling of the memory for proper names and for the names of even common things. Dr. Ogle, in 1868, related instances of aphasia resulting from snake poisoning, which may precede the loss of consciousness, and sometimes persists for days and weeks after all danger to life

is past. Wyllie notes that this particular aphasia seems to be entirely confined to its production side, as the patients seem to understand what is said to them while conscious. The chief mineral poison with which aphasia is associated is lead, specially during chronic plumbism, in which it may be combined with other symptoms, such as epileptiform or apoplectiform seizures, or the milder manifestations such as colic. Many cases are on record which show this association of chronic plumbism and aphasia.

In the case of almost all poisons the symptoms have to be considered in two different relations—(1) Those due to the continued action of the poison; (2) those the result of abstinence therefrom. Some of the first series of symptoms may be at once cured by abstinence from the poison, and practically no bad results follow; but in the majority of cases, more particularly of drugs, the symptoms of sudden abstinence after long continued poisoning are as severe and critical as those the result of the abuse, and require the utmost care to avert a still more serious mental condition or an actual fatal termination.

It will now be best to consider toxic insanity under several heads, and the first to which attention is directed is that which occasionally follows the inhalation of one or other anæsthetic agent when administered for therapeutic reasons.

Savage has more particularly studied this causation of insanity, and in 1887 reported several cases of more or less temporary and even permanent mental disorder which had followed the administration of chloroform, ether, or nitrous oxide. He is of opinion (1) that any agent which can produce temporary disturbance, such as delirium, may also produce insanity; (2) that such insanity is frequently delirious; (3) that it may be transient, persistent, or lead to general paralysis. Wiglesworth considers chloroform narcosis equivalent to transitory acute mania, for the highest, latest developed, and hence most unstable centres are first affected. The occurence of insanity after anæthesia has a most important bearing on the etiology of post-operative delirium, as many reported as examples of the latter might also be examples of the former. To help in the diagnosis between these two results, the time at which the mental disturbance begins must be noted; some cases show symptoms at once, others not for hours or days. In a fair proportion, either marked excitement or unusual depression, heaviness or drowsiness, sometimes with irritability, appear within a week, and constitute the chief mental symptoms. But as will be seen later, many of the cases of

post-operative delirium also begin within a week, so that the probability of the delirium being due to the anæsthetic increases with the rapidity with which it appears after the anæsthetic has been given. If chloroform be given to a patient recovered from mania, the mania may be redeveloped, even after apparent cure has existed for two years. In other cases the administration of chloroform seems to act as a prophylactic. Ashe records a case in whom no chloroform was used at the first confinement, and puerperal insanity followed. In subsequent labours chloroform was used and no insanity followed, though there was hereditary predisposition. Contrariwise, Savage has noted cases where temporary insanity has followed uncomplicated labour during which chloroform was used, while the labours before and after were normal. In all these cases there is usually a hereditary or acquired neurosis, which should influence the surgical opinion. Guinon cites four cases in whom hysteria developed after a single administration of chloroform. Wiglesworth says that after having administered chloroform to a maniacal woman for the purpose of a uterine examination, the mania increased for a few days, but there was no distinct development of mania in the case of other forms of insanity. Tuke reports a case of permanent insanity after a nitrous oxide inhalation, and Savage also publishes a case of a lady with acquired neurosis from alcoholism who, after having a tooth extracted under gas, became maniacal; though she quieted down in three weeks, she has never recovered her reason nor recognised her friends, and has gradually fallen into a fatuous, demented condition. He also notes two cases of insanity after chloroform, and has notes of several others which are spread over the reports of many years. One was a man with hereditary and acquired neurosis from alcohol. He was admitted to Bethlem in an acutely maniacal state, during the onset of which he injured his hand; cellulitis developed and the mania ceased, but on being chloroformed, to open the cellulitis, the mania again exploded, just as before the accident. When the chloroform was withheld he recovered his senses, and though the cure of the cellulitis was followed by a reappearance of the insanity, he finally very slowly recovered. Another case, though more doubtful, is that of a young woman who, after removal of the breast under chloroform, became irritable, then presented symptoms of general paralysis, which finally caused her death, and lesions of the brain and meninges were found *post-mortem*. Savage also notes a case in which a clergyman of unknown antecedents was etherised for an operation on a malignant

rectum. After recovery he remained in a stupid, demented state for many days, but suddenly recovered his intelligence. I am indebted to Prof. Annandale for permission to record the two following cases, one of which is probably undoubted chloroform delirium, the other possibly so, but complicated by shock and whisky:—

CASE I was a man, aged 21, a pupil teacher; father rheumatic; uncle rather affected with chest disease; and a sister with weak spine. Personal health good until three years ago, when he had measles. About this time his knee became painful, but improved with blisters; as it relapsed it was excised under chloroform in October, 1891. He took chloroform fairly well (quantity not noted), but when taken back to the ward about 1 P.M. he suddenly became exceedingly noisy, swearing loudly, and in a tremendous passion abusing everyone about; crying for a drink but refusing it when brought. One-sixth of a grain of morphia hypodermically had no effect; it rather increased the excitement, as he sat up in bed and offered to fight anyone. Another injection was given about 3·30 P.M., and in half an hour he was asleep. In the evening he was noisy at intervals, but was more easily quieted down, and next day he was much quieter. On a subsequent occasion, when a small abscess was opened without chloroform, he became excited and abusive, but otherwise his recovery was complete in all respects.

CASE II.—A man, aged 36, was admitted in September, 1893, suffering from abdominal and various other injuries. He was chloroformed and suprapubic cystotomy performed; then his arm was amputated. He required a whisky enema during the operations and another when returned to bed, but the quantity was not stated, and the last one was not retained. When he came out of the chloroform he was noisy, clutching at his dressings, but became quieter later, and was sensible by 8 P.M. He died next day at 11 A.M.

Tait also reports a case of mania after an ovariotomy, which began immediately on coming out of the chloroform. That an operation is not the essential element in the production of insanity after chloroform is proved by the fact that insanity has followed the inhalation though no operation has been done, as was the case in two out of Sear's 185 instances of post-operative insanity. There is no reason to believe that post-operative insanity is more or less frequent after either chloroform or ether or *vice versa*, and I can find no records of insanity following the inhalation of other anæsthetics, such as the A.C.E. mixture or methylene. They are probably used so

comparatively rarely, that the percentage is not sufficiently large for cases to have occurred. The percentage of cases after chloroform inhalation must be very small considering the scores of thousands of inhalations given.

As regards local anæsthetics, cocaine is the most important, and it is better to class it under this heading when so used than to place it under toxic agents introduced from without, which will be noted later. Matison reports two cases of acute mania lasting three hours after the injection of cocaine, and, according to Vene, other authorities have also observed hallucinations and mania. Reclus, however, has performed seven hundred operations under its use and seen no case of intoxication.

We will now proceed to consider briefly cerebral symptoms the result of certain other drugs, analgesics, and toxic agents.

1. Hypnotic drugs may produce a transient delirium in some, in others dreams of varying natures, and in others an actual craving for them is soon evinced which is most difficult to counteract. Opium is perhaps the oldest and most largely consumed hypnotic, and it has long been known how the symptoms vary from a slight exhilaration, then lethargy, to stupor and coma if the dose be large enough. But in many there is begotten an extraordinary tolerance of the drug; large amounts, fatal if taken in one dose if unaccustomed to it, may be borne, and in fact must be taken to satisfy the craving for stimulation. The symptoms may be considered under two conditions—(1) those the result of its abuse; (2) those the result of abstinence. In the former case there is a feeling at first of *bien être* and a stimulation of the faculties; then the moral tone of the person wavers, he becomes a slave to the passions, his will is paralysed, he loses self-control, exhibits depraved instincts, indulges in excesses, and ultimately is a degenerate wreck physically and mentally of his former self. He usually dies before the age of 40, after suffering for a longer or shorter period from disordered sleep, pain, terrors and hallucinations, sometimes melancholia, less frequently mania, which latter symptom has been especially observed in some parts of Indo-China and Malay. The loss of moral responsibility is most marked, and is well illustrated by a case reported by Sutherland. A lady, 50 years of age, had an attack of Bright's disease twenty years ago, when she first began to take opium; gradually the habit was confirmed, she became reckless, dishonourable, forged and gambled to the extent of one million pounds. After six years of such a life, she was put under control as she suddenly developed acute

delirium, with delusions of being poisoned and of redhot irons being put in her bed. It was found that for six years she had had supplied to her the equivalent to 16 grains of pure opium daily. She gradually improved and was discharged relieved. (2) The way in which the drug has to be stopped is most important, both in such acute cases and also in others of a more chronic nature. The euphoria disappears, they are irritable and critical, exhibiting great mental weakness, and may become torpid and pass into a state of agitated melancholia with complete insomnia, though sometimes they are delirious and maniacal. In fact, in many elderly people who may have contracted the habit, it is quite impossible to break it off, for they have come to be so absolutely dependent on the stimulating and exhilarating effect of the drug that collapse and a fatal termination would ensue if it were rapidly withdrawn or even seriously diminished. It is therefore better to medicinally graduate the increase which is required than to attempt to stop or decrease it. Another curious effect of withdrawing opium when given medicinally in cases of diabetes is that coma may be rapidly induced.

In countries where Indian hemp is largely used, a form of insanity is often associated with its abuse. Ireland found that in British Guiana 30 per cent of the patients admitted to the lunatic asylum had been in the habit of smoking it. Bhang, the cheapest and commonest preparation, induces quiet pleasant delirium and stupor; while churras, the dried sticky resin, produces excitement with violence. Asthma is common among those who use or abuse the drug, but no pathological changes other than what may be attributed to the asthma are usually found. The chief types are—(1) acute mania with homicidal impulse; (2) acute melancholia with attempted suicide; (3) chronic dementia. The insanity is almost entirely confined to males, and "running amok," which is an irresistible homicidal impulse, is a characteristic result of the abuse of the drug.

In the Bombay Lunatic Asylum Report for 1893, it is stated that 275 patients were admitted, and of these the assigned cause of the insanity was churras smoking in 1; ganga smoking in 26; bhang in 4—in all 31 out of 275. The asylums in the Punjaub for the same year also report that at Delhi Asylum, with only 40 admissions, no less than 14 of these were suffering from toxic insanity from the abuse of Indian hemp in various ways. It is thus seen that the percentage of toxic insanity from this cause is a very large one, and is a preventible one by proper restrictions as to the sale

of the drug. In contrast with this, it may be noted that out of the 275 cases admitted into the Bombay Asylum, only one was attributed to opium eating or abuse.

Perhaps bromide of potash is one of the most largely used and abused drugs on record; abused not only by patients on their own account, but also by medical men, specially in the treatment of any complaint which can with the least amount of difficulty be assigned to hysteria or epilepsy. The wonder is that the wholesale abuse of the bromide has not been accompanied by more serious nervous symptoms, but probably the saving of the drug is the acne it produces in many instances. It is not common for actual acute cerebral symptoms to be induced by medicinal doses, but the following cases have been reported by Greenlees from the Cape; and Carlyon, of Truro, has also had a curious case of aphasia and other nervous symptoms resulting from a few doses of bromide of potash. It has been noted that bromide of sodium has more tendency to induce delusions than the potash salt. Greenlees cases are—(1) A man with idiopathic epilepsy was admitted to the Grahamstown Asylum in February, 1887, and was put on 25 gr. doses of bromide of potash three times a day. Three weeks later he fell into a stuporous debilitated state, tongue dry, sordes, indistinct articulation, dysphagia, and general muscular relaxation and anæsthesia; this increased and he died comatose on 6th March. The *post-mortem* showed intense meningeal congestion with focal softening at the front part of each optic thalamus. (2) Another patient, after two or three weeks' administration of the same dose of bromide, became stupid and lethargic. Stimulants and strychnia replaced the former drug, but the stupor increased, general motor and sensory paralysis supervened, and he died.

Harley reports two cases of sulphonal toxæmia, though at the time of their occurrence the possibility of some obscure auto-toxæmia was held in view, but as Kober and Stern each also report a clear case of sulphonal poisoning with similar symptoms to those of Harley, it is most likely that they were sulphonal poisoning. (1) A woman, aged 27, was always healthy until five weeks before admission into the Royal Infirmary, Edinburgh; at that date she was married, and a week after she became nervous and sleepless, and this latter symptom increased and was accompanied by a painful feeling of weight over the abdomen and chest. Sulphonal and chloral in unknown doses had no effect as regards the inducing of sleep, but she now became listless, wandering, had a vacant expression, with great muscular weakness and sense of pressure

on the head. Sight was normal, but she said she had been blind for three days. She was conscious of being spoken to, but was slow to reply. No sleep could be obtained anyhow, and she died collapsed in three days' time after her admission to Dr. Wyllie's ward. The urine was like port wine, but contained no albumin, bile, sugar, or blood. (2) A woman in Sweden, aged 54, had an alcoholic insane father, and her mother died of apoplexy. Patient was weak-minded and restless, and took sulphonal. She had a syncopal attack in March, but recovered though weaker, and was confined to bed, conscious but taciturn and sleepless, and complaining of pain through the whole body. There was no sickness nor paralysis, but she was anæmic though not emaciated. Expression was vacant; she was conscious when spoken to, but replied slowly and almost unintelligibly. She felt cold though there were plenty of clothes on her and she was perspiring freely. She became more apathetic, and died suddenly on the sixth day after admission. Her urine, like that of the previous case, was of a dark wine colour, contained no albumin, no sugar, bile, or blood, but gave a pigment spectrum. Two abnormal pigments were found, the result of a lesser oxidised state of the normal urinary pigments, and the auto-intoxication occurred from this defective oxidation, but whether this was primarily due to the drugs or to an intrinsic lesion it is difficult to determine. The following case, however, seems to leave no doubt that sulphonal was at fault:—Kober reports that a man, aged 52, became very melancholic on account of increasing deafness, and more particularly tinnitus. Sulphonal, among other drugs, was given in doses of from ·5 to 1·5 grammes for four or five weeks. After a period of apparent improvement, repeated vomiting, with attacks of abdominal pain and constipation, occurred, and the urine, which was less than 1 litre in amount, was burgundy-red to reddish-black in colour, and contained at first no albumin and never any sugar, the specific gravity being 1021. No sulphonal was present, nor was there the exact hæmoglobin reaction though hæmin crystals were obtained. The sulphonal was stopped but the colour deepened; albumin, leucocytes, and casts appeared, though there were no red cells; and he died after having retention (? suppression) of urine. It was evident that the sulphonal was stored in the body, probably in the liver.

Besides such serious symptoms there may more frequently be found a peculiar ataxic condition either after too large a dose or after too continuous administration. The ataxy is accompanied by headache and some nausea, and exhibits

itself both as regards the unsteadiness of the legs and in the inability to write properly from inco-ordination of the arm muscles. In the graver cases, it might be well to try the effect of frequent inhalations of compressed oxygen, as the condition seems to be due to a deficient oxygenation of the drug.

Toxic delirium, the result of absorption of iodoform, is sometimes observed after operations, and has to be differentiated from traumatic delirium. The chief points are the smell and taste of the drug in the mouth and food, nausea and coryza, cutaneous eruption, and a state of extreme languor and headache. But all these may be masked if the toxic delirium is prominent, and the usual mental symptoms noted by Rossignol are sometimes melancholia, sometimes mania and terrifying hallucinations. Clouston's experience is one of intense incoherence, with dry tongue and prostration. Chiene has had two cases of post-operative delirium from this cause. In the question of differential diagnosis Le Dentu depends mostly on the extreme languor, anorexia, headache, absence of pyrexia but frequent pulse. Iodoform may produce symptoms at once if absorbed in sufficiently large quantity, or its absorption may be slower and so an accumulative dose have effect later.

Oldenburg also records a curious case in which a female patient, aged 51, injured her hand during an epileptic fit, which she had suffered from since she was 20, but she was quite normal psychically between the attacks. A 10 per cent iodoform ointment was applied, and twelve days later she became excitable and confused, and soon had hallucinations. The urine gave a distinct iodine reaction. When admitted to hospital she talked incessantly, would not answer questions, could scarcely be kept in bed, and complained of plots and persecution. The restlessness increased and she became cyanotic; the urine contained albumen, and gave a very slight iodine reaction. She then remained quiet for a few days, but again became demented, after which she had another period of quietude, followed by another outbreak which, however, subsided, so that she was then able to be discharged. Dr. Oldenburg thinks the condition cannot be regarded as a post-epileptic disturbance, because of the interval that elapsed between the last attack and the onset of mental symptoms. He thinks it was determined by the iodoform acting upon a nervous system predisposed by epilepsy to grave disturbance.

In all such cases it is important to examine the urine for the iodine reaction, which was present in the early stages of this

case, as it would be a sure point in favour of iodoform disturbance in contradistinction to mere post-operative or traumatic insanity.

Antipyrine is a drug which is now so freely used, both by medical advice and on the patient's own responsibility, that the following case of antipyrinomania is pertinent to the subject. It is reported by Luigi Cappelleti, and was that of a girl, 23 years of age. In infancy she was weak and nervous; two years ago she took small doses of antipyrine for occasional headache, with much relief, but soon it became a necessity, though it had lost its analgesic action, and if refused a dose she had a hysterical fit. Ultimately she took 8 grammes daily; her health failed, bad appetite, sleepless, intense headache and tinnitus. The craving was intense, and she was able to detect any diminution in the dose; if the time passed for its administration she sobbed and lamented, while if forcibly suppressed violent convulsions with suicidal tendency supervened. She desired to be cured, and was admitted into a home for this purpose. The dose was reduced to 2 grammes at once, and a dose of sulphonal given at night, but this reduction produced nausea, vomiting, complete anorexia, pallor, flabby pulse, and pronounced general depression, necessitating lying in bed. There was intense headache and sensible pulsation. This depression lasted three days, and was succeeded by an excitable stage, constant movements, loquacity, and irritability. The dose of antipyrine was increased, and then more slowly diminished, while bromide of potash was given in 2 to 3 gramme doses. The excitement did not diminish until the dose of bromide was 6 grammes, when after six days of this treatment she became calm, and the antipyrine was again diminished, the bromide being still continued, and a tonic of valerianate of quinine given. Even now the diminution caused mental confusion, irritability, pains in the neck and arms, and gastric and intestinal disturbances, but it was still lowered to 1½ grammes, and the bromide was increased to 7 grammes and the valerianate to 60 centigrammes, with 2 grammes of sulphonal and chloral at night, and prolonged tepid baths. When 1 gramme of antipyrine was reached the symptoms increased, there being extreme pallor and mental confusion; the baths were stopped and the bromide lessened. When the antipyrine was entirely suppressed there was an extremely small pulse, three days' pyrexia, paræsthesia, and transient paresis of the limbs, with ocular and aural hallucinations. This condition lasted seven days; 75 centigrammes of caffeine were given and the bromide diminished. She now gradually

improved, but insomnia and inaptitude for work remained for a long time before finally disappearing. The caffeine was slowly diminished, an iron tonic was given, and in fifteen days she had a good colour, was fat, resumed her usual vivacity, and was discharged cured ten days later.

Cocainism, as opposed to the temporary intoxication after its use as a local anæsthetic, has been particularly studied by Erlenmeyer, and Clouston has also reported cases. The former's cases were mostly combined with morphinism, and in fact the cocaine had been taken in the first instance to cure or be a substitute for the morphia. As a rule, the cocaine had to be greatly increased and the morphia resumed, so that a more complex intoxication than formerly was produced.

Under cocaine, patients soon lose weight and emaciate; there are vaso-motor disturbances and interference with the cardiac and respiratory functions, and profuse sweatings. Mania may be readily developed and be of a homicidal variety. Visual hallucinations are usual in the early stage, and are characteristically described as "dark spots or points on a white plane," the result of a multiple disseminated scotoma; delusions that the spots are fleas or bugs follow, and they spend their time in trying to catch them; there are other sensory disturbances, such as a feeling of being electrified or as if cold water were poured on them. There is an extreme prolixity in conversation and correspondence, they can never finish speaking or writing, and this is a most important symptom. Symptoms from abstinence are not very severe, and consist of palpitation, fainting, and great depression of mind and loss of will power. The hallucinations and illusions soon disappear, but concealed insanity is often present. In the treatment of pure cocainism a half to one grain can be abstained from at once, but large doses of alcohol and a little morphia are required. In morphia and cocaine combined, give the morphia but no cocaine; the result is much less favourable than in pure morphinism. In pure cocainism there are many relapses after treatment.

Several other drugs and substances have sometimes cerebral and mental sequelæ either from acute or from chronic poisoning. Alcohol is perhaps the commonest of all poisons, and will be first passed under review. Payne defines a poison "as a substance capable of injuring the body, either by causing damage to the tissues, or by producing functional disturbance," and all must admit that alcohol comes under this definition. Alcohol is a narcotic poison after producing a preliminary stage of cerebral over-action and stimulation.

All the symptoms are transitory, if not actually fatal. But it is also a tissue poison after repeated actions, and the symptoms are more permanent. The tissue changes are chiefly connective tissue hyperplasia, fibroid and cirrhotic changes, and also the accumulation of fat, due to the alcohol being oxidised in the body instead of the tissue fat, which should be burned up. In this respect it is like phosphorus. Clinically, alcohol is a direct cause of insanity on account of its toxic action on the nervous tissue, and Gairdner considers drunkenness identical with true insanity in almost all respects, except its mode of origin, duration, and the fact that it is a voluntary dementia. Alcoholic excess, however, may be a mere symptom as well as a cause of insanity, and the intolerance of even a small quantity of alcohol after head injuries and sunstroke is well known. Griesenger considers that erratic and extravagant acts performed under the influence of alcohol, though not drunk, show a predisposition to nervous disease. Sutherland says that in about one-third of cases called alcoholic insanity, the alcoholic excess is a preliminary symptom and not the actual cause, hence one has to take into consideration the previous habits of the patient. If a previously sober man suddenly takes to alcoholic excess, probably it is the result of mental worry or impending insanity, as the highest centres are already affected, and loss of control is the result. The first attack of acute alcoholic insanity is functional, as are also perhaps the second and third; but each attack weakens the powers of resistance to the poison, and then actual tissue changes, and more permanent damage, with mental symptoms, result. The motor and vasomotor cells in the fifth layer, and presumably the inhibitory cells in the second layer, and neuroglia are directly affected with secondary changes in their vascular supply, and suspicious delusions and a homicidal tendency develop; but when gastric and hepatic changes come to be more prominent, melancholia and hypochondriasis are the chief mental symptoms, and, in any case, dementia ultimately supervenes. Noot found that, in the ten years ending 1892, there were 325 admissions into Broadmoor, and of these 26·46 per cent were alcoholics; of these 34·88 per cent had a hereditary history of insanity, 15·11 per cent of hereditary intemperance, 16·27 per cent of mental worry, 11·62 per cent of sunstroke, and 10·46 per cent had a history of head injury. When intemperance is a cause of insanity, the delusions are disagreeable, suspicious, or grandiose, with a tendency to homicidal mania, or suicidal melancholia, or eccentricity; but, according to Sutherland,

when the intemperance is a symptom, there is a subdued melancholia, and the delusions are quiet, referred to others, and not personal. Again, if intemperance be the cause of acute alcoholic insanity, the subjects invariably begin to indulge within a year, but not necessarily so if it be merely a symptom. Transient epilepsy may occur in true alcoholic insanity, usually in the last stage, and it is then incurable, but, if earlier, total abstention may cure it. Gairdner suggests that these symptoms might be classed according to their duration, thus—acute, periodic, or constant. The term "caused by" is not strictly correct, for the alcohol, or any other poison or agent, does not cause the insanity, but only the negative physical condition of the highest centres which allow the lower ones to evolve in inverse proportion to the amount of dissolution which the poison has caused, until ultimately coma or acute temporary dementia is the result in the acute cases or terminal dementia in the more chronic and organic cases. The whole duration of the disease varies much in different cases according to personal idiosyncracy, hereditary predisposition, and the rate at which life has been led. In certain countries restrictions on the sale of alcohol seem to have worked marvels in reducing this insanity. Dahli reports that, in Norway, of 10,000 deaths between 1853 and 1855, 33·8 per cent were from alcoholism, while in the period from 1881 to 1885 the percentage was reduced to 10·1, and a further reduction to 6·9 took place between 1886 and 1888, and it is notable that statistics of suicide show a corresponding decrease. Becca reports that 57·0 per cent of the admissions into the Santiago asylum in the year 1890 were stated to be due to alcohol. In 1891 it was 43·5 per cent, though the males were still 59·5 per cent of admissions. The largest number of admissions was always after public festivals. Crichton Browne found the percentage of alcohol as a cause of insanity vary much in different counties, thus—it was 15 per cent in York, 3·5 per cent in Cornwall, 29·2 per cent in Durham. He considers that alcohol is always the cause of (1) delirium tremens, (2) *mania a potu*, (3) monomania of suspicion, (4) alcoholic dementia. For the ten years 1878 to 1887 the percentage of males admitted to all the asylums in England and Wales suffering from alcoholic insanity was 19·8, and, in the case of females, it was 7·2 per cent, or a total of 13·4 of the total admissions. The effect of an alcoholic history on the prognosis of an ordinary acute disease or severe accident or operation is almost invariably detrimental, and in many cases it contributes directly to a fatal issue or to the

supervention of delirium tremens or traumatic or post-operation delirium; it also markedly increases the malign influence of lead and other poisons on the tissues.

Some important points have also been adduced in this country as to the question of the influence of intemperance in the parents on the occurrence of imbecility in the children. Fletcher Beach found that in 430 cases of imbeciles, 31·6 per cent had a history of parental intemperance—72 males and 66 females. Of the 72 males, 47 were congenital and 25 acquired, whereas of the 66 females, 44 were congenital and 22 acquired. In 27 out of the total 138, the sole cause seemed to be parental intemperance, but in the others it had only an indirect accessory or predisposing *rôle*. Shuttleworth, in better-class patients, had only 16 in 300 cases, while Langdon Down believes that only 2 per cent of cases are caused by parental intemperance, the special occasion being drunkenness at the time of procreation; one instance of his had four idiots following this cause. The report of the Society for Studying Inebriety contains some interesting points in relation to the effect of hereditary alcoholism in one parent or the other on the child. It was found that when it exists in the mother alone the troubles of the child were confined almost entirely to the physical health and an instability of the nervous system, as evidenced by extreme agitation and excitability, or psychic faculties of the child were more often affected, there being defect of moral sense, absence of volition and such like attacks of lethargy, with sometimes a tendency to convulsions. Digestive and other derangements were also more likely to occur. In the cases of parental alcoholism, however, the In other cases the tendency may remain dormant for a long time, and be only accidentally lit up by chagrin, joy, emotion, illness, and then the neurosis rapidly develops. When heredity runs through several generations, the brain is so susceptible that the smallest dose of alcohol may provoke extraordinary effects and abnormal tastes, acts, and thoughts almost to the point of insanity.

Absinthe acts like alcohol, but the impulses are more irresistible; there is more conscious melancholy and depression during the intervals of acute attacks; and epileptiform convulsions are very frequent.

Poisoning by lead, with resulting cerebral symptoms, is probably the next most important toxic insanity under this class. The types are various, and also the curious methods by which plumbism may be acquired. Dr. Oliver, of Newcastle, has had extensive opportunity of studying

this subject. It is curious, in the first instance, that lead encephalopathy cannot be directly attributed to the lead in the brain, though lead may be intimately combined with the cell protoplasm. Ebstein reports a case of plumbism with chronic nephritis but no encephalopathy, though lead was found in the brain, while a case of Oliver's with encephalopathy had no lead in the brain; and in not one of Oliver's cases, even when lead was in the brain, did the amount reach one grain of the metal. Women are much more quickly poisoned than men, and alcohol greatly increases the influence of the lead specially when combined with such causes as sex, predisposition, and poor food. It has been specially recommended by Oliver that a free breakfast of a reasonable amount of milk should be supplied to all workers in lead factories, as it is likely to postpone, or even prevent, the appearance of plumbism. Next in frequency to trade poisoning comes poisoning from contaminated drinking water, and such an one is as follows:—"A man, aged 50, suddenly became unconscious and fell, as in syncope. He was never well afterwards, had severe abdominal pain, mental depression, and shortly after general paralytic symptoms appeared, delusions, and fibrillary tremor of the tongue and lips; right pupil was dilated; he was cachectic, and had a bad taste in the mouth, with a blue line along the gums. He improved at the seaside, but relapsed at home; the blue line was deeper; he was more depressed, and fuller of delusions; no albumen, but a trace of lead in the urine, while in the drinking water there was ·0028 of a grain per gallon. He died of intercurrent disease, and the *post-mortem* showed increase of subarachnoid fluid over the fronto-parietal convolutions, slight thickening of the pia, and extreme pallor and œdema of the brain."

Oliver and Dr. Richards (late of Hanwell Asylum) have both seen mania and acute delirium in other cases of plumbism. Macdonald had two cases of lead poisoning from wearing cheap false teeth plates; both had a blue line, and became insane. Moxon reported a case of mania, with hallucinations, in a patient who had used a strong lead vaginal douche. O'Carroll also reports three cases, the result of using lead hair dyes; one was fatal; one of the others had various symptoms about every three months for the past three years—headache, coma, delirium, and sometimes convulsions, usually a period of insanity, the coma lasting from one to six days, and the insanity one to six weeks. Improvement followed disuse of the hair wash; it is nine years since

the first attack, and he was well when reported. A fourth case was that of a plumber, who began to be forgetful, had headache and epileptiform attacks (spasmodic on the right side), contractions occurring about 60 per minute; there was right hemianopsia. He died in three months, after repeated convulsions. Lead was found in the liver, kidney, and spinal cord, and there was a curious black pigmentation of the neuroglia cells and neighbouring capillaries.

