On poisoning by tartarized antimony : with medico-legal observations on the cases of Ann Palmer and others / by Alfred S. Taylor.

POISONING BY TARTARIZED ANTIMONY;

WITH

MEDICO-LEGAL OBSERVATIONS ON THE CASES OF ANN PALMER AND OTHERS.

By ALFRED S. TAYLOR, M.D., F.R.S.

It is well known that had William Palmer, of Rugeley, been acquitted on the indictment for the murder of John Parsons Cook, he would have been put upon his trial for the murder of his wife, Ann Palmer, by poisoning her with Tartarized Antimony. His conviction on the charge of murdering his friend rendered it, however, unnecessary to institute a judicial inquiry into the scientific and moral evidence by which it was intended to prove that his wife had also died from poison, and that by his hands the poison had been administered. Poisoning by antimony is, comparatively speaking, rare; and the precise mode in which there is reason to believe the life of Ann Palmer was destroyed, had not, so far as I know, ever before been made a subject of legal investigation on a charge of murder in this country.

For this reason, probably, the opinions expressed by Dr. Rees and myself at the inquest held on the body of Ann Palmer at Rugeley, on the 14th January, 1856—that this lady had died from the effects of small, or medicinal doses of tartarized antimony, was by some members of the profession regarded as contrary to all experience on the action of this drug, and therefore, medically speaking, inadmissible. We were reminded that tartarized antimony was in daily use in the treatment of disease, and that it had been given in

large doses to a considerable extent by Rasori, Tommasini, Laennec, and others, not only without ill effects, but with positive benefit to the patients. For many months, letters appeared either in the daily papers, or in the weekly medical journals, testifying, according to the experience of each writer, that tartarized antimony was *not a poison,* and could not destroy life so long as a medicinal dose was not exceeded; and even asserting the perfect safety of large doses by reference to the practice of the Italian school of Contrastimulists. With a view apparently to meet and refute our opinions at the future trial, experiments on animals were performed by gentlemen employed for the defence, and the result was stated to be, that so far from this substance exerting a poisonous action, the animals throve and took their food with unabated appetite! Had the case of Ann Palmer come to trial, much of the medical sophistry thus thrown over a question of serious importance to society, would no doubt have been exposed and refuted.[1] But it speedily met with a practical refutation in the trial and conviction of a woman (Macmullen), at the Liverpool Summer Assizes, in 1856, for causing the death of her husband by the administration of small doses of tartarized antimony; and more recently at the Lancaster Summer Assizes, 1857, in the trial and conviction of a man (Hardman), for the murder of his wife, by similar means.

The two criminals in these cases followed the example of William Palmer. Distrusting the theory of those medical writers who had furnished the elements of an unsound medical defence to the daily newspapers, they simply adopted the practice, and with like results. The husband in the one case, and the wife in the other, undeniably fell victims to a mode of poisoning which these writers had so recently pronounced to be impossible. On neither of these occasions had

[1] Some months before the trial of Palmer for the murder of Cook, the question was put to me by a learned judge whether tartarized antimony was a poison. He had been informed by a member of the profession occupying a very high position in the metropolis, that it was *not* a poison. Great pains were taken by the attorney for William Palmer, acting as he said on the advice of eminent medical men, to imbue the public mind with the doctrine that *medicinal doses* of tartarized antimony had never been known to kill a human being, and *therefore* would not destroy life! Further, that a medicinal dose, as he was instructed, would be comprised between half a grain and half an ounce!

they the moral courage to stand forward and protest against convictions for that which, in their opinion, must have been an impossible crime. It is not credible that this specious defence of Palmer was based solely on the consideration that he was a member of the medical profession, and that he required special protection by medical theories; but at the same time it is difficult to understand why medical men should voluntarily publish opinions which they have not the courage to maintain when a practical necessity arises, and human life is at stake. Either persons can be killed by medicinal doses of tartarized antimony, or they cannot. If they can, then the professional letters written by these zealous partizans in defence of Palmer before his trial, were a mere imposition on the public; on the other hand, if persons cannot be thus killed, there have not only been two judicial mistakes in the convictions for homicide by this drug, but all medical experience on the matter must be false, and the alleged fatal cases must be regarded as mere inventions for the persecution of a "professional brother."[1]

The mode of criminally administering antimony selected by William Palmer has then already had imitators, and it is likely to have more. It can hardly be said that the practice originated with him, for it is stated on good authority that Dr. Castaign who was convicted and executed in Paris, in 1823, for murder by poison, and more recently, the notorious Wainwright, who had speculated in life-insurance by means of poison, had first dosed their intended victims with tartarized antimony. In the case of Castaign, this substance was proved to have been purchased by the criminal at the same time as the alkaloidal poison used for the perpetration of the murder.[2] It is probable even that this mode of destroying

[1] The fraternizing terms applied to Palmer by a medical journal, 'Assoc. Med. Journal,' May 10, 1856.

[2] When we read the imperfect accounts of symptoms and appearances in some of those cases of poisoning which struck so much alarm in the minds of people during the seventeenth and eighteenth centuries, we are forcibly reminded in some of them, of the effects of tartarized antimony in small and repeated doses. Pitaval an authority quoted by Beckman, (i. 59), in reference to the criminal poisonings of the MARCHIONESS OF BRINVILLIERS, thus describes the deaths of two persons alleged to have died from poison. "The lieutenant-civil continued still to grow worse. After having languished a long time, being seized with a *loathing* of every

life has been secretly carried on for some time in this country, and that it has hitherto escaped the notice of the profession. The symptoms do not always present a well-marked character, and in the absence of an examination of the dead body, no suspicion may exist that death has proceeded from other than natural causes. Death from small doses of tartarized antimony may be easily referred to inflammation of the stomach, bilious cholera, or to wasting chronic disease. The body of Ann Palmer had been lying fifteen months in the grave under a regular professional burial certificate of death from bilious cholera, when the sudden death of Cook, and the detection of antimony in his body, led to the exhumation of the body of this lady. It was then only for the first time ascertained, that there existed in the body a cause for the symptoms which had not been even suspected during the last illness of the deceased. How many more may have died under similar circumstances, whose deaths may have been caused by the secret administration of this mineral, and are registered as deaths from natural disease! But for the fact that, fifteen months afterwards, Palmer was led to the commission of another murder, the cause of the death of the wife would probably never have transpired; and there is still a dark shadow of mystery hanging over the deaths of his wife's mother, his friend Haden, and three children, all of whom, as I am informed, had died under his roof, and under his medical superintendence! The evidence in the case of Macmullen, which will be noticed hereafter, showed that some druggists in Bolton and other localities, have been in the habit of selling

kind of food presented to him, his *vomitings* still continuing, and nature being at length *exhausted*, he *expired without any fever*. The three last days he had *wasted* very much; he was become extremely shrunk, and he felt a *great heat* in his stomach. When opened, that part and the duodenum were found to be black and *sloughing off* in pieces (aphthous desquamation?); the liver was mortified and as it were burnt. The counsellor was ill three months, had the like symptoms as the lieutenant-civil, and died in the same manner. When opened, his stomach and liver were found in a similar state." Making due allowance for imperfect description, and the effects of putrefaction in the dead body, the reader will find that the symptoms and appearances are similar to those described hereafter as a result of poisoning by antimony. The criminal wisdom of one generation is the ignorance of another. The mediæval art of poisoning consisted rather in the skilful mode of administration, than in the more potent nature of the substance used.

to women tartarized antimony in doses of a few grains under the name of "quietness powders," for the express purpose of administration to their husbands, with a view to cure them of habits of drunkenness! It is at present easily accessible to all classes; and the following fact, communicated to me by a professional man soon after the inquest on Ann Palmer, shows that a knowledge of the mode of using this substance so as to produce the greatest injury to health with the smallest risk of detection, is pretty widely diffused. It happened some years since, an elderly lady, the widow of a clergyman residing in the country, suffered for many months, at intervals, from nausea and frequent vomiting. She became much reduced in strength and emaciated, and at length it was feared that she must die before long, when it was accidentally discovered that her servant, without any apparent motive, was in the habit of administering to her in her food, small doses of tartarized antimony. This was confirmed by the girl's confession, and, after her dismissal, the patient gradually recovered her health.

In the case of a lady, in which I was consulted in April, 1857, the suspicions of the medical attendant were excited, and the attempt at secret administration was discovered and frustrated. This lady suffered from extreme irritability of the stomach, and sickness; the vomited matter, of which a portion was sent to me, had an intensely yellow colour from admixture with bile. There was slight, unconnected wandering, no sleep, paleness of the countenance or flushing, swelling of the face, injection of the eyes, an aphthous state of the tongue and mouth, soreness and constriction of the throat, with pain and a burning sensation in the region of the stomach, and tenderness in the abdomen; there was a sense of loss of power, and coldness from the waist to the toes, and a tingling sensation in the upper and lower limbs, with slight muscular spasms in the arms and hands. There was irritability, with soreness of the rectum, and movement short of diarrhœa. There was some difficulty and pain in passing the urine. The pulse was generally low, and from 120 to 132. The most prominent symptom was *a constant feeling of such depression that death seemed to be close at hand.* The treatment pursued appeared to produce very little effect on these symptoms. A portion of

the patient's urine was sent to me for analysis; it was found to contain *antimony*, and the cause of most of the symptoms, as well as of the dangerons condition of this lady, was then revealed. The medical attendants had prescribed no antimonial medicine at any period of the treatment; and it was clear, from the chemical result, that the metal was then actually in the process of elimination from the system. The detection of antimony confirmed their suspicions, based on the anomalous symptoms, as well as on moral circumstances; and I am informed there was reason to believe that a death which had occurred in this family in 1852 might be referred to this cause. They took a proper course, by informing the members of the family, and the patient was thus protected against this secret administration of poison.

It is clear from this and similar cases, that if there is great facility for slowly undermining health and destroying life by the administration of small quantities of tartarized antimony at intervals, there is equal facility on the part of a cautious medical practitioner in detecting and exposing the attempt. His suspicions may be fairly excited when there is nausea, with retching and vomiting, soon after taking articles of food or medicine, the illness supervening suddenly without any sufficient natural cause to account for it—when the vomiting is of a bilious or mucous character—when there is soreness or constriction of the throat, with such extreme depression that the patient appears sinking. An examination of the urine, which is not usually removed by those interested in concealing the facts, will reveal the attempt even with more certainty than the vomited matters. Unless these are procured soon after the antimony has been swallowed, the mineral may not be detected in them.