Perhaps the most interesting cases from a medico-legal point of view are those published by Pope, both in women who took diachylon plaster rolled into pills to procure abortion. Both were fatal. One, when admitted to hospital, had ordinary signs of plumbism, and was treated with iodide of potash. Three days after she suddenly became comatose, and died in a few hours. The other case, when first seen, seemed of weak intellect (though not so formerly), had a fatuous expression, and would not speak above a whisper; had abdominal pain, and in about a week she was convulsed at night, and became paralysed. More convulsions occurred two days later, with crying out, rolling of the head from side to side; the diaphragm became paralysed, and she died next morning. The chief point in the first case was the sudden coma which supervened after a short course of iodide treatment. This has been noticed before, and is due perhaps to the rapid accumulation of a soluble iodide of lead, which was not removed sufficiently rapidly by purgation. It is thus important always to combine an active saline purgative with or between the doses of the iodide. In many instances renal disease is present, and may account for some of the convulsive phenomena.

In many respects saturnine poisoning is like the alcoholic variety, and it may occur in various clinical types as arranged by Régis, thus:—(1) Subacute, acute, or hyperacute mania or melancholia; (2) dementia; (3) pseudo general paralysis; and (4) simple inebriety. The subacute forms are rarer than the acute varieties, and are mostly melancholic in type, with insomnia, terrifying hallucinations, tremor, and suicidal tendency, just as in alcoholism, but the blue line is present opposite the teeth. The acute insanity is always mania, and is preceded by such prodromata as headache, depression, somnolence, increased pulse-rate, vertigo, tremor, and sometimes albuminuria. These symptoms may come on after a rapid poisoning, or sometimes on abstention from habitual or chronic intoxication, sometimes after a physical or moral injury or shock. The duration of this form is about two to three weeks, recovery

is usual, but they sometimes die suddenly. Hyperacute insanity or stupor is rarer than in alcoholism, and if the patient do not die there is always great obtusion of the intellect. No gross lesion is found in fatal cases. Dementia, with or without previous acute delirious or convulsive attacks, is more rapid and marked than in alcoholism, and is usually due to some gross lesion, such as softening, atrophy, or lead. The chief characteristics of plumbic general paralysis, as compared with the idiopathic disease, are that the former begins abruptly and noisily, and reaches a climax at once, and, as soon as the hallucinations and delirious symptoms subside, the pseudo general paralytic condition is evident and fully fledged, and other signs of plumbism may be present. There is often no pupillary inequality, and the speech is bad from the first. It is merely cerebral obtusion in the extreme, and they are often admitted to the asylum in a completely paralysed condition, which may be cured.

Elkins published a case of phosphorus poisoning in a lunatic, and there were certain interesting alterations in the mental state, evidently the direct result of the toxic agent. The patient was a voluntary inmate, with slight depression; menstruation was present; she bought two boxes of red-headed matches, ate all the heads, and died in one hundred hours. The mental symptoms were that she became listless, drowsy, restless, confused, and unable to understand what was said to her, or to answer questions correctly, or to readily recognise her friends. She was semi-conscious, semi-delirious, then delirious, and had fits of great restlessness and violence; she constantly used the word "yellow" when delirious. The expression was maniacal, and before becoming unconscious she complained of pains. She was apparently blind, and speech became thick and drunken-like. Pupils were fixed and dilated, with external strabismus of the left eye; these latter symptoms are nearly in order of incidence. The *post-mortem* revealed pial hæmorrhage one-eighth of an inch thick, but pia not adherent though veins were engorged. Brain on section was rose-pink; fatty particles were found in the capillary walls, and fatty granules in the larger nerve cells, some quite full of them, and in the nucleus also. The fourth layer of cells was most affected. The interesting points are that the patient was menstruating at the time, adding one more to Costi's collection; the occurrence of the term "yellow" may be due to fatty degeneration in some of the transparent ocular cells, and is analogous to the yellow vision after a dose of santonin; lastly, that like alcohol, it is the

cells in the deeper layer that are mostly affected with fatty degeneration.

Two cases of insanity from inhaling the fumes of sulphuretted hydrogen during work are reported by Wiglesworth. A man, aged 30, with no hereditary history, was seen to be acting strangely, throwing his arms about, and shouting. He lost the power of his legs, but was excited and rough all day, did not recognise his brother, and was next day admitted to the asylum maniacal, still throwing his arms about, very unsteady on trying to stand, and wriggling about when in bed. He was quieter in three days, then became taciturn and depressed, sitting or standing for hours doing nothing. After many months, delusions of persecution and of interference appeared, and he became dangerous for more than a year. He improved lately, though still delusional, excitable, and talkative, but is more tractable, and works outside; probably he will not fully recover. A second case was an engineman at chemical works, who accidentally inhaled some fumes; headache, stupor, prostration, and delirium, lasted a few days, then violent mania for two or three weeks; he improved in a month and was discharged in five months' time.

Peterson reports three cases of mania after poisoning by bisulphide of carbon; no hereditary taint; all were male workers in rubber works; none had neuritis, and all recovered. The symptoms consisted of intense headache, frontal and temporal, giddiness, intoxication, excitement, and hilarity. In more advanced cases, muscular paresis from neuritis appears, mental weakness, apathy, amblyopia, tinnitus, cramps, increased then diminished sexual desire.

Rosenthal reports a case of benzine poisoning: a girl of 18 months swallowed an unknown quantity of benzine, and in ten minutes was in a stuporous condition, with half open eyes. The stomach was washed out, and she recovered; but in some cases the benzine may be inhaled, as in the case of an alcoholic who was in the habit of inhaling alcohol and took benzine by mistake; a stuporous state supervened. This poisoning may also accidentally occur in glove cleaners, with similar results.

Oxide of carbon produces an intoxication of two varieties: (1) a chronic or professional form found mostly in ironers; and (2) an acute form from overheated iron stoves. In the acute form there is very prominent a retrograde amnesia, while in the slower cases of intoxication there is vertigo, oppression, syncope, mental obtusion, hallucinations, and delirious conceptions. If such a condition is continued for a long period, Régis has observed rapid and incurable dementia.

Ruata, of Turin, reports a case of active delirium lasting for five days after exposure to the fumes of a coke stove in a close room, and I have also had a patient, an ironer, who is often subject to vertigo, headache, and visual hallucinations when first awaking, but no amnesia, no sickness. She is always worst after glossing with a red-hot iron, and during the drying. She states that many other women suffer from headache, but that they put it down to the heat.

The subject of septic poisoning from within, in its relation to mental disease, has to be considered chiefly in its connection with the puerperium, and traumatism or disease with open wound, or operations.

Savage remarked the frequent association of puerperal fever and puerperal insanity, and it is a matter of common observation that delirium very often accompanies any febrile action the result of sepsis after an injury or wound of any origin. In the majority of cases this delirium is more or less transient, and passes off, after an acute and active course, as the sepsis is combated, but in certain cases, probably those with a hereditary predisposition or an acquired neurosis, a more lasting and even permanent, if not actually fatal disturbance, may supervene.

In the years from 1878 to 1887, the percentage of puerperal and parturition cases admitted into all the asylums in England and Wales was 6·7 per cent, which, when taken in relation to the total admissions, is equal to 3·4 per cent, but Savage's experience is that puerperal insanity reaches a higher percentage, varying from 8 to 10 per cent of all acute cases admitted into hospital, and this increased percentage is accounted for by the fact that only acute cases entered into his statistics. Over and above this percentage of cases admitted into asylums, considerable numbers are treated at home. He believes this form of insanity, including what may be the more purely traumatic and non-septic cases, to be less curable than is usually supposed, for he found that 5 per cent of acute cases, mostly septic, were fatal, and that 20 per cent drifted into dementia. More Madden found that 668 per 1,000 recovered in six months, that the next percentage died, and that the remainder were incurable, which is somewhat different in this latter respect from other statistics. As to the frequency of its occurrence in relation to the number of obstetric cases, this varies considerably in the practice of different medical men. Thus, in the four years 1878 to 1882, in all England and Wales, puerperal insanity occurred in 1 in 1,950 obstetric cases. Rigden had 6,000 cases, with 5 subjects of puerperal

insanity, or 1 in 1,200; Reid had 1 in 397 cases; and another reports 1 in 398 in 11,940 cases.

Clouston is of opinion that there is no one cause, but that the etiology may be best expressed by the phrase, "the accompaniments of childbirth." Heredity is very frequently met with, and is particularly active if transmitted through the female line in elderly primipara. Reid found that 45 out of 111 in Bethlem, and Tuke that 22 out of 73 in Edinburgh, had a hereditary predisposition, which makes the sensorium all the more ready to break down under any moral or physical shock; it is stated that 64 per cent of 2,281 cases in asylums were unmarried, and More Madden found, in a collection of 1,334 cases, that 883 were single, and in 120 other personal cases 12 were single. There has likewise often been some complication, such as post-partum hæmorrhage, obstetrical operation, or laceration; in others there may have been a previous attack of insanity not necessarily puerperal, but sometimes it is a continuation of the insanity of pregnancy. There are three clinical types: (1) mania; (2) melancholia; and (3) dementia. As a rule, mania comes on within sixteen days after the confinement, and all melancholic cases develop after that date. The primary demented form is much rarer than either of the other two, and has no special time of appearance, and is probably not connected with septic conditions. When the condition is one of mania, there is mostly evidence of sepsis, and this is the most fatal form. It is also to be noted that mania occurs almost invariably in the early period where sepsis is possible, and may be thus quite independent of a pure traumatic origin and subsequent nervous shock. It has already been pointed out that Bevan Lewis found an abnormal condition of the blood in five cases of puerperal insanity. The hæmoglobin was in all from 20 to 78 per cent lower than normal, and in one case there was only 40 per cent of red cells. In uncomplicated cases the red cell percentage was nearly normal, but the corpuscular value in hæmoglobin was invariably low. This is strong proof that something more than mere shock is a factor in these cases, and, doubtless, further observations in this direction will perhaps enable one to differentiate the purely traumatic from the purely septic cases of puerperal mania. It is also a difficult matter to differentiate between the two sources of septic infection, for there is the septic infection from without and that from within, the result of auto-intoxication, which will be alluded to later.

The melancholic type, which occurs later in the puerperium,

is more purely an anæmic insanity. The time of its appearance practically puts acute sepsis out of court, and it is thus more like the insanity of lactation which occurs still later, after six weeks, than the mania or the dementia already alluded to as sometimes being primary. This primary dementia is usually incurable, but Thornton reports the case of a lady just confined, who had "a fit," became comatose, and remained in stupor for three months; there was slight albuminuria; she was sent away, and suddenly recovered.

The importance of the septic element from without in the case of surgical practice is very great, and I have been permitted to examine the books connected with Professor Annandale's wards from the year 1882 to 1894 inclusive. During this time about 5,500 operations of one kind or another had been performed, not including compound fractures and other examples of serious injury, excluding cranial injury which did not require surgical interference. So far as I can make out, there were seventeen cases in which actual sepsis, either before or after the operation or injury, undoubtedly had as a sequel mental derangement sufficient to necessitate the removal of the patient in most instances to the special ward. There were also seven cases in which the uræmic element probably took part, and two of these developed cerebral thrombosis. These seven comprised four strictures, one calculus, one "abscess of bladder," and one a trivial operation unconnected with the urinary organs. A case of traumatic stricture, aged 60, gradually became weaker after simple dilatation, wandered, and developed hemiplegia which killed him in three days. Cerebral thrombosis also probably supervened in the case of an old man, aged 73, after removal of a calculus by median cystotomy; he died in six days, and developed hemiplegia and coma two days before death. He had marked atheroma and chronic renal disease. Another patient, aged 73, had suprapubic cystotomy performed on him for the relief of stricture and cystitis; next day he had to be removed to the special ward, where he was detained two days, but he quietened down, and was ultimately discharged cured. A man named Swan, whose age is not noted, was admitted to Ward 6, suffering from stricture and delirium, whether alcoholic or uræmic is not specified; he was detained there for ten days, and was then discharged. Another man, admitted in a similar condition, died in two days; while a third, said to have "an abscess of the bladder," died in eight days, but no note was made as to whether any operation was performed on him. The seventh was a man, alcoholic and slightly albuminuric.

He had to be sent to Ward 6 on the evening of the day when a trivial operation was performed (excision of the head of a metacarpal); he was detained two days, and was then discharged cured three days later. When the seventeen cases, presumably or evidently septic, are considered, some interesting facts are found. There were six open epitheliomata which were operated on; one a sarcoma of the breast involving the skin, though it was not ulcerated, but subsequent tension and suppuration took place; seven were operations on already septic tissues, comprising gangrene, putrid abscess of the leg, abscess of the knee, periostitis, spinal abscess, and compouud fracture. The remaining three cases were, two inguinal herniæ, and a fire-damp explosion and burn. Thus in all these sepsis was almost inevitable, and in some had actually begun at the time of operation, which in most instances was the sole chance of saving life. It is almost impossible to arrive at any reliable data as to the question of heredity, or at any definite information as to the alcoholic tendencies, but the latter was a probable predisposing cause of the mental breakdown in six of these. The average age of these seventeen cases was 45·9 years. Only three were females, two being children, aged 8 and 15 years, both septic on admission, and one old woman, aged 73, whose breast was excised for sarcoma. The time after operation when definite mental symptoms developed was noted in only twelve cases, and the average was the fourth day. Two cases were in connection with erythema, one a gangrene patient, and the other a malignant arm which was amputated, and he afterwards said he had left his wife at home suffering from the "rose." Two cases were complicated with tetanus, one a severe burn of the whole arm, which was amputated at the shoulder although he was already septic and anæmic, and had commencing stiffness of the jaws. The other was a case of compound fracture of the leg, in which tetanus set in on the eleventh day, and was cured by amputation of the thigh and excision of a portion of the sciatic nerve higher up; his subsequent mental state will be noted later. Two died of hyperpyrexia, one the tetanised burn already alluded to, the other a burn after a fire-damp explosion; he was an alcoholic. Bryant has seen six cases of burns with hyperpyrexia, of whom five were fatal; but it may also occur in non-septic cases, as meningeal hæmorrhage or laceration of the cortex with or without fracture. In simple fractures also a rise of temperature, though not hyperpyretic, is often seen, Horsley finding that 92 per cent of 168 cases had it, while Volkmann and Angere compute it at 78 and 70 per cent respectively.

In fifteen cases in which it was definitely noted the average duration of the mental disturbance was from six to eight days, and when they had to be removed to the special ward their average period of detention was six days. In one the patient was in a mild delirium not necessitating his removal from the general ward for many weeks after a radical amputation of the penis, scrotum, &c., for malignant disease. In another, the compound fracture of the leg which had tetanus, a taciturn irritable stupor or dementia supervened after the amputation, and persisted for several months; but both these cases quite recovered ultimately. Perhaps these two, and another one of thirty days' duration after a hernia cure, were the only cases in which the mental symptoms reached the severity of actual and persistent, though temporary, insanity.

As regards the immediate fatal result, this occurred in eleven instances. The average age of these cases was 46·7, thus closely approximating the general average age at the time of the operation; but, if the girl with spinal caries and the two accidents be excluded, the average age of the remaining cases rises to 57·1, which probably is a more correct figure, and exemplifies the fact that badly nourished brains and bodies in people over 45 are much less able to stand the shock of septic absorption than those less aged and better nourished. In the case of sepsis and uræmia combined the average age of the four patients operated on is much higher than the general average, being 59·5; and of the two who died, both with hemiplegia, one was 60, the other 73 years of age. Of the seventeen cases under consideration, excluding the uræmic ones, perhaps only five became actually septic at the time as a result of operative interference, and this gives an average of about 1 per 1,000 in the 5,500 operations of all kinds in whom severe mental symptoms resulted from the sepsis. This is very near the figure given by Rigden as representing the occurrence of puerperal insanity; but if the whole seventeen cases are considered, the average of 3·09 per 1,000 is also like that which some others experienced in their puerperal cases, taking all conditions as they occurred.

The sub-section of toxic insanity due to autointoxication is one whose importance has only recently been recognised in this relation, though the fact that reabsorption of toxic agents from the alimentary canal in particular has long been well known. In 1833 Jukes, in his book on the use of enemata, remarks that "ten out of every twelve cases of death in childbed may be traced to the ill effects of costiveness during

pregnancy, when females are more liable to it than at any other period of their lives." This costiveness is a frequent source of a more or less constant toxæmia due to reabsorption of toxins from the intestine, and that such can and does take place may be readily appreciated by the fæcal odour of the breath in many cases. In fact, I consider fæcal odour of the breath as almost pathognomonic of fæcal impaction, and is an endeavour of nature to excrete the volatile waste products through the lungs instead of through the flatus *per anum*. Doubtless the non-volatile products are absorbed, and either poison the various tissues and the blood and lymph with which they must come in contact, or they irritate the various organs and their secretions during the course of their vicarious elimination. The changed disposition and feeling of well-being in many persons after a free evacuation of the bowels is most marked, and I have already quoted at length a case of more serious mental disturbance resulting from fæcal impaction in a woman who was cured when this was relieved. This subject of intestinal toxæmia has been so impressed on the minds of some alienists that Régis and Bettencourt-Rodrigues among continentalists, and Macpherson at home, have practised both gastric lavage and also a systematic course of intestinal disinfection in certain cases in which they believe toxæmia is an active cause of the mental symptoms. Bouchard considers "that man is a storehouse and laboratory of poisons," and that he defends himself by their destruction and elimination; but he is under a constant danger of being poisoned, which he realises in various ways whenever these poisons, the result of tissue changes, are produced in too great a quantity or are not sufficiently rapidly eliminated. These poisons have an undoubted influence on the central nervous system, and may in some instances produce insanity, for the functions of the human brain must be equally subject to the rules and laws of general pathology. The faculty of intelligence can only be presumed normal so long as the blood is properly constituted, and that this was apparent to the ancients is evidenced by the term melancholia, and also in other ways in the writings of Homer, Aristophanes, and others.

Autointoxication is due either to undue retention or undue new formation of toxins, or to a combination of these two abnormal states. In cases where there is indigestion either the result of chronic catarrh, atony, &c., with or without actual dilatation of the stomach, putrefactive bacteria produce many poisons and fatty acids in great excess; these

have been classed by Albertoni as peptotoxins, leucomaines, aromatics such as sudol, volatile fatty acids, ammonia, methan, sulphuretted hydrogen, acetone, and many others. Many of these are present in a healthy condition, but there are certain natural agents which prevent their excessive formation, and these are the dilute hydrochloric acid in the stomach, and glucose on the one hand, and on the other there is the normal oxygenation of the body tissues. Thus we find that auto-intoxication is indirectly caused by such bodily conditions as are seen in prolonged dyspepsia, anæmia, fatigue, fasting, and the action of certain pathogenic microbes, all of which conditions permit of undue fermentation taking place. If the urine contain sulphoacids, phenol, acetone, peptones, indican, &c., there is always a suspicion that autointoxication is taking place, though even in the normal state the urine may be toxic. Gastro-intestinal disturbance is thus a most powerful aid to the formation of toxic bodies, and as this condition, with or without some constipation or gastric dilatation, is more or less marked in every case of acute mental disease, it is only rational that attempts be made to combat this source of infection. With this in view, Macpherson has followed the following *regime* in acute melancholia. First wash out the stomach, then give an aperient dose of calomel; repeat the lavage daily for a week, and regulate the bowels. On the second day begin administering naphthalin in 10 gr. doses three times a day, and this dose may be increased to 40 or even 80 grs. daily. As regards diet, nitrogenous food must be eliminated and only farinaceous food used. The best test of an intestinal disinfectant and the effect of food is obtained by examining the urine and discovering the ratio of free to aromatic sulphates, as recommended and practised by Hunter, who found in his researches on pernicious anæmia that, on mixed diet the ratio of free to aromatic sulphates was 9 to 1, whereas farinaceous diet reduces the aromatic sulphates, which are the index of putrefactive loss occurring in the food in the intestine, and the ratio was found to be 15 to 1. Such being the case, body weight increases, anæmia disappears, fæces are devoid of smell, sleep is gradually induced in varying time, and no bad reaction or depression on waking was observed, as is usually the case after hypnotics, which frequently make an excited patient worse and a melancholic more depressed after its somniferous effect has ceased. Naphthalin probably shortens a mild melancholia, though not in the majority of cases. It certainly causes a rapid disappearance of the restlessness and diminishes the mental distress and suicidal feelings in melan-

cholia. This result is comparable to the occasional cure of a mental disorder after a critical diarrhœa, an urticarial or scarlatiniform rash, as if in one case the motions and in the other the sweat were charged with the elimination of the poisons. That gastric lavage, since its first introduction into this country by Affleck, has established itself as the most important point in the treatment of dilated stomach, and also certain other fermentation dyspepsias and intestinal affections, no one can deny, and the wonder is that it has not been applied to the cases at present under consideration before.

Another form of insanity in which there seems to be a special gastric derangement is that associated with pellagra. Agostini has studied twenty-two non-maniacal cases, and in all there was retarded and imperfect digestion. Peptones were deficient, and the total acidity and free HCl was less, and in 50 per cent of the cases free HCl was entirely absent. The gastric movements were impaired; abnormal organic acids and excess of mucus were present. Lavage with salt solution before meals and the administration of a HCl mixture after are recommended in this condition, as the deleterious effect on the blood has already been noted, and the usual termination is cachexia and death. In relation to this lavage with salt solution the following may be noted. Dr. Carlo Sanquirici, of Sienna, experimented with two series of animals; both were poisoned with the same doses of strychnine, chloral, alcohol, aconite, paraldehyde, caffeine, and urethane. Into one series was injected a saline solution amounting in quantity to 8 per cent of each animal's weight. The other series were untreated and all died, whereas those into whom the saline had been injected recovered, which is taken as evidence that vegetable alkaloids can be diluted and washed out of the system before their toxic effects are complete. Dr. G. F. Keen has put this experiment into actual practice by injecting not less than 2 quarts daily of sterilised blood-warm normal saline solution in a case of insanity, a woman aged 33, suffering from religious melancholia, who refused her food, and had lately contemplated suicide. One quart was used night and morning until 15 were injected, and he says the improvement was marked and immediate, so much so that he considers it sufficiently encouraging to extend this treatment to all those cases of of insanity believed to be of somatic origin due either to auto or other intoxication.

In all toxic conditions the poisons act on the body through the medium of the blood and lymph, and hence there is little to marvel at when various serious alterations in its constituents

are frequently found; it cannot fail to be influenced by some of the poisons which it bears to the emunctory organs, which in some instances neutralises them, in others excrete them directly. Thus the liver neutralises the alkaloids; the skin excretes normal and abnormal salts, water, carbonic acid, and volatile fatty acids; the lungs excrete volatile poisons as well water and carbonic acid. The intestine is chiefly engaged in passing the various toxins, the result of normal and abnormal digestion, bile salts, and gases; whilst the kidneys excrete all the poisons except gases, and hence urine is always toxic, and has, so far, been shown to contain at least seven toxic substances, which will be further alluded to.

Closely allied to these more definite cases of faulty physiological chemistry are the great diathetic diseases, rheumatism and gout, and probably diabetes and cancer to some extent. As regards the first and second of these there seems to be a common basis, or an arthritic diathesis, as it is called by some authorities. Bouchard defines this "arthritism" as a "general vice of the organism characterised by the retardation of the nutrition, and made up of a host of manifestations that all appertain to an arthritic nervous cycle, in which we find, side by side, megrim, epilepsy, diabetes, hysteria, chorea, gout, and rheumatism, and also precocious atheromasia and arteritis, with angina pectoris. It is specially characterised by a tendency to congestion, by which the general nutrition is profoundly altered, and toxic foreign bodies engendered, which act first on the vascular, and secondarily on the parenchymatous portions of all the organs and tissues." He believes that the special mental type of this broad class is one of restlessness, indecision, anxiety, and mental instability in general, often accompanied by illusions and hallucinations, claustrophobia, and unpleasant dreams. All these symptoms, which may occur in actual attacks of insanity, may be relieved, aggravated, or cured by various chemical changes, and usually coincide with such conditions as hypoazoturia, hypophosphaturia, oxaluria, or uric acid in excess at the end of the attack. These views are fully corroborated by the elaborate studies of Dr. Haig on the subject of uricacidæmia, which he holds accountable for megrim, epilepsy, headaches of certain type, and melancholic depression. Thus the mental disturbance in the course of acute rheumatism is not merely a febrile delirium, though hyperpyrexia may frequently simulate insanity. Hyperpyrexia may be divided into two types, one with little previous fever, but sudden loss of pain and rise of temperature to 106° to 112° F., and the patient dies; the other with pericarditis, in

which the temperature may fall, and then suddenly rise and end fatally; as a rule, however, if it is checked it always tends to rise again. In rheumatic and typhoid fevers the rise of temperature is the actual cause of death. In 1,300 cases of rheumatic fever, 2·6 per cent died, and from one-third to a half of the fatal cases were due to hyperpyrexia, 50 per cent of which are fatal in spite of everything. In 65 cases of Greenfield's, there was marked delirium in 57, and in 47 of these it preceded or coincided with the hyperpyrexia, while in the rest the symptoms were slighter. Hyperpyrexia may also occur in tetanus, general and specially extensive superficial burns, cerebral and spinal hæmorrhage, opium coma, alcoholic poisoning, and certain injuries, either cranial or more general. When mental disturbance, independent of a hyperpyretic state, is associated with acute rheumatism, it is one common to the aforesaid arthritic diatheses, and most frequently appears in the convalescent stage, but it may also replace an arthritic exacerbation in the course of the disease, in which case it is usually maniacal in type, whereas the former is invariably melancholic, with torpor, terrifying visions, sometimes refusal of food, and even suicidal tendencies. Chorea, cardiac or pericardial complications, may be present, and alternate with the articular symptoms. Similarly in the case of gout, mania may occur in the course of an acute attack, or melancholia alternate with the diathetic condition. It is an old observation that a gouty patient frequently never feels better in his life than just before a bout of acute gout, and this feeling of well-being is due to the temporary stimulation by the excess of urates and uric acid, which produce increased blood pressure. Aphasia is a temporary symptom which may also occur as a result of autointoxication in gout, uræmia, acetonæmia, and diabetes insipidus. Wyllie remarks that though there is the toxic element in the excess of urate of soda in the case of gout, some of the cases reported may have really been uræmic from gouty nephritis. He considers the history of transient aphasia so important that in every instance such cases should have their urine examined, either for albumen or sugar, as there are now numerous cases on record both of uræmic and diabetic aphasia which passes off speedily like temporary uræmic amblyopia, or forms a prelude to uræmic or diabetic coma.

The subject of diabetes has already been alluded to in general, but it is necessary just to note the autointoxication which sometimes suddenly occurs, and which is commonly supposed to be due to the condition of acetonæmia. Acetone may be excreted in the healthy man or dog to the extent

of 12 to 15 milligrammes, and may also be produced experimentally by means of destruction of blood elements, such as may also occur in the course of disease, autointoxication, and some febrile conditions. But though it can be produced experimentally by lesions of the solar plexus, it was found by Cristiani to be entirely absent in certain clinical cases suffering from nervous diarrhœa accompanied by glycosuria. In diabetes, however, when acute cerebral symptoms appear, and the characteristic coma, sweet-smelling breath, and dyspnœa are present, acetone is usually a constituent of the urine.

The chief causes of this sudden termination are too rapid changes of food, stoppage of opium or codeina, and any moral or physical shock, such as over-fatigue, alcoholic indulgence, or the contraction of influenza. It is usually more or less rapidly fatal, but in a case under the care of Dr. Affleck, recovery took place, though there were present in the urine, sugar, acetone, and albumen. As this patient was somewhat elderly, the question whether it was genuine diabetes or merely gouty glycosuria naturally arises. She certainly presented many symptoms of the true diabetic, and the presence of these three abnormal bodies in the urine inclined one at first to give an unfavourable prognosis, but this was not verified. This case is so important that the following brief notes may be interesting now:—

J. B., aged 53, was admitted to Ward 30 on 12th January, 1888, at 10 A.M. She was cold, drowsy, with deep sighing respirations, 24 per minute; breath had a peculiar mawkish, sweet smell; pupils contracted; hair on head scanty; skin dry. Been ill six days. There is a history of diabetes for a considerable time, and also of recent alcoholic indulgence at New Year time. The urine contained over 200 grains of sugar, had the acetone reaction with iron, albumen was present, and there were 5 grains of urea to the ounce. There were no abnormal pulmonary signs; heart weak; pulse, 110; temperature, 97° F. Patient was difficult to rouse, but could answer sensibly when thoroughly wakened. Blood very dark and sticky, and very difficult to get to run, but no corpuscular abnormality was detected, and there were no ophthalmoscopic changes. Patellar tendon reflexes present, slight tremor of right arm; no vomiting nor headache. At intervals she wakes up, takes a drink, and subsides again. Next day the temperature was 99°; pulse, 100; and respirations 24. On 14th January dyspnœa was better, and she was more intelligent; asked for beef-tea. Sugar, 223 grains. Subsequently the albumen dis-

appeared, the urea and sugar increased, and, lastly, the acetone was also absent, and she was discharged, having gained a pound and a half in weight. No treatment was adopted, and the balance is on the whole in favour of its being a gouty glycosuria, with temporary acute renal inadequacy due to the alcoholism, which was a direct cause of the defective oxidation, and led to the acetone being present, and replacing the glucose to some extent. As the acetone diminished, the glucose gradually increased, as was also the case with the inverse decrease and increase of the albumen and urea respectively. In diabetes proper, however, when coma and dyspnœa appear there is usually only a short time to live, and when all the sugar is removed by drugs, as occurs in some cases, there is apt to be a replacement by acetone with temporary symptoms, and the same may occur when restricted diet or opium preparation is suddenly changed or stopped. The following case, also under Dr. Affleck's care, is interesting, as she had well-marked diabetes, which was apparently cured. She was a married woman, 32 years of age. On admission the urine varied from 70 to 100 ounces per diem, and contained from 20 to 30 grains of sugar per ounce; there was no albumen, and the urea was increased; diarrhœa was troublesome, and interfered with the correct estimation of the amount of urine. Under diabetic diet and codeina, which was increased from a half to 2 grains three times per diem, the specific gravity and also the amount of sugar fell, but still gave a marked reaction to Fehling's test, when the specific gravity was only 1012 to 1020. Weight increased 7 lb. in six weeks. On 17th January, after five weeks' treatment, the urine was found to be entirely free from sugar, and it never reappeared. There was no acetone nor albumen, and the amount remained increased. There was slight headache and sickness on this day, but this soon passed off, and she was discharged practically cured on 11th February. Some months later her urine was still free from sugar. The chief interest in this case is the freedom from serious cerebral symptoms on the disappearance of sugar from the urine, though there were headache and sickness of a temporary nature.

M. Chouppe reports a case in which aphasia was a passing symptom in the course of diabetes insipidus; he was fatigued by walking, became comatose, and when found was aphasic, but produced a hospital ticket on which were the words "polyurie simple." About ten minutes after having drunk nearly 2 litres of water he recovered his speech, and M. Chouppe attributed his aphasia to simple dehydration of the blood, and this possibility must be held in view in ordinary diabetes cases

in which the blood is sometimes remarkably sticky and dehydrated even without the presence of acetone.

Pellagra, which Lombroso attributes to poisoning of the organism by certain alkaloids of altered maize, has an intimate connection with insanity. The subjects become cachectic and melancholic, with a tendency to suicide by drowning, but sometimes a pseudo-general paralytic condition develops. It is almost inevitably fatal, and is unknown in this country, though it constitutes about 20 per cent of admissions into Italian asylums. The blood changes in it have already been noted.

Some of the rarer intoxications may be noted, such as that which takes place in the course of acute yellow atrophy of the liver. The mental symptoms come on early in the shape of delirium and then stupor. The mental and physical lethargy accompanying ordinary jaundice are well known to be the result of biliary toxæmia, and the increased frequency of gall-stones in the insane, specially in female cases, is now invariably acknowledged, and is of interest when considered in relation to the excretion of urinary pigments, which form some of the toxic elements in that secretion, and to the fact that a proper supply of bile is essential to antagonise certain intestinal toxins.

The delirium attendant on many acute and chronic cardiac, respiratory, and hæmopoietic diseases is undoubtedly in part due to toxæmia resulting from diminished excretion of toxins from the lungs, and also to their excessive formation in the body. Similarly, one cannot help recognising the probability of auto-intoxication in a negative sense in cases of myxœdema and its sequential mental derangements, and also in some cases where marked symptoms have followed the removal of the thyroid, on the one hand, and of the ovaries and testes, on the other. In such cases some improvement and even cure has taken place after administration of the fresh juice of the gland in question, as recorded by Régis in a case of insanity after oöphorectomy. I also found that considerable relief was afforded by the administration of suppositories of ovarian extract in the case of a patient who was greatly troubled with flushings after double oöphorectomy. It is evident that this can only be the result of supplying some element which probably neutralised other toxins which are therefore not destroyed or eliminated when the particular organ is either atrophied or removed.

Campbell Clarke has studied 40 cases of puerperal insanity, and finds that in four-fifths of them it is preceded by either

constipation or abundant diarrhœa, the motions being very fœtid specially when diarrhœa is present. The amount of urine was lessened in two-thirds of the cases; the specific gravity was below normal in 9 cases where albumen was present. Usually there was a notable diminution of phosphoric acid, and he found that urea fell to an average of a little over $3\frac{1}{2}$ grammes per twenty-four hours. Eclampsia is also due to an intoxication, and it is only rational to believe that it is due to a similar process as is shown to be present in these cases, but that the sensori-motor area has been more particularly affected on account of a larger amount of convulsant alkaloids having been produced or not efficiently excreted. The why and the wherefore of these cases it is difficult to determine, but in the case of insanity there is a large number of patients who have a hereditary central nervous weakness, which may act as a predisposing cause to intellectual rather than to mere sensori-motor disturbance. These observations of Clarke, made in 1886 and 1887, closely resemble Juke's remarks made in 1833, and though more or less clinical and empirical, in the latter case they are none the less true still.

It is thus seen that an exhaustive analysis of the urine is able to materially help one in understanding many of these conditions, and we will now shortly consider some of the results of such chemical analysis and their bearing on nervous and mental symptoms. When mental symptoms appear in the course of autointoxication there is either an absolute increase or inefficient elimination of normal effete products, or a production of abnormal toxins. Among the results of the former we may class asphyxia, uræmia, uricacidæmia, cholæmia, glycæmia, and also the results of some alkaloids, while the abnormal constituents which are most active in producing symptoms are leucin, tyrosin, from defective liver action and often associated with acute yellow atrophy, and also other substances which appear in the urine as abnormal pigments, which are accompanied by various manifestations such as eclampsia, acholia diabetic coma, &c. It has already been shown that one of the chief causes of this increased production of normal or abnormal effete products is abnormal intestinal action and digestion, especially after a vegetable repast. Acute delirium only occurs after intense autointoxication, though many other nervous symptoms are frequently the result of a lesser dose of the toxin, such as is seen in the occurrence of tetany in gastrectasis. The poisons contained in the body have various origins, and may be classed under four

heads:—(1) Mineral substances introduced with the food; (2) the products of physiological secretions, such as the saliva, bile, intestinal digestive juices which transform albuminoids into peptones and gives rise to various toxins or poisonous alkaloids; (3) toxins, the result of intestinal putrefaction; (4) other poisons in the tissues, the result of cellular metabolism, mostly mineral salts, potash, creatinin, &c., which pass by means of the intercellular lymph stream into the lymphatics and blood-vessels, and so are universally distributed, producing first stimulation, then depression, and are subsequently eliminated by the various organs. The constitution of the urinary excretion will now be more fully detailed. The kidneys eliminate all effete products except gases, there being water, two-thirds at least of solid materials, above all, mineral salts eminently toxic, and much nitrogenous matter. Thus one can easily understand how a functional or organic lesion of these organs can produce directly an intoxication of varying degree and intensity. Bouchard in 1883-84 studied minutely the phenomena which follow the intravenous injection of urine in the dog, and was able to separate seven toxic substances from the urine:—(1) A diuretic, urea; (2) a narcotic; (3) a sialogogue; (4) a mydriatic; (5) an antipyretic; (6) an organic convulsant; (7) a mineral convulsant, potash.

Without going into the exact methods by which Bouchard dissociated these substances, M. Chevalier-Lavaure quotes his experiments as follows:—"The first phenomenon which follows injection is contraction of the pupil; after the injection of 10-12 to 15 cc. myosis appears, and becomes more and more marked till the aperture is punctiform. Shortly after the commencement of the injections the respiratory movements are accelerated, with a diminution of their amplitude. Then the animal becomes weak, its movements are undecided and laborious, and sleep supervenes. There is also an increase in the urinary secretion and a frequency of emission. Urine, more than any other substance, augments urinary secretion, the diuresis produced by injecting distilled water not being comparable to that produced by the injection of normal urine. At the same time the temperature falls, and though it always falls after the intravenous injection of any liquid, it is much more marked after the injection of urine. The amount of heat lost by the animal is greater than that which is necessary to raise to the temperature of the blood the quantity of liquid injected. This fall is due to a diminution of calorification. The temperature of a dog may fall from 39° C. to 37° C. or even 32° C., and this fall is in itself sufficient to cause death.

The palpebral and corneal reflexes are diminished, and there is often exophthalmos. Death comes at last, either without convulsions or with moderate muscular tremor, and the heart continues beating. The pupil remains contracted up to death, then it dilates in some cases." If only sufficient urine be injected to produce coma, the animal remains in this condition for a time, them the torpor diminishes, and in about half an hour the return to health is definite. It requires an average of 45 cc. per kilogramme of animal to kill it, and Bouchard found that pathological urines were not always the most toxic, being sometimes less toxic than normal urine, or acting differently and so producing other symptoms. Certain other pathological urines, with a dose of only 10 cc., determined convulsions which were never observed after the injection of normal urine, while with others one could obtain phenomena or death only after injecting as much as if it had been distilled water—viz., 97 cc. per kilogramme.

As the urine of waking and sleeping differ in toxicity, it was always noted during what time the urine was secreted, and he collected the urine from 5·30 A.M. to 8·30 P.M. on the one hand, and from 8·30 P.M. to 5·30 A.M. on the other. Thus, the day or waking urine was secreted in fifteen hours, and the night or sleep urine in nine hours. This distribution was found necessary, as the sleeping of insane patients is shorter and more restless than in sane people. All drugs were withheld and the quantity of urine noted, as also the presence of albumen or sugar and its acidity, together with the weight of the patient and the weight of the rabbit experimented on. The patients were melancholics, hypochondriacs, and also some subjects of mania and *folie circulaire*. Intravenous injection was always practised, and the amount of bicarbonate of soda required to neutralise the acidity was also noted. In all, twenty-six experiments were made with the urines of eleven patients, and the following is a *résumé* of the results:—

Speaking broadly, normal urine secreted during the day produces salivation, diuresis, myosis, fall of temperature, narcosis, and coma, whereas convulsions are produced by the urine secreted during sleep. The average quantity of normal day urine required to kill a kilogramme of the animal was 25 cc., while it required 35 cc. of the urine secreted during sleep; but in the case of mania the results were different. It was found that the toxicity of maniacal urine is nearly the same day and night, and is less than that of normal urine. The general results from either day or night urine from a maniac are similar to those normally obtained only from

urine secreted during sleep—viz., convulsions rather than narcosis and coma; hence, presumably, there is an over-production and elimination of one set of substances to the detriment of others, and in this case it is an over-production and excretion of the convulsant elements which mask the narcotic substances which should act chiefly in the day urine. Of the two substances which produce convulsions one is fixed and inorganic—viz., potash; the other is insoluble in alcohol, is not an alkaloid, but appertains to the group of colouring materials. On the whole, then, the results obtained from injecting maniacal urine compare with those following the injection merely of these two convulsant substances, which have been separated from normal urine by evaporation and extraction. As regards the lowering of the temperature, it has been found that this is probably due to the colouring matter, and it is also known that the urine of jaundiced patients produces myosis, spasms, agitation, and lowering of the temperature; but that when the urine is decolourised the fall in temperature is considerably less, and tonic convulsions with opisthotonos are produced. These are due to the potash which is not removed by the decolouration of the urine.

In the cases under review it was noted that the kidneys were normal, so that it was an over-production and not a faulty elimination of the convulsant bodies. Hence the alterations which are found in the blood, and the relation of this convulsant element to the altered composition of the bile, which contains both salts and colouring matters, are most important when the greatly increased frequency of biliary calculi in the insane is taken into consideration. Biliary calculi are mostly found in melancholics and the various dements, and the mental condition may thus be explained; that there is a premature precipitation of the salts and colouring matter in the form of calculi, which should have circulated through the body and been excreted, and acted as an antagonist to the narcotic and comatogenous matters which were found to be in such great excess, as the subsequent statements of the results of experiments will help to show. Bouchard found that urine secreted during sleep was less toxic than that secreted during the waking hours, and after experiments he was able to suggest the following solution:—A man elaborates during sleep from two to four times less poison than during an equal time of cerebral activity; the body constructs a substance which when it accumulates produces sleep; and during sleep, in place of this narcotic substance, a convulsant is elaborated, accumulates, and by

producing muscular tremor wakes the sleeper. Urea is not toxic or hardly so, but the colouring matters contribute to the toxicity of the urine about three tenths, extractives from one to two tenths, and potash and mineral matters from four to five tenths. It is the number of these toxic agents and their various combinations that give the varied symptoms in a case of uræmia, and determines it either a convulsive or a comatose variety according to the preponderance of either one or other toxins in the body. Bouchard has also made many investigations with pathological urine from cases of fevers, uræmia, typhoid, and cholera; and Lepine and Guerin, Feltz and Ehrmann have also made researches in this direction; Dupard, a pupil of Lepine, wrote a thesis in 1883; Vilers found the alkaloids demonstrated by Bouchard, but only in abnormal cases.

This question and its attendant results help to show the great influence of the physical on the mental state, and more particularly the effect of nutritional disorders on the production of insanity, by means of producing an increased formation or retention of normal toxins, or an elaboration of other toxic substances. M. Chevalier-Lavaure undertook a series of experiments with a view of corroborating many of the above statements, and in his thesis he gives in great detail the exact methods and patients whose urine he experimented with, so that his results and deductions might be as scientific and reliable as possible. The normal acidity of the stomach is antagonistic to the action of micro-organisms and ferments; but the ferments are only neutralised, and start activity again in the alkaline contents of the intestine till they are arrested by the bile, whose influence, however, is lost in the large intestine, where toxic alkaloids are specially produced.

It has already been shown that by appropriate intestinal disinfection the aromatic sulphates and also the toxins in the urine may be diminished, and hence the relation between the production of them in the intestine and their elimination by the kidneys is complete.

As all acute insane cases have gastro-intestinal disorder and constipation, the usual prodromata are sleeplessness and headache, which continue after the actual alienation appears, and the delirium of acute obstruction is comparable to the chronic headache, malaise, and sleeplessness of a person less intensely poisoned by constipation. In the case of hypochondriacal melancholia the urine secreted at night produced respiratory troubles, myosis, exophthalmia, and convulsions, but it was of a toxicity less than that of normal urine

secreted at the same time, whereas the injection of urine secreted during the day produced the same respiratory phenomena and some tonic convulsions, and also coma, but the toxicity was greater than that of normal urine secreted at the same time. It was also noted that the temperature rose one degree, in half of the experiments, to fall again to its former height at the moment of death. In two cases there was neither salivation nor emission of urine. The urine of agitated melancholia produced the same results whether it was secreted during the day or night, and comprised respiratory troubles, clonic convulsions, opisthotonos, and death. This is practically the same as what resulted from the injection of urine secreted by maniacal cases, but differed in this essential respect, that the urine secreted during the day had a normal toxicity, whereas the urine secreted at night had a toxicity more than double that of normal urine secreted at that time. These results were constant in all the experiments, and one is thus enabled to say that particular forms of mental disease determine a corresponding and particular toxic quality of the urine; and it may also be concluded that the simple or hypochondriacal melancholias are associated with merely intestinal intoxication, whereas mania and excited melancholia are more general disturbances, and are associated with more general intoxication and more serious blood changes, especially in the direction of liberation of potash salts and various pigments. This, however, does not exclude other factors being at work, such as heredity and other predispositions, which are ready to be excited by the occurrence of any intoxication the result of a primary disorder of nutrition and cell life, whereas the ordinary toxic results of uræmia are due to a primary disorder of the renal apparatus, and so the phenomena are different in details. Pure uræmia does not occur in this series of cases, as it is not a want of elimination of normal toxins, but an over-production of normal and abnormal toxic agents.

Uræmia may be classed under three heads:—(1) Dyspnœic; (2) gastro-intestinal; (3) cerebral. If there is only one toxin which produces by its retention dyspnœic phenomena in uræmia, it must be produced in very great excess in some of the insane patients considered, for in them the kidneys were normal. The second class may be considered as common cause and effect, and the intimate association between the gastro-intestinal intoxication and renal elimination has been fully considered. The third type may be divided into (*a*) the

comatose; (*b*) the delirious and convulsive. The symptoms of comatose uræmia are the same as may be produced by the injection of normal urinary extractives soluble in alcohol, or from the day urine in a case of melancholia. The symptoms produced by the injection of normal urinary toxins insoluble in alcohol correspond to the convulsant and delirious variety of uræmia, in which the patient suffers from their retention and is intoxicated by them, whereas in mania the patients eliminate them and are suffering from the effects thereof, and similarly in cases of melancholia.

Uræmic cerebral symptoms are frequently provoked by surgical diseases or operations, more or less trivial, on the urinary tract. The varying mental symptoms are partly caused by the normal daily and nightly variation in the character of the urine, and many combinations and alternations of coma and convulsions, melancholia and mania, are thus more readily appreciated and understood. It is not the mere presence of albumen in the urine which causes the cerebral and other symptoms. The presence of albumen merely affords ground for the strong presumption that the kidneys are inadequately performing their eliminating functions, and that the toxins are not being excreted as they should be. This retention of the normal toxins is the prime cause of the particular form of uræmia. That this is so is amply proved by the beneficial effects of proper dieting by milk, and Raymond, Barie, and Dieulafoy report cases in which, when the albumen and toxins were reduced below a certain figure, symptoms ceased, but on the relaxation of the milk regimen the uræmic symptoms rapidly reappeared.

Before concluding this subject of urinary intoxication, it may be shortly noted that Voison and Peron have made observations on the toxicity of urine in epileptics, and their results are as follows:—When injected into rabbits and guinea-pigs the urine was found to be less toxic when secreted before fits, and more toxic when secreted after a series of convulsions had ceased, but it was less toxic than normal if the fits were followed by maniacal excitement or if profound mental disorder were present. They also found that in eclampsia, while the blood serum is hypertoxic during the convulsions, the urine at the same time was hypotoxic, and that if the urine was found to be still hypotoxic in the interval between convulsions, the series of attacks had not yet finished.

Rason reports a case of acute delirious mania from whom he was able to cultivate bacilli. The patient was a man, aged 45, who had headache for six days, and died in eight days

with opisthotonos, facial and pharyngeal spasm. Tubes of broth inoculated with fluid from the subdural space produced pure cultures of one organism, a small bacillus, ends rounded, three times as long as broad, occurring singly and in chains, not stained by Gram, but by ordinary anilines. Rabbits inoculated under the dura died in two days, if under the skin or mucous membranes in four to six days, with a marked rise of temperature. The same bacillus was found in the subarachnoid fluid and in the blood, and in brain sections between the nerve elements.

M. Chevalier-Lavaure's conclusions are—(1) Toxins are normally in the whole organism. (2) Under various influences —dyspepsia, cellular malnutrition, &c.—there is an increase of the normal poison, and a change both qualitative and quantitative in their toxicity; abnormal agents are also produced, and usually there is deficient elimination of this increased production, and hence intoxication. (3) This may produce mania or melancholia, according to the hereditary or other predisposition in the individual. (4) Mania is due to increased production or inefficient elimination of convulsant poisons, and melancholia from narcotic poisons. (5) Antiseptic or antifermentative treatment of gastro-intestinal autointoxication alleviates or may even cure the mental symptoms.

Part III.

The consideration of mental disturbance following traumatism may be divided into those cases in which there is actual cranial or cerebral lesion, and those of a more general nature, without actual gross cranial or cerebral injury. In both instances the question whether the injury is recent, say within ten days of the appearance of cerebral symptoms, or remote, at a period later than ten days, has to be determined. Any blow or jar, not necessarily confined to the head, may so affect the brain and spinal cord that there is more or less suspension of their functions in some respects. Subsequently to this, some of the ordinary psycho-neuroses or traumatic neuroses may develop, and even subacute, or chronic organic disease of the brain or cord. Injury acts in two ways as a factor in producing mental aberration, being either a predisposing or an exciting cause. Nervous symptoms may appear immediately and then subside, but leave, as a sequel, a tendency to mental disorder, or actual chronic organic change. But actual mental symptoms may appear at once or after only a short interval. Thus the action of trauma may be slow, slight, or predisposing, or, it may excite a neurosis on which is grafted a psychosis, either with primary gross lesion or only after secondary chronic changes have taken place. But it may also merely precipitate or modify a latent or actual insanity, or excite an insanity ready to break forth on the slightest provocation. In all these instances the trauma is only one factor and may be associated with others, such as the age of the subject, a pre-existing neurosis or insane diathesis, an irritable or emotional constitution, or syphilitic or otherwise degenerated nervous system. The age at which the injury takes place has certainly an important bearing on the type of mental dis-

turbance resulting therefrom, and it is convenient to follow Mickle in his division of this part of the subject, into the following groups. External violence or maternal emotion may affect the embryo or fœtus in utero. The child may subsequently be injured during birth, either by the pressure exerted by the maternal parts or by forceps. Still later in life an injury to an infant's head may be the starting point of idiocy or imbecility with convulsions, chorea, athetosis, &c., and impulsive and destructive attacks or epileptic automatism. Such cases usually undergo progressive mental failure, and after death local atrophies of the brain and evidences of old hæmorrhages are usually seen. But in certain other cases, in which convulsions, irritability and violence with mental automatism and progressive dementia are the chief symptoms, the cerebral substance is seen to be the subject of developmental irregularity in the arrangement of the sulci, and wasting is more general than in the other class of cases.

The characteristic symptoms of traumatic insanity in youth are quasi-maniacal attacks, a mischievous and irritable disposition, either recurrent or more or less constant with idio-impulsive attacks, in fact, it is a moral insanity. But in the adult, the condition is much more complicated, as may be readily understood by remembering that the various parts of the brain have all been educated and differentiated since the more simple condition in childhood or youth.

Thus mental disorder in the adult, especially after direct cerebral injury, may be classed under four heads. (1) Ordinary forms, even if modified, of functional mental perversions of the more simple type usually termed psychoneuroses. (2) Paranoia and its immediate congeners, in other words, delusional insanity in all its forms. (3) Mental and other symptoms dependent on severe traumatism, organic brain disease or alteration, whether due to secondary morbid processes or to these as well as primary brain lesion. (4) Functional neuroses of certain types with mental symptoms, which may occur in any of the other groups.

Taking the cases as a whole they may be considered under two great groups (1) those with hereditary predisposition and (2) those with none. In a large number of cases of general traumatism followed by mental symptoms no hereditary predisposition is ascertainable, and the mental

disorder is little influenced by the degree of severity of the general or even local cranial lesion. Head injuries are of course especially liable to have as a sequel some cerebral disturbance, but it is impossible, according to Dent, to predict the amount of mental disorder likely to be permanent in any individual case. A patient may be comatose for days or weeks and still be no more likely to become insane than one who had merely a temporary and passing period of unconsciousness, and Powell, in his thesis on traumatic insanity, has pointed out how important it is to ascertain whether the patient had even a transient stunning or comatose state immediately after the accident.

Subsequent to this comatose state, if the patient do not become more comatose and die, he may become more or less acutely delirious merely from the dissolution becoming more or less rapidly less, and this delirium has to be distinguished from that which may appear later, to be succeeded by coma, resulting from inflammatory processes in the meninges or brain, or the breaking down of a blood clot and abscess formation. It is thus convenient to subdivide cases of direct cranial injury, clinically, into those (1) with a foreign body in the brain, and laceration of the meninges and cerebral substance, and (2) those in which there is probably no foreign body, with the exception of effused blood which is practically inevitable, though it may be only microscopic. Further, in the case of the first group it is necessary to consider those with a septic foreign body separately from those in which the foreign body is probably aseptic. The importance of this lies in the fact of the possibility of suppuration occurring or not, as upon this the prognosis greatly depends, both as to immediate and as to more remote contingencies.

In favourable cases without septic inflammatory symptoms, the delirium may continue for several days and gradually subside; then there may be only some loss of memory or some functional impairment such as aphasia, &c., depending on the site of the injury or counterstroke; this may last for some weeks and then gradually or sometimes suddenly disappear. But where more gross lesion has occurred the amnesic or aphasic condition may be permanent and the actual cerebral lesion may continue to act as a starting point from which secondary degenerations with mental and cerebral symptoms may radiate, or as a focus for Jacksonian epilepsy, which is frequently associated with any type of insanity, as has just been noted.

In some cases such secondary symptoms may not occur for years after the injury, in others they may appear at a much shorter interval. In all cases there is a marked intolerance of alcohol, in some glycosuria develops, and is usually considered an unfavourable symptom ; in others the epilepsy may continue for years, and may be associated with marked brachycardia, or paroxysmal tachycardia may supervene. According to Lasègue, a large proportion tend to pseudo-general paralysis, actual traumatic general paralysis, or other form of organic dementia. In the interval between the appearance of definite mental failure and the subsidence of the cerebral symptoms the immediate result of the injury, there may be noted many changes in the character of the patient. He may be subject to occasional attacks of maniacal fury which subside and leave him irritable more or less constantly. In many cases excesses of one kind or another are perpetrated, sometimes expansive ideas predominate ; there may be pain over the site of the old injury, vertigo, and the general and special senses may be modified, either in the direction of (1) failure or loss, (2) hyper-æsthesia, or (3) perversion. Such patients gradually become worse one way or another, suicidal or homicidal, and may be then confined as actually insane. In Trinity College, Dublin, there are three skulls with depressed fracture of the parietal bone with a ray to the base ; they had all recovered but developed homicidal mania ; two were hung and one was confined in Dundrum asylum.

Drew found a large number of epileptics among convicts, and in 100 indiscriminate cases in Broadmoor, only 8·8 per cent. had no scalp or cranial injury present, and three cases admitted for violent crimes had depressed fracture of the skull. Recently too, Deeming's skull was closely examined and numerous scars and depressions were found. One was not far from, if not within, Ferrier's twelfth area, and tremors of the eyes were complained of and had been seen by others. He said he often suffered from headache, but never vomited. He was quite destitute of moral sense, which is quite compatible with perceptive powers of unusual efficiency ; he had a good memory for dates and details, had great cunning, but the usual want of judgment and compassion.

Cases subject to psycho-neuroses may show a variety of symptoms, the result of either direct cranial injury or more general traumatism without cranial injury. These may be the perpetration of various immoral acts, such as larceny,

&c., done in an automatic way; more or less stupor may be present, or acute hallucinations with unsystematised delusions. They may be emotional or dejected, and have attacks of explosive violence, or sometimes a suicidal tendency resulting from delusions or hallucinations. In these cases Strumpell remarks that they have a strong resemblance to paralytic neurasthenia and hysteria, though they are not merely instances of hysteria after an injury.

All the symptoms cannot be analysed in the same way, nor can the same value be attributed to the same symptom in different cases, and they are apt to be very persistent. These cases may have no gross lesion discoverable at the time, but the way may be paved for the development of chronic organic lesions such as tumour, and degenerations with paralytic symptoms. In cases where an earlier injury has occurred, these milder symptoms are apt to become more grave and definite paranoia or delusional insanity may develop. If they are alcoholic, the delusions are usually of persecution and hypochondriacal, or of conjugal infidelity; they often pass through a stage of dissolute excess and brutality, complain of headache, insomnia, vertigo, and various sensory disturbances, ending in dementia and death, with or without convulsions. When actual cerebral lesion has taken place either primarily or secondarily after a varying interval of months or years, the cases resemble ordinary organic dementia, sometimes like the senile type, precipitately brought on by the trauma, and they may be subject to epileptiform attacks, progressive incoherence, confusion and paretic symptoms, the result of various lesions which are sometimes found *post mortem*.

Pseudo-general paralysis may come on gradually some months after the injury, and may improve for a time, but ultimately dementia supervenes, with secondary spastic spinal symptoms. There are also undoubted cases of traumatic general paralysis, about 1 per cent. of all the cases, whose exact symptoms seem to vary according to the severity of the lesion on one or other side.

Thus Mickle finds that if the right hemisphere has been more injured, the usual typical general paralytic excitement and exalted ideas are the rule, and if convulsions should occur, they are mostly confined to or start on the left side. Whereas in the more depressed and melancholic type the left hemisphere is found to be more seriously injured, and in cases of convulsions they usually affect the right side more severely. The prognosis in gross organic cases is extremely

unfavourable, but a number of functional cases recover, especially those that supervene immediately after the accident; but if they develop more slowly and appear as a remote symptom, or if convulsions be general and apparently nonfocal, or if the type be delusional, the prognosis is unfavourable, as secondary degeneration is most probable.

In the case of Jacksonian epilepsy developing after direct cranial injury, operative procedure may be available and will be noted later. The class of cases which have first a neurasthenic and then a hysterical basis, with subsequent mental perversion and failure, is the most difficult to deal with, as they are not so frequently the recipients of direct cranial injury, and correspondingly have very little to show as an exciting cause for the train of symptoms which they complain of so much, and the mental incapacity which they suffer from or simulate. There have been placed before the profession three views as to the causation of this condition. Charcot was inclined to class it with hysteria, and certainly in many cases there is a strong resemblance. A second view is that a medullary lesion has been caused, and Russell Reynolds supported this theory by the fact that there is a marked morbid emotional state, and often dominance of a single idea; while the Germans incline to a theory of a special traumatic neurosis, a combination of Charcot's hysteria with their own views as to the origin of the functional disorder. Bataille broadly considers that traumatism is an excitant to any diathesis, and that the ætiology of any subsequent mental disturbance is dominated by the laws of heredity and degeneration: in the absence of lesion sufficiently gross and definite to account for the various symptoms, this is perhaps the most satisfactory way of considering the relation between cause and effect. The traumatism may be local or general and as a rule the intellectual troubles are less in the former, though the severity of the accident is no guide to the severity or reality of the nervous symptoms. In the consideration of these injuries we shall, so far as possible, exclude direct cranial injury and its results, and the symptoms may always be divided into immediate or remote.