In the present state of medico-legal science, however, a medical practitioner who had the knowledge to detect, and the courage to expose a crime of this nature, would find himself surrounded by difficulties. It would be alleged that the discovery of antimony in a dead body proved nothing; it might have been the result of some lawful administration many years previously:—unless found in an impossible quantity, *i.e.*, unless enough metal were separated from the tissues to destroy the life of another human being, it would be solemnly affirmed

that there was not a fatal dose, and therefore the deceased could not have died from it; if found in the liver, the heart, or kidneys, this fact, it would be contended, did not prove absorption during life, but merely imbibition from the stomach after death; if found in the contents of the stomach and bowels, this, it might be urged, would not prove that any portion had been taken recently before death, but simply that the mucous membrane of the stomach and bowels was an eliminating surface to the liver and kidneys: and as to its presence in these organs, medical theories would be satisfied provided it could be proved that antimony in some form or other had been taken by the deceased at any antecedent period of life! The facts—that antimony was found in all the tissues—that none had been prescribed by the medical attendant during the illness of the deceased, that the nature of the illness was such as to have forbidden its use, would be considered unimportant; and the illness itself, although presenting such symptoms as might be produced by antimony, would be attributed to natural causes. It is proper that every reasonable theory or explanation of medical facts should be exhausted before we adopt the conclusion that antimony found in a body has caused death; and, on the other hand, we have a right to expect that the presence of antimony, in however *small* a quantity, as it is not a natural constituent of the body, shall be reasonably and satisfactorily explained. Sophistical and irrelevant scientific objections taken to medical evidence on grounds such as those above-mentioned, by objectors who have either no knowledge of the facts of a case, or who ignore or misrepresent them, may have the temporary effect of confusing a criminal court, and procuring an acquittal, but they produce the lasting evil of encouraging secret murder by poisoning, and discouraging its detection and exposure.

The object of this paper is to examine some of the medical questions connected with antimonial poisoning, on which a great discrepancy of opinion appears to exist among members of the profession, and to illustrate the present state of medico-legal knowledge by reference to several cases which have come before our legal tribunals.

History and Nature of Tartarized Antimony.

The earliest account of antimony is found in the writings of Basil Valentine, who lived about 1415. He made this metal the basis of all his medicines, and called it *omne in omnibus*. From the universal and rash employment of these compounds many accidents no doubt arose, and this may have led to the proscription by the parliament of Paris of the use of antimony in the Materia Medica during a whole century, *i. e.*, from 1566 to 1666.[1]

Cuvier assigns as a reason for this proscription, that antimony was used under circumstances which rendered it a dangerous and uncertain medicine. Wine and other liquids were allowed to remain for variable periods in vessels made of or containing glass of antimony, and accidents arose from the large quantity of dissolved antimony occasionally taken at a dose. Medical practitioners regarded and called it a *remedium in extremis*, and Guy Patin applied to the compound with tartar the name Tartre Stygié, in place of Tartre Stibié.

Tartarized antimony appears to have been introduced into the Pharmacopœia of the London Royal College of Physicians in the year 1721, under the name of Tartarus Emeticus.[2] It is stated to have been discovered by Adrian de Mynsicht, a Dutch chemist, in the year 1631, but there is no evidence that a salt of the precise composition of tartarised antimony was known, at least in England, until a much later period.[3] Magendie states that it was much used, in common with other antimonial preparations, by the members of the Academy of Medicine, in the year 1666; but in an English Pharma-

[1] Pereira's 'Materia Medica,' 4th ed., vol. ii, part 2, p. 858.

[2] Phillips's Translation.

[3] The formula of Adrian de Mynsicht was as follows:

℞ Olei vitrioli veneris et martis rubicundissimi; Reguli antimonii āā ℥ij
Mercuri loti et purgati . . . . . ℥ss

"Minutissimè contere et in cucurbitam mitte super ignem impone et lento igne digere. Adde spiritum vini tartarizatum. Est maxime accommodatum corpori humano arcanum: hæc est nobilissima medicina cum spiritu propriatâ ('Thesaurus Medico-Chemicus,' Hamburg, 1631.)

Some tartrate of antimony may have been here produced, but not the tartarized antimony of modern times. This formula no doubt led to its discovery.

copœia of the date of 1677 there is no notice of it, although other antimonial compounds are introduced.[1]

In an edition of Boërhaave's 'Chemistry,' of the date of 1727, this preparation is not noticed.[2] The oxides, chloride, and other compounds of antimony, are, however, described as poisons by this old writer. It is clear that tartarized antimony could have been but little known in his time, as from the copious details which he gives of the chemical substances used in pharmacy, it would certainly have found a place in his treatise. The noxious properties of the oxides and sulphuret of antimony had, however, been long known.[3] Owing to their insolubility and comparative inertness, they are far less adapted to secret administration, than the preparation which we are here considering. From its first introduction into the London pharmacopœia, about one hundred and forty years since; tartarized antimony has been extensively employed in medical practice, and is well known as a most useful medicine in the treatment of numerous diseases. Like all remedies, it has passed through various phases of popularity, some condemning it as unsafe, and others relying upon it almost exclusively, as a valuable specific. Towards the close of the last

[1] 'Pharmacopœia Collegii Regalis Londini,' Lugduni Batavorum, apud Johannem A. Gelder, MDCLXXVII.

[2] 'A new method of Chemistry, including the theory and practice of that Art,' 4to, London, 1727.

[3] The MARCHIONESS of BRINVILLIERS, with her infamous accomplices Sainte Croix and La Chaussée, were acquainted with the properties of antimony. Corrosive sublimate, regulus of antimony and vitriol were found in a casket belonging to Sainte Croix; and it is not improbable that they used the regulus of antimony for preparing the compound discovered about forty years previously by Adrian de Mynsicht. Sainte Croix was probably acquainted with some of the more subtle compounds of arsenic recently described by Bunsen. He was accustomed to wear a mask while working in his laboratory, and on one of these occasions, owing probably to the accidental escape of some poisonous vapour, he was found dead. His death, and the subsequent confessions of La Chaussée, led to a knowledge of the criminality of the marchioness. La Chaussée was broken alive on the wheel, in 1673, and the marchioness, who in the mean time had fled from justice, was convicted and beheaded on the 16th July, 1676. Her body was afterwards burnt. In a written confession, she admitted that she had put to death a greater number of persons than any one had ever suspected. By making use of La Chaussée, she poisoned her father and her brother, admitting that, to the former, *ten doses* of poison were given before he died. The reader will find some curious information on secret poisoning in Beckman's 'History of Inventions,' vol. i, p. 47, Ed. 1846.

century, it was adopted as the chief remedy of a sect of Italian physicians, represented by Rasori, known as contra-stimulists. They prescribed it in unusually large doses, and their practice is only of medico-legal interest in this respect, that it has been erroneously brought forward in recent times to prove that tartarized antimony is not a poison.

Tartarized antimony is a white crystalline solid, composed of tartaric acid, potash, and oxide of antimony. It contains about 43 per cent. of this oxide, to which its medicinal and poisonous properties are due; and this quantity of oxide (SbO_3) corresponds to about 36 per cent. of metallic antimony. It is necessary that this should be borne in mind, inasmuch as the quantity of metallic antimony found in a dead body has been erroneously assumed to represent an equal weight of tartarized antimony, whereas, every 3·6 grains of the metal represent 10 grains of the antimonial compound. Tartarized antimony is the only soluble preparation of the metal which is used internally as a medicine. It is sometimes administered in the form of powder; on other occasions, in a state of solution in water or other liquids. It is soluble in water at 60°, in the proportion of thirty-one grains to the fluid ounce. The pharmaceutical solution (antimonial wine) contains this substance dissolved in the proportion of only two grains to the fluid ounce. The taste of the powdered crystals is described by the late Dr. Pereira as feebly sweetish. I have perceived in the powder and concentrated solution a strongly metallic taste. The ordinary antimonial wine has no taste derivable from the presence of this substance, and I find that a solution prepared by dissolving two grains of the powder in one fluid ounce of distilled water has no taste. This compound presents even greater facilities than arsenic for secret administration in small doses. It is much more soluble than arsenic; it is either quite tasteless in small doses, or its taste is readily concealed by any liquid article of food or medicine; and thus it may be criminally administered without exciting suspicion. There is also another point in which it differs from arsenic. By its greater solubility and its specially emetic and purgative powers, it is more easily expelled from the stomach and bowels than arsenic; and thus, unless a person has taken a dose within a very short period of death, the quantity found

in these parts of the alimentary canal after death, will necessarily be small.

It is proper to notice here that the crystals of tartarized antimony occasionally contain traces of arsenic. I pointed out this contamination about nine years since,[1] and quoted a case in which it had given rise to some embarrassment in chemical evidence. Two cases have since occurred in this country in which, although antimony was believed to be the cause of death, minute traces of arsenic were found associated with antimony in one of the organs of the body. The source of this contamination is to be traced to the presence of arsenic in the proportion of from 1-60th to 1-20th of its weight in all the German and French sulphide of antimony. Metallic antimony contains from 1-50th to 1-200th. The crystals of tartarized antimony which are first formed are free from this impurity; but, according to Martius, the larger crystals which are principally formed in the mother-liquid contain arsenic.[2] The use of arsenical sulphuric or hydrochloric acid in the preparation of the compound may also furnish an additional source of contamination. Orfila attributes some of the severe symptoms occasionally produced by antimony to this contamination with arsenic.[3]

2. Action of Tartarized Antimony in small doses as a medicine and as a poison. Chronic poisoning.

There are few pharmaceutical compounds which have a more variable action than this. It has been used with great effect as an astringent to arrest purging in diarrhœa and cholera, in doses of from 1-16th of a grain every two hours to 1-10th of a grain every half hour. Dr. Billing, who has recommended the use of this agent as an astringent, observes: "it will surprise some to learn that tartar emetic, as a general sedative remedy, will allay sickness. For example, inflammation of the mucous membrane of the intestines is accompanied by nausea and sickness; these symptoms may be checked

[1] On Poisons, p. 491.

[2] Gmelin's 'Hand-book of Chemistry,' vol. iv, p. 317.