Dent considers that injuries other than cranial are an extremely rare cause of insanity, but that it sometimes occurs. This result may be due to a reflex from the injured part, such as has been seen in the case of foreign bodies, adherent cicatrices, &c., in which there may be attacks of periodic delirium. Wandt reports a case of

periodic epileptiform convulsions due to the involvement of the auriculo-temporal nerve in a scar. In all such cases, there is an obvious cause which can be removed, and the reflex chain obliterated or checked at least. Certainly in this country such cases are rare, and one cannot help being struck by the comparative frequency of reports of mental disturbance following trivial bruises, contusions or a general shake, such as some French and German authors contribute. One striking feature is that they occur mostly in women and more so, that in the majority of cases, menstruation was taking place, or was about to take place or was subsequently disordered. This is worthy of being compared with the known change of character which occurs in a sane woman at this time, and also with the fact previously alluded to, that in the insane an exacerbation usually takes place at this time, either in the direction of recurrent or increased mania, or increased depression and even suicidal longings. Thus Castex mentions six cases who had suffered from various degrees of local and minor injury or fright, and in whom mental and nervous symptoms were manifested shortly afterwards. Case 1 was a woman, aged 33, who was tripped up and dragged along the ground; her knee, leg and lower part of the abdomen were bruised, but not seriously. In forty-eight hours she had an epileptiform attack, complained of pain in the head, was almost unconscious and had tonic convulsions of the limbs; there were two such attacks in the day. In five days she was surgically cured but the attacks persisted though less frequent, and were preceded by an aura from the bruised knee. A critical sweat and cold feeling terminated the attack; she was confined to bed and still unable to work two and a half months after the injury; though the attacks were less frequent, they were more severe and slightly changed in character, and she had evening flatulent attacks. She denies hereditary predisposition, but has anæsthetic zones, and her disposition is at times sad, at others irritable.

Another case (2) was that of a girl aged 17, who was knocked down by a cab and was struck on the neck, lower part of the abdomen and right leg below the knee. There was slight cerebral disturbance at the time, but in two hours she became excited, and a quarter of an hour later was somnolent, passed motion and urine, and the injured leg was anæsthetic. There was no fracture of the skull nor spine, only the bruises. She was comatose for eight days, exhibited various contractures, and general anæs-

thesia, retention of urine and dysphagia, and had an epileptiform attack five or six times a day. She menstruated very little three days after the injury; improvement began in ten days, but the general anæsthesia, lumbar pain and retention of urine was present at the end of a month, though some months later she was quite well. There was no antecedent nor hereditary neurosis, so this was regarded as a case of latent hysteria.

Another woman (case 3) received a sprain of the wrist and a blow on the lower part of the abdomen while she was menstruating; the flow ceased at once, and was followed by pain in the genital sphere, and later various hysterical troubles persisted for a month. He also reports that a woman (case 4) became so frightened at seeing a cab coming near her, that she developed nightmares, tremor, and other nervous manifestations. Tissot regards the element of fear, even without injury, as most important in such subjects, and it was noted that there was a great increase in the number of epileptics during 1870 and 1871, and also after earthquakes. I have frequently seen a sudden blow from behind, though only a tap on the shoulder, produce an epileptic seizure, and Hughlings Jackson notes an interesting case of this nature first reported by Dr. James Dunsmure.

The most frequent results of trivial peripheral injury are the conditions of hysterical paralysis, contracture, arthralgia, and sensory disturbances; in such cases, great care has to be exercised to discriminate true pathological hysteria, which may be defined in this relation as a derangement of the normal connection between the psychical and physical processes, from voluntary and artful simulation and exaggeration. The differentiation between the cases is of the utmost importance medico-legally, and it may be necessary for any one of us to give a grave opinion on such a case at any time. This subject will be more fully mentioned later, after the effects of major and general injuries have been considered. Meanwhile in local cases it is necessary to know that such neurotic women usually do exaggerate, perhaps quite unconsciously, the gravity of the injury, and that in most cases it is not for some hours or days that the apparently serious symptoms are manifested, such as epileptiform attacks with an aura from the injured part, or the various hysterical crises, convulsions, tympanites, and palpitation, which have occurred in some of the cases just quoted. Hysterical stigmata are often able to be made out,

and also various anæsthetic areas, including a narrowing of the field of vision, said by Strumpell to occur in 33 per cent. of the cases. Doubtless there is often hereditary tendency in these cases, but it is difficult to trace or to say that before the accident they were decidedly neuropathic. The mental prognosis is variable, there being sometimes transient epilepsy, but this occasionally persists and is followed by mental disturbances and cerebral degenerations, like those which have already been noted as sometimes following direct cranial injury. Surgeons in such evidently neurotic women must give a guarded prognosis, even after a trivial injury which has quite healed; but fortunately such cases in this country are extremely rare, thanks to our more stable nervous equilibrium.

Unhappily it is somewhat different in the case of major smashes, more especially railway collisions, and in one sense a simple uncomplicated labour is a trauma and does in certain cases produce mental symptoms either at the time of labour or later, and this latter instance may be independent of any septic element which has already been considered. The immediate effects of a major smash without direct cranial injury are, shock more or less marked, resulting either from loss of blood externally or internally, or from injury to the abdominal and other sympathetic systems, either directly or reflexly; following the shock from any of these causes may be delirium, and the type of it will to a great extent depend on the age of the patient, and the previous history as to alcoholic habits. It frequently happens that an accident, simple or compound, will precipitate an attack of delirium tremens in an alcoholic, or mania in a case of chronic plumbism, just as it may precipitate mental disturbance in those otherwise predisposed to it. The prognosis in alcoholic delirium following compound fractures, &c., is as a rule worse than for those who suffer from delirium, which is an exhibition of traumatic dissolution, rather than a morbid complication and condition of the cerebral substance and body fluids themselves. There is also the delirium and excitement consequent on tension, sepsis, and the abuse of antiseptics, but the course of the case renders this mostly self-evident, and it need not be further alluded to here. Comparable to this purely reactionary delirium is that which occasionally takes place during normal labour, either as the head is being projected through the cervix, or when it is emerging from the external orifice. In either case transient delirium may occur coincidently

with the pains, or until the extreme stretching is over. After this there is usually a period of depression and shock, and in most cases nothing further abnormal occurs. In another class of cases no delirium takes place during the labour, but at a longer or shorter time after its completion, sometimes suddenly, more usually with certain prodromata, a maniacal condition supervenes, generally before the sixteenth day, the average day being the third to fifth. This puerperal insanity may be the continuation of an abnormal mental state during gestation, and there may have been other circumstances in the case, such as heredity, fear or dread of the labour, especially if the patient be an elderly primipara, and has suffered from hæmorrhage or some obstetrical operation, which have so acted on the nervous system that the trauma alone is the crowning blow to its stability.

If the mental break-down be postponed until after the sixteenth day it is almost invariably of the melancholic type, and is of more gradual development; occasionally a stuporous or demented state supervenes without a previous stage of actual mania or melancholia; this is a different condition from that which supervenes on the maniacal state later in the course of the disease. Putting the question of septic infection on one side, such cases are more or less strictly comparable both in their incidence and sequelæ, to the mental condition occurring after general trauma or surgical procedure, where anxiety, pain and hæmorrhage play a similar part in its production, but the duration, in cases which recover, is usually much more prolonged in the case of puerperal than in acute traumatic or post-operative insanity.

The wider subject of traumatic neurosis following such general shock or injury as occurs in a railway smash or any other major concussion, not necessarily involving gross bodily injury or mutilation, has now to be considered. It must first be noted that there are various nervous troubles which may be sequelæ of such an injury, other than the more purely cerebral ones under consideration.

It is therefore necessary to exclude these symptoms, the result of gross spinal or peripheral nerve disease, which would be sufficient to account for the various sensory and motor disturbances in one or more of the ways which have been mentioned. In the present instances the motor and sensory disturbances are apparently due to purely functional disorder of the central sensorium, and hence come under

the wide term cerebral disturbances. These psychic derangements have been especially studied in this country in relation to railway accidents by Erichsen, Herbert Page, and Bramwell, and Alamartine has also made extensive and elaborate analyses of the various psychic and other symptoms resulting from general trauma, which he finds may be classified in the following manner. (*a*) Various automatic acts may be performed after the accident and totally forgotten. The individual is in a sort of semi-conscious, semi-stuporous state; he may then become hypochondriacal, apathetic and even suicidally depressed with terrifying dreams and hallucinations, generally connected with the accident. In others there is more or less loss of will power and control. These symptoms may disappear gradually in about fifteen days, but may persist and increase in severity, and be accompanied by a further abolition or perversion of the intellectual functions. (*b*) In most cases there is an impairment of the memory in one way or another, some remember facts before the shock, but cannot recollect more recent ones; others forget facts before the shock for a varying time, but without loss of faculty of remembering subsequent facts, and they may execute acts as if in a normal state. In all cases it is very rare to remember the actual accident itself, and if so, it is vague and confused. This is called retrograde amnesia, and it is very important medico-legally, when taken in connection with (*c*) ambulatory automatism. This may be of short duration and end suddenly, though subsequently the intellect is obtuse. It is not a frequent condition and consists in the performance of various acts more or less complicated purely automatically, without remembrance of them. Kaempfen reports a case of an officer who was thrown from his horse, but he remounted and continued to give his riding lesson for three-quarters of an hour automatically. In all reported cases of this symptom the subjects have continued to do their ordinary work, and only discovered that something was wrong when a new train of thought or ideas was required. It is then found that the actions performed between the accident and the time when he first becomes aware of something being wrong, are completely forgotten and have been automatic. (*d*) In other cases there may be a simple diminution of memory for words or names, or he may not be able to remember what he has done or should do, and calculating and writing is defective. Retrograde amnesia is usually present in these cases. (*e*) The power of concen-

tration and of attention is often affected. They cannot read or work or maintain a continuous conversation; and aphasia is often present in some of its varieties. Professor Gairdner reports the following curious case, under the care of Dr. Pagan, resulting from cerebral concussion, without fracture of the skull and but little external injury.

"A youth, aged 16 years, was admitted to the surgical wards with well marked symptoms of concussion of the brain, the result of a fall on his head from the rigging of a Welsh ship about two hours previously. He was completely insensible for forty-eight hours after admission, when he began to speak his native Welsh language, incessantly and incoherently, as said by his companions, and the subjects were mostly recollections of past events. He remained in this condition for three days, when he began to speak unmistakable English, but every word was a most horrible imprecation. During the next three or four days he may be said to have spoken Welsh and sworn English, and as consciousness gradually returned, he ceased to speak Welsh and swear English. When he recovered completely, he spoke English and ceased to swear."

This case shows, as Wyllie remarks, "that the native language, being most deeply engraved in the memory, is the least easily obliterated, and that an acquired tongue is first enunciated in terms which have been imprinted, probably by frequency of repetition and emphasis of expression." This may be compared with Dr. Scandella's case, previously noted, and also with Dr. Lewis Bruce's case of dual brain action—curiously affecting a Welshman also. Exactly the same thing happens in the case of other functions and neuroses, whereby the most deep impressions continue to be acted upon automatically, as in the case of the officer continuing his riding lesson, though quite unconscious of his surroundings at the time. There is often a change of character, moral perversion and an inability to stand alcohol or wine, even though no direct cranial injury has been done. (*f*) Headache is often constant and is always aggravated by work or attempts to do so. Insomnia and vertigo are frequent, and agorophobia may be present. (*g*) Mental hebetude and even alienation, either of the excited or depressed type, may supervene in the course of time, which Pean thinks occurs mostly in those with hereditary tendency. (*h*) Ambulatory epilepsy is stated to be a frequent cause of desertion from the army, and also morbid impulses due either to suggestions from the outside or from within, which

the patient is unable to withstand. Jauchen found that in the great majority of such cases there was a history of shock, fall, or blow received in childhood, which had not always left trace of injury in the mature skull. (*i*) Somnambulism has been noted by Mesnet to occur after traumatism; the subject must get up in his sleep to walk away from his dreams, or to perform acts which he is dreaming of, such as seeing the accident anew in faithful detail.

In the above *résumé* it is almost impossible to confine the various symptoms merely as having occurred in patients whose head was not to some extent shaken as was the rest of the body, but in most cases, these symptoms were not the result of gross lesion of the cranium though concussion was doubtless present in many cases.

The question of Exaggeration and Simulation has now to be reviewed and the great guide according to Vibert is, whether there is a marked disproportion between the subjective symptoms on the one hand, and the objective symptoms and the state of general health on the other; one has a right to suspect exaggeration when there is a marked disproportion between these two groups of symptoms, but exaggeration does not negative the presence of actual disease. As to simulation, this like exaggeration, is more apt to be associated with the question of damages, but it is very difficult for a person to simulate the exact mental and intellectual failings, far less the hysterical stigmata, the eccentric distribution of hysterical anæsthesia, contractures, ocular troubles and narrowing of the field of vision, which are present in varying degrees and combinations in a genuine case of traumatic neurosis.

Lauenstein uses chloroform to unmask simulated traumatic neurosis and reports a case of injury to the knee with subsequent contracture, and complete immobility for three years, and one of dislocation of the elbow which was at one time reduced but was subsequently rigid for two years. Chloroform was administered and both limbs were freely moved without any hindrance, hence he concluded that it was a case of malingering, as, if the movements and contractions of the muscles cease when the will and intellect are paralysed, they must be voluntary when the chloroform is not acting; but this does not exclude a condition of mental block without any actual or voluntary malingering. In Hill's cases illustrating blocking of the brain's action, there was no question of injury at all, but every inducement to act, but the subjects could not; a man may be neither

mad nor shamming when, after an honest attempt to use his legs he cannot overcome the resistance to movement due to fear or other morbid mental condition. This hysterical paralysis or contracture is due to a cause affecting the central nervous system from below, and is a reflex from the periphery, whereas imagined paralysis, putting the purely hysterical reflex variety on one side, is due to a similar affection of the central nervous system, but the cause is from above, is in the ideational part of the brain and there is no indication of peripheral nerve disease.

Oppenheim studied sixty-eight cases of malingering and came to a correct diagnosis in sixty-seven. He considers that the disappearance of tremor when the patient's attention is directed to it, is valueless as evidence of malingering, as it occurs not only in hysterical and neurasthenic patients, but also in paralysis agitans, and in some organic cerebral lesions. One convincing objective sign of traumatic neurosis according to him is inequality of the pupils, dilatation being usually present on the same side as sensory, motor and vaso-motor disturbances are manifested. Concentric reduction of the visual fields is frequently found, but this may be feigned, and Schultz does not consider it characteristic of traumatic cases, as it is of too frequent occurrence to be of value, and is absent in many functional disorders after traumatism. At the same time Oppenheim considers that it is governed by different laws, when present with functional disturbances, from those which operate in organic cases. Some cases in whom no monetary compensation was in question, had contracted field of vision without expansion when at a greater distance from the perimeter, and in hysterical cases there is often no expansion under similar circumstances. In simulated contraction a wholly irregular intersection of white and colour fields is found. Cutaneous sensibility is often contradictory, and this is not necessarily evidence of malingering, as it often depends on the amount of attention directed to the contact, especially in excitable or actually insane patients whose attention wanders. There is also an exaggerated irritability of the muscles to mechanical stimulus, and augmented excitability of the nerves, slight percussion producing strong muscular contraction in real cases, but many mistakes are made in the interpretation of the signs and symptoms and in the diagnosis, by not duly recognising any change in the psychological condition of the patient. In the diagnosis of traumatic neurosis, it has just been stated that there are ocular changes which it

is difficult to simulate, and hence a correct understanding of their occurrence is of the utmost importance as an aid to the correct diagnosis of the case, and the exclusion of malingering. As Schultz among others, considers that contraction of the field of vision is of too frequent occurrence to be of much value as a diagnostic sign, and there is no doubt that various contractions of the visual field may be found in cases other than those apparently suffering from traumatic neurosis; so it is all the more incumbent on us to thoroughly study the particular types and forms which may be met with in those cases of traumatic neurosis in which it does occur. Thus "Förster's type" of visual field contraction is seen in a perimetric record which is obtained by always moving the test object centripetally, next the visual field is measured by moving the object centrifugally, and the latter record is found to be smaller in every direction than the former. König discovered in 1891 that this type may occur in traumatic neurosis, and Placzek has since ascertained that this type was present in all but one of the patients suffering from traumatic neurosis examined by him, in whom there was any concentric narrowing of the visual field. More recently still, in August, 1892, König demonstrated enlargement of the blind spot in hysteria and periodic dipsomania on systematic tiring of the retina, and his researches showed that the blind spot enlarged only towards the periphery and not towards the fovea, and that the enlargement was greater in the eye on the hemianæsthetic side. Freund stated in September, 1892, that he found in traumatic hysteria, a striking enlargement of the visual field for white and especially for colours. In some instances the limit for white outwards and downwards was 115° to 110°, and the area for colour perception extended nearly as far. Usually the periphery of the retina tired quickly, so that too long fixation tended to error in the perception of colours, and a short rest after the examination of each meridian was necessary. In two patients this condition was unilateral, the eye on the anæsthetic side of the body having a concentrically narrowed field of vision. All the patients had good direct vision for form, and very good central quantitative colour sense. Associated with this retinal hyperæsthesia was also hyperacusis, or hysterogenetic zones and neuralgia, and though expansion of the visual field for colours may be obtained by increasing the intensity of the colour tests, and the field for both white and colour may be enlarged by the hypodermic injections of strychnine, Freund's observations

were carried out under ordinary conditions of illumination and without the action of drugs.

Hubscher, in six cases of traumatic neurosis, found a failure of the power of convergence, that is a failure of the joint action of the two internal recti, while all the other actions were normal. He terms this motor asthenopia and considers it present in all railway cases.

When the question of exaggeration or simulation has been overcome, it is necessary to attempt a differential diagnosis between the hysterical or traumatic symptoms and those which may be the result of central or peripheral nerve lesion. To do this, Alamartine considers them under three heads :—(1) Intellectual ; (2) Sensory ; (3) Motor derangements. As to the intellectual troubles it is necessary to decide between those the result of an insanity which has been alighted by the accident, from those which are more purely hysterical, or from those due to diffuse meningo-encephalitis ; and one has to base their diagnosis on the constancy, degree and nature of the symptoms themselves, and also on other concomitant symptoms. Similarly hysterical stigmata and sensory variations have all to be differentiated from those the result of peripheral neuritis, which are characterised by lancinating, severe, continuous and badly borne pains, lowering of surface temperature, and anæsthesia distributed in a certain fashion, following exactly the course of the nerve. Again in the case of myelitis, the sensory troubles are often absent, varying nevertheless with the site of the lesion, girdle pains being often present. Motor lesions are more complicated, and five varieties of paralysis have been distinguished by this writer :—(*a*) Hysterical ; no symptom is pathognomonic of this form, but one has to consider especially the grouping, the appearance and the termination, and the fact that there is no reaction of degeneration. (*b*) In peripheral neuritis, there is more or less marked atrophy of the limb, out of proportion to that which naturally occurs from simple want of use, and it corresponds to the peripheral distribution of the affected nerve, thus differing from the atrophy resulting from an anterior poliomyelitis. A change in the colour of the skin is always present, there is reaction of degeneration, the reflexes are abolished, and cutaneous trophic troubles may appear. (*c*) In the case of myelitis, the atrophy is considerable, and there are cutaneous trophic lesions and sloughs. Spastic paralysis is shown by the exaggerated reflexes and spinal tremor, and there may be paralysis of the sphincters and

genital troubles. (*d*) In cerebral hemiplegia the muscular sense is not injured. It is rarely accompanied by pharyngeal anæsthesia, and is of longer standing than the hysterical variety; it is always followed by degeneration of the pyramidal tracts, and is accompanied by facial paralysis, which is always wanting in hysterical hemiplegia. (*e*) Diathetic paralysis may be due to whatever latent diathesis has been lit up by the injury, and hence enquiries must be made as to the previous history of the patient, the occurrence of syphilis, rheumatism, or plumbism, engrafting special characteristics to the symptoms.

There are often combinations of symptoms the result of more than one of these pathological processes, hence the study has to be very minute to avoid error as much as possible, and the diagnosis is always a delicate matter.

As regards the connection between the injury and the mental state, there is little doubt that if a healthy person shows signs of organic lesion immediately after the accident it is the result of it, but if a considerable time elapses, many years for example, there is only a probability in favour of the accident being the cause. If the patient be previously hysterical or neurasthenic, the accident acts as an exciting cause, and is therefore only an occasional cause of the actual symptoms, but traumatism may also relight an old lesion, or a latent diathesis, and in such a case it takes a secondary position in the ætiology of the symptoms and the responsibility of a railway company is less.

Byrom Bramwell is of opinion that organic disease and permanent paralysis are rarely primarily caused by railway accidents, though railway spine, which is really more cerebral than spinal, is much more frequent after railway accidents than after other accidents apparently equally severe, though not on a railway, such as in mines. As to duration, no time can be definitely fixed; the symptoms may last from two to seven years as reported by different authorities. After compensation they sometimes rapidly disappear, at others only slowly, and this post-compensatory improvement does not prove wilful exaggeration nor simulation. Sometimes a lively emotion has cured the case, and usually ultimate recovery takes place, unless, according to Oppenheim, a heart lesion such as tachycardia develops, or despondency is marked, or in old debilitated subjects who, even if they recover, seldom regain their former strength. When there is actual psychic derangement, depression and anaphrodisia, the prognosis is bad. The general conclusions

arrived at by Alamartine are—(1) Trauma alone may produce certain particular symptoms, intellectual, motor or sensory. (2) These nervous accidents are frequent after railway collisions, but are also sequelæ to the most diverse injuries, falls from a height, firedamp explosion, lightening stroke, operations, &c. (3) In most cases the symptoms are manifestations of hysteria, which can be produced by trauma in a predisposed subject, but often likewise an organic lesion of the central nervous system may be caused, which may be latent for a long time, but is demonstrated later by the symptoms appearing. It may also happen that a neuropathic condition like hysteria may be grafted on to an organic lesion. (4) Even when there is no actual organic lesion discoverable, the functional troubles are usually very persistent, and the prognosis, progress and duration are very variable. (5) In the case of actual cranial and cerebral lesion, the immediate prognosis varies more especially according as to whether there is a foreign body in the brain or not, but even after survival for years, it is always unfavourable if it be not removed. Flourens is of opinion that if a bullet or other body be lodged near the upper surface of the brain, it has a tendency to sink down gradually towards the vital basal ganglia, and opinion varies as to whether the frontal or occipital lobe is the more dangerous seat of lodgment; Guthrie thought the former, and Brodie the latter, the more dangerous.

Insolation or sunstroke is a condition which not infrequently leads to severe cerebral disturbance and insanity, but the frequency with which true cases are met with is a matter of varying opinion among psychologists. Hyslop collected fifty-five cases of sunstroke insanity, and found that eight had a hereditary history of malaria, five of syphilis, and seven of alcohol, and it appeared that the asphyxial and hyperpyrexial types were more frequently followed by insanity than the syncopal. In infants six cases of imbecility and weak-mindedness, not the lower grades of idiocy, were recorded, as following insolation, and epilepsy was also a common sequel in conjunction with the mental defect; both of these states resulted from the common cause, and thus differed from the mental deterioration which may accompany or result from ordinary epilepsy. On the whole, insolation is like traumatism, and acts as an acquired predisposition to insanity. In 1,947 cases in Bethlem, 2·6 per cent. were cases of sunstroke, many were like general paralysis, others like syphilitic disease, or alcoholic or

paralytic insanity, but Yellowlees is of opinion that it is "not a progressive degenerative inflammation like general paralysis, but rather a confused dreamy dementia with lucid intervals and irritable spurts." An attack of sunstroke also renders the subject very susceptible to alcohol even in a small dose. In the ten years from 1878 to 1887, the percentage of sunstroke cases to all admissions in the English and Welsh asylums and registered houses was 1·2, being 2·3 in men, ·2 in women. It is generally recognised that there are two factors in the causation of sunstroke: (1) the actual heat, (2) the action of the light vibrations.

That this is so, is proved by the fact that in India the effects of the strongest sun may be entirely antagonised by the use of a layer of yellow material inside the clothes and hat, which, while not materially adding to the warmth of the clothes, or of the person, intercepts the extreme and noxious light vibrations, which are thereby rendered nugatory, and only the heat rays pass to the surface of the body.

Tourdes has studied the effect of Lightning stroke, and finds that there is loss of consciousness at once, the subject falls without knowing the accident has happened, not having heard the thunder. There is often loss of memory for events and impressions antecedent to it. When consciousness is regained, there is a prolonged sensation of terror, nervous instability, headache, tinnitus, and sometimes hallucinations and mental alienation. There may be deafness or impaired hearing with or without rupture of the tympanum.

Guinon considers the various paralyses and mental troubles as traumatic hysteria, the result of the violent shock and emotion.

Sestier collected 600 cases. There were 250 deaths, and 350 recoveries. The greatest danger of being struck as regards locality, seemed to be in houses and public places, as compared with being under trees or in open spaces, but the cases struck in the former localities were less fatal than those struck in the latter sites. The action of lightning on the body is due to electricity. Death supervenes after circulatory and respiratory troubles, constituting the state of asphyxia, but functional mechanical respiratory troubles may be due to bulbar affection, or to nervous exhaustion of other parts of the central nervous system, or even by tetanus of the respiratory muscles, specially the diaphragm. The chief *post-mortem* evidences are seen in the lungs, such as subpleural ecchymoses, described by Tardieu as being

characteristic of asphyxia, and also sanguinary infiltration and œdema of the lung tissue with distension of the heart by dark-coloured and often fluid blood. According to Ritter, the blood becomes acid after a shock of electricity, is less able to absorb oxygen, and hence contributes to death by asphyxia. Poisoning by sulphuretted hydrogen in these circumstances is not possible, as it is not constantly found either in the surrounding atmosphere or in the fluids and secretions of the injured, neither are the symptoms of it evidenced. More ordinary electrical currents may also be dangerous, as is occasionally shown by street explosions. D'Arsonval reports the case of a man struck by a current 4,500 volts or 750 milliampères. The current entered at his hand and issued at his back. More than half an hour elapsed before any artificial respiration was attempted, but he recovered. Donellan also records the case of a man who had 1,000 volts passed through him; he instantly became comatose, pupils dilated, face pale and sweating freely. Delirium with tonic, alternating with clonic spasms, supervened, pulse 80, respirations stertorous, then of Cheyne-Stokes type. An injection of morphia was given, then of strychnia; a deep sleep came on and he awoke convalescent.

Experiments on animals usually show that respiration is first arrested causing asphyxia, and secondary heart stoppage, but sometimes this order is inverted. Mr. Cutler of the Stanley Electric Manufacturing Company, gives the following account of the passage of 4,560 volts through himself. For a brief instant he had a sense of being drawn downwards by the arms, then everything became black, and remained so for seven minutes, during which time artificial respiration was practised on him. Those standing near state that he gave two agonising groans as he fell, but he had no recollection of them. One of the wires had to be pulled out of his hand and he received another shock. For seven minutes there was no pulse beat, and there was every indication of death. He slowly regained consciousness and repeated incoherent remarks about the accident. When he first opened his eyes all he could see was a huge black spot which gradually diminished and disappeared. At one time he recognised several people by their hats but could not see their faces. Half an hour after the shock he could recollect everything before and after the few minutes of total unconsciousness, which remain a total blank. He felt as usual the next day and his nerves were not appreciably affected, though the scars were down to the bone.

Firedamp explosions seem to have some special character which it is necessary to consider separately from the general subject. When such occur, and a man is killed on the spot, he dies either from asphyxiation from various noxious gases or from burns and the dynamical effect of the explosion; but he may live and be neither burnt nor asphyxiated, may leave the mine and walk home, and it may not be on the next day, nor on the day after, nor for several days, nor months after the explosion, that consecutive nervous troubles appear, such as persistent vomiting, mono- or paraplegia, disorders of sense, general or special, such as derangement of bladder functions. Alamartine considers the best theory to explain this is the one advocated by Chavanis and Dujol, which is that there is a slow ascending neuritis of the pneumogastrics which radiates through all its plexuses like the diphtheritic poison; but Cenas, on the contrary, likens it to prolonged chloroformisation, fatty degeneration of the heart resulting from the acute toxæmia by the gases inhaled at the time. The whole subject requires working out, as neither these nor any other explanations at present given are satisfactory. One case of firedamp injury under Mr. Annandale's care was shortly noted as follows:—"A young man, with alcoholic history, was admitted on July 24, 1891, suffering from a burn of the second degree extending over the face, thorax, and arms. On July 26 he became restless and wandering, with a temperature of 102° Fahr. He was given a hypodermic injection of morphia July 27. Still very restless, and more morphia was given, but it was noticed that he was more restless after its effect had worn off, so chloral and bromide were administered, and these quietened him for a short time. The heart's action became weak, and he died on July 29 with hyperpyrexia to 110° Fahr. The *post mortem* showed intensely congested lungs with blood effused into the air cells. The heart was healthy and there were no duodenal ulcers."

Earthquakes are also responsible for disordered cerebral functions, and though there is very little literature on the subject some facts are available. Two works were published in America in 1886 and 1887, and in them were described symptoms which followed the earthquake in Charleston. Pègre Porcher and Guiteras say that many of their patients felt the most bizarre impressions at the moment of the shake, but instead of attributing them to considerable nervous shock, these authors desire to consider them as illusions and hallucinations after the shake. Guinon,

in 1889, relates a very interesting observation communicated by Charcot. It was that of a young woman, aged 17, who after the earthquake at Nice in 1887, suffered for two weeks from complete paraplegia of hysterical origin, which disappeared in three days after a course of douches. But she was constantly troubled by the recollection of the accident, continually had a feeling of instability, and dreamed all night of earthquakes. This condition only slowly improved. If one admits that in these cases there is little actual injury, while the emotion is considerable, then they are related to those cases already discussed, in which the mental state and the emotions play a more important part in the origin of the illness than the concussion or injury.