[3] Traité de Toxicologie, i, 616, 5me ed., 1852.

sometimes without bleeding by frequently repeated small doses of tartar emetic." He relates the case of a patient admitted into the London hospital, who had been labouring under diarrhœa and vomiting for two days, for which he had taken chalk-mixture, catechu, and opiates unavailingly. His skin was hot and dry, with wiry pulse and dry tongue. He prescribed for this patient 1-16th of a grain of tartarized antimony every two hours. The man did not vomit after the second dose, and rapidly recovered.

This experienced physician attributes the efficacy of antimony as a remedy in inflammation to its astringent effect on the capillary vessels, as well as to its sedative effects on the heart and pulse.[1]

In doses of from one twelfth to one sixth of a grain, tartarized antimony promotes perspiration and expectoration; of from one fourth to half a grain, it causes nausea; of from one to two grains, it acts as an emetic; and in doses of from one to four grains, every two or three hours (on the contra-stimulus mode of treatment), it produces at first nausea, pain, vomiting, and purging, afterwards followed, in certain constitutions and under certain states of disease, by an arrest of these symptoms and a beneficial medicinal action. This medicine is observed to exert a powerfully depressing influence on the action of the heart, producing a feeling of sinking, and giving to the patient the sensation of extreme exhaustion and of impending dissolution. Of all emetic substances known in medicine, tartarized antimony produces the greatest amount of nausea and depression.[2] Besides the depression of the nervous functions, there appears to be a relaxation of the tissues of the muscles, so that the patient has a feeling of great feebleness, and is incapable of any exertion. In repeated doses, it increases the secretion of the mucous membrane of the stomach and bowels, as well as of the kidneys, liver, and skin, causing often profuse perspiration, while the skin may be at the time cold. The increased secretion of mucus and bile is in general indicated by the appearance of the matters thrown off the stomach or bowels.

It is obviously impossible to fix any boundary between the

[1] Principles of Medicine, pp. 103—106.

[2] Pereira's 'Materia Medica,' vol. i, p. 747.

medicinal and poisonous action of this compound, or between a medicinal and poisonous dose. The age and constitution of the patient, even in cases in which the same dose is administered, influence the result. Infants appear to be especially predisposed to the noxious action of this drug, and some adults suffer, from an ordinary dose, symptoms and effects of a very severe kind.

It may be stated generally, that a medicine in a large dose is a poison, and a poison in a small dose is a medicine: hence there can be no definite boundary between a medicine and a poison. The greater number of substances described as medicines, may act like poisons according to the dose or circumstances under which they are administered. The proof of the crime of poisoning should rest, therefore, upon the intention with which the substance is administered, as well as on the effects produced. A man may administer tartarized antimony in *medicinal* doses with good or evil intention. His intention may be not to remove disease, but to destroy life. He may administer it secretly, under circumstances in which its lawful use would certainly not be required: he may continue to use it at intervals in medicinal doses, even when its dangerous effects are clearly manifested by symptoms, and when any medical man, dealing *bonâ fide* with a patient, would, if he had prescribed it, immediately withdraw it as a medicine. Is such an act as this to be covered by that thin veil of medical sophistry which was spread over it in the case of William Palmer, apparently because he was a man of education and a member of the medical profession? Is it to be received as a reasonable or safe doctrine for society, that tartarized antimony is a medicine and not a poison, because it has been given in some instances in large doses, without causing death? Or, that provided the doses are what may be called "medicinal," there can be no act of poisoning? If a criminal act of the worst dye—the professional use of remedial agents to destroy life—is to be thus frittered away by a definition, murder by poisoning might be carried on with impunity throughout this country, whenever a motive for crime presented itself; and the greater the skill and the more perfect the cunning used in the perpetration of a crime, the more surely might a wealthy and educated criminal rely

upon receiving a certain amount of quasi-professional protection.

The passage from the *medicinal* to the *poisonous* action of tartarized antimony is witnessed in the administration either of one large dose, or of a number of small doses, following each other at such intervals that there is no complete recovery from the effects of one before another begins to operate. The professional and popular idea of poisoning by this substance has been hitherto limited to the former case, *i. e.*, the administration of large doses; but in reality, the adoption of the latter plan, *i. e.*, the administration of small doses at intervals, is far more efficacious in bringing out the noxious action of this mineral.

We are indebted to Dr. Mayerhofer of Munich, for a knowledge of the effects produced on the healthy human body by the repeated administration of small doses of tartarized antimony. The experiments undertaken by this gentleman were performed with a purely scientific object, and not with a view to obtain results in support of a foregone conclusion. They are, therefore, the more valuable and trustworthy.[1] Dr. Mayerhofer being at the time in a good state of health, experimented on himself. He dissolved a grain of tartarized antimony in one hundred drops (minims) of distilled water, and took one minim daily, for five days, in a table-spoonful of water immediately before going to bed. He suffered from no marked symptoms of any kind.

Hence, the 1-20th of a grain in divided doses, over a period of five days, produced no effects.

[1] An account of these experiments will be found in an elaborate Prize Essay, published in Heller's 'Archiv für Physiologische und Pathologische Chemie und Mikroskopie,' &c., III Jahrgang, pp. 100, 227, and 321, 1846,—under the title of "Physiologische, pathologisch-anatomische und pathologisch-chemische Wirkungen der Antimonial präparate auf den gesunden menschlichen und thierischen Organismus von Dr. Carl J. C. Mayerhofer, Dr. der Medizin, &c., aus München." It will be perceived that this essay was published ten years before the Rugeley crimes were brought to light. The questions which led to its publication, were proposed by the University of Munich, in the year 1841, and was as follows: "Quinam sunt effectus Antimonialium præparatorum in animalia viva? anne resorptio et transgressus horum remediorum in sanguinem et organa comprobari potest? quænam mutatio mixtionis et compositionis et in remedio applicatio et in organismo efficitur?" It will be perceived that this tripartite question embraces all the important points connected with the medico-legal relations of antimony.

On the sixth day, he took one minim three times, *i. e.*, in three separate doses. His sleep was disturbed; there was a sense of fulness of the head on awaking, which soon disappeared; tongue dry and clammy; appetite unaffected.

On the seventh day, three mimims to a dose were taken thrice. There was a feeling of oppression in the region of the heart; greater fulness in the forehead; taste clammy; rest much disturbed.

On the eighth day, the same dose was taken. In addition to the above symptoms, there was a sense of oppression in the stomach after eating; constriction in the throat, with oppressed breathing; feeling of coldness and loss of power in the limbs; constipation for three days, with tenseness of the abdomen; sleep much disturbed.

On the ninth day, four minims were taken at each dose, making twelve in the whole. Symptoms showed themselves in a more aggravated form. There was heat, with a feeling of congestion in the head; great oppression in the heart; pulse small and irregular; oppression in the stomach; nausea, with a disposition to vomit; increased flow of saliva; two liquid stools; restlessness at night.

On the tenth day, the same doses were taken at the same intervals. Symptoms the same. There was eructation of bile; sense of weight in the stomach, nausea, retching; increased thirst; a sense of coldness extending from the spine over the whole body; pain in the abdomen, followed by two liquid stools; sleep much disturbed.

On the eleventh day the doses were repeated. Additional symptoms manifested themselves in the form of abundaut perspiration; pain in the region of the stomach and liver; two liquid stools, strongly coloured with bile.

On the twelfth day, he took in the morning six minims in a table-spoonful of water. In an hour afterwards, he suffered from great oppression or sinking in the heart; heat and uneasiness throughout the body; fulness of the head and nausea. After much retching, he vomited a ropy, watery mucus, which had a bitter taste and acid reaction. Traces of antimony were subsequently detected in this liquid. There was a bitter taste in the mouth, with loss of appetite and increased thirst. Antimony was not found in the urine passed at this period. Two

half-liquid stools of an intensely yellow colour were passed. Antimony in traces was detected therein.

An interval of two days was allowed to pass in consequence of the illness induced; and on the fourteenth day, sixteen minims were taken in four doses. The symptoms were much aggravated: tenderness of the abdomen; a strong desire to pass the stools, but without effect; sense of weight in the limbs; a general feeling of coldness throughout the body, with a universal feeling of illness; pulse quick and irregular; giddiness while lying in bed; restlessness at night, and a catarrhal feeling of the throat on the following morning. On the next day, two half liquid stools of a dark yellow colour were passed. In the first there was no antimony; but traces of the metal were found in the second. There was no antimony in the urine.

On the following day, eighteen minims were taken in three doses. After the second dose, the experimentalist felt very unwell: there was nausea, with a sense of sinking and pressure in the stomach; and after the third dose, constriction of the throat, amounting to a sense of choking; much retching, followed by vomiting of mucus coloured with bile; violent perspirations over the body, especially on the chest; much urine passed, and still later, two liquid mucous and bilious stools. The pulse was small and contracted, and there was great thirst. There was restlessness at night, and in the morning, fulness of the head, with a general feeling of illness. Neither the urine nor the stools, on this occasion, yielded traces of antimony. The vomited matters, however, consisting of water, mucus, and bile, were found to contain antimony.

Some weeks afterwards, when Dr. Mayerhofer had recovered from the effects produced by these small doses, he took at one dose, *one grain* dissolved in a fluid ounce of distilled water. In *ten minutes,* he perceived a feeling of oppression in the region of the heart, with oppressed breathing and nausea; in *fifteen minutes,* heaviness and fulness of the head; flow of watery saliva, hurried respiration, quick pulse, sinking feeling at the pit of the stomach; loss of sight and hearing, with complete relaxation of the muscles; in *thirty minutes,* oppressive illness; a feeling of coldness; paleness of the face; nausea, violent retching; choking sensation, with constriction of the

throat; and, under violent straining of the chest and abdomen, vomiting of a ropy mucus, followed by partly digested food, and an intensely coloured bilious liquid, of a bitter taste. During the vomiting, the skin was covered with copious perspiration. A large quantity of pale urine was voided, and after some hours, two half liquid stools were passed. After this, Dr. Mayerhofer felt completely depressed and exhausted. He fell asleep, and awoke in a copious perspiration.

The vomited matters contained tartarized antimony in solution, and gave strong indications of the presence of the metal. The other principal constituent was the colouring matter of the bile. The urine passed subsequently to the vomiting presented nothing abnormal; it contained no antimony. Even that which was passed at a later period, and on the following morning, yielded no trace of the metal. Antimony was, however, found in the mucous and bilious fæces which had been passed.

Dr. Mayerhofer does not appear to have carried his experiments on himself beyond this point.