Part IV.

Closely allied to traumatism, and its associated cerebral and mental derangements, is the mental condition which is sometimes found as a sequel to a surgical operation. But in considering this particular sequel and complication to a surgical operation, it is only right and convenient now to briefly review the whole subject and the interrelations of surgery and mental and cerebral derangement, both in respect to the advisability of surgical procedure in the insane, either on æsthetic or life-saving grounds, and also in those cases in which possibly some mental improvement, or even occasionally a cure, may be hoped for.

It is therefore convenient to divide this part of the subject into various points which will be considered seriatim, and the preliminary considerations to attract our attention are (1) the effect of an operation on an insane patient; (2) whether it is justifiable to operate on insane patients for diseases other than fatal ones; (3) whether it is justifiable always to operate on an apparently sane patient with a bad hereditary history or an acquired neurosis in cases other than of fatal disease.

(1) Speaking generally, alienists have not observed in those insane cases which have required operation, or in those who have been injured, that there is any effect on the usual condition of the patient, more than would occur if he were sane. One risk doubtless is that he may be more difficult to manage, and sepsis less easily controlled or avoided, but this is exceptional, and there seems to be no marked want of trophic influence, as is evidenced by the satisfactory way in which wounds heal. Sometimes the effect of an operation or trauma is beneficial in a way other than that directly the consequence of the operation. Thus it is well known that several instances of so-called recovery,

or at least of very long remissions of the symptoms of general paralysis, have occurred after accidents to the head, and some psychologists see only this revulsive effect in the temporary improvement which may take place after trephining in such cases, but this will be fully discussed later. It is also known that hernia cerebri and actual loss of brain substance sometimes seem to have a beneficial action on a previously irritable and violent disposition, though, unfortunately, the reverse is much more frequently the case. Allison reports that insanity was cured twice in one woman after two separate fractures of the thigh. It may then be allowed, that so far as the surgical progress of the case is concerned, the majority of insane patients may be operated on without much more risk of actual mortality; in fact Paget considers that the insane bear operations with less distress and ill consequences than the sane, but that more tedious convalescence is to be expected in chronic cases.

(2) When is it thought advisable to operate? This point is of great importance, for it opens up a large unexplored field. Are we justified in performing a major operation on a lunatic for disease or injury which will not in itself hasten death? And if so, what class of cases is most favourable for interference? Perhaps this mostly refers to female insane patients, for there are still grave doubts as to the advisability of oöphorectomy and other gynæcological operations in the case of the insane, in those instances where the disease will not of itself be fatal, and this is practically very seldom.

It has already been pointed out that Wiglesworth found 67 out of 109 *post-mortem* records which showed more or less serious disease of the female reproductive organs, but that in twenty-two of these there seemed to be no particular connection between the somatic and the psychic disorder; and in one-fifth of the remainder the ovaries and tubes were diseased. In some cases the removal of a seat of irritation may ameliorate or even cure the mental disorder, but in others the local irritation may be cured and the mental disorder persist; again the mental disorder may disappear though the local disease cannot be cured; while the removal of these organs actually seems to cause insanity, or at least some neurosis, in some apparently sane cases where the removal of the irritation was hoped to be the curative agent of a neurasthenic condition.

Régis, of Bordeaux, remarks that in France they are but little concerned in the operative treatment of insanity,

particularly the removal of the ovaries in women, which has never been practised there with a purely therapeutic end in view. But in the United States oöphorectomy has been recently practised in asylums considerably, and it is really a passionate question among rival surgeons; the majority seem to dispute that this operation is at all favourable, and even some consider it inhuman, inexcusable and illegal under the circumstances. This is particularly the opinion of Morton, of the Pennsylvania Hospital, and of Barlow, who was also on the Commission on insanity held in Philadelphia. They both condemn the operation when practised on insane women with a mental therapeutic end as being unjustifiable, illegal, and capable of making the patient or her friends prosecute the operator criminally in case of loss of life. It is thus at once a medical and an ethical question. As regards the latter it necessarily varies somewhat according to the different standards in different countries, and according to the way in which the exact nature of the operation, its prospects and its risks, have been put before the patient's friends, after having been seriously considered at a consultation of the medical men in charge of the case. If they conscientiously believe that some or all of the symptoms are a reflex psychosis, the result of disease of one of the reproductive organs, then they will be justified in placing the suggested treatment before the friends for their consideration, neither pressing the argument one way nor the other, and if they desire that such an operation be performed, clearly understanding its experimental nature, it can hardly be said that the surgeon acts against an ethical code if he removes structures which are found to be diseased. On the other hand the removal of healthy appendages, in the hope of curing certain forms of insanity, is not yet an operation which is usually justifiable, either from a medical or an ethical point of view, and stands on an entirely different footing from the question of the advisability of removing diseased organs in an insane patient in the hope of ameliorating the mental or even the bodily condition.

(3) The third point at this time is the question of recommending an operation not required to save life, in a person with a bad hereditary or acquired history, the danger of course chiefly consisting in the risk of post-operative delirium or insanity. Paget remarks that "only under the strongest probability of insanity ensuing after it would the fear justify one in dissuading a patient from submitting to an operation which is necessary for health or life," at the

same time "one should never operate on a patient with delirium tremens or on the verge of it, unless it is absolutely necessary." But delirium before an operation may be due to tension, &c., and may then be relieved at once by the operation, and so this has to be carefully differentiated from the delirium of alcoholism.

In considering the operations which may be undertaken or recommended for the cure or even relief of mental symptoms excited by bodily disease, it may be easier if the various symptoms be passed in review, and the different cases of operation briefly noted.

In the Alimentary System the removal of any malignant disease, if diagnosed sufficiently early, both in the course of the mental disease and in its own progress, may be most beneficial to the patient; in chronic dilatation of the stomach which has not benefited by antiseptic treatment or lavage, and is accompanied by various sequential mental or nervous symptoms, such as tetany, gastro-enterostomy or gastrorrhaphy might be proposed, or pyloroplasty, or Loreta's operation performed, according to the exact nature of the case as found at the operation.

In some cases in which nothing radical can be done, improvement for a time may take place in the bodily condition, and the stomach contract to a considerable extent. There seems to be no doubt that in cases of hypochondriacal melancholia, biliary calculi might be more frequently sought for and submitted to medicinal agents in the first place, and if not amenable to this treatment, one of the operations on the gall bladder should be proposed in the hope that some of the toxæmic effects of other poisons might be neutralised if the flow of bile were made more normal. This has been fully discussed under autotoxæmia. As sitiophobia has been found connected with chronic peritonitis, this likewise requires careful diagnosis to determine the absence of such a condition in such cases, for if this were present there is reason to hope that operative treatment might be followed by amelioration of the reflex or toxic mental symptoms. More systematic observation as to the odour of the patient's breath and subsequently of the condition of the colon, would probably reveal, in a large proportion of cases, evidences of a state which it is impossible to dissociate from auto-intoxication.

Ruggi's operation on a malignant tumour of the pancreas is one of the most encouraging reports one can read, and is shortly as follows: A woman, aged 50, was admitted with

an abdominal swelling and occasional attacks of severe pain in its neighbourhood. There was profound mental depression, which indeed was worse to bear than the bodily pain. Laparotomy was performed on September 4, 1890, and a soft shapeless mass of brain-like consistence was removed from the site of the pancreas and weighed 650 grammes. She recovered and was discharged cured on October 26, the mental depression having entirely disappeared. How much this depression was due to the fact of the tumour being malignant, or that the whole pancreas was apparently functionless and presumably permitted of faulty intestinal digestion and fermentation, is not at first sight apparent, but it was probably the former and its accidental site and influence on the solar plexus, for the intestinal condition would be practically the same after the operation as before, so far as the action of normal pancreatic juice was concerned. Minor operations in the rectal region such as for piles, fissure, fistula, and ulceration, usually greatly improve the mental condition of the patient, for there is almost always a most aggravating degree of mental depression in all those cases, even though not severe nor serious in themselves.

Operative treatment in diseases of the Circulatory and Respiratory Systems is naturally very limited and may be considered together. When mental symptoms supervene on failure of cardiac compensation or from pulmonary embarrassment, either in the course of acute or chronic disease, bleeding, in one way or another, may be confidently recommended as a most powerful, rapid and efficient surgical agent, and the various ways in which bleeding may be performed may be enumerated as follows: cupping, wet or dry, leeching, venesection and pulmonary phlebotomy, which I first introduced, and recorded cases in which it was practised. In all these cases there is actual loss of blood from both systemic and pulmonary circulations, but in active catharsis, or aspiration of passive serous effusions into the serous cavities, or the use of Southey's tubes, we have also powerful derivatives, all or any of which may be required according to the bodily symptoms of the particular case. One of the most striking effects of any of these methods of bleeding, is the mental calm, peace, and consequent sleep, which is often rapidly induced, and so long as there is improvement after bleeding in any of these ways, there is hope, and it should be persevered in. The results of arterial disease have also been relieved in some few cases,

in which coma or acute temporary dementia, or paralysis slowly progressing and probably proceeding to a fatal termination, is the result of hæmorrhage into the substance of the basal ganglia. Horsley proposed ligature of the common carotid in such cases, and two cases are reported, one dying shortly after.

Chiene trephined for a rapidly increasing comatose condition from non-traumatic cerebral hæmorrhage in a patient of Dr. Smart, with the best result. Smart observes that though there was a slight abrasion of the scalp on one side, it was not such as to cause the grave cerebral symptoms due to basal hæmorrhage, the result of chronic alcoholism. After giving notes of nine cases of fatal non-traumatic cerebral hæmorrhages, all of which, from *post-mortem* examination, might possibly have been relieved surgically, Dr. Dennis remarks:—"If the same group of symptoms were found in a case in which there had been injury and violence the patient would have been trephined, with the likelihood of relieving, not only from present suffering but almost from certain death, many who, in the absence of traumatism, were hopelessly relegated to the police cells or alcoholic wards." It is thus seen that Chiene's case is the first to carry out this opinion, which, however, was expressed independently, and it is so far unparalleled in the annals of surgery. Lanphear recommends trephining later if intellectual disorder remain as a result of softening after the primary pressure symptoms have subsided. He reports the following case in favour of this operation: A man, aged 56, had a cerebral hæmorrhage six years before, resulting in aphasia and paralysis of the right upper limb. His memory was good, but he had intense headache and at times was irritable and threatening, though his intellect was not constantly affected. He was trephined over the lower part of the Rolandic area, and a large amount of creamy broken-down brain matter was removed. He recovered and has had no headache since, and the mental irritation has disappeared, though there is no improvement in the paralysis.

In cases of disease of the Hæmopoietic System associated with cerebral disorder, there is not much in the way of surgical procedure that can be applied. If a case of myxœdema seems unable to stand the thyroid treatment in any of the various ways of its administration, it might be well to see if thyroid grafting, which was an early suggestion by Horsley, would be more successful; this can be done by placing a piece of fresh and warm thyroid gland either in

the subcutaneous tissue, as reported by Macpherson, or in the peritoneal cavity, in the hope that it may become incorporated with the neighbouring tissues, and influence the fluids by a continuance of its beneficial and necessary secretion. As to exophthalmic goitre I am not aware of any operative treatment being carried out on the gland with the end in view of merely improving the mental condition, but perhaps electrolysis might be tried in the first instance in some such case. In cases of cerebral disturbance from either acute or progressive pernicious anæmia, the best and quickest remedy is doubtless transfusion, and if this be carried out on the lines practised by the surgeons of the Edinburgh School, there is the least possible delay, and, therefore, the greatest possible advantage. Brakenridge reported five cases of pernicious anæmia in which Dr. Duncan transfused, with success, in four, and Dr. Affleck has had a similar experience. That no great paraphernalia is required to perform this little operation, may be seen by the fact that I have done it with a common glass syringe, a piece of drainage tube, and a quill toothpick!

While mentioning transfusion, it is well to note that it has been tried in some cases of autotoxæmia and septicæmia; first, the patient is bled, and then a more or less corresponding amount of either normal saline solution or healthy blood and phosphate of sodium solution is injected, in the hope that at least some of the toxic agents might be lost by the bleeding, and that the addition of plain saline or sanguineous saline solution, would aid in the destruction and dilution of some of the remaining toxins. No great success has followed this procedure, however, though there has been noted a temporary improvement in uræmia and diabetic coma, and in one case of pyæmia after severe traumatism and secondary hæmorrhage, reported by Cotterill, there is no doubt that the timeous transfusion, which was repeated four times, greatly aided the recovery of a patient whose case looked absolutely hopeless. In another case of acute septicæmia under Professor Annandale's care, transfusion of blood from the writer did not seem to confer any benefit. Under the head of autotoxæmia the injection of salt solution subcutaneously has been mentioned as being practicable in certain cases of melancholia and acute poisoning by alkaloids; this might be tried.

The operative treatment of diseases of the Nervous System, associated with cerebral and mental derangements, opens up a wide field, for it is only comparatively lately that

the cranial cavity has come to be considered with comparative levity from an operative point of view, just as operations on the abdominal cavity, at one time so severely criticised, have to many surgeons lost the dreadful risks of sepsis in a vast majority of cases. Indeed, one has at the present time rather to affect the dissuasive attitude in cerebral and cranial surgery so as to prevent the pendulum of surgical opinion swinging too far afield.

As far as possible purely cranial traumatic cases will not now be considered, but merely some of the diseases of the brain or membranes which cause cerebral symptoms, and how they may be relieved, or in some cases cured. The majority of diseases of the scalp, cranium, and meninges supervene after an accident and will be treated under that heading, but at the present time certain cases which might be accompanied by cerebral symptoms may be merely named, such as syphilitic or malignant diseases of the scalp, cranium or dura mater, each case of which might or might not be suitable for operative treatment according to its starting point, adhesions and other circumstances. But other diseases of the dura mater, not always traumatic, have sometimes been found in some cases correlated with mental and cerebral symptoms, though in others no symptoms seem to have arisen; such a one was reported by Willet, in which, *post mortem*, a fibroma of the dura mater (2 inches in diameter) was found compressing the upper part of the fissure of Rolando, without the production of any symptoms. This is probably accounted for by the great slowness with which such a condition advances, and hence plenty of time is given to the brain to accommodate itself, and its functions are not so rapidly interfered with.

Cases of Pachymeningitis hæmorrhagica interna, apparently non-traumatic, and not in cases of general paralysis, have been met with producing various symptoms, sometimes of localising value, sometimes not. Such a case was operated on by Mr. Annandale in 1886, the patient being in Professor Grainger Stewart's wards with symptoms at first pointing to cerebellar lesion, but later and comparatively suddenly more or less complete coma supervened. Exploratory trephining revealed extensive pachymeningitis hæmorrhagica interna, in the usual vertical situation. The man died in three days, and at the *post mortem* nothing abnormal was found in the cerebellum to explain the apparently typical symptoms. Suppurative meningitis is not usually associated with successful operative treatment,

except in certain ear cases and in some traumata, which will be alluded to later. But lately tubercular meningitis, for so long counted incurable and not in the least amenable to treatment, has been operated on with a certain amount of success.

The subject of Hydrocephalus has long been one on which many contradictory opinions as to value and justifiability of operative procedure have been given, and it must be evident that many of these have been given truthfully enough, but concerning entirely different stages of the disease.

To arrive at any definite opinion as to the value of an operation, and its attendant risks and advantages, it is necessary to divide the cases into the two natural groups, acute and chronic, for what is suitable and advisable for the one, is not necessarily so in the other. It has long been known that tapping a hydrocephalus may cure it, but this simple operation is only suitable in chronic cases. Thus Dr. Beedor, of Troyes, in 1827 tapped the ventricles of a child, aged 14 months, suffering from chronic hydrocephalus; about a pint of clear serum was evacuated, and the operation was repeated nine times within four months, after which the child is said to have got well and remained so for a year, when it died of pneumonia. Between this date and 1830 Callaway of Guy's, Marsden and Armstrong of London, repeated this operation, and in 1830 Conquest of St. Bartholomew's had four cases, two successful. One was shown to his class after having had the right ventricle tapped by a specially made trocar, which he passed in obliquely from the edge of the frontal bone on the right side. Some inflammatory action took place and severe convulsions followed, after which the coma disappeared, and the child improved so much as to again become intelligent. The head was kept strapped for some time after, not definitely stated. In the early sixties Wilks removed a large quantity of fluid from the ventricles of two children, no ill effects followed though the children ultimately died. He found it impossible to restrain the formation of fresh fluid, even with an elastic bandage tight enough to abrade the scalp, but why he did not tap again when re-accumulation took place he does not say. West subsequently collected the records of fifty cases, and the results were so unsatisfactory that the operation seems to have in great part been abandoned, but occasional more or less successful cases are reported, such as one by Tordoff in 1876, a child of 2 years, apparently a hopeless instance of

the disease. He aspirated 10 ozs. of fluid, and the child steadily improved, the fontanelles closed, he began to walk and was looked upon as cured, but some time after he was left alone in the house and was found burnt to death.

The treatment of acute hydrocephalus is of much more recent date, for in 1841, when Sir J. Risden Bennett wrote his Fothergillian lecture on this subject, he was unable to make any mention of operative procedure. The present advance was, according to Keen, first proposed in a general way by Wernicke in 1881, and Zenner, of Cincinnati, in 1886. Their proposition was to trephine first, and then puncture the lateral ventricles. The first operation of this nature was performed by von Bergmann on July 15, 1887, but it was not published till 1889, in the second edition of his book on "The Surgical Treatment of Brain Lesions." The first formal statement of the method of operating seems to have been made by Keen in November, 1888, when, in ignorance of the previous propositions in 1881 and 1886, and of von Bergmann's operation in 1887, he proposed to trephine, puncture and drain the lateral ventricles, and also pointed out the three practical routes to get to the ventricles, viz; frontal, occipital, and lateral, and showed the advantages of the lateral method. The second case operated on was done by Ayres and Hersmann in December, 1888. The third case was Keen's first, done in January, 1889, when he was unaware of previous observations and operations. The fourth case to be performed and the first to be successful was done by Mayo Robson on February 8, 1889.

It is apparently necessary to subdivide acute cases into two classes (1) acute primary meningitis, simple, syphilitic, or tubercular, as in the majority of cases; (2) an acute exacerbation in the course of a chronic case. These two broad classes require somewhat different treatment, have mostly a totally different history as to results, and so will be considered separately.

In ordinary acute hydrocephalus or tubercular meningitis, there is usually an absence of the physiognomy so characteristic of the more chronic variety. This latter may not always be due to chronic tubercular meningitis, as anything which presses on and blocks the veins of Galen or the foramen of Majendie may produce more or less ventricular distension, on one or both sides according to circumstances. The operative treatment of acute cases consists in trephining the skull or other region of the nervous skeleton, and drainage of the lateral ventricles or

of the basal lymph spaces. This operation of trephining may be performed in various sites, not merely for tubercular, but also for other forms of meningitis, and of these may be mentioned: (1) That recommended by Keen by which the ventricle is most easily reached laterally; (2) trephining through the occiput as performed by Waterhouse and others; (3) trephining through the upper cervical vertebræ, as done by Walsham; and (4) lumbar drainage, which Pasteur says is the routine treatment of excessive intra-cranial pressure in Middlesex Hospital.

The great majority of operations have been performed on the lateral region of the skull, the exact point selected being in accordance with what part of the ventricle it is desired to tap. If the anterior is to be reached, it can be done by puncturing through the posterior extremity of the second frontal convolution; if the posterior cornu, through the posterior extremity of the superior temporo-sphenoidal convolution, while if the lateral part is to be tapped, it is best done by inserting the needle through the lower end of the second parietal convolution. Whichever point is selected, it is best to map out the convolutions on the shaved scalp with nitrate of silver, and drill a small hole through the scalp to the bone, to be a guide to the central point after the scalp has been reflected. The size and shape of the incision may be varied according to the exact nature of the operation which is to be performed; thus if a simple tapping is thought to be all that is required, only a small incision and trephine is necessary, but if a more permanent drain is desirable, or more complete exploration is necessary, it is well to use a flap and a larger trephine, or to make use of the circular saw and reflect a bone flap attached to the scalp, as practised by Cotterill. The dura mater is then incised, leaving a margin, and some of the various drains may be introduced after the removal of the fluid. In some cases horsehair has been used, in others an ordinary drainage tube, but in both instances it must be of sufficient length to allow of the retraction of the brain without its premature withdrawal from the ventricle and consequent failure to drain, as happened to one of Mayo Robson's cases.

The exact site of the operation may be determined by a variety of symptoms, such as the history of previous or present otorrhœa, the presence of optic neuritis, the condition of the heart, not merely the number of beats in any one minute, which is of small account in this relation, but

rather whether there is marked irregularity, not only when comparing one minute with another, but also one quarter or half with the next quarter or half. This irregularity is diagnostic rather of basal than ventricular inflammatory disturbance, and may be more definitely exemplified by giving the figures in Waterhouse's second case. At 2 p.m. the pulse was 108 and regular; at 3 p.m. it was 120 and regular, but in a few minutes it was 70 with intermissions, and two or three minutes later it was 80 with no intermissions. In cases where there is a history of ear disease it would be best to operate at a site where the most frequent cerebral sequelæ of ear disease are found. This is generally recognised to be in the temporo-sphenoidal region, and hence this site should be chosen in these cases when any other symptom of localising value—such as paralysis of a limb—is not present; but even then an exploration of the temporo-sphenoidal lobe and posterior cornu might clear up the case. In a case of apparent meningitis with gradually increasing coma, optic neuritis, but without history of otorrhœa, nor marked interference with the functions of the basal ganglia, in the direction of the cardiac irregularity just noted, and with perhaps brachial or crural paralysis supervening, the most favourable site seems to be the parietal, for from it direct access can be had to the motor area, and the lateral ventricle can also be explored. But in the ordinary case of typical tubercular or simple or syphilitic meningitis, it is more likely to be found that, if operated on early, the site might advantageously be on a lower plane than that selected for either the temporo-sphenoidal or parietal operations. In such a case the diagnostic points appear to correspond somewhat with the three stages of the disease which are so often seen. Thus it may be noted that when the peculiar irregularity of the pulse is still present, it is probable that no marked distension of the ventricles has taken place, for usually the disease is of basal origin, and it takes time for the tubercles and the inflammation to spread along the course of the lymphatics and cause blocking of the foramen of Majendie, or pressure on the veins. Likewise it will probably be found that if optic neuritis has not by this time developed, it will do so when the intra-cranial pressure becomes markedly and generally increased, and this may be a point of differential importance, if taken in connection with other symptoms, when trying to differentiate the coma of basal origin from that of basal *plus* ventricular, or from solely ventricular causation. Waterhouse operated on a

case of Ord's who was 5 years of age, apathetic and exhibiting other signs of increasing intra-cranial pressure, including double optic neuritis. The conditions of the pulse and respirations are not fully noted in this case, though they were quoted from his second operation. The occiput was trephined in the region of the cerebellar fossa, and a small quantity of fluid escaped; a tube was left in, fragments of bone replaced and the wound closed. The child did well, though at one time the wound seemed to be infected with tubercle. In this case if the coma had been ventricular, this simple operation would probably not have relieved the symptoms unless there was no blocking of the foramen of Majendie, which would be improbable. Mr. Walsham, in a similar case, operated through one of the cervical vertebræ, a position which he considers presents several advantages over the occipital bone. This child died, and though there was no tubercular inflammation, there was increased intra-cranial pressure. A routine lumbar drainage must be attended by some failures, for it is evident that it can only help those cases in which the increased pressure is intra-cranial but extra-cerebral, unless the intra-cerebral pressure be accompanied by a patent foramen of Majendie, which, as before remarked, is improbable in cases of inflammatory origin. Thus the earlier a case is seen, if it be a simple or tubercular meningitis, the greater the probability that the symptoms are the result of basal irritation and pressure, but later, when coma becomes more marked, and monoplegia, or hemiplegia, or paresis occurs, as contrasted to some extent with the temporary paresis or paralysis mostly confined to cranial nerves in the earlier stages, then the probability is that there is ventricular distension from one cause or another, and hence the high operation is the most likely to be beneficial.

We now come to consider the second group of acute cases, namely, those who are already the subjects of hydrocephalus chronicus, but who are suffering from more or less acute or subacute inflammatory action with corresponding pressure symptoms. These cases must be to some extent differentiated from the purely chronic hydrocephalic cases, which are more or less stationary, for some time at least, and many of whom have been treated by tapping, as already alluded to. Broca reports the following case whose ventricles he drained with some amelioration of the symptoms, and complete success so far as the operation was concerned. The child was a boy 3 years of age, who had first shown

symptoms of nerve disease by having convulsions at 7 months, when his head began to enlarge. When 2 years of age he had another attack of convulsions, affecting the right side with temporary partial right hemiplegia and contracture of the right arm, which passed away in a few weeks and the child began to "feel his feet." When about 3 years old he had a series of convulsions affecting the left side, followed by contracture of the left limbs and hemiplegia. When Broca saw him two months later, he had a characteristic physiognomy, the fontanelles were closed, and the sutures united. The child was dull, could not speak, though he uttered inarticulate cries, and presented convulsive movements of the upper limbs. He could not stand even when assisted, and with difficulty sat up. The left upper limb was flexed in contracture. In this condition he was operated on, on September 19, 1890. After a crucial incision was made, the centre of which was one-fourth of an inch above and behind the right external auditory meatus, a five-eighth of an inch trephine was applied. When the bone was removed the dura mater projected, and on its division the brain protruded but was non-pulsatile. A large aspirating trocar was introduced in the direction of the opposite external auditory meatus, and when at a depth of one and a half inches, a liqueur glassful of clear fluid was allowed to escape, and later a gentle flow continued when the canula was detached from the aspirator. A drainage tube was then introduced, and altogether about three ounces escaped during the operation, after which the brain ceased to project and pulsated normally. The dura mater was replaced unsutured, and the skin sutured round the tube. The dressing was soaked next morning, but the next twice the dressings remained on for two days. The tube was removed on November 3, as little fluid had escaped for eight days, and the patient was discharged considerably improved on November 10. He appeared more intelligent, slept well, the contracture of the arm had disappeared, the convulsive movements were less, no inarticulate cries were uttered, and when supported he tried to stand. Dr. Thiriar of Brussels had a similar case, but it was fatal.

Phocas reports two cases, one a boy of 11 months, whose lateral ventricle was tapped and drained by horsehair, but he died in five days from septic meningitis. The other was a boy 25 months old, with a very large head and ossified fontanelles, nystagmus, and optic neuritis; he was very restless, but could neither walk nor sit up, could

understand nothing, but uttered inarticulate cries. He was trephined in 1892, one half-inch above the external auditory meatus, the aperture being one quarter of an inch in diameter. The dura mater was opened, fluid escaped, a horsehair drain was introduced and the skin sutured. The cerebral pulsation became evident after the flow of fluid. There was a rise of temperature for twenty-four hours, and the first dressings were bloodstained, but the wound healed by first intention, though the fluid continued to drain along the hair for some time. On the eighth day the child sat up in bed without retraction of the head; there was no restlessness, and on the whole he was decidedly better. Four months later the child was nearly blind from the optic atrophy, but could walk.

In 1893 Herne of Darlington reported six cases in which he had repeatedly tapped the lateral ventricles. In all of these the head was rapidly enlarging and in five this ceased after the first tapping. The sixth case progressed, and was found to be a cerebellar tumour. The amount of fluid removed varied in the different cases, from two ounces upwards, and the five cases all seemed to improve. From his experience in such cases he was of opinion that there is not much danger from the operation if performed slowly and aseptically, that improvement may frequently follow, and that the earlier the operation is done when it is evidently required, the more chance of a more or less complete recovery or improvement in the physical and mental condition. His most successful case was a child 2½ years old, weighing only 23 lbs. and only 26 inches high. The head was 22½ inches in circumference and the body only like that of an infant 10 to 12 months. It lay still during the day, but cried and twitched all night; the left eye was totally blind. On April 29, 1890, he was tapped through the tense open fontanelle, two and a half ounces were removed, with immediate relief to the nocturnal crying, and all the acute symptoms. In July, 1890, the head had not increased, the child used the limbs freely, and took more notice, but the fontanelles were again non-pulsatile and crying at night had returned. Tapped on July 17 and three and a half ounces were removed, after which progress was steady and uninterrupted.

Baskett in 1894 reported an interesting case in which he incised the anterior fontanelle. The child was 9 weeks old and was delivered with forceps; it was syphilitic and had convulsions. There was intense œdema of the retina, and

the discs were indistinguishable. Pressure was of no effect, so he was tapped to the extent of ten ounces, and then pressure was applied, but in a few days the anterior fontanelle had to be incised, and a tube was introduced with obvious improvement. The tube was removed when the fluid was not excessive, and in a few weeks he repeated the operation on the other side. Improvement again appeared and lasted for over a month, but convulsions came on, and the head enlarged asymmetrically. Thin pus was aspirated from the left ventricle, but nothing was found in the right one. The left-sided scar was reopened to drain through, but the child died in four days. At the *post mortem* the left ventricle was found shut off from the right one by a plug of lymph in the foramen of Monro, and in the right ventricle there was no hypersecretion at all.