Dr. Wetzler, of Augsburg,[1] having dissolved twelve grains of tartarized antimony in six ounces of water, took a tablespoonful (= 1 grain), every hour, from five o'clock in the morning until three o'clock in the afternoon. The pulse was slightly increased. In an hour and a half there was nausea with vomiting of a mucous liquid, but this ceased, and did not return; there was then abundant perspiration for twelve minutes. The tongue was dry, and of a brownish-yellow colour. In five hours, there was intense thirst. In seven hours, a complete loss of appetite, fulness of the head, heat of forehead, great depression, and a feeling of general illness. At three o'clock, he found he could take no more of the antimonial mixture. In a few days he recovered. A fortnight afterwards he repeated the experiment with like results, excepting that from a feeling of the greatest loathing, he could not take the antimonial solution beyond a period of seven hours from the commencement. After the lapse of fourteen days, the experiment was performed for a third time. The solution was taken for ten hours and a half; violent

[1] Kleïnert's Allg. Repertorium der gesamt. Deutsch-Mediz-Chirurgisch. Journalistik. Leipzig, 1827. 1 Heft. p. 61.

vomiting followed, and on this occasion the illness was more severe. Dr. Wetzler felt that he could not continue his experiments.

Dr. Jankowich, of Ofen,[1] wishing to determine for himself the action of tartarized antimony on the healthy body, took, on the 14th July, 1841, a dose of the following mixture every hour:—Tartarized antimony, twelve grains, dissolved in three drachms of distilled water; of Mucilage of Gum Acacia, and Opiate Syrup, each half an ounce. Dr. Jankowich took eight grains of the antimony in five doses, or about *one grain and a half* for a dose hourly, commencing at eleven o'clock in the morning. Shortly after the first dose, he suffered from giddiness and a feeling of illness; after the second dose, a shivering over the whole body, cold perspiration, nausea, and retching. After the third dose, a painful feeling in the pit of the stomach, vomiting of much mucus and bile; uneasiness in the bowels, but without pain or purging; excessive and constant perspiration; increased flow of saliva:—and thirst, which he was compelled to satisfy by taking small quantities of cold water. He suffered from such extreme depression and weakness that he had not the power to rise from his seat. The fourth dose was followed by a feeling of increased illness, vomiting and purging. After the fifth dose, such apathy and disgust were excited that he felt quite ready to die. The pulse was considerably reduced. Up to this time, he had not suffered from any burning heat, constriction in the throat, or severe pain in the stomach and bowels; but his repugnance to any more doses of the medicine was such, that he found it impossible to continue it. He took some broth, which, however, he speedily vomited; this was followed by a further action on the bowels, nausea, perspiration, and great depression, lasting until night. He slept calmly, and the next day the unpleasant symptoms had disappeared.

We have, therefore, in this interesting series of experiments, an illustration of the effects of comparatively small doses of tartarized antimony, taken at intervals, on the human body. In Dr. Mayerhofer's case, one grain was taken in

[1] Med. Jahrb. der österr Staat. v. Raimann, 1842, p. 49.

doses of hundredths over a period of fifteen days; then we have the effects produced by a grain at a single dose.[1] Dr. Wetzler's experiments illustrate the effects of a dose of ten grains, taken in hourly doses of a grain over a period of ten hours, and in this case the condition called "*tolerance*" appears to have been set up to a certain extent, as in the Contrastimulist use of the mineral. Dr. Jankowich's experiments show the effects produced by a total quantity of about eight grains, taken in five hours in hourly doses of one grain and a half. These experiments represent the effects of this mineral on *healthy* persons, the condition which generally presents itself in cases of poisoning demanding medico-legal inquiry. They are far more valuable than the accumulated results of experiments with this substance on rabbits which do not vomit, and on dogs which do not perspire; and they are therefore calculated to be a safer guide in the formation of medical opinions. Dr. Mayerhofer furnishes the following summary.

When *a grain* of tartarized antimony is taken by a healthy person in doses of 1-100th gradually raised, the symptoms which show themselves are, a feeling of oppression and weight in the pit of the stomach, nausea, weight and fulness in the head, uneasiness; relaxation of the limbs, especially of the thighs; pains in the joints; shivering, as in fever; secretion of a watery saliva; tongue coated with a clammy mucus; increased appetite and thirst, with inward heat; great weakness and depression; hence a disposition to sleep, with painful dreams; frequent, irregular full pulse; giddiness;

[1] The reader will not be surprised at the powerful effects obtained from so small a quantity of the medicine, or at the results produced by Dr. Billing from doses not exceeding the sixteenth part of a grain, when he considers other well-known facts in toxicology. The quantity of carbonate of lead which produces lead colic and paralysis in workmen in white lead factories is not appreciable. It is the result of long exposure to the accumulated effects of numerous minute doses, and is in fact a form of slow poisoning. The Orleans family, living at Claremont, were poisoned by lead in a most severe form by the use of water containing only one seventy-thousandth part of its weight, *i. e.*, about one grain of lead in a gallon. The whole of the lead extracted from five hundred gallons, and taken at one dose, would not have produced the same serious effects that followed from the minute quantities in which the metal must have been taken day by day. Thirteen out of thirty-eight persons suffered from lead-poisoning in a severe form, and all the evil effects had been produced before the source of the poison was even suspected.

eyes dull and heavy; increased mucous secretion in the throat, with painful swallowing. After a longer period: appetite diminished; stomach painful on pressure; breathing difficult; a sinking feeling in the region of the heart; coldness of the body and limbs, with a sense of extreme illness and depression. The abdomen is tense and painfully sensitive; the stools are at first normal; then become gradually irregular, liquid or solid, and in the meanwhile there is often constipation. The secretion of urine is gradually increased; the urine is for a long time clear and watery, and but little changed in chemical constitution.

In these small doses, tartarized antimony, according to Dr. Mayerhofer, acts chiefly upon the mucous membrane of the alimentary canal; and in this view his experience is in accordance with that of Dr. Billing. The doses prescribed by this physician have been larger, namely, the sixteenth part of a grain; but still these are small compared with ordinary medicinal doses. The effects on the brain and spinal marrow are secondary, and are probably owing to the absorption and diffusion of the poison.

If tartarized antimony be given in small but increasing doses for a longer period, the symptoms are developed in a higher degree. The uneasiness, nausea, and retching are increased, and vomiting follows; the stools are pasty, and diarrhœa, attended with thin bilious and mucous discharges, gradually sets in; the abdomen is at the same time distended and tense. The voidance of urine is more frequent and violent. The region of the stomach is tender and painful; that of the liver appears fuller, and is sensitive to the touch. There are griping pains in the bowels, with stiffness and pains in the lower limbs. The warmth of the skin is at first increased; there is itching or irritation with alternation of heat and cold. The appetite is suppressed, and when any substance is eaten there is nausea, with an immediate disposition to vomit. There is a sense of roughness or rawness in the throat, with painful swallowing; the tongue is covered with a dirty mucus, and there is clamminess of the mouth. The head feels full and heavy. At a still later period the fæces contain much mucus, and are frequently strongly coloured with bile. The blood gradually loses its fibrin, becomes

almost liquid, and dark coloured. It contains a greater proportion of fluid and saline matters, with traces of antimony. If the use of the substance be longer continued, there is slowness with loss of power in the heart and pulse; the breathing is difficult, the complexion dusky; there is complete depression of the vital powers, with great debility and emaciation; the legs become heavy and stiff, as if paralysed, and death may follow as a result of the noxious impression produced on the more important organs of the body. Small doses act more powerfully when dissolved, than when administered in the form of powder. In addition to the above symptoms, the vomiting, from which the patient suffers, is either attended or followed by distension of the abdomen, and flatulence; liquid bilious motions, with colicky pains, paleness and sunken appearance of the countenance; cold perspiration, giddiness, great prostration of strength, incapability on the part of the patient of raising himself to the erect position, disposition to rest and sleep, loss of strength, fulness and frequency of the pulse, faintings, in many cases a feeling of coldness, accompanied with heat or flushing of some parts of the body, *e. g.* the face. If there is a recovery from this condition, pain in the stomach is felt for a long time afterwards, and inflammation of the stomach to a greater or less extent is set up. After the vomiting, there remains for a longer or shorter period, an unwillingness to take food, and nausea in partaking of it. Among the other effects, the perspiration and the urinary secretion are observed to be greatly increased.

If the use of tartarized antimony be continued in increasing doses when the poison has been already carried into the blood, the secretory organs are more strongly stimulated, and absorption as well as secretion, especially of the serous liquids, is greatly augmented.

If vomiting does not take place after larger doses, the following symptoms of poisoning are observed: metallic taste, nausea, retching, and vomiting, by which a large quantity of bile is expelled; violent pain in the stomach, heat and burning sensation in this organ, sometimes with a sense of burning heat and contraction of the throat and gullet, rendering swallowing difficult or impossible. There are spasms in the muscles affecting the neck and jaw, leading to locked jaw;

severe pains in and flatulent distension of the abdomen, with frequent watery or liquid motions; faintness; small, contracted, frequent pulse; the skin cold and pale, cold and clammy perspiration, sometimes great heat of skin, difficulty of breathing, painful sobbing, giddiness, stupefaction, loss of consciousness, delirium, spasms of the arms and legs, with the most complete prostration of strength. Death appears to result from the impression produced on the nerves of motion, as well as on the nerves of the lungs and heart, leading either to asphyxia or paralysis.