The above cases are examples of various methods of operating in such cases, and on the whole the results may be considered encouraging, and would probably be more so if the cases were seen or submitted to operative procedure earlier, both in the instances of ordinary acute tubercular or simple basal meningitis, and also in the case of rapidly increasing hydrocephalus chronicus.

To summarise, one may say (1) That it is not often possible to diagnose a simple from a tubercular, or other form of basal meningitis. The probability is that it is tubercular if it occurs after the age of 3 months, and if there are present some of the ordinary pretubercular symptoms; any history of ear disease has a most important bearing on the probable site or focus of inflammatory action, either tubercular or septic. D'Astros believes that hydrocephalus the result of congenital syphilis comes on earlier in life than that due to tuberculosis or other causes, namely, within the first three months, but this does not exclude syphilitic cases occurring at a later period. The symptoms run a rapid course, and do not differ from those of acute hydrocephalus of other origin, and may appear either before or after the skin lesions. The prognosis in these cases is very bad. (2) It is of the utmost importance to attempt a differential diagnosis between coma the result of extra-cerebral pressure—such as occurs in the earlier stages of all basal meningeal inflammations, and of which the irregularity of the pulse and respirations, and the presence of temporary paralysis or paresis of various cranial nerves are of frequent occurrence—from the coma which has as its chief cause a distension of the lateral ventricles, either

from occlusion by lymph, syphilitic disease of the ependyma or tumour formation, in which cases, if symptoms be present, it may be found that the pulse is either slow or rapid according to the exact stage of the disease, but whichever it is it is less irregular than in the other cases, and mono- or hemiplegia is of more frequent occurrence with contractures, &c., than the more purely cranial nerve paralysis before mentioned in basal cases. This attempted differential diagnosis is most important, as it gives a cue to the site most favourable for operation and to the exact nature of the operation itself, viz., trephining to relieve the basal symptoms either through the occiput, cervical vertebræ, or in the lumbar region, or at a higher level, such as is more suitable in those cases with history of ear disease, or in whom the coma seems to be the result of general ventricular pressure, in which case tapping and drainage of the ventricles is necessary. (3) In cases of chronic hydrocephalus, simple aspiration either of subarachnoid fluid or of ventricular accumulation may relieve some of the symptoms, and this may be repeated as is necessary quite easily when the fontanelle is not yet closed. In other cases it may be advisable to incise the fontanelle, or it may be necessary to trephine the cranium in older cases, and in them the same operation is required whether the symptoms are more or less chronic, or rather subacute or acute, the result of either inflammatory action or the progressive growth of a tumour. Thus the axiom which I laid down as to paracentesis of the thorax equally applies to some of these chronic cerebral cases, as in those of the chest and abdomen and it is expressed as follows in my paper on Paracentesis Hydrothoracis: "When a passive serous effusion takes place in such a position that the expected relief afforded by the depletion necessarily attendant thereon cannot, or does not, supervene, aspirate." (4) In certain other cases which were mentioned by Frank, such as supposed hæmorrhage into the ventricles, or abscess bursting therein, the prospects are not so favourable, on account of the sudden shock to the brain, but it may be justifiable to explore, and if blood or pus be found then wash out and drain.

The subject of Microcephaly will now arrest our attention, for during the past ten years this has also been the field for novel operative procedure. The operation which may be performed on these cases is craniectomy, and though an American, Lane, is said to have attempted it two

years before M. Lannelongue performed his first operation —in August, 1888—still it is to the latter that surgery is indebted for fully bringing the operation and the suitable cases before the profession. No doubt there are rival methods of treatment, specially non-surgical, chiefly advocated in France by M. Bourneville and his pupils, but that we cannot now study except so far as to mention their grounds of opposition to operation. The pathological basis of the operation is, that the brain cannot properly expand on account of the cranium being either prematurely ossified, or that it does not grow *pari passu* with the brain—hence idiocy results. Bourneville and his pupils deny that it has been proved that this ossification of the cranial bones occurs more prematurely in the majority of idiots than in sane children of the same age, and that, as this observation is incorrect, the basis of the operation is hypothetical. Bourneville collected twelve skulls of idiots in which the sutures did persist, and the causes of the idiocy were, variously, cerebral tumour, meningo-encephalitis, atrophic sclerosis and parencephalitis. Only three had clearly pathological sutures. Again, Tacquet examined twenty-nine skulls of idiots, and stated that premature ossification of the sutures is not constant, and that in any case the synostosis commences most often at the lower part of the coronal suture, whereas most surgeons operate to liberate the sagittal suture, which for the most part he found already open. Hence he concluded that it is illogical to seek to cure idiocy by the suppression of a cranial defect which only exists exceptionally, that it is only justifiable in those cases where it does exist, but that it is very difficult to diagnose it beforehand. He also makes a statement which in turn is denied by M. Lannelongue, viz., that new bone may develop in the opening, and that as the dura mater is as inextensible as ever, mere craniectomy cannot allow the brain to grow. These surgeons would therefore desire to see the operation, if performed at all, limited to those cases in which it can be diagnosed that there is premature cranial ossification, but they think that in any case the results are not permanently convincing, and as the risk of the operation is considerable, it should only be performed after the failure of a special systematic course of training of at least six months' duration, and of a purely educational and physical character.

We will now consider M. Lannelongue's own results and experience, which were the cause of the foregoing

opposition. In the first place he does not assume in microcephaly proper that premature ossification of the sutures is the only cause of the arrested development of the brain. He is aware that C. Vogt, Broca, and Montane have shown examples of microcephaly in whom there was not complete ossification even at the twentieth and fortieth year. Both these and other observers have remarked, however, that the sutures are abnormally tight at the same time as the fontanelles are very narrow at birth, and Lannelongue found that in three cases with slight cerebral symptoms, and in a fourth, a newly-born infant, the fontanelles were even closed. Thus on the whole he believes that ossification is premature, and one must admit that such may produce defective or premature arrest of cerebral development, and he considers this quite different from a devolution, as has been suggested by some. He believes that this premature ossification is a purely morbid state, mostly due to hereditary syphilis, alcoholism and rickets, which may account for the various lesions that may be found in the brains of certain microcephalics, such as ventricular distension, disseminated or diffuse sclerosis or other conditions. Craniectomy may thus be of use in a variety of morbid states, arising from causes both hereditary, congenital, acquired, or traumatic.

The cause of the purely congenital cases is unknown, and the symptoms may be evident within a few months, or not until the third or fourth year, when it is much more certainly diagnosed, and some instances, in those later cases, seem to appear after an attack of persistent diarrhœa, whooping cough, or measles, though the exact *rôle* of such infectious disease it is difficult to determine.

Traumatism in the shape of compression during labour no doubt causes a certain number of idiots and backward children, and even before birth various intra-uterine conditions may have had a malign influence, such as great deficiency of the liquor amnii, and in these cases the child may be either physically or mentally depraved, or both. These latter cranial deformities are distinguishable from artificial or ethnological types by the fact that if the skull has a depression to such an extent that one of its diameters is much shorter than the corresponding diameter, the other diameters are not exaggerated on that account. This compression has so modified the cranial vitality that no compensation in the other bones and curvatures takes place. There are two different depressions from intra-uterine

causes, one due to the pressure of the uterine wall, the other according to the position which the fœtal head assumed, and Lannelongue has many times made these out in clearly intra-uterine cases. A result of the actual labour may be meningeal hæmorrhage, and this, even if it occur later, produces similar effects by means of a pachymeningitis, or cyst formation with partial cerebral atrophy or porencephaly, which are evidenced by various sensori-motor troubles, epilepsy or idiocy; in such cases the sooner a craniectomy is performed and the pachymeningitis or cysts relieved, the better for the motor and mental development of the child.

In M. Lannelongue's twenty-five cases in which he performed this operation, he often found such external pachymeningitic conditions accompanied by great thickening of the dura mater, and partial congestions of it. In other cases he found osseous plates embedded in it having a thickness of from a sixpenny to a shilling piece. In still others, he found evidences of hereditary syphilis, eburnated hyperostosis and cranial thickening. Purely cerebral lesions consisted of (1) local cerebral atrophies due to diminished arterial calibre, which acted indirectly by altering the general tension of the cerebral circulation, and thus affecting its nutrition; (2) local or diffuse sclerosis or meningo-encephalitis, which may produce symptoms like general paralysis in the adult; (3) Bourneville's hypertrophic cerebral sclerosis. These lesions are often associated with cranial thickening and eburnation, and though it is impossible to know how far they may or may not be amenable to treatment, some of them seem to be conditions which might, in some way, benefit by local interference. It is not at all a simple thing to decide whether a given case is suitable for operation or the reverse, and to arrive at such a decision M. Lannelongue studies the patient minutely, so as to come to as exact a diagnosis as possible on the points of degree and site of lesion. To do this the skull must be shaved so as to give a correct idea of its form, volume and the various curves, deformities, depressions more or less marked, and its projections, all of which form important localising clinical indications, corroborating signs and symptoms shown by the patient.

If an operation be decided on, it may be by one of two methods, a linear or a flap craniectomy. The former is mostly used parallel to the longitudinal sinus, and may cross either the frontal or occipital sutures. It may also be performed on the occipital bone, or vertically downwards

from the vertex to expose the motor area, or parallel to and in front of, the fronto-parietal suture crossing the longitudinal sinus. Craniectomie-a-flambeaux is, on the other hand, mostly applied to individual bones, or combinations of bones, such as the parietal, or fronto-parietal, &c., as may be required, and the flap may be of various shapes, such as horseshoe, U-shaped, V-shaped, T or L-shaped, and used either inverted or cross-wise. Lannelongue removed more bone at his later operations, and if a suture is crossed, great care is required to detach the dura mater, which may afterwards be scarified or opened so as to allow of exploration of the brain, removal of cysts, &c. His opinion is, that regeneration of bone is not usual, and that it is not necessary to reset the dura mater. He replaces no bone, which is sometimes extremely eburnated, and very difficult to cut. Of 25 operations, 24 recovered in an average of ten days; one died in forty-eight hours from hyperpyrexia after a large loss of cerebro-spinal fluid. There was no case of necrosis. The youngest patient was 8 months, and the oldest 12 years. The sexes consisted of 13 boys and 12 girls, and he has documents to show that a great number of these cases are improved temporarily at least, but they are all too recently done to enable one to judge of the permanency of the improvement.

On the whole craniectomy may be performed in cases of Microcephaly with premature ossification and closure of the fontanelles, in obstetrical paralysis of central origin, or obvious cranial depressions from other causes, meningeal hæmorrhage, hæmatoma, circumscribed pachymeningitis, hyperostosis with congenital syphilis, megalocephalus with thickening of the skull, non-microcephalic idiocy, and premature closure of the fontanelles. The sole difficulty is the exact diagnosis of some of these conditions, which renders the operation in many cases a purely exploratory and experimental one. In certain cases it may be attended by most gratifying improvement in the physical and mental state of the patient. The following are some cases which have been recently published, and which in some instances show the marked improvement that may take place, and in others the risk of the operation or its apparent uselessness.

Prengreuber operated on a case and reported it in 1892. The patient was a boy, aged 9 years, a microcephalic idiot with bony exostosis on the left side which appeared on both surfaces of the skull and compressed the brain. He accordingly removed a strip of bone from the left side

measuring 11 cm. by 2 cm. Immediately after recovering from the anæsthetic the boy sat up and asked for food, and moreover it is specially noted that "in the first moments following the operation it was clear that the child had already improved, as regards his cerebral functions!" His appearance was better, and his speech more intelligible. Next day the dribbling of saliva from the mouth ceased, he blew his nose for the first time in his life. He soon learned to play with toys, blew a trumpet, and did not urinate in his clothes or bed as he previously had done.

Estor operated on a case presenting the usual symptoms, and removed a piece of bone, 11 cm. by 2 cm., but there was no appreciable improvement in the mental condition, though he could now stoop to pick up an object without falling down.

Miller, of the Western Ophthalmic Hospital, London, reports the following interesting instance. The child was 8 months old, microcephalic, and blind from double optic neuritis; spine and limbs rigid; thumbs adducted and fingers flexed over them; nystagmus and convergent squint, and orbits deep in the sockets. Swallowing generally easy, but the nipple had to be moved about in the mouth and lips before it was sucked. Sutures were ossified and the lower middle incisors were through. It had been remarked that there was no fontanelle present at birth. Forceps had been used but there were no marks of them. The coronal edge of the frontal bone was raised, the left parietal was flattened, and the forehead receded. The frontal eminences were only one inch from centre to centre. The child was very restless, cried, and was constipated, though no vomiting was present, and little intellectual activity was shown. During the administration of chloroform, there was an attack of syncope, from which it recovered after oxygen inhalations and hot sponges to the head were applied. As more and more bone was removed, the pulse and breathing improved, the piece being 3 inches long by one half inch wide; when the operation was completed, the heart was beating regular in force and rhythm and of good strength. The spastic condition improved, both testicles came down, the penis grew, and though he previously only dribbled his urine, he now micturated in a stream. The nystagmus and squint disappeared, and the eyeballs were now further forward; on the whole the expression was more natural and sucking and swallowing were prompt. In the first five weeks' time, the distance between the frontal eminences

increased half an inch and the total circumference three-eighths of an inch. He was now able to stand when holding on to an object, and the intellect was correspondingly better.

A case of traumatic origin was reported by Morrison who operated. It was a boy who was delivered by forceps in 1888, and sloughs appeared at the two points of pressure. He was defective mentally and seemed drifting into idiocy. Two subsequent children were normal. Linear craniectomy was performed in 1891, and a piece of bone seven inches long and three-eighths inch wide was removed, one inch from the middle line. The dura mater was not markedly adherent. After the operation attention was more readily engaged, and he followed things and persons with his eyes. In a few weeks he pointed to food, and began to pick up words. Thirteen months after there was decided improvement, both mental and physical.

Joos reported a case in 1893. A boy, idiotic, walked at three and a half years, uttered inarticulate sounds, was restless and very dirty and irritable, and would only lie on his belly arching his back and biting things. In November, 1891, the right side of the head was operated on and now he lay on his back and did not force out a prolapsus ani as formerly. Next month he became cleaner, tried to play, made gestures for food, and picked up a few meaningless words. In June, 1892, the other side was operated on, and next month he learned his name, then the alphabet and names of objects, jumped and played, became good tempered and liked music.

Horsley published two cases in 1891, one of which improved, the other, of which the following are short notes, died of hyperpyrexia. The boy was 7 years of age, and was of premature birth; had fits first when 7 months old, and could speak a few words at the end of one year; then he lost speech and only said a few words in mimicry. When 5 years old "the heat of the sun caused an illness;" he became feverish and semi-conscious for four months. The fits stopped during this period, but recommenced after the illness, first once a week, but now nightly, just when waking. He was operated on, but perhaps too extensively, as he died of hyperpyrexia, probably due to injury to the cortical thermotaxic centres which Horsley thinks undoubtedly correspond to the motor area; at the *post mortem* a few punctiform hæmorrhages were found in the pia over the middle and ascending convolutions.

It is needless to multiply cases, and I shall now sum-

marise what I can find from those reported. It is very difficult to obtain reliable information or statistics of the results in these cases, for several men have collected cases from various sources, and it is thus almost impossible to be absolutely certain that some of them are not included in more than one series of cases. But certain facts may be stated with confidence. Thus Lannelongue has performed 25 operations with only 1 death, and the remaining 24, at the time of publication, at varying intervals after the operation, were in almost all instances improved or improving, but the time was too short to be certain of any definite permanent benefit. Règis collected 12 cases which had been operated upon in Bordeaux, and found that 1 died, and that no great benefit had been conferred on the 11. Starr made a report on 25 operations, 18 of which had been done in the States, and of these 7 died shortly after the operation, while the other 11 were improved, though the time was too short to be certain of the result. He considers it impossible to determine exactly what pathological state may be found in cases of hemiplegia, sensori-motor defect, and imbecility, and hence exploration is necessary. If there be manifest atrophy, the result is doubtful, but if apparently there is arrested development, some improvement may occur. If clots, cyst, or tumour be found, the chances of recovery are better, and if microcephalic, the brain may get space to grow, epileptiform attacks may be reduced or modified, as also other sensori-motor changes, but the improvement in the imbecility is doubtful. Jacobi gives statistics of 33 cases in which craniectomy had been performed for idiocy or microcephalus, and special enquiries as to the condition of the patient before and after the operation were made. It was found that 41 operations had been performed on the 33 cases, of whom 14 died, and 19 recovered. The deaths occurred at various ages from 1 to 6 years, and most of them occurred soon after the operation, 6 within a day, but the cause was not always given, though in one it was attributed to the anæsthetic. Some developed a very high temperature, others died of shock a few hours after the operation. The final report was, in 1 no history was obtained, 1 was uncertain, in 7 no improvement took place, in 7 there was slight improvement, in 1 "some" improvement, and 2 were much improved.

Keen's opinion after an experience of 14 cases (whether any of his are included in the foregoing is not said), is that the mortality was very high, and the gain moderate, though possibly worth the risk.

Wyeth, who had operated on 8 cases, considered the operation so dangerous that it was only justifiable in very marked cases of microcephalus with undoubted symptoms of compression. Mynter had 5 cases of microcephalus on which he performed linear craniectomy with no improvement. Finally Jacobi expresses the opinion which is similar to that which has been summarised, viz., that it is most suitable in cases of uncomplicated premature ossification of the sutures and fontanelles, which takes place between the fifth and tenth month instead of the fifteenth month. The child is thus often normal, physically and mentally, for the first few months, then develops symptoms of irritation, and finally of compression.

In 26 more individual cases operated on by 20 different surgeons, some perhaps in the previous statistics however, only 1 is said to have died from the operation, 17 improved certainly, 2 were not improved, and the other 7 cannot be traced at present. Thus in all, out of 110 cases with 118 operations, there were 24 deaths from the operation, but the death-rate varies so much, that one cannot help thinking that there must be in this, as in all such special operations, a strong personal element, over and above the purely surgical risks, such as shock, sepsis, and hyperpyrexia. That hyperpyrexia is really not uncommon in cerebral cases, is shown by Bryant having seen it in 8 out of 100 cortical injuries, lacerations, or meningeal hæmorrhages. The cases must be most carefully selected, for it is perfectly evident that every microacephalic idiot is not a suitable subject for operation, and that in the great majority of cases, though a certain amount of temporary improvement undoubtedly takes place as a result of the freeing of the cranium, how much of this is due to the actual operation or to the revulsive effect of it, it is unwise at present to try to decide. Shuttleworth considers improvement after operation is mostly due to the extra attention, nursing, &c., acting as an education to the child, as judicious sensorial stimulation and training increase the volume of the brain which moulds the skull, and not *vice versa*. Fletcher Beach says that Virchow has abandoned the premature ossification theory in relation to the ætiology of microcephalus, and Wiglesworth is of a similar opinion, that such a pathological basis is erroneous, and that improvement is really only temporary, and is due to the educational or revulsive effects of the operation.

Closely allied to this particular subject of increased cranial

or cerebral pressure in these idiotic cases are cases of General Paralysis, which have also lately been submitted to operation in the hope that at least some of the symptoms may be relieved, or life or the remnants of sanity be prolonged for a little time. As in most operations, there are two opposing theories and practices. One may be represented by Clouston, who is of opinion that general paralysis is an inflammatory disease primarily of the nerve cells and tissue, and that the symptoms of increased cerebral pressure are due to a hyperæmia, while the presence of fluid in the space between the dura and arachnoid is to him evidence of the existence of a want of pressure, otherwise it would not be there. He is therefore quite opposed to operative interference on the ground that it is performed to relieve a form of pressure which he considers is non-existent.

On the other hand Batty Tuke, Shaw, Goodall, and Macpherson, have all had experience of the operation in these cases, and though the results are not permanently satisfactory, they all seem convinced that the presence of free fluid, whether it be a primary inflammatory exudation, or a secondary compensatory effusion, is the actual cause of the symptoms of increased cerebral pressure. As in the case of acute hydrocephalus, so in general paralysis there seems to be ample evidence of a dual or even more complex state of affairs, which are in some stages sequential one to the other, while in a later stage the other predominates and masks the presence of the former active agent.

Thus according to Macpherson the earlier symptoms of general paralysis are due to an arrest of the free lymphatic circulation in the peri-vascular canals and peri-vascular sacs, resulting from (1) a dilatation of the paralysed arterioles in the canals, (2) an inflammatory accumulation of leucocytes in the canals, and (3) a nuclear proliferation in the cells of the tunica adventitia. Later the nerve cells degenerate and a growth of spider cells still further interferes with the lumen of the canals, kinks the vessels, and all these changes not only diminish the fresh nutrient stream to the cells, but also interfered with the satisfactory elimination of waste products from the plasma ; when the abnormal condition of the blood, as shown by Macphail and others, is also taken into account, this latter is a most important element. Heynsius and Preyer hold that nerve action and function depend on the chemical reaction of the lymphatic fluid at the time; normally it is alkaline, but in these cases it probably varies. According to the physics of the cranium, when the cerebrum

diminishes in size, a result in this case of atrophy and degeneration of the cortical cells, compensatory fluid must take the place of the cerebral substance, and so it is necessary to distinguish between the primary inflammatory exudation, which is almost a certain cause of increased cerebral pressure, from the later secondary compensatory fluid, no doubt partly inflammatory too, which to a large extent acts as a stop gap and is to Clouston an evidence of want of normal pressure, while the symptoms are merely due to the cortical degeneration. Whichever theory will be found to be correct as our clinical experience increases, there seems to be no doubt, as Tuke says, that the surgeon has a right to interfere, as even a very small decrease, perhaps only 20 to 30 minims, of cerebro-spinal fluid, is followed by at least a temporary change and amelioration of the symptoms in many cases, just as Mickle has noted several instances of prolonged remissions or even recovery after an accident, and Robertson of Glasgow reports a case with well marked symptoms of general paralysis which was said to be cured after severe counter-irritation of the scalp. Tuke does not think that absence of bulging dura mater when a disc of bone is removed, precludes the existence of abnormal pressure in the brain, and he is of opinion that the operation is presumably followed by the same results as if the pleura or peritoneum had been tapped, which allows of more healthy lymphatic circulation, and after this diminution of tension, the cerebral nutrition may for a time improve and sclerosis may be stayed. In early cases the operation shows absolutely the presence of an inflamed pia mater and effusion, and the relief afforded is most probably due to the getting rid of this inflammatory effusion, for so long as the fluid can drain away there appears to be relief to the patient; when the wound heals, the compression symptoms return and the disease resumes its course, though perhaps in a modified manner.

Goodall also holds that a study of the cerebral cortex in all its bearings fully justifies this treatment, and that, even if the affection were a primary degeneration of the nerve cells, benefit could accrue, as it actually does, from the removal of any excess of bad lymph. Macpherson says, "it may be urged against this form of treatment that it is empirical and that it has no rational nor extenuating basis founded either on physiology or pathology;" but "if no operation is to be performed, the precise physiological resultants of which cannot be accurately detailed, the pro-

fession must abandon a host of effectual procedures too numerous to mention." "It is a mistake to hold that all cerebral pressure is fluid pressure. No assertion on the part of the advocates of this operation could be more baneful than that this procedure is intended solely for the removal of intra-cranial fluid. Fluid pressure has undoubtedly to be reckoned with, and in many early cases of general paralysis undoubtedly exists, but in others on the other hand, it is either not apparent, or does not exist, or is only in small quantity. Yet all cases benefit temporarily or permanently by operation."

As the mortality in cerebral surgery for the relief of pressure generally, has been so slight or so conspicuous by its absence, even an anti-experimental argument falls to the ground.

The following are short extracts from some general paralytic cases which have been submitted to this operation.

Duncan operated on a case under the care of Batty Tuke and Muirhead in 1890. The previous history and symptoms on admission need not be recapitulated, suffice it to say that in all these reports the diagnosis of general paralysis was undoubtedly correct. When the discs of bone were removed, one on each side, the dura mater was found to bulge markedly on one side only, but it was not opened and the discs of bone were not returned. As a result of this slight operation, no systemic irritation at all took place, but whereas formerly the pupils were unequal, variable, sluggish and almost insensible to light, on the morning after the operation they were equal and the light reaction was better, and this change continued for five days. His intellect was much clearer and he now for the first time recognised that he was in hospital. He was more sane and calm than formerly, headache was gone, and he had no hallucinations as before. In five days, however, all the symptoms returned except the headache, and he was removed to the asylum, where he has been remarkably tranquil and much demented, with ataxic symptoms. Tuke had another case which was trephined and drained to the extent of about 8 ounces per diem for three weeks, during all which time there was relief of symptoms; he therefore would recommend continuous drainage after laminectomy of the third or fourth lumbar vertebra, such as has already been alluded to as being a routine practice in Middlesex Hospital in cases of increased cerebral pressure.

Cripps also in 1890 operated on two cases of Claye-

Shaw. One was a doubtful traumatic case of general paralysis with no syphilitic history; there were megalomania, motor impairment of speech, some ataxy and great pain in the region of a blow on the head about two inches above the left ear. The operation was performed in this area; two discs were removed; the bone was not thickened. The dura bulged, was incised and drained. Wound healed by primary union. The pain was entirely relieved, the memory was better, there was no trace of any delusion and only a certain amount of contentment and *bien-être* remained. Motor symptoms were stationary. He was apparently more responsible and could have made a will, and could not have been certified insane at this time. The second case was more advanced and had frequent convulsive seizures on the left side. He was trephined in July, 1890, and improved until September 18, 1890, when he had an attack of faintness and numb feeling in the left hand. The mental condition had improved and he was able to read several hours consecutively and was more cheerful. Memory was also better and he had no recurrence of the convulsive attacks, though the other motor symptoms did not improve. He was discharged, but on February 14, 1891, he had bad convulsions, became comatose and died about eight months after the operation. Cripps had a theory that a new lymphatic stream was set up through the skin being apposed to the cerebral surface, and that therefore a large piece of bone should be removed, but in a fatal case of Macpherson's there was found no such adhesion of the scalp to the cerebrum or to the membranes, so that Cripps' theory is untenable. Shaw believes that the best time to operate is when speech is markedly affected, and that the site most suitable is either over the posterior part of the frontal lobe, or at the site of any injury, or on the side opposite to that which is more convulsed, or on which the pupil is more contracted. He also broaches the question of tapping the ventricles in such cases, but this has apparently not been directly practised. Goodall had a case which did not benefit at all, and had a curious complication not noted in other cases. On the fifth day there were localised convulsions, articulatory defect, aural hallucinations and tinnitus, all of which passed off in a fortnight. The site of this operation was over the temporo-sphenoidal lobe, which would account for the aural symptoms.

Rey reports a case which was trephined over a depression in the left parietal region of unknown cause. There was

notable improvement, the mental depression and exalted ideas disappeared entirely, but the operator was afraid this improvement would only be temporary. Macpherson and Wallace reported five cases which were operated on by the latter. They summarised thus:—(1) The best site is over the orolingual centre on the left side. (2) The bone varied in the cases as to thickness, one had no diplöe. (3) The dura mater was not extremely adherent, but was more dense and thick than normal; it did not bulge in any case. (4) Fluid escaped in all cases in varying quantity, a clear, limpid stream with no flakes; in two cases it spouted out about an inch. (5) Pia was redder and more vascular and milky along the vessels in two cases; a small amount of fluid escaped on incision. (6) Pulsation was less than normal until the dura was opened, when it was more marked, in one case the brain was sucked in three-fourths of an inch during inspiration. (7) All healed well and were none the worse, and in all except one there was marked improvement for from one to three weeks, after which they gradually deteriorated. This deterioration corresponded to the complete healing and hardening of the wound; a horse-hair drain is unsatisfactory. Subsequently there was no bulging of the scalp, rather a depression, not due, however, as found *post mortem*, to adhesion of the scalp to the membranes or cerebrum. (8) As it is necessary to operate early, and as it is difficult to diagnose it early absolutely, and to exclude alcoholism, the present state of surgical treatment is somewhat unsatisfactory, for though improvement takes place in the majority of cases, it is only temporary; this might, however, be rectified by more permanent drainage being established, perhaps by the lumbar operation.

The subject of operating for nontraumatic Epilepsy will now require a short notice, as there are sometimes cases which improve after such interference. I have already quoted Hughlings Jackson's opinion that the connection between epilepsy and insanity is a relation of sequence, but not one of community of character, so that the acute mania after a fit, or the chronic mental failure in epileptics, is really not an essential of the disease, though so frequent a concomitant resulting from a pathological cerebral state independent from that which obtains in pure epilepsy. Ordinary idiopathetic epilepsy affords little scope for surgical treatment, but certain other types have been benefited. Thus Tait records a case of menstrual epileptic

mania which he cured in 1880 by oöphorectomy; fits had accompanied menstruation all her life and lately acute mania developed. The fits were about fifteen a month, and after the operation there was immediate improvement, arrest of the mania, and only three fits in a month. The pathological condition of the structures removed was not reported. Bacon reports two cases in males, whom he castrated for epilepsy; one improved, and he considers the cases suitable for this proceeding are incurable epileptic insanity with masturbation. Another result of altered cerebral pressure is, according to Macpherson, cortical erethism and limited epilepsy, and as Jacksonian epilepsy is undoubtedly accompanied by an erethism of a motor cortical area, and can be localised, "it is a distinct duty to cut down on the said area, as this exposure has in many instances cured, and in others relieved the fits." As Macpherson remarks "if the removal of local pressure relieves a limited epilepsy, it is not too much to infer that a unilateral hallucination, say auditory, might be cured by trephining over the superior temporo-sphenoidal convolution, where at least one terminal associated area might be expected to be found in a state of functional erethism." He proceeds to report the following case, successfully treated in the asylum :—

"A man, 35, was admitted two years ago with epileptic insanity. The fits were generally limited to the ring and little finger of the left hand, sometimes extending to the arm and occasionally to the left leg. The centre for the fingers of the left hand was exposed, and the localisation verified by electrical stimulation, which was too strong and produced a convulsion; the resulting local congestion was so severe that only a very minute speck was removed as the part bled profusely, though it was intended to remove the area. The patient made a most satisfactory recovery; he had numerous fits for the first fortnight, as is generally experienced, but was discharged in three months time, and for eighteen months has been earning his livelihood as a tram conductor in Paisley, free from fits and sane."

Wallace also operated on another of Macpherson's patients suffering from chronic mania, with automatic rhythmical movements of the right arm. The left-sided centre was removed on December 13, 1893. Five days after, paralysis of motion of the right arm set in, there was no change of course in the mental condition; she died of cerebral softening in January, 1894. "The portion of the

cortex removed at the operation, as well as the rest of the motor cortex of the left side examined after death, showed advanced degeneration."

Similarly, cerebral symptoms attendant on Abscess or Tumour may be relieved if not cured, either by the successful drainage of the former, or by the removal or drainage in the latter when it is impossible to make a complete operation. Horsley points out: "It is evident that some new growths are so interfered with in their nutrition by opening the skull and suddenly altering the pressure therein, that they forthwith degenerate." One case on which he operated for Dr. Buzzard, proved "to be too extensive for complete removal, and was obviously malignant and rapidly growing; but the patient survived for two years, the hemiplegia improved, and at the necropsy it was found that the tumour had undergone complete destruction by the mere exposure at the operation; and though such a satisfactory result cannot be always expected, it is an argument in favour of deliberately opening the skull for the purpose of palliating a condition which cannot be cured."

Bramwell examined the records of 10,115 *post mortems* and 8 per cent. had cerebral tumour. In one there were no symptoms, in 18 there were no local symptoms; in 30 operation was impossible, or improbable, 2 were multiple, 4 were malignant and 2 with associated lesions. Seventeen improved under treatment. In 74 out of 79 cases, successful operation could not have been performed, in 5 it was hopeful, in 3 good and in 2 doubtful. In a series of 28 other cases only one could have been successfully operated on.

In the case of cerebral abscess it is somewhat different, for it is a disease most dangerous to life, and if timely surgical aid be not afforded, death must result. As a rule the acute abscess is more readily diagnosed than the chronic one, which may exist for a long time with no symptoms definite enough to demand exploration; or on the other hand a case with all the usual indications may not be the subject of chronic abscess at all. Murri, one of the latest writers on this subject, states that though the most reliable signs are "pyrexia, headache and optic neuritis," no one of these can be depended on, as there is often no pyrexia, but the reverse, headache is only suggestive, and optic neuritis may be the result equally of tumour or meningitis; though paralysis may be of localising value, it affords little information as to the cause. The most

importance must be laid to the history or signs of a condition known to be a cause of cerebral abscess, such as middle ear disease, local injury or caries of the cranial bones, or an attack of some specific fever. The operation of exploration is practically free from danger, and hence it is better to be on the safe side and operate before definite symptoms appear than to wait for their appearance, which, in the majority of cases, is merely a prelude to death, and this result the surgical procedure is most likely futile to prevent by that time.

I have already alluded at some length to the propriety of oöphorectomy as a cure in certain mental diseases associated with diseases of the Reproductive System; also to Tait's report of a case in which he removed the ovaries to relieve menstrual epilepsy, and to Bacon's cases of castration in two male epileptics. It is now only necessary to mention castration as a suggested cure of psychopathia sexualis in old men with enlarged prostate. This operation has lately been advocated as a cure for the prostatic affection, but in cases of the above-mentioned mental disorder, the operation might have a double effect. Varicocele has also frequently been operated on to cure the depressed condition which the subjects of this are often in. Thus Annandale operated, in 1892, on a man, aged 54, who was in a distinctly melancholic condition, and who greatly improved after it; and there are many other instances. Circumcision is most beneficial in some cases of reflex psychoses, and masturbation with epilepsy, but clitoridectomy, which was at one time freely practised for the cure or relief of similar affections in the female, has been found to be of little avail, though the freeing of an adherent clitoris is sometimes as satisfactory as the freeing of the prepuce if adherent in the male, in certain hysterical and spinal irritation cases.

One must also note that the obstetrical operation for the induction of premature labour is sometimes necessary in cases of eclampsia, with or without albuminuria, acute chorea or mania, occurring during the later months of pregnancy. At other times vomiting may be so severe that the only treatment available is to terminate the pregnancy, so as to save the mother further strain on her nervous system, or avert a fatal issue from exhaustion and starvation.

As regards the Urinary System, Thompson reports that in 1877 he operated on a man, aged 66, who was in an asylum, and who had a large calculus composed of uric

acid and phosphates. There was very severe hæmorrhage at the time of the operation; the wound healed, but a small fragment required to be removed later by the lithotrite. Seven months later he gradually became sane and remained so. Other cases in which the cure or relief of a traumatic or idiopathic stricture has been followed by disappearance of cerebral symptoms are not uncommon, but these probably are cases of mixed ætiology, there being a strong uræmic element in them.

Two special organs of sense which can be surgically treated when associated with mental derangement, are the Ear and the Eye. The possibility of relieving auditory hallucinations has already been alluded to, and we are now more concerned with actual disease of the ear or its appendages which may be the cause of cerebral symptoms. In the first place, many cases of delirium in infants and children too young to express or specifically indicate the seat of disease, are in reality acute inflammatory diseases of the ear, and the alarming symptoms often subside with the appearance of otorrhœa or on incising the membrana tympani. The former may gradually clear up, but in many cases it becomes septic and in time other troubles follow, not merely in children but also in adults. One of the most frequent results is mastoid disease, and such is a case in point:—"G. P., aged 32, was admitted late at night to Ward 6, Royal Edinburgh Infirmary, in 1884, as he was in an excited condition. On examination it was found that he was suffering from a mastoid abscess; soothing remedies were applied and the abscess was opened next day with instant relief and speedy cure." Williams reports a much more severe case in which he had to operate on three occasions before the abscess finally healed, but the patient became sane after the first operation. In other cases further disease has taken place and actual meningitis or thrombosis of the lateral sinus or internal jugular vein may have resulted. Again, if the case be sufficiently chronic, cerebral or cerebellar abscess may have been engendered, with corresponding cerebral symptoms. It then becomes necessary for exploratory trephining to be performed, in the hope of relieving the condition, and in some cases the internal jugular has also to be ligatured and the clots cleared out. Pitt found in 9,000 *post mortems*, 57 cases of ear disease with cerebral lesion, which was about ·66 per cent. Toynbee's deductions as to the probable site of the abscess, according to the part of the ear diseased, were

not quite satisfactorily corroborated. Certainly the temporo-sphenoidal lobe is the most frequent site of abscess, the cerebellum being less frequent. It, therefore, is necessary to be prepared in any given case, where no marked localising symptoms are present, to perform first an operation at the most likely seat, and failing abscess there, proceed to explore the cerebellum. As a rule, however, abscess of the brain does not supervene until the otorrhœa has persisted for months or years, but other cerebral symptoms, such as headache, tenderness, vertigo, sickness, general malaise and incapacity to work, with anæmia from the chronic toxæmia, may result from the slow absorption of septic pus. In such cases only the extra-cranial cavity of the mastoid antrum requires to be drained. These cases are certainly often overlooked, and are undoubtedly too serious in their possible results to be lightly treated when discovered. There is also a possibility of some cases of so-called tubercular meningitis being really disease of the middle ear, and if early enough diagnosed as such, they might be far more satisfactorily dealt with than at present.

Reflex insanity or hallucinations from local organic disease, even in the otherwise sane, are more frequent than may be supposed, and if the exciting cause be found, and can be removed or alleviated, the resulting improvement in the mental condition is gratifying. Some instances of this are found in cases of ear disease.

Thus Rayner reports two cases: one presenting delusions of persecution founded on hallucinations of hearing; he was sleepless, haggard, and unable to work. After wax was removed from his ears he gradually improved. The other case had similar delusions and sensory hallucinations from a diseased membrana tympani.

Thomas also records a case in which great depression, feeling of weight on the vertex, and general sleepy sensation in the head were produced by an abnormal condition of the right membrana, which looked thin and brittle, and moved too readily in and out, thus giving the sensation of something suddenly dropping or flapping in the ear, stopping his hearing and thickening his speech. This condition might recur for days and then not appear for weeks. When it did happen the above-mentioned symptoms at once appeared, and were probably due to altered pressure in the labyrinth.

Colman notes certain ear lesions which have produced cerebral symptoms in the sane: (1) wheat grain in the ear;

(2) cold in the ear, accompanied by the sound of particular bells only once heard years ago under mental distress; this was cured by hot water syringing; (3) otitis media; (4) labyrinthine noises and auditory vertigo, which latter is really an illusion, and when a person is below par the noises may take a definite shape and appear as a voice. This may be accompanied by a visual or even olfactory illusion.

Diseases of the Eye are also sometimes the cause of mental depression, and this has on some occasions been relieved by operation. Thus Bouisson reported in 1860 the case of a man, aged 50, with double lenticular cataract and complete dementia. Both eyes were couched, and on the tenth day he exclaimed, "I can see," which were the first sensible words uttered for a long time. He afterwards became more manageable, and was discharged in six weeks able to earn his living. The dementia was probably not deep, and he remarks that "sensation stimulates the mind, as electricity stimulates nervous action, the patient being at the time favourably situated for such impression," and the stimulation of the retina by the light seemed to be sufficient in this case to produce a general cerebral impression and change in nutrition. In the same year Davy reports three cases of a similar nature; one in Colombo, a second in Colney Hatch, who was couched and discharged cured, and a third who was greatly improved after the operation, and though incurably insane she became "able to do some washing and some fancy and general needlework." Unfortunately these cases are rare, and the much more frequent order of things is, that mental depression supervenes after an operation has been performed.

Colman notices instances of local eye disease with transitory mental disturbance. (1) A woman with old choroiditis, with floating bodies in the field of vision, had hallucinations as to beetles with red eyes, and a woman in red all on fire. This lasted a few days and then cleared up. (2) A man had re-awakened syphilitic retinitis, and the floating bodies assumed definite faces of every one he had seen in his life. He recognised these as illusions. (3) A woman with retinal hæmorrhage in the course of pernicious anæmia thought that a blackbird was perched on her bed and would not go away. (4) Other cases of cataract in which various hallucinations developed for a time.

He remarks that "all these cases are not merely due to an imperception, or failure to perceive the nature of the

stimulus, but there is the positive factor, the invention of mental images for which the sensory stimuli give no warrant. This is due to an indefinite sensory impression in a person who is run down and below par from nervous tension or expectant attention, and arises from fear, hope, or curiosity." In all cases it is a danger signal of mental breakdown which can usually be averted.

The Nose and Naso-pharynx have been held responsible in certain diseased states for the condition of aprosexia. This has already been alluded to so need not be further considered, except to remark on the benefit which sometimes results after adenoids have been removed in such cases.

The surgical treatment of mental disorder following Trauma to a very large extent is confined to cranial and intra-cranial operations. But there are also a few cases which require no cranial operation, and these are chiefly cases of reflex epilepsy, due to an irritating scar or foreign body embedded in the tissues, the removal of which is usually successful in curing the epilepsy.

The purely cranial surgery may be divided into two groups of cases, one recent and the other remote, as has been done in considering the subject generally, and in both groups the question of a foreign body, septic or aseptic, either pressing on the membranes or embedded in the brain, is of great importance from a prognostic point of view. Almost any injury to the head, however slight, may cause temporary cerebral disturbance, varying in duration from a momentary stunning to a more prolonged period of coma. The length of this period of unconsciousness does not seem to bear any direct relation to the severity or duration of subsequent cerebral symptoms, if they should appear. It is also impossible to absolutely predict whether any given case who shows no immediate symptoms, will continue exempt from remote ones, for in many instances the mental disorder does not appear definitely for months, or even years after the injury from which the patient appeared to recover perfectly at the time. Such being the case, the surgeon has to consider the propriety of immediate operation in head cases, not merely to relieve actual pressure symptoms if present, but also and perhaps in a larger number of cases than at present, to prevent subsequent mental disorder and lessen the risk of traumatic epilepsy more or less severe and pronounced. Of course in all head injuries, simple or compound, with pressure symptoms, immediate operation

should be performed for their relief, but in certain other cases, even where no active pressure symptoms are present, it seems to be a mistaken line of treatment to run the risk of septic or even aseptic inflammation and the possibility of further cerebral symptoms, if such could be forestalled by an operation at the time. In this respect the presence of a foreign body is of great importance in deciding whether to operate or wait, and the probable septic or possible aseptic condition of the body is perhaps the crucial point. If it be undoubtedly septic, every effort should be made to remove it, for the subsequent septic inflammation is almost sure to be fatal. But if it be probably aseptic it may be well to wait, so long as no acute symptoms are present, for there are many instances of lodgment of foreign bodies in the brain without immediate symptoms, and if the patient can be tided over the immediate risk of the accident without an exploring operation so much the better. He should not be indefinitely lost sight of, however, for as already pointed out, the prognosis is always very unfavourable, even though he survive ten years or more. It has likewise been pointed out that a very large proportion of convicts and dangerous criminals and lunatics bear the marks of head injury of varying degree and age, and no man can tell how much their line of life might have been varied, had operative interference in place of masterly inactivity in the absence of acute pressure symptoms been practised. In some situations, such as the base of the skull, direct operative procedure is well nigh impossible, and the expectant line of treatment is the only one which can with safety be carried out, unless it be deemed advisable to relieve pressure indirectly by trephining the vertex. The following are records of such cases. One is reported by Walker of Peterborough. The patient was seen three hours after receiving a bullet wound of the base of the skull and brain. He was semi-conscious, bleeding from the mouth, nose, and left ear; left eye was closed by ecchymosed lids, and a bullet wound was seen at the back of the hard palate. There was a puffy swelling and fractured bone on the vertex, which was removed by incision; some brain matter escaped and also the bullet, weighing 135 grains. He remained for three days semi-conscious, drowsy and quiet, but on the fourth day there was suppuration at the back of the orbit, and he was delirious, obstinate and troublesome. The abscess discharged on the eighth day, and the delirium subsided. Ultimately there was slight exaggeration of the

previous mental peculiarity and various paralyses. In such a case nothing more could be done. There are also many other instances of injuries with or without loss of brain substance from which the patients recover, but the ultimate and remote mental condition is seldom given, and can only be gauged by the accounts of cases which required operation for the relief of traumatic epilepsy or other cerebral symptoms. In the War of the Rebellion, nineteen cases recovered after bullet wound with lodgment in the brain. In four the site of entrance was above the right eyebrow; of these, one developed epilepsy two years after the injury was healed; a second had to be discharged from the service owing to persistent headache and hallucinations; the third was pensioned four years after on account of vertigo on exertion; while the fourth, whose report is very meagre, returned to his regiment after being in hospital two months. Out of the whole nineteen cases, seven had vertigo, two epilepsy, while the remaining cases, who suffered variously, complained of paralyses, pareses, headache, impaired vision, and hearing. All, however, did not have sequelæ, at least some were apparently healthy five to eight years after the publication of the history, from 1861 to 1865.

In many of these cases the recovery may be due to the remarkable deviation which the bullet may take in its course within the cranium. Thus Ryan reports a *post-mortem* record of a man, a criminal, aged 74, who had attempted suicide by hanging; two years previous to death he shot himself with a revolver held three feet from his head; when he died he was demented. The *post mortem* showed that the bullet, which was ·38 inch, had entered the frontal bone and deflected round the vertex, being found on the tentorium cerebelli adherent to the dura mater and lying in a small cavity on the surface of the occipital lobe close to the median fissure.

It has already been pointed out that trauma, like acute disease, sometimes has a beneficial effect on a previous mental disorder. Mickle, Allison and others have reported such, and Sloan mentions the case of a man with a strong hereditary history of insanity, who was really quite certifiable before he shot himself with a revolver. The brain was extensively injured in the frontal region, and the bullet was found on the cribriform plate. He recovered and is now quite well mentally. Clouston has reported a similar happy result after fearful head injuries having been inflicted suicidally; the case recovered and is now free from mania.

Lucas-Championniere recorded a series of sixty-four cases of head injuries, ten of which were recent. Three were fatal and were bad from the beginning, but seven were successful, though some were almost hopeless apparently. He considers it best to interfere early, and Mynter, in a series of twenty-seven cases, was also of this opinion. Annandale says that if one is in any doubt as to the course being taken by a traumatic intra-cranial inflammation or suppurating condition, it is best to explore at once, as it is also the best to do in cases of ear disease and other idiopathic conditions if there are any localising symptoms. Likewise in traumatic hæmorrhage, operate at the seat of injury, and if nothing be found there open at the site of counterstroke. If the base is fractured and severe pressure symptoms be present, trephine, and if there be evidence of irritation, such as epileptiform seizures, the wound must be thoroughly explored and all depressed bone, spicules, foreign bodies, or extravasated blood removed. The convulsions must be always watched from the very beginning, so as to obtain as accurate localisation as possible of the primary seat of irritation.

Macewen reports four cases of cranial injury, all of whom recovered perfectly at the time, but within a year, two had cerebral symptoms and the other two also suffered even later. It is thus evident that if compound depressed fractures or even cases of simple depression be not interfered with on account of the absence of symptoms apparently severe enough to warrant immediate operation, great risk of subsequent cerebral and mental derangements is run, and is out of all proportion to the risk of any operation performed at the time of the accident. In some cases operation even may be unable to prevent the supervention of cerebral or mental symptoms, on account of laceration or other severe injury to the brain, but it undoubtedly puts the patient in the best possible condition. Quenu remarks that in penetrating wounds of the cranium, it is generally wise to operate at once, unless examination shows a foreign body at great depth. Wharton reports the result of 316 cases of foreign body in the brain; 160 recovered. The object was removed in 106 instances, and of these 72 recovered. The occipital region was found to be twice as fatal as the frontal or parietal, which agrees with Brodie's opinion. How many more of the 210 would have recovered if they had been operated on it is now impossible to determine, but from these figures the immediate line of treatment seems to be about 30 per cent. better.

Acute insane conditions, excluding the primary delirium or coma, are rarely the immediate results of head injury, there being in most instances a longer or shorter interval of comparative health, though perhaps with some subtile changes in character, memory, &c., before the actual traumatic insanity or traumatic epilepsy is shown. Thus these operations at the time of recent injury are beneficial, not only in giving free access to the inflammatory and other discharges, and removing the immediate pressure symptoms if present, but perhaps most of all as a powerful preventive of mental derangement and traumatic epilepsy in the future history of the case. Sometimes the epilepsy precedes the insanity, at others the insanity precedes the epilepsy. Having done what is best for a patient with a recent head injury, we must not be too sanguine that no further trouble will supervene, for Hilton's teaching that "a concussed brain is a bruised brain" is as true to-day as ever it was, and no amount of operation at the time or hereafter can alter it except in this way, that the pressure symptoms and sources of irritation to this bruised brain are at once removed. Another trouble which is probably quite independent of any early operative interference, is the development of a cerebral tumour after an injury. Bastian remarks that "the occurrence of intra-cranial tumour after a blow on the head is a sequence of which it would be possible to collect many cases. The liability may be greater in children with active formation processes. The blood may lacerate the tissues and the reparative process may start a growth, or the blow may cause a modified meningeal inflammation leading in one case to the formation of lymph, in another to widespread meningeal growth." When intra-cranial tumours do occur, Bramwell found that only a limited number are able to be successfully removed.

Taking a case of head injury with not very severe symptoms and which has not been operated on, let us try to follow its possible course in the remaining years of life, after the primary symptoms have subsided and he appears to have recovered.

(1) The patient may have no serious mental or cerebral symptoms develop at all. (2) Various changes in his character may appear sooner or later; he is not the same man as he was, as to memory, temper, ability to work, &c.; more or less persistent headache may be his constant companion, while vertigo and other hallucinations, delusions or a state of general confusion of ideas, may gradually supervene,

but the frequency with which such symptoms happen, it is practically impossible to determine accurately. (3) Actual insanity may develop, either with or without traumatic epilepsy, and the number of such decided cases can be more accurately stated, though still there is considerable margin. Thus Schlager, of Vienna, puts it at 10 per cent. after analysing 500 cases; Krafft-Ebing, out of 462 cases puts it at 1 per cent. In the reports of the Indiana Hospital for the Insane, out of 3,034 cases admitted in four years, 4 per cent. are said to be traumatic. This latter figure is more in accordance with British experience, for in the ten years, 1878 to 1887, in all English and Welsh asylums and houses, accident or injury was the cause in 5·2 per cent. of males, and 1 per cent. of females, which is equal to about 3 per cent. all over, and in Scotland Annandale put the figure at 2 per cent. These figures, so far as I can make out, do not include cases of idiocy and its congeners, resulting from injury to the child either before or during natural labour or after instruments, and the surgery of such cranial conditions has already been mostly treated of under microcephaly. (4) The time after the injury at which mental symptoms develop varies greatly. Thus Christian found that in 100 traumatic cases, 54 had an interval of from one to five years before any definite symptoms appeared; in 21 it varied from five to ten years, in 11 it was from ten to twenty years, in 7 from twenty to thirty, and in 7 it was more than thirty years since the accident happened which was credited as the cause of the mental condition. As a rule the more remote the injury, and the less gross the lesion found, the more doubt one can have that some other cause such as induced alcoholism, or a latent lesion or diathesis, may be a concomitant excitement to the insanity. (5) The form of insanity which occurs varies and comprises idiocy, recurrent mania, dementia, mania e potu, dementia with epilepsy, and senile dementia. Crichton Browne noted that in 42 cases, 18 were mania of various types, 13 dementia, 5 dementia with epilepsy, 3 general paralysis, and 3 melancholia. Christian in 104 cases, found 16 dements, 29 maniacs, 47 general paralytics, and 12 epileptics; while Eccheveria particularly emphasised the prevalence of moral changes, and found that in 19 cases 2 had satyriasis, 1 nymphomania, 1 kleptomania, 3 pyromania, and 16 homicidal impulses. Christian's percentage of general paralysis is probably excessive, if applied to this country, for in 341 cases of general paralysis in Devon county asylum,

103 had a well ascertained history, and of these only 12 could be said to be traumatic, while many alienists put it at an even lower figure, though it will vary probably with the districts from which the patients are drawn. (6) The chief pathological changes found in insane patients whose insanity was traumatic in origin consist in local or general conditions, the latter being either a primary result of the trauma, or secondary to an originally local lesion. The local changes may consist of adherent membranes, bony spicules, cysts, &c., while the more general are dilatation of the ventricles, puckering of the cerebral substance and scattered hæmatoidin crystals, the remnants of capillary hæmorrhages, and most important, a general sclerosis with white softening. (7) To compare with these lesions found *post mortem*, the following have been found in the course of operation, in cases which have suffered from traumatic insanity. Depression of bone is most frequent, and then adhesion of the membranes to the skull or cerebral surface, osteophytes projecting from the inner side of the skull, and fragments of the inner table pressing upon or wounding the membranes or brain substance. In some cases no depressed bone was found, but only a cerebral cicatrix or other evidence of old contusion. It is most important to remember that the inner table may be splintered or even necrosed, though no evidence of injury to the outer table be found and merely a history of scalp wound or contusion without depression be given. Other lesions found are thickened and congested bone, diseased bone, serous or hæmorrhagic cysts in the membranes, and in some cases unsuspected foreign bodies have been discovered. Thus in the great majority of cases the lesion is superficial in its site, comprising chiefly pathological conditions of the scalp, cranium and membranes. Duret and Powell lay particular stress on the part that an abnormal dura mater plays in the causation of mental derangement. Duret drew the following conclusions after a study of this subject. (1) The The dura mater is abundantly supplied by the fifth sensory nerve. (2) Irritation, specially of the inner surface, causes pain. (3) Irritation causes reflex action, more general than that the result of cerebral irritation, and similar to that resulting from peripheral sensory irritation. (4) The reflex results may be on the same side, and on the opposite side, not as in direct cortical lesion. (5) Secondary contracture appearing on either or both sides is due to reflex dura matral irritation after injury. (6) Reflex vaso-motor dis-

turbances also follow. (7) The varied manifestations of dura matral irritation complicate and mask phenomena due to nerve lesion proper.

In 67 cases collected by Powell, 27 had depressed bone distinctly pressing on the dura mater, 15 had osteophytes piercing it with or without depressed bone, 4 had cysts, and 7 were abnormally adherent. In 8 whose dura mater appeared normal, 6 were cured and 1 relieved by operation, and often the recovery is too rapid to allow of regeneration of actual nerve tissue. The injured part of the dura mater is no guide to the form of insanity, as all forms of insanity follow indiscriminately injury to any part of the skull. The above details have been gone into fully, so as to afford a sound basis for surgical procedure in these cases, and it is evident that if the chief cause in the majority of cases is a dura matral irritation, its successful surgical treatment is practically assured. In any case it is perfectly justifiable, as the prognosis is usually unfavourable if left untreated.

Although trephining or trepanning is one of the oldest surgical operations, it is only comparatively recently that it has been systematically applied to such cases. In 1705 Le Motte trephined for traumatic epilepsy, and 99 years later Cline repeated the operation on a sailor who was comatose for a year after a fall on the head. The removal of the depressed area of bone was followed by a satisfactory recovery. Since then various isolated cases have been reported at different times, but it was not until West, of Birmingham, published his case in 1879 that the subject was thoroughly grasped and taken up. As the epilepsy is the most prominent feature of the case usually, its relief is a great consideration to the patient, and in all probability the insanity accompanying it has more of a common cause than that which follows in the wake of idiopathic epilepsy. In some cases the insanity was the earliest symptom, and epilepsy followed; in others the epilepsy preceded the insanity, which is the more frequent arrangement when they coexist, while in a third group of cases the insanity and epilepsy appeared together, and proceeded concurrently; and lastly there may be insanity without epilepsy. It is quite impossible to determine the factor of delay in the appearance of the symptoms, and when they do appear, why they should do so apparently so erratically.

The various cures and curious cases of lapsed memory are too numerous to give in detail, for it is now necessary

to try and define what cases are suitable for operation. In the first place one is not always able to reach the seat of lesion, which is the point of irritation, as in cases of basal fracture which are not infrequently subject to mental derangement. Again, the evidence of gross lesion of considerable extent may be so clear that probably no mere superficial operation would benefit, and a more dangerous one would not be justifiable. But when there is a definite localising of symptoms such as pain in the scar, or tenderness, or mental or cerebral symptoms produced by pressing it, then operative interference is demanded. Usually the mortality of such operations is slight and it is well worth the risk to undergo it. The mortality in Powell's 67 cases was 5, and in 45 other cases collected by me, during the past fifteen years, only 2 were fatal. In the 67 cases 41 are noted as mental recoveries, 12 as of great mental improvement, 5 as of slight improvement, and only 4 in whom no improvement took place, though in 2 of these 4 there had been temporary benefit. In one of the mental recoveries it did not take place until five months after the operation, and the nature of the insanity, acute mania, may allow it to be thought that it was non-traumatic in origin, as it took so long to improve.

In all such cases the head must be completely shaved so as to allow of a most thorough examination of the skull, and a history of an apparently trivial injury even must not be disregarded, seeing how readily the inner table may be splintered or detached without any obvious injury to the outer table.

Lapse of time appears to be no bar to an operation, other points being in its favour. Lucas-Championniere, in a series of 54 cases of cerebral disease, either very old traumatic or non-traumatic, found in all except the 7 fatal cases and 2 others, that there was either a cure or marked improvement in the symptoms. The 7 fatal cases would all have died shortly, and he considered that none of their deaths were directly due to the treatment. He also found in this series that 50 per cent. of Jacksonian epilepsy cases died soon, but the exact cause of death was not stated in this relation, though probably they consisted in gross lesion of the brain. In his opinion, pain is the best indication for trephining in disease; it is always relieved, sometimes cured, as is also the vertigo which may accompany it, but in both instances the operation has to be free, and may have to be repeated. When cure is complete, the patient is able to stoop with-

out feeling giddy. Good result is also to be obtained in the diffuse encephalitis or meningo-encephalitis of trauma, which closely resembles general paralysis, and is ultimately certainly fatal, though it may be arrested by operation if performed sufficiently early. Mynter had a series of 27 cases, and of these 15 were fractured skulls, 4 of which had also a basal fracture and died. Of 5 cases of traumatic epilepsy 4 made great improvement.

In 11 other cases which I have collected from various sources, I find, that the average period at which operation was performed was about six years after the injury. In some the primary cerebral symptoms seemed quite cured, in others the mental derangement, the direct result of the injury, merely persisted and became aggravated as time went on. Of these 11 only 1 was said not to be improved a year after the operation, though he had obtained temporary relief. In the majority of these cases, sufficient time seems to have elapsed, between the time of the operation and the date of publication, to enable one to infer with a reasonable amount of certainty, that the improvement or cure was permanent or increasing. When these facts are taken into consideration along with the evidence afforded by Walsham's and Powell's lists of cases (in the list of the latter only 4 showed no improvement), it is perfectly evident that in the first instance, when a case of compound fracture of the skull comes under surgical treatment, it is best for the future cerebral condition not to employ merely expectant treatment; Second, that even when the injury appears trivial, serious cerebral symptoms may result years afterwards from slow osteo-sclerosis, chronic meningeal irritation or osteophytic formation; Third, that the primary operation should err rather on the side of freeness than the reverse; and Fourth, that in old or remote cases, it is certainly a surgeon's duty to advise and practise cranial operation in the hope that some improvement may take place, as the operation is in itself practically free from danger, whereas the mental condition of the patient slowly but surely degenerates and deteriorates, and he dies from his injuries. At the same time it has to be noted that every one who has had a trauma and dies with cerebral symptoms does not die of a disease resulting from the said injury, as *post-mortem* examinations in some cases certainly prove.