The facts here recorded prove affirmatively that the action of tartarized antimony on the *healthy* human organism, when administered in small and gradually increased doses, is far more powerful than it is commonly supposed to be. It is easy to conceive that a very slight addition to the small quantities taken by Mayerhofer, Wetzler, and Jankowich, or even a persistence in the doses for a still longer period, would have destroyed the lives of these experimentalists. Had some of those writers who, on the occasion of the Rugeley poisonings, manifested so great a desire to prove that tartarized antimony was not a poison, and could not destroy life, showed only a reasonable confidence in their own theories, and had made themselves the subjects of experiment with the drug, instead of relying upon rabbits and dogs, much erroneous speculation would have been spared, and the public would not have had to lament over new differences of opinion among medical men on a question of fact affecting human life.[1]

Tolerance.—The medicinal or poisonous action of tartarized antimony appears to be subjected, in certain cases, to peculiarities which have erroneously led to the belief that the substance may be taken with impunity even in large doses. I have already alluded to the practice of Rasori, Tommasini, Laennec, and others, in prescribing tartarized antimony in large doses in certain forms of inflammatory disease. This practice has been quoted as furnishing proof that the substance is not a poison; and the somewhat illogical inference has

[1] The papers on the action of Antimonial Preparations, published in Heller's 'Archiv.' for 1846, were referred to in the last edition of my 'Medical Jurisprudence' (5th edition, 1854, page 120) as worthy of notice.

been drawn, that if large doses can be borne by patients in certain states of disease, similar, or even larger doses may be borne with impunity by persons in a state of *health!* Laennec, who carried out the *Italian* practice to a considerable extent in treating his patients, began with a dose of a grain every two hours, until six doses had been taken. The medicine was dissolved in a large quantity of liquid, so as to prevent any local irritant action. The patient was then left to repose for seven or eight hours if the symptoms were not urgent, or if he experienced any inclination to sleep. In the more severe cases, he either gave the medicine uninterruptedly at the same interval, in the same doses, or he sometimes increased the dose to a grain and a half, two grains, and even to two grains and a half.[1] In the practice of M. Louis, from one to two grains were given at a dose, the whole quantity administered daily varying from six to twelve grains. M. Lepelletier, a writer of some repute, states that the dose best supported by adults is comprised between the quantity of six and twenty-four grains daily. Sir John Forbes, in commenting on this practice, gives as the result of his experience, that the doses safely adapted to this mode of treatment range from one to two grains, administered every two or three hours. The period over which such doses might be given was from one to nine days. Dr. Marryatt, of Bristol, who appears to have been the first to promulgate this mode of treatment (subsequently called Rasorian), recommended similar doses.[2] This physician had used tartarized antimony on a large scale; it was his chief remedy in the treatment of disease. His object in using it, like that of Rasori and others, was the very reverse of poisoning, *i. e.*, to endeavour to produce an effect on the body wholly exclusive of any sensible evacuation. He says, "I have seen many instances wherein a paper has been given every three hours, of which there have been ten grains of tartar emetic in six powders (about one grain and a half to a dose), without the least sensible operation by sickness, stool, sweat, or urine," &c. He does not appear to have tried it on

[1] 'Laennec,' transl. by Forbes, 3me edition, 256.

[2] Marryatt's 'Treatise on Therapeutics,' was first published in 1758; it reached ts eighth edition in 1788.

the healthy; and the diseases in which he gave it as a medicine were chiefly cases of pleurisy and fever.

The essential feature of Rasori's practice consisted in regarding tartarized antimony as the principal, and generally speaking, the sole remedy in the treatment of diseases of the chest. Rasori first employed it about 1799 in the treatment of an epidemic fever which raged at Genoa. He subsequently prescribed it in other diseases, in very large doses, and with a view to an *effect on the system* and on the *disease*, entirely *independent of any evacuation whatever*. He called this operation of the drug contra-stimulant—the reverse of stimulant or depressant. It seems that he rarely commenced the treatment with a smaller quantity than twelve grains, to be taken in the course of the day, and he caused this dose to be repeated at night. When the pneumonia had already made some progress, he gave twenty grains, or even thirty grains, daily; and afterwards went on increasing the dose to one drachm (sixty grains), or even many drachms daily, *according to the morbid state*.

On the power of the human organism to support these large doses, to which the name of *tolerance* (tolleranza) has been given, Rasori thus expresses himself:—"The fitness of the living organism to support large doses of the salt *without producing vomiting, or any other symptom of powerful action on the intestinal tube*, belongs only to the *morbid state*, is *limited to this*, and *lasts only so long as this*. The general morbid state designated by the word diathesis, is that which, in all cases, constitutes the fitness of the living body to *support with impunity*, or to express it more correctly, *with utility*, the different doses of the medicine." He especially enforces the doctrine, that where the disease diminishes or changes its character, the aptitude to support strong doses of this substance is also diminished or changed. There will be repugnance to the remedy, or nausea and vomitings, and a manifestation of what may be called excessive (or a poisonous) action of the medicine.[1]

[1] 'Bibliothèque Thérapeutique,' tom. i, p. 196. See also 'Della nuova Dottrina Italiana. Prolusione,' del Prof. Giacomo Tommasini, Firenze, 1817. As I have reason to know that there was an intention to misrepresent and misapply the principles of this Italian doctrine, for the purposes of the defence of William Palmer, had

It was observed in the practice of Laennec, that when tartarized antimony was given (to the diseased) in the doses already described, vomiting ordinarily followed the first, and generally the second dose, the bowels being sometimes simultaneously affected, and sometimes not, while the two or three doses next ensuing produced purging. After this, the alimentary canal, in cases favorable for this plan of treatment, became *tolerant* of the medicine, and no evacuation was produced. So far indeed from purging being a uniform effect, it was often necessary to suspend the employment of the antimony, and to administer clysters or purgative medicines. Some patients were observed to bear the medicine at once, and there was no vomiting or purging. In general, the remedial power of tartarized antimony was most rapidly manifested in those cases in which it gave rise to no evacuation. In one instance, a man took six grains daily, for two days; tolerance was established on the second day, and the symptoms of pneumonia disappeared. In another, twenty grains were prescribed in the twenty-four hours, and by a mistake, *forty grains* were taken. It occasioned but little evacuation, and the patient was benefited. In a third, the first dose of the medicine having increased a diarrhœa under which the patient laboured,

he been tried on the charge of murdering his wife, it may be as well to place on record here, for guidance in future cases, the *ipsissima verba* of the eminent pupil of Rasori, Giacomo Tommasini, of whose views and practice I had personal experience, during a residence in Italy, in 1828-9. Neither Rasori, nor his pupil, entertained the remotest idea that their 'nuova dottrina' would be perverted by medical men in England to a justification and excuse for secretly poisoning healthy persons by tartarized antimony. Contrasting the effects produced on the body by this drug, in a state of health and disease, Tommasini expressly says: "Mentre gl' indicati controstimoli l' ipecacuanha, per esempio, *il tartaro emetico*, gli acidi ed il nitro, non riscaldano, e non aumentano mai l' eccitamento in un corpo *sano, prima di gettarlo nella debolezza, ma i fenomeni di debolezza per primo ed immediato effetto producono.*" (Op. cit p. 65.) Here it it clearly implied, that doses which may benefit the diseased may injure the healthy. Again: "Le guarigioni (ottenute nell Ospedale de Milano dall' inventore di questa Dottrina), di tante inflammazioni di petto *col tartaro stibiato a dose generosa e senza corrispondenti evacuazioni*, quelle di simili ed altre malattie parinente flogistiche, per mezzo di digitale purpurea e quelle di tante dissenterie parimente flogistiche sotto uso della gomma gulta: *diminuendosi e sospendendosi per questo rimedio lungi dall aumentarsi gli scarichi*, sono fatti che non ammettono alcuno dubbio," p. 66. The conditions, therefore, which constitute the *poisonous* action of this drug, are those which do not occur, and cannot occur, without danger under this mode of treatment.

and the evacuations having occasioned syncope, it was suspended after two or three grains had been given. If the medicine had been persisted in, in spite of this warning, there is no doubt that the patient would have been poisoned by it. When tolerance was established, it was found that it might be given with safety, but only *so long as the tolerance lasted.*

Rasori attributed this tolerance to what he termed the diathesis, in other words, the peculiar morbid state or inflammatory condition of the system. Laennec ascribed it to the largeness of the dose, considering that a large, is less emetic than a small dose, to habit and the agreeableness of the vehicle (infusion of orange leaves) in which it was administered, as well as the intervention of two hours between the doses. Whatever theory we may adopt respecting the cause, the fact itself is undisputed, that in these inflammatory states of the system, larger doses have been borne than in a state of health :— the poisonous action of the drug appears to be suspended, and effects are produced quite different from those which are observed in the healthy. Sir John Forbes has very justly remarked, that the view of Rasori regarding the cause of this tolerance is probably correct; for, beyond all question, an inflammatory condition of the system renders it capable of supporting agencies, *e. g.*, the free use of cathartics, bleeding, and cold, which in health would be highly prejudicial. It is further a question with respect to the Rasorian treatment, whether imflammations, as they present themselves in Italy, are not less tractable, and whether they do not require remedies in more powerful doses than those which we are accustomed to prescribe in this country. It is quite certain that, although in the north of Europe, Rasori's treatment has been adopted by skilful practitioners, they have in no instance ventured to give tartarized antimony in the enormous doses which he has recommended.

According to Sir John Forbes, in Rasori's practice, out of 832 cases of pneumonia treated by him, 173 patients died, showing a mortality of 22 per cent. Rasori considered this to be very successful! Wagner, who witnessed the practice of Rasori at Milan, states that out of thirteen cases of pneumonia which he saw treated, seven were fatal, the deaths being caused, in his opinion, more by the practice than the disease.

Tommasini states, of his own practice, that out of 115 cases, 14 died, a mortality of between 12 and 13 per cent.[1]

Those physicians who have relied upon this practice, to show the non-poisonous action of the drug, have assumed that in all cases, its operation was beneficial and that it never caused serious symptoms or death! Laennec, it is stated, lost only two patients out of fifty-seven. M. Bouillaud, on the other hand, asserts that out of fifteen patients treated for pneumonia, by large doses of tartarized antimony, six died, showing a mortality of about 40 per cent.! The practice of Louis and Lepelletier, shows a mortality of about 14 to 15 per cent. How many of these died from actual poisoning by the medicine, we are not informed. The successful cases appear to be invariably set down to the "heroic" remedy, and the failures to the disease. Whenever tolerance is not established, the patient incurs a risk of life; and, according to the advocates of this mode of treatment, if tolerance cannot be established within a reasonable time, and before the powers of the patient are too much exhausted, the medicine should be withdrawn. In two cases, Laennec was obliged to discontinue the antimony, owing to his not being able to produce tolerance. In prescribing it for his patients, he was especially careful not to repeat the dose, if the preceding dose had occasioned any ill consequences. This of course obviated risk, and was, to a certain extent, a safeguard against the poisonous operation of the drug. In cases in which the evacuations were too copious, it was withdrawn.[2]

Sir John Forbes relates a case of affection of the heart with violent bronchial inflammation, in which there was at the same time tenderness at the pit of the stomach. Tartarized antimony was administered in large doses, with the effect, that not only was tolerance never established, but vomiting remained for some time after the antimony had been withdrawn. This was with difficulty subdued, and intense epigastric pain remained, until the case terminated fatally. On inspection, in addition to the indications of cardiac and bronchial affections, the mucous lining of the stomach was found in some parts quite pulpy, and almost every where intensely vascular

[1] Forbes' 'Translation of Laennec,' p. 264.

[2] Op. cit., pp. 258, 260, 262.

(reddened from inflammation).[1] Who can doubt from this description that the patient fell a victim to the Rasorian treatment; in other words, that he was poisoned by the remedy. Dr. George Wood, U. S., in remarking upon this antimonial plan of treatment, observes, "that it is not without its dangers. The depression may be too great—or gastro-intestinal inflammation may be induced, or the patient may be *exhausted by excessive vomiting and purging*. A patient who is placed under its use, should seldom be long unseen by the practitioner, as serious evils may happen in the intervals of his visits if long protracted. The plan is altogether unsuited to cases in which there is already gastro-intestinal irritation. Having witnessed fatal effects from the abuse of tartar emetic, I have been from the first averse to the plan, and the result of the few cases in which I have seen it employed, has not tended to reconcile me to it."[2]

It would appear that there are other diseases in which full doses of tartarized antimony may be borne, not only without symptoms of poisoning, but with benefit to the patient. Mr. Curling quotes a case of chronic traumatic tetanus, in which this medicine was given in doses of one grain every hour.[3] Large doses of tartarized antimony are also said to have been borne in cases of acute rheumatism, delirium tremens, and insanity (acute mania), without producing the usual symptoms of irritation amounting to poisoning.

According to Magendie persons affected with apoplexy, paralysis or mania, will bear large doses without injury. He relates the case of a patient, to whom he was called, who had been seized with sanguineous apoplexy. When he arrived, he found that twelve grains of tartarized antimony had already been administered to him without exciting vomiting. He then prescribed fresh doses until thirty-six grains had been taken in an hour and a-half. This was followed only by slight vomiting. The case ended favorably. The large quantity of tartarized antimony administered did not appear to produce any injurious effects.[4]

[1] Translation of Laennec, 3d edition, p. 423.

[2] 'Practice of Medicine. Special Pathology. Pneumonia,' vol. ii, p. 47. Philadelphia, 1847.

[3] 'A Treatise on Tetanus,' p. 179.

[4] 'De l'Influence de l'Emetique sur l'Homme.'

On the other hand, Orfila reports a case which shows that, although a state of apoplexy may give rise to such a tolerance of this compound, as to prevent the appearance of the ordinary symptoms of irritation during life, it will not prevent its action as an irritant, so far as appearances in the dead body are concerned. A man was seized with apoplexy on the 24th February, and died on the 1st March. During the five days of his illness, there were administered to him thirty-seven grains of tartarized antimony in divided doses. There was neither nausea nor vomiting, and only slight purging. After death, there was found considerable disease of the brain with serous effusion, and these morbid changes were doubtless the cause of death; but the intestinal canal presented appearances which could be ascribed only to the irritative action of the antimony. The stomach was much reddened, inflamed, and filled with biliary and mucous matters. The inflammation of the mucous membrane was in spots or patches—of a deep cherry red, or a violet rose-coloured ground. There was no ulceration. In the second and third curves of the duodenum, there were similar patches of redness on the mucous membrane. The small intestines were of a rose colour, and did not appear much inflamed. They contained mucous matters and bile. The cæcum presented three patches of a deep red colour. There were some on the colon but less red. The rectum was healthy. There were dark irregular patches in the lungs, extending into the substance of the organs.[1] Serious effects are occasionally produced by tartarized antimony, even when it appears to be tolerated in diseases of the lungs (see case No. 16, in the table at page 411.) In another case, a patient affected with pneumonia died while under treatment with large doses. An inspection showed that the medicine had produced serious mischief. The mouth, throat, and gullet, were covered with pustules. In a third instance in which ten grains dissolved in seven ounces of water, produced neither vomiting nor purging, the patient was attacked with severe angina. The mouth and lips were swollen, tongue red, dry in the middle, the fauces deeply reddened from inflammation, and covered with small bladders. These parts were coated with a tenacious mucus, so that swallowing was difficult.

[1] Case by J. Cloquet, 'Orfila Toxicologie,' i, 625.

Fever and delirium set in.[1] To the disordered condition of system thus induced by this medicine taken to excess, the term "*stibialism*" has been applied. There is reason to believe that many pneumonic patients have died from the antimonial treatment, while their deaths have been ascribed to the disease. M. Saurel, in admitting the benefits obtained from the medicine, deplores the serious accidents which ensue, and for which apparently no foresight can always provide. He relates two cases which fell under his own observation. In one, tartarized antimony was given in large doses; but while the pneumonia was benefited—the mouth was salivated—the papillæ of the tongue were enlarged, and converted to aphthous sores. They acquired a black appearance, and there was no doubt that the whole of the alimentary canal was affected in the same manner. The patient died in a month. He did not observe any indications of intolerance of the medicine. In a second case of pneumonia, the medicine was given in increasing doses—one grain and a half, two grains and a half, and then three grains; the whole quantity taken not exceeding *ten grains*. Retching appeared, and the antimonial mixture was withdrawn. A kind of catarrhal affection supervened,—a result of stibialism. This alone, however, would have been manageable. The death of the patient arose from intolerance in the alimentary canal; scarcely anything was retained. The whole of the mouth was covered with an aphthous eruption extending apparently throughout the alimentary canal. No treatment arrested its progress; and the patient died in about five weeks.[2]

M. Baudet considers that these serious effects on the mouth, throat, and alimentary canal, are owing to the medicine being taken in a *liquid* form. He recommends in preference that the antimony should be prescribed in the form of pills. Whatever view may be adopted on this point, there is no other term which can be applied to such effects than—*poisoning*. Stibialism is only another scientific expression of an esoteric kind.

[1] 'Med.-Zeit v. Heilk,' No. 41, 1839; also 'Heller's Archiv,' 1846, iii, p. 107. At page 110, is reported another case in which ten grains given in thirty-six hours, caused a purulent eruption on the back and arms, like that caused by local application of the ointment.

[2] Bouchardat, 'Annuaire de Thérapeutique,' 1856, p. 110.

Dr. Brinton, of King's College, has added his testimony to the noxious action of tartarized antimony, in cases in which it has been prescribed medicinally for the treatment of pneumonia. He has made special reference to one, a strong man suffering from pneumonia involving less than one sixth of the lungs. The drug had been prescribed, and had caused continuous vomiting for a week. The patient was in a hopeless state when first seen by him; the symptoms were those of a failure of circulation (his muscular strength being much less affected), a cold clammy perspiring skin, blue lips, and peculiar mental depression and anxiety. The instant and frequent administration of stimuli in large quantities, did not prevent his continuing to sink, and he died in about four hours. In two or three other cases of a similar kind, but not fatal, he had seen a peculiar eruption of the skin, like that produced by the external application of the poison,[1] although it had been given internally. From this accumulated evidence on the Italian mode of treatment, I quite concur in the opinion expressed by my friend Dr. John Webster,[2] that "the practice is frequently followed by very decided results." The results, however, are not always favorable, and the patient is poisoned *secundum artem!*

Let it not be supposed that by these remarks I wish to undervalue a mode of treatment for pneumonia, which certainly has the sanction of high medical authority; but when the successful cases of "tolerance" are brought forward for the purpose of proving that the practitioner is dealing with a perfectly safe and innocent drug; and the numerous cases in which this "heroic" treatment has either proved directly fatal or accelerated death, are either ignored or kept in the background—it is necessary to the interests of science and justice that the truth should appear. Assuming that cases of pneumonia will hereafter be treated as they have been on Rasorian principles, it is only proper that those of the public who are not suffering from pneumonia, should be protected from the possible consequences of large and frequent doses of this drug secretly administered. At present, the conclusion drawn by the advocates of the theory and practice, is, that the healthy

[1] Med. Soc. of London, 'Lancet,' May 31st, 1856, p. 590.

[2] 'Lancet,' January 26th, 1856, p. 107.

ought not to die from its effects, because the diseased have been in many instances cured by it without bleeding, &c. Let those who believe this doctrine submit themselves to experiments as a test of their sincerity, and follow the example of Mayerhofer in recording their experience for the benefit of society.

The tolerance of this medicine may be more apparent than real. The ordinary effects may be replaced by some other noxious mode of operation. Dr. Male states that he was called to a child to whom a large dose had been given, and no vomiting had taken place. The child lay in a state of insensibility, the extremities were cold ; the pulse languid and almost imperceptible. On administering strong brandy and water, violent vomiting succeeded, and the child recovered.[1]

Orfila on one occasion prescribed three quarters of a grain for a child ten years of age with a view to act as an emetic. Vomiting did not take place, but in half an hour there was severe pain in the throat, with great difficulty of swallowing. There was no pain. These symptoms lasted more than two hours.[2]

A case of pneumonia is reported by Dr. Haldane, in which tartarized antimony was given in divided doses, until the quantity amounted to forty or fifty grains. The man then complained of severe sore throat. He died of pneumonia in four days—the lung was found diseased. Aphthous ulceration was found in the mucous membrane of the pharynx and larynx including the epiglottis. There could be no doubt that this had been caused by the antimony.[3] Three cases of pneumonia in which it proved fatal, by leading to hæmorrhage from the nose and the bowels, are reported by Dr. Peebles, U. S.[4]

Cramp in the stomach and gastritis have been frequently observed to result from the free use of tartarized antimony in the treatment of the autumnal fevers of the United States. In the opinion of Dr. Drake it is a frequent cause of death.[5]

Dr. B. W. Richardson states that he prescribed for a delicate strumous man, suffering from pneumonia and pleuritis, one third of a grain of tartarized antimony, to be taken every

[1] 'Juridical Medicine,' p. 96.

[2] Orfila 'Toxicologie,' vol. i, 621.

[3] 'Edinburgh Monthly Journal,' August, 1854, p. 184.

[4] 'American Journal of Medical Science,' April, 1848, p. 339.