Part V.

We may now consider those cases of insanity or mental disorder which are apparently directly caused by surgical operations. In a large proportion of instances, as in pure traumatic cases, there is an absence of hereditary tendency to insanity, but in others there may be noted either a hereditary weakness or an acquired neurosis, which may be a powerful predisposing cause in these particular cases. As regards the particular operation it is well, in the present instance, to entirely exclude cranial or cerebral surgery for obvious reasons, and it has already been shown that anæsthesia, sepsis, uræmia, and other auto-intoxications may, in certain cases, be more to blame than the actual operation. Thus, so far as one is able to differentiate, the operations now considered are not on the head and are aseptic, while the probable effect of the anæsthetic, and other intoxications if present, will be alluded to individually if necessary. The occurrence of mental derangement after operation is unfortunately too frequent to be put down to a mere coincidence or to the operation acting as an exciting cause in a person predisposed to insanity. For in many instances, on the one hand, there is no hereditary or acquired neurosis, while on the other hand, cases with a history both of hereditary insanity and with "mental" relations, or of an acquired neurosis, may undergo serious major operations and exhibit no tendency to mental disorder.

The type of insanity which is the rule may be described broadly as Acute Confusional insanity, which is defined by Norman as a form "intermediate between the acute mania and acute dementia of older writers, and characterised by the engagement of consciousness in the form of a dream-like confusion, together with hallucinatory disturbances." But in many recorded cases it is more definitely, though

perhaps less accurately, noted that the insanity was of a more restricted form, such as mania, melancholia, &c., and of 163 cases which I have collected and in which this more definite statement of type is made, 67 are described as mania, 45 as melancholia, 1 as hypochondriacal, 2 as delusional, 10 as dementia, 8 as alcoholic, 24 as acute confusional and hallucinatory, 2 as nymphomania, and 4 as hysteria. It is thus evident that almost any form of insanity may be a sequel to surgical interference, but that mania and melancholia are the two sub-groups of the broad acute confusional type that are most frequent. Sears, in 185 cases, remarks that the type in all instances was the acute confusional, but I am unable to determine whether any of my 165 cases are included in his 185 cases, or whether he does not merely consider them all as acute confusional without subdivisions. In any case, it is now definitely decided that this post-operative insanity is entirely different in onset, course and cause, from the delirium which may appear after an injury or operation in an alcoholic patient, for this is merely delirium tremens pure and simple. The age at which this sequel was found to be most frequent by Sears is, in 67 per cent. of 80 cases, over 40 years, varying from 10 to 80. Frankl-Hochwart, in commenting on 32 cases after ophthalmic surgery, says that 15 patients of ages varying from 30 to 90, were affected by the acute confusional form, while 7, merely termed "aged," suffered from simple confusion and dementia. In 29 cases, in which I have notes of the age, the average age is 47·3, 11 of the 29 being under the age of 40, the remaining 18 varying from 40 to 73. It may again be noted that the average age of 17 septic cases was 45·9, and that 6 of these were under the age of 40. Thus no doubt the age is a most important point, and may be taken as indicating more or less exhaustion from cerebral malnutrition, resulting either from acquired atheroma, or from more or less normal senile arterial changes. The sex has also to be taken into consideration as an important element, for there is no doubt that mental disorder is far more frequent after gynæcological than after general or even ophthalmic operations, but if gynæcological procedures be excluded, and merely general surgical cases be considered, the great preponderance of the female sex element at once disappears. Thus Sears finds that out of 167 cases in which the sex was mentioned 102 were women, but if strictly gynæcological cases be subtracted, there is little difference between the

sexes. He also found that in 41 ophthalmic operation cases there were only 16 women who had mental sequelæ, and in another series of 18 consecutive cases 10 were men. Thus in eye surgery the balance is rather to the disadvantage of the male sex, and indeed in some statistics, ophthalmic surgery runs gynæcological surgery very close as to the number of sequential mental cases. Sears, in 185 cases, found that 60 were gynæcological, 62 ophthalmic, mostly cataract, 10 excisions of the mamma, while 45 were general surgical cases, including 4 extractions of teeth, 1 catheterisation, and 2 simple chloroform anæsthesia. Kiernan, in 186 cases, had only 35 ophthalmic cases and 65 gynæcological, while Le Dentu, in 68 cases, states that 38 had had a gynæcological operation performed.

In 124 cases which I have noted and in which the sex and operation is definitely stated, 102 are females, and of these 95 were gynæcological operation cases, 2 were other abdominal operations and 4 general surgical cases, with 1 eye case. There were 18 males affected, 3 with hernia, 2 eye cases, 3 bladder cases, and the rest general surgical cases varying from an epithelioma of the lip or ordinary piles, to amputations. Besides these, another case of double hydrocele was admitted into Ward 6 in the Edinburgh Infirmary, but no further note of it can be traced, and one was admitted into Hanwell Asylum acutely maniacal suffering from a strangulated hernia. Fourteen cases are indefinitely noted, either as regards the sex or operation; they include 1 strangulated hernia, 2 eye cases, 1 amputation of the wrist, and 10 others which were probably gynæcological.

The frequency of this unfortunate sequel to surgical interference varies considerably, according to different authorities. Thus Homans in 1,000 laparotomies, including 700 ovariotomies and hysterectomies, had only 2 cases. Werth had 2 cases in 228 abdominal operations, Schnabel had 12 cases of insanity in 186 ophthalmic operations, while in the Massachusetts Eye and Ear Infirmary, of 128 cases operated on, only 4 were insane, one other was restless during the night and tore off the bandages, and several others only behaved badly at night from doubtful mental unsoundness. Denis in his thesis computes it at 2·5 per cent. of operation cases, but this is evidently an absurd exaggeration of the frequency. So far as I was able to make out after examining the clinical records of cases in Mr. Annandale's wards from 1882 to 1894, it appeared that

about 5,500 operations of all kinds had been performed, including cranial and cerebral operations. I have already noted the cases which had cerebral sequelæ the result of sepsis, uræmia, anæsthesia and simple trauma or cranial injury, and there are 10 other cases who had mental symptoms after operation, and in whom so far as one can judge, none of the foregoing causes were present. I have also a series of 50 cases of operations performed in my private practice during the past eighteen months up to April, 1895, of whom 1 became acutely delirious. Thus in about 5,600 general surgical cases there were 11 instances of mental derangement, which is about 2·0 per 1,000 over all, a very different figure from 2·5 per cent. given by Denis, even though to a large extent in connection with purely abdominal cases.

Besides the age, sex, and nature of the operation, there are certain other more personal matters which undoubtedly have great influence in the causation of insanity under these circumstances. Thus there may be a hereditary tendency, which Sears found marked in 13 out of 60 cases, but perhaps still more important is the actual personal habit of mind and body during every-day life, or at any rate shortly before the operation. In this way Sears noted that no fewer than 34 out of 74 cases had been previously "queer, eccentric, hysterical or nervous." Still, such a personal history, even when associated with similar collateral failings, may be unable in certain cases to cause mental derangement, while in others after the same operation insanity may follow. This point is exemplified by the family and personal history of a case of ovariotomy, who became acutely maniacal within a week after the operation by Mr. Annandale, whereas in contrast, a poor woman in my practice in bad condition, eccentric and taciturn, with several relations similarly disposed, was operated on by Mr. G. E. Keith. An ovarian tumour weighing 28 lbs. was removed, and she never had the slightest trouble. Likewise it does not follow that mental disturbance will be an inevitable sequel to one operation because it occurred after a previous one of a different nature, for Ill reports an instance of a woman who had melancholia after an urethral operation, but no mental symptoms after an operation of another kind; while, contrariwise, one of Le Dentu's cases had had puerperal mania and was perturbed after a surgical operation. This same want of unison in sequelæ has already been noted in cases of puerperal insanity, and also

in insanity after anæsthetics. Alcoholism is certainly the most important acquired neurosis, which might act as a predisposing cause, not merely to an attack of delirium tremens, which has already been excluded in these cases, but of actual insanity. Sears had 13 cases in which this was a possible factor, in 2 it was a family failing, in 11 it was personal.

The use of certain antiseptics has been blamed occasionally for the appearance of post-operative delirium, and of these substances the most important are Carbolic acid and Iodoform. The former is in some cases very readily absorbed, as is evidenced by the rapid appearance of carboluria, but actual poisoning by carbolic acid in this way is very rare. The symptoms likewise are hardly those which are seen in post-operative insanity. Carbolic acid acts as a narcotic to the brain, specially affecting the basal ganglia. When swallowed the symptoms consist of rapidly supervening stupor, total muscular relaxation, anæsthesia and stertor, and nearly all the cases die comatose. Similar symptoms were described by Hamilton in 1873, in an instance where strong acid was used in dressing a case and the child died. One would expect cases more frequently if such were a cause of post-operative insanity, and the mere fact of dark urine is no guide to the seriousness of the absorption, or to the imminence of serious toxic symptoms, for the same can be produced by salol or carbolic acid in medicinal doses.

It seems, however, to be very different in the case of Iodoform. In this substance we have a chemical agent of the same type as chloroform, and undoubtedly it is absorbed in some cases, and in some of these severe mental symptoms may follow. The chief symptoms arising from its absorption are a taste and smell in the mouth, coryza, languor and headache, all of which may be masked by a mild delirium. In other cases the delirium is most acute and incoherent, without rise of temperature, but a dry, dirty tongue. This may appear at once as soon as it is absorbed, or not until some time later, during which it has probably been accumulating, and in this case there may be some melancholic symptoms as well. Chiene has had two cases of iodoform insanity after operation, and Clouston has also studied this toxæmia. In all of Le Dentu's cases iodoform was used most sparingly if at all, and in Werth's cases practically none was used. As a rule, too, in ordinary laparotomy cases iodoform is very

little used, but it is after them that the majority of insanity cases arise.

In some cases the Morphia, often given after an operation, has been credited with causing mental symptoms, and Ball noted such in one case, but in these as in the majority of acute toxæmiæ, the entire excretion of the agent is accompanied by a remission of the symptoms.

Véne mentions that chronic Plumbism may act as a predisposing cause, but I have made enquiries in this country through Oliver, of Newcastle, and Richards, late of Hanwell asylum, and neither of these experienced gentlemen can recollect such a sequel, and they would be disposed to consider it rather in the light of a coincidence than of cause and effect. At the same time plumbism predisposes one to attacks of explosive violence, and Régis believes that in such a case, the operation may be the exciting cause of an acute plumbic mania, just as it may precipitate or excite an alcoholic delirium tremens. But the intimate association of chronic plumbism and arterial and renal degeneration, over and above a possible actual nerve lesion, must be also taken into account in such a case, and it would be well for a plumbic patient, who required an operation, to undergo some medical treatment in the hope of eliminating some of the lead before being submitted to the surgeon.

Uræmia has been treated of, and it is now only necessary to mention that the mere absence of albumen does not exclude the possibility of renal disease. Wilson found too that anæsthetics have an influence on the kidneys, for he discovered casts after anæsthesia, though there were none before, and, such being the case, it seemed to him that anæsthesia may be able to provoke, determine or aggravate a urinary insufficiency. Hence it is always necessary to carefully examine the urine not only for albumen and casts, but also for the total amount of urea excreted in the twenty-four hours. In cases where the operation is on any part of the urinary track this is imperative, as transient uræmic delirium is not uncommonly thus excited, and may be even due to operations unconnected with the urinary organs. Other predisposing causes which may act with more or less severity according to the hereditary and personal tendencies, are, the natural excitement and nervous tension produced by thinking about an operation, whether the anæsthetic is safe, whether the operation will be successful, and many other thoughts which must come before a patient, no matter how strong and how brave, at such a time. In other instances

it requires rather a purely emotional disturbance to upset the mental equilibrium, such as occurred to Ahsfeld, who had a patient become insane after the introduction of a vaginal speculum; or Billroth's two cases of rhinoplastic operation, where doubtless the disfigurement and deformity led to morbid introspection and melancholia.

Then there is the actual physical trauma to various more or less sympathetic organs and structures, and along with this must be included those cases where an organ is removed, such as the thyroid, ovaries, testes, &c., and in which nervous symptoms may appear, in the former case certainly as a result of the absence of the special thyroid secretion, and in the latter perhaps partly so, and partly on account of the trauma to the rich sympathetic plexuses effected during ablation.

Savage of Birmingham says he has never seen insanity follow the removal of only one ovary, though statistics show that in the majority of cases in which insanity has followed ovariotomy, the disease has been unilateral. Althaus describes two forms of insanity following oöphorectomy: (1) a violent delirium lasting a few days; (2) pronounced melancholia; but in other cases there may be a more or less hypochondriacal condition, or one of hysteria, stupor or even dementia. Cullingworth states he has never seen a case of insanity following removal of normal ovaries, because he never did such an operation, and he did not believe that the removal of abnormal organs would be likely to cause mental trouble. Such belief, however, is untenable in the face of facts, though it may be difficult to see why the loss of two ovaries that are practically physiologically functionless, should produce such an impression on the nervous system. Again, in the case of hysterectomy, Dr. T. Keith's experience shows that insanity follows in 10 per cent. of the cases. In 138 cases of all sorts that I have collected, there are 16 hysterectomies, so that though some authorities state that 10 per cent. is unusually high, it does not seem to be so from these figures.

In cases of insanity following ophthalmic surgery, Frankl-Hochwart gives the following reasons for the occasional occurrence of this sequel:—(1) There are numerous nerve trunks connecting the eye and brain, and lesion of the eye itself occasionally produces psychical affections. (2) Irritation of any sensory organ is reckoned a cause of insanity. (3) Predisposition by the depression caused by the blindness. (4) Advanced age at which cataract operations are often

performed, but younger cases have also similar disturbances. (5) The darkness cure is depressing, some people getting hallucinations on merely closing their eyes, and the longer the darkness, the greater the predisposition, though it may follow operations where no darkness has been employed, and also in cases where no operation, but only darkness practised.

Acute cerebral anæmia from loss of blood has already been considered, and in certain other cases perhaps a gouty diathesis or recent infective fever may have something to do with it, while the part played by atheroma and other arterial degenerations in the cerebrum have also been frequently alluded to as a most important agent in producing a condition of malnutrition; then the excitement or the anæsthetic causes congestion, and so overaction may readily take place, and even dementia may occur in old people. Lastly, the patient may have had a latent or dormant cerebral lesion, which produced no symptoms so long as his usual life was led, but which only required something unusual to happen to bring it forth, such as a trauma, fatigue, alcohol or operation. Thus any patient almost may have some such weak point in his organism unknown and unknowable until it breaks down.

We must now shortly consider the Accession of this form of insanity. There seems to be great variability in the time of the incidence of the mental derangement, and also in the mode of its development. In some cases it gradually creeps on, just as puerperal insanity sometimes does, and then suddenly freely shows itself; while in others it suddenly appears, with or without a short prodromal melancholia or other symptoms hardly noticeable; both of these modes of onset have been noted by Dupuytren, G. Thomas, and others. In Véne's series of 68 cases, including Le Dentu's, the average date of accession was from the second to the fifth day. In 20 cases noted by Denis only 2 were delirious immediately after the operation, and in Dupuytren's 7 cases only 1 was sudden in accession.

Eillebrown had 3 cases whose insanity only made its first appearance three to four months after the operation, and in Werth's 6 cases, 2 occurred after complete cure from the operation, and 2 others not for two to three weeks after the same operation. In 20 cases of my collecting, in whom the date is more or less definitely stated, I find that in 13, whose insanity commenced within sixteen days, the average day of its appearance was

the fourth day, but taking all the cases, including 1 not appearing for six weeks, 1 at a month, and 2 at three weeks and over, the average day of incidence is about the eleventh. This average day is therefore considerably later than that which was found to be the case in septic instances, in which it was the fourth, but if only the cases occurring in the first sixteen days are counted it is seen to be the same. The time after the operation at which mental symptoms develop is also of importance in trying to arrive at a conclusion whether the anæsthetic had any influence in its causation. Savage remarked that in cases of chloroform mania some developed at once, but others not for hours or days, and that a fair number exhibited symptoms within a week after the inhalation, some showing marked excitement, others unusual depression, but there may have been irritability from the first. This does not seem to afford much help to differentiate the several possible causes, though at first sight one would expect that chloroform insanity would appear within a reasonably short interval after its inhalation and hence a pure case would show symptoms either immediately after recovery from the anæsthesia, or within twenty-four hours; but this time limit is perhaps too hard and fast a line to draw between those due to chloroform and those due to shock or nervous excitement. It is also worthy of remark that though the fourth day after the operation is the average date of accession in the early cases, in a certain number of other cases, not necessarily abdominal, the insanity did not appear until after the wound had healed, and even in the great majority of abdominal cases there is practically no wound on the fourth day, so that in these cases any septic infection from the cutaneous wound is almost absolutely excluded. Sears found that in 86 cases, 50 appeared in the first three days, 15 between the fourth and seventh, 14 between the eighth and fourteenth, 4 between the fifteenth and twenty-eighth, and 3 in two months, which, on the whole, is similar to my results on a smaller scale.

The Duration and Termination of the insanity was found to be variable. Thus Véne reports on a series of 68 cases, that 5 became incurable or chronic, having lasted one or more years, 13 lasted one to two months, 33 less than a month, 6 were of unknown duration but not fatal, and 11 were fatal. He is therefore of opinion that post-operative delirium is sometimes fatal, rarely chronic and mostly benign. Sears states that out of 91 cases, 60 per cent.

recovered, 21 died, and 16 remained insane. Krafft-Ebing computes the recoveries at 70 per cent., which rather resembles the statistics of puerperal insanity, in which the recovery percentage is from 65 to 75.

Of 15 cases of which I have notes as to the more or less exact duration, in 10 the average duration was eleven days, 2 lasted for two months, 1 for eight months, and 2 were more chronic cases. There were 2 fatal cases, one on the seventh day after hysterectomy reported by Swain, and one on the twenty-eight day from senile dementia and refusal of food, after supra-pubic cystotomy by Annandale. In 5 others the duration is not mentioned, but they were evidently not fatal.

Sears in his cases found that the actual age did not have such an influence on the recovery as the sex, for out of 25 males, 22 recovered, 2 died and 1 remained insane; while out of 64 females, 32 recovered, 17 died and 15 remained insane. If the case is not fatal, then the acute variety has a better percentage rate of recovery and recovers sooner than the more tardy to develop, which is as a rule longer in duration, and is more apt to drift into a chronic insanity, more especially if the patient have any predisposition or be at all aged or atheromatous. All these facts as regards this form of insanity, the varying time of accession, duration and termination, agree with the general features of the broad type of Acute Confusional Insanity, which includes likewise puerperal, postfebrile, climacteric, rheumatic and some other groups of mental derangement from a variety of causes.

It is also to be noted that the insanity does not always by any means subside at once on the complete healing of the wound, in those cases in which it appears before complete cicatrization had taken place; this must be taken along with the fact previously mentioned, that it may develop even after cicatrization is complete. There seems in all cases to be no interference with the trophic functions, as the wound almost invariably proceeds satisfactorily, and the absence of marked increased temperature or pulse rate, such as occurs in septic cases, is one of the most distinguishing features of this form of mental disease.

Perhaps the best description of post-operative delirium is that which Dupuytren gave in his clinique in 1832, though he had noticed it after a fracture of the tibia in 1819. Schroetter was, however, the first to draw attention to this complication of traumatism or surgical operation. At this

early date the chief point in the discussion was whether this delirium was not merely an example of delirium tremens, but it is now practically settled, that though delirium tremens in all its classical features may appear frequently in alcoholic subjects, after a traumatism or operation, there is a different delirium which has no relation to alcoholism, which may and does appear in some cases of trauma or operation. "If, on the evening, the next day, or the next again after a fracture, dislocation, or operation of any kind, the patient appear in a state of unnatural gaiety, is loquacious, with a bright eye and brusque and involuntary muscular movements, and if he affects a courage which fails, be on your guard. Ere long he manifests a singular confusion of ideas as regards places, persons, and things. He is a prey to insomnia and is ordinarily dominated by an idea more or less fixed, but often in connection with his profession, his tastes, age, or sex. He is engaged in a constant jactitation, the upper part of his body is bathed in an abundant perspiration, the eyes become brilliant and injected, his face animated and flushed, and he utters with extraordinary volubility menacing words and terrifying cries. The anæsthesia is often such that the subject of a comminuted fracture of the leg will take off his splints and walk on the broken limb without showing the least pain. Others with fractured ribs, who became agitated, sang loudly without manifesting any suffering, and lastly a patient who had been operated on for hernia, introduced his fingers into the wound and coolly amused himself by pulling out his intestines as one would do in a cadaver. In spite of the apparent gravity of these symptoms the pulse is tranquil and calm, and only experiences an alteration in relation to the disordered movements. There is no fever and the excretions are performed with their accustomed regularity, but the appetite is gone; at the end of two, four, or five days the disease may terminate fatally, but much more frequently recovery follows. When this happy termination is going to take place, the calm reappears with an apparent crisis, as suddenly as the disorder commenced. The patient falls into a deep sleep, and when he awakes he has his full reason without knowledge of what has passed. This delirium may be renewed twice or thrice after one or two days remission, and after each relapse he is more feeble."

The general features of acute confusional insanity could not well be better described, but it is necessary now to give a brief résumé of the chief points of the two forms which

may occur, namely mania and melancholia. We have already seen that the former variety of insanity is the more frequent, and as a rule develops sooner after the operation or accident than the melancholic form, which, along with the rarer cases of dementia, develops at a later date. The mode of accession has been noted to be sometimes sudden, sometimes more gradual, and may be even preceded by a short stage of melancholia or childishness, which, however, is to be distinguished from the more lasting melancholia or dementia which appears later. If the patient be in bed, he may more or less suddenly begin to be restless, and want to get up or out, and perhaps try to take off his dressings. Then the loquacity becomes more marked, and ends by being a most incoherent volubility, the ideas not having any association, the same words being repeated over and over, in a monotonous voice. The tongue becomes dry, and the voice is soon hoarse and worn out. The pulse is rapid only in relation to the increased movements. The temperature is usually normal, and insensibility is complete. It is impossible to attract his attention, or to obtain any reply to a question. Anorexia is absolute. In each case there is a different degree and intensity of the delirium, as is seen in asylum cases. It is thus not always correct to use the term "delirious mania," but it was used in its exact meaning in 8 out of 12 of Vène's cases, which he reported as occurring in the practice of Le Dentu. He also found the association of hysteria with the maniacal form very frequent. In 26 cases in which the age, sex, and form of insanity are noted, I find that 17 were the subjects of mania, that only 2 of these developed after the second week, that the average age was 47, and that 9 were females and 8 were males.

The melancholic form has been called by Le Dentu "calm or depressed delirium," for in all the cases of this form depression was the characteristic of the delirium. The expression was sad and dejected, and the taciturn tendency was generally marked; when they did speak it was merely to express some discouraging and depressing ideas, such as their belief that they would never be cured, and that they were sure they were going to die shortly, but they were unable to say why they were sad. Their movements were slow, sometimes they were almost rigid, and thus form a great contrast to those manical cases just described. This was the form of insanity in 5 out of Le Dentu's 13 cases, and each of these had a different aspect of depression, 1 being at one time maniacal, another like general para-

lysis, and a third like senile dementia. Out of the 26 cases of my collecting, I find that 4 were noted as melancholia, 1 as depressed general paralysis, and 4 as dementia, but for a certain reason, it seems to me to be better to consider the cases of dementia separate from the purely melancholic cases. In almost all the cases the symptoms began late, that is, after a period of two weeks after the operation. The average age of the 4 melancholic and 1 depressed general paralytic cases was only 41, and the sexes were the converse of the maniacal cases, for there were 3 males and 2 females affected. In the cases of dementia the average age was 67, and the sexes equally affected. This greater average age seems to me to be sufficient to differentiate the more ordinary depressed condition from that of dementia, for while in the former the more slowly developing and slighter mental dissolution appears at an age less than the more rapid and greater dissolution of mania, in dementia, where the greatest dissolution has taken place, the patients are much older, and presumably the subjects of far more advanced degeneration, and hence more readily succumb to any nervous and bodily strain.

The mortality in these 26 cases was confined to the melancholia and dementia cases, with 1 exception, an acute mania after hysterectomy, who died of exhaustion on the seventh day after the operation, the mania having suddenly appeared on the third day. The depressed general paralytic case died after an illness of over five years. A young woman died in eleven days from starvation and melancholia, after an operation on her upper jaw, and an old man died in twenty-eight days from similar causes with marked senile dementia, after the operation of supra-pubic lithotomy.

I cannot do better than conclude this thesis by giving the conclusions at which Sears arrived after the study of his extensive series of cases. (1) Post-operative insanity is the same as that which may follow acute bodily disease. (2) It is a sequel, occasionally, to the most trivial or most serious operation, and is possibly more frequent after gynæcological operations than after other surgical procedures, though probably the occurrence of insanity after ophthalmic operations is as frequent as after gynæcological ones, perhaps more so. (3) More women are the subjects than men, but if gynæcological operations be excluded, the sexes are about equally affected. (4) It is caused by perverted nutrition,

shock, anxiety, relief of mental tension after the operation is over, sepsis, age, &c. (5) It is impossible to say the exact part played by iodoform or other similar agents, but if it is a cause, it is only a rare one. (6) The insanity appears mostly in the first two weeks, but it may be evident immediately after the operation, in which case the action of the anæsthetic has to be carefully considered, but if no abnormal mental symptoms appear for two or three months, the operation can only have an indirect influence. (7) Between 60 and 70 per cent. recover, and the recovery rate is larger in men than in women; it usually takes place within a few months. (8) Heredity has but little influence comparatively, but the personal condition and a nervous instability act as decided factors. (9) When there is marked insane tendency or actual insanity, the responsibility of advising an operation is great, unless it is absolutely necessary. (10) The progress of the wound is not affected *per se*.

I now append a table showing the list of 17 septic cases which were treated in Mr. Annandale's wards or in Ward 6, to which several of them had to be removed. There is also a table of 10 cases in Mr. Annandale's hospital practice, probably instances of pure post-operative delirium, and also one case which occurred in my private practice; as before stated, this gives a proportion of 11 in about 5,600 operations of all kinds. The other points alluded to in the text may be readily seen by reference to these tables, either as regards the accession, duration, or result. I also give as full a list as I can of references to which I have been greatly indebted in the compilation of this thesis.

TABLE I.

Septic Cases.

No.	Sex	Age	Operation	Accession	Duration	Result	Remarks
1	M.	46	Amputation of penis	?	? weeks	Cured	Alcoholic
2	M.	62	Thyroid incised	?	8 days..	Died	Malignant
3	M.	72	Amputation of thigh	2nd day	4 days..	Died	Gangrene, erysipelas
4	M.	42	Amputation of thigh	2nd day	4 days..	Cured	Abscess of leg
5	M.	29	Amputation of arm	3rd day	3 days..	Died	Burn, tetanus, hyperpyrexia
6	F.	76	Excision of mamma	10th day	6 days..	Cured	Sarcoma
7	M.	66	Excision of upper jaw	6th day	2 days..	Died	? Meningitis
8	M.	62	Amputation of foot	?	8 days..	Died	Malignant
9	F.	8	Lumbar abscess	?	3 days..	Died	
10	F.	15	Amputation of thigh	?	5 days..	Cured	Periostitis
11	M.	21	Amputation of thigh	?	7 days..	Died	Septic knee
12	M.	60	Inguinal hernia	9th day	11 days	Died	Septic from urine
13	M.	25	Amputation of thigh	11th day	? months	Cured	Tetanus on 11th day, mutism
14	M.	62	Inguinal hernia	2nd day	30 days	Cured	Double
15	M.	49	Tracheotomy ..	?	5 days..	Died	Glands malignant
16	M.	65	Amputation of arm	12 hours	2 days..	Died	Malignant, erythema
17	M.	20	Burn, explosion	2nd day	3 days..	Died	Fire damp

TABLE II.

Simple Post-Operative Delirium.

No.	Sex	Age	Operation	Accession	Duration	Result	Remarks
1	M.	65	Piles, internal..	1st day	2 days..	Cured	Clamp and cautery
2	M.	25	Amputation of thigh	12th day	12 days	Cured	Strumous knee
3	M.	73	Suprapubic cystotomy	1st day	2 days..	Cured	Stricture, cystitis
4	M.	23	Syme's amputation	26th day	14 days	Cured	Tubercular ankle
5	M.	62	Inguinal hernia	3rd day	22 days	Cured	Double
6	M.	?	Excision of lip..	24 hours	2 days..	Cured	
7	F.	70	Amputation of shoulder	19 days	.. ..	Chronic	Sarcoma, senile dementia
8	F.	53	Ovariotomy ..	5th day	10 days	Cured	Hereditary
9	M.	60	Suprapubic cystotomy	?	28 days	Died	Refused food
10	M.	?	Amputation of leg	4th day	?	Cured	Alcoholic
11	F.	53	Laparotomy ..	24th day	5 days..	Cured	Exploratory, malignant (?)

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NOTE.—*Brit. Med. Sup.* = *British Medical Journal Epitome. The figures refer to the paragraph not the page.*

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