[5] Beck's 'Medical Jurisprudence,' vol. ii, p. 603.

four hours. In half an hour after he had taken the first dose he suddenly became restless, cold, and faint; he then vomited, and soon afterwards was violently purged. In three hours, although the pain at the chest had disappeared, the vomiting, purging, and prostration were extreme. There was little pulse, the surface was cold; the legs were cramped. The case was similar to one of Asiatic cholera, and was evidently a case of poisoning by antimony. It was found that, owing to an accident in dispensing, *three grains* of tartarized antimony had been taken by the patient. On another occasion he prescribed for a stout, active, well-built man, fifteen minims of antimonial wine (= 1-16th of a grain of tartarized antimony). This small dose was prescribed as the patient had informed him that he suffered severely from the effects of antimony. It produced incessant nausea for many hours. There was abdominal pain with griping, faintness, general exhaustion, and great prostration of strength. There was no purging.[1]

The result of this investigation is, that there appear to be certain diseased states of the body which modify or suspend that excessive action of tartarized antimony on the system to which the term "poisoning" is applied: that great precautions are required in its use, even in these cases, or it may destroy life; that large and repeated doses have been frequently taken by patients without causing symptoms of poisoning, and with actual benefit; but there are no facts to justify the inference that this substance is not a poison to the healthy, or to those persons who labour under any disease in which tolerance is not speedily established. The healthy and the diseased will die alike from its effects, if the symptoms indicative of poisoning (vomiting, purging, pain, and depression), are once established, and not afterwards suspended, either by the withdrawal, or in certain cases by the continued administration of the medicine.

The facts have hitherto presented no difficulty to medical jurists except in their perversion. The late Professor Orfila pointed out, in the last edition of his work, the fallacy into which some medical writers have fallen in describing the properties of tartarized antimony. In referring to the influence of dose on the poisonous action of various substances, he says: "Persons labouring under certain forms of disease will bear without

[1] 'Lancet,' April 12th, 1856, p. 400.

injury considerable doses of a poisonous substance, while much smaller doses would produce dangerous effects on the same persons in a normal (healthy) state. We may quote in proof of this, the effects of tartarized antimony in inflammation of the lungs. Would any one take it into his head to assert that these poisonous substances are not deleterious to man, because they do not act as poisons even in very large doses? Assuredly not, the fact would merely prove that those substances which are poisonous in the generality of cases, are not poisonous in the same doses under certain conditions in which they are tolerated."[1]

It is strange that so soon as a vital necessity arose for acknowledging this scientific truth, it was wholly ignored, even by writers of a respectable professional position. At the same time they would admit that persons suffering from tetanus or hydrophobia have taken with impunity doses of opium which would have infallibly destroyed them, if they had not been labouring under these diseases. Is it to be said that opium is not a poison, and that a few grains of this drug will not destroy the life of a healthy adult, because larger doses have been given without dangerous consequences to the hydrophobic or tetanic patient? Yet either this must be the extent of the argument, or it amounts to nothing with respect to the variable action of tartarized antimony on the body. In the mean time, the promulgation of such illogical views, when the attention of the public was specially directed to the subject of poisoning, and a trial was pending in which the criminal use of tartarized antimony was the main question at issue, has had the evil effect of causing that crime to be imitated, and has led to the perpetration of at least two murders! It would have been an honorable course for those who entertained reasonable doubts on the poisonous action of this drug, to have presented themselves as witnesses in the case, and have tendered the evidence of their experience; but it was most injurious to the profession and public to disseminate imperfect views, which could only have the effect of misleading lawyers and the class of men who constitute juries, on the question which was then about to be tried.

[1] 'Traité de Toxicologie,' tome i, p. 13, 5ème ed., 1852.

3. Action of Tartarized Antimony in large doses as a poison. Acute poisoning.

It has been remarked by most writers on toxicology, that cases of poisoning by tartarized antimony are not common. In 1837-8, out of 527 deaths from poison, in which the poison taken was ascertained, there were only two deaths which had been caused by this substance. In France, out of ninety-four recorded deaths from poison, (1825—32), there was only one from tartarized antimony. Out of 213 cases of poisoning admitted into the London Hospital during eleven years, 1846—1856, there was, according to Mr. Burch, only one in which tartarized antimony was the poison used (in 1846), and in this instance the patient recovered. In twenty-seven cases of poisoning admitted into Guy's Hospital in three years, 1854—6, there was not a single instance. During a period of twenty-six years, the number of cases referred to me as actual or suspected poisoning by tartarized antimony, in which this substance had been administered, have amounted to only nine, of which two proved fatal. Five of these cases, including the two which were fatal, have occurred since 1855. The infrequency of cases of poisoning by this substance has been erroneously supposed to indicate that it is not poisonous, and that the free use of it is not attended with danger. The same mode of reasoning would prove that strychnia, atropia, and aconitina were not poisonous. When a substance is rarely taken or administered as a poison, the number of fatal cases must necessarily be few. Although, for reasons already stated, tartarized antimony is not so energetic and certain a poison as arsenic, yet if it were taken or administered as frequently, cases of its fatal operation would be far more common. In medical practice, care is invariably taken that its medicinal, does not pass into its poisonous action; and the doses are either reduced, given at longer intervals, or altogether withdrawn, when any injury to the patient's condition is manifested. Fortunately, sufficient warning is given of the probable danger before injurious effects are produced; and, in general, the rapid recovery of the patient when the medicine is suspended, forms a striking contrast with the effects of arsenic under similar circumstances.

We are indebted to Magendie for our knowledge of the earliest cases of poisoning by large doses of tartarized antimony.[1]

1. A man, æt. 50, swallowed eighteen grains in a glass of water. He was brought to the hospital of St. Louis; mucilaginous drinks were freely prescribed, and he recovered in two days.

2. A woman, æt. 26, swallowed twenty-four grains in a glass of water. She suffered from painful purging and vomiting of mucous matters mixed with blood; severe pain in the epigastrium, and some convulsive movements. Under treatment with gum water, &c., she recovered.

3. A stout woman, æt. 40, took thirty-two grains in cold water. She had repeated vomitings, which gradually subsided. On the next day, she merely complained of uneasiness of the stomach.

4. Breschet met with a case in which a woman swallowed sixty grains in the pulp of an apple. She was immediately taken to the hospital of St. Antoine. She rejected, by vomiting, the pulp, in which there was a visible quantity of tartarized antimony, and she recovered.

5. A man swallowed by mistake, *twenty grains* of tartar emetic, in a decoction. In a few minutes, there was pain in the region of the stomach, which increased in severity, and was followed by fainting. There was then excessive vomiting of a bilious liquid; and when the patient was first seen by Magendie, these fits of vomiting succeeded each other with frightful rapidity. There were severe colicky pains in the abdomen; incessant purging, the stools being liquid and copious. The pulse was small and contracted; the face pale; there was great prostration of strength, and painful cramps in the legs, a symptom of which the patient complained most. A demulcent treatment was adopted with benefit. In the evening, the patient complained only of weakness. The irritation produced by this large dose on the mucous surface of the stomach and bowels, gave rise to symptoms resembling those of cholera morbus. They continued for a period of five or six hours, and then subsided under treatment.

6. A young woman swallowed thirty grains. She was soon

[1] 'De l'Influence de l'Emétique sur l'Homme et les Animaux,' 1813.

attacked with violent vomiting, which continued until the evening, in spite of the administration of infusion of Peruvian bark. With the exception of a feeling of weakness, she recovered on the following day.

7. A man swallowed twenty-seven grains in sugared water. He had hardly gone twenty paces, when he felt a burning heat in the stomach, accompanied by loss of consciousness and convulsive movements. In ten minutes after he had swallowed the poison, he was brought to the Hotel Dieu. The symptoms from which he was then suffering were: cold and clammy state of skin from head to feet; respiration short; pulse small and contracted, and the region of the stomach swollen and painful; there was at this time hiccough, but no vomiting. In two hours, there was copious purging and sweating, followed by vomiting, which continued the next day. An attack of inflammation of the stomach supervened, which lasted several days. A month afterwards, he still suffered from pain in the pit of the stomach.

8. A girl swallowed six drachms (about 360 grains) of tartarized antimony. M. Lebreton, who saw her half an hour afterwards, administered to her a large quantity of oil. She vomited immediately, and probably brought up the whole of the poison, for the vomiting and other symptoms soon ceased.

Magendie refers to some cases among his patients in which ordinary grain doses of this substance did not cause vomiting, although other symptoms of a severe kind were manifested, *e. g.*, pains in the chest and abdomen, and convulsions, with great prostration of strength. In one instance the patient took several large doses in succession, until the whole quantity taken had amounted to *twenty-two grains;* there was no vomiting, but other symptoms of a vicarious kind appeared, *i. e.*, profuse evacuations of glairy, mucous, and bilious stools, with constant straining (tenesmus). This patient did not recover from the effects for three years.[1]

It is quite clear from these, and similar facts recorded by others, that there are some cases of poisoning by this substance in which vomiting is absent; but its absence is com-

[1] Op. cit., pp. 25, 26.

pensated by other symptoms of a violent and depressing kind.

The conclusions drawn by Magendie from his researches were—

1. That tartarized antimony in a large dose may give rise to alarming accidents and even death; and if in certain cases large doses have been swallowed without serious effects, this is owing to the rejection of the substance by vomiting, or in the evacuations.
2. That its deleterious action is specially manifested on the pulmonary tissue, and on the mucous membrane of the alimentary canal from the stomach to the rectum.
3. That when it causes death, this effect cannot be ascribed to the local action of the substance on the organs, but to its absorption and diffusion through the whole circulation.

Cuvier, in reporting on Magendie's researches, observes, it is fortunate that the first effect of this substance is to produce vomiting, and thus the dangerous symptoms, and even death, likely to be caused by it, are counteracted by its own operation, when taken in large doses. He further remarks: the duration and copiousness of the evacuations, as well as the intensity of the symptoms, depend less on the dose of tartarized antimony than on the constitution or idiosyncrasy of the person to this particular drug. This is a point of which a medical jurist should not lose sight, as it serves to explain many anomalies in its effects in relation to the dose taken.

With these plainly expressed views, it is surprising that some medical writers should have quoted Magendie as an authority for the statement that tartarized antimony is *not a poison!* Magendie states that he has not met with a fatal case; but in this respect he is not singular, for there are many physicians in extensive practice who have probably not seen a fatal case of poisoning by tartarized antimony, strychnia, or even arsenic. On the other hand, he has known persons to recover after having taken large doses of tartarized antimony, and there are recorded many cases of poisoning by arsenic and opium, in which persons have equally recovered after having taken very large doses of these poisons. With

respect to fatal cases of poisoning by tartarized antimony, so far from denying their occurrence, he expressly says: "Il se pourrait donc que des cas de cette espèce se fussent rencontrés, les expériences que j'ai rapportées me paroissent rendre la chose probable. * * * La conséquence générale qu'on peut déduire de tout ce que j'ai dit, est qu'on pourroit le prévoir par le simple raisonnement, savoir qu'un homme ou un animal pourra prendre sans danger une dose très forte d'émetique, *pourvu qu'il vomisse promptement après l'avoir prise ; et qu'en vomissant, il rejette* à très peu près *le sel* qu'il avoit avalé. Dans le cas contraire, c'est à dire, si l'homme ou l'animal qui a pris l'émetique en grand quantité, ne vomit point, ou vomit sans rejeter la plus grande partie de l'émetique qu'il a avalé, il pourra en résulter *des accidens graves* et *la mort*. Dans ce dernier cas, ou aurait encore un semblable resultat, quand bien même la quantité d'émetique *ne seroit point très considérable*." The facts observed and recorded by Magendie admitted of no other conclusion than that which he has here drawn. The cases related under 5, 6, and 7, are clear cases of poisoning by this substance. In Case 5, only twenty grains were taken, and the effects were such as might have caused death in persons naturally feeble or weakened by disease. That other persons have taken, without much suffering, the same, or even larger doses, does not affect the question whether the substance be a *poison or not*. Ten negative results cannot affect one clearly established affirmative instance. But these negative results were here observed in cases in which there had been early and judicious treatment, with free and copious evacuations, either by vomiting or purging, or by purging alone. Had Magendie continued to dose his patients with antimony, instead of relieving them by proper medical treatment, it is easy to comprehend that the greater number, if not all, would have died. As it is, the facts show that which experience has since confirmed, that there is a better chance of recovery under treatment in antimonial poisoning than in some other forms of mineral poisoning in which the substance is not so readily expelled from the body.[1]

[1] I have here placed these facts on record that the real views and conclusions of Magendie may be known. At the time of the Palmer trials, these views were grossly misrepresented in various publications, in order to make it appear that the witnesses

In the subjoined table I have ~~collected and~~ arranged those cases of poisoning by tartarized antimony which I have been able to collect from authentic sources. Assuming that the deaths among healthy persons are few compared with the number of cases, it must be remembered that this is the general character of poisoning. There are some poisons from which the recoveries are proportionately few, such as prussic acid; but taking a large number of cases of poisoning indiscriminately, the recoveries bear a large proportion to the cases when these are submitted to early treatment. Out of 213 cases of poisoning recorded by Mr. Burch, as received at the London Hospital during eleven years, there were only fifteen which proved fatal, a ratio of 7 per cent., or ninety-three recoveries to seven deaths. Among sixty-three cases of poisoning treated at the Birmingham Hospital in eight years (1848—56), reported by Mr. W. Wilson, there were only five deaths, a mortality of less than 8 per cent. Of twenty-seven cases admitted into Guy's Hospital in three years, there were eleven deaths, showing a larger proportionate mortality, *i. e.*, about 40 per cent. These results will of course be influenced by the nature of the poison and the stage at which the case comes under treatment. If we take an individual poison, such as opium (laudanum), we shall find that, as in tartarized antimony, the recoveries bear a very large proportion to the deaths. Out of sixty-one cases of poisoning by laudanum reported by Mr. Burch, there were only four deaths; and of the five cases of this kind of poisoning reported in the Guy's return, all recovered. The fact, then, that recoveries are numerous, and deaths are proportionately few, must not be allowed to influence our judgment on the question whether a particular substance is or is not to be regarded as a poison.

for the Crown were mistaken. It was even asserted that Magendie himself had been summoned as a witness for the defence of William Palmer, although it was well known to the scientific world that he had been dead many years! Could his evidence have been procured, the relation of the symptoms in Case 5 would have completely corroborated the conclusions drawn by the witnesses for the Crown regarding the effects of antimony.

Cases of Poisoning by Tartarized Antimony.

No.	Authority and date of occurrence.	Dose taken and symptoms observed.	Result.—Appearances after death.
1	Magendie, 'De l'Influence de l'Emétique sur l'homme et les Animaux,' Paris, 1813. A man, æt. 50.	Eighteen grains in a glass of water. Treatment in hospital.	Recovery in two days.
2	Ibid. A woman, æt. 26.	Twenty-four grains in water. Painful purging and vomiting of mucous matters, mixed with blood; severe pain in abdomen; convulsive movements. Treatment in hospital.	Recovery.
3	Ibid. A woman, æt. 40.	Thirty-two grains in water. Repeated vomitings, gradually subsiding; uneasiness of stomach the day following.	Recovery.
4	Ibid. (Breschet.) A female.	Sixty grains in pulp of apple. Immediate treatment. Pulp with the poison rejected by vomiting.	Recovery.
5	Ibid. A male. (Dr. Barbier, Amiens.) Orfila, op. cit., i, 622.	Twenty grains in a decoction. In few minutes severe pain in stomach; fainting; incessant vomiting of bilious liquid and incessant purging; liquid stools; cramp in legs; pulse small and contracted; great prostration of strength. Treatment.	Abatement after five or six hours, and recovery. Great weakness and disordered digestion remained.
6	Ibid. A female.	Thirty grains. Speedy and violent vomiting, continuing the whole of the day in spite of treatment.	Recovery next day. A feeling of weakness.
7	Ibid. A man, æt. 43. (Dr. Serres.) Orfila, 'Toxicologie,' i, 622.	Twenty-seven grains in water. In a few minutes burning heat of stomach; loss of consciousness; convulsive movements. In ten minutes skin cold and clammy; *no vomiting;* stomach swollen and painful; breathing short; pulse small and contracted. In two hours, copious purging and sweating, followed by vomiting. Gastritis of several days' duration. Treatment.	Recovery; but for a month after taking the poison, suffered from pain at the pit of the stomach.

No.	Authority and date of occurrence.	Dose taken and symptoms observed.	Result.—Appearances after death.
8	Magendie, 'De l'Influence de l'Emétique sur l'homme et les Animaux, Paris, 1813. (Lebreton.) A girl. Orfila, 'Toxicologie,' i, 620.	Six drachms (360 grains). Oil speedily administered. Vomiting; poison ejected.	Recovery.
9	Dr. Carron, 'Journal Générale de Médecine,' 1811. Orfila, op. cit., i, 620. A man, æt. 30.	A large dose. Speedy and violent vomiting; severe pain in stomach; after some hours difficulty of swallowing; almost complete obstruction of gullet; spasm of muscles of neck; face red and congested; eyes suffused; giddiness. These symptoms lasted thirty six hours. Treatment.	Recovery—spasm of the gullet occasionally presenting itself.
10	Ibid. (Dr. Carron.) A female.	Seventeen grains. Severe pain; incessant vomiting; spasmodic closure of the jaws; convulsions. Symptoms removed by treatment.	Recovery; but an irritability of stomach remained, only relieved by milk and mucilaginous drinks.
11	'Journal Générale de Médecine,' Mai, 1825. Orfila, 'Toxicologie,' i, 623. A female, æt. 23. (Dr. Sauveton.)	Fifty-four grains in solution. In ten minutes, found covered with a cold sweat. Symptoms imperfectly described. Nausea and colicky pains in the pit of stomach.	Recovery; but pain in pit of stomach for some months.
12	Orfila, 'Toxicologie,' i, 623. (Dr. Recamier.) A man, æt. 50, of strong constitution.	Thirty-six grains in a small quantity of liquid. Speedy vomiting; violent purging and convulsions; violent pain in abdomen, which was distended; pulse imperceptible; delirium and convulsions.	Death on the fourth day. Inflamed state of cerebral membranes, with serous effusion: brain soft. Mucous membrane of stomach swollen, reddened and softened, except at the greater end; of the duodenum, also reddened; intestines empty.
13	'Gazette Médicale,' Dec. 18, 1841. (Dr. Sacli.) Orfila, 'Toxicologie,' i, 624. A man, æt. 40.	Six grains and a quarter in four ounces of water. No vomiting although warm water freely taken. After some hours, uneasiness; nausea; heat in pit of stomach; restlessness; giddiness; fainting. In eight hours, loss of consciousness; convulsions; difficulty of breathing; livid face; pulse slow and full. Treatment.	Recovery in two days, with slight pain in stomach, heaviness of the head, weakness in limbs, and disturbance of speech.

14	Casper's 'Wochenschrift. (Dr. Lambert.) 'Med. Jurisprudence,' 5th ed., p. 118. A man.	Four grains. Violent pain in abdomen; vomiting and purging, followed by strong convulsions, lasting half an hour; loss of speech; pulse imperceptible; cold skin, and collapse. Treatment.	Recovery in fourteen days.
15	Orfila, 'Toxicologie,' i, 625. (Cloquet.) See ante, page 397. A man.	Thirty-seven grains, in divided doses, in five days. No vomiting, only slight purging.	Death in five days, from disease of brain. Stomach, duodenum, and cæcum inflamed in spots or patches. Dark patches on the lungs.
16	'Gazette Médicale,' 1839, No. 2. Heller's 'Archiv,' iii, 1846, p. 105. A man, æt. 66.	Sixty grains in four days, for pneumonia. On third day symptoms much aggravated; breathing rapid; pulse 106; restlessness and great anxiety; membranous exudation in the mouth.	Death. Mouth, throat, and gullet covered with false membranes; in the latter, ulcerated pustules, as far as opening of stomach; mucous membrane of stomach covered with mucus; dotted redness in great curvature; mucous glands of small intestines enlarged; lungs partly hepatized, and infiltrated with pus.
17	Heller's 'Archiv.,' iii, 1846, p. 108. (Mayerhofer.) A woman, æt. 33.	Six grains, wrapped in paper. In half an hour, severe and painful vomiting of mucus, mixed with bile and some blood. The next day a red tongue; intense thirst, and heaviness of the head.	Recovery.
18	Ibid., p. 109. (Prof. Giacomini.) 1833-8.	Twenty grains in solution. In ten minutes trembling of the knees; giddiness and shiverings of the body; insensibility for half an hour; forehead and hands covered with cold sweat, which, when removed, speedily returned; face pale; lips livid; pulse scarcely perceptible, sometimes quick, at others slow; increased secretion of saliva and urine. On the next day there was purging.	Recovery.
19	Ibid., p. 111, 1842. (Consbruch.) A man.	Dose unknown. A concentrated solution of tartarized antimony.	Death in a few hours. In stomach, a thick, bloody mucus; mucous membrane intensely inflamed, corroded, and easily removed from muscular coat; the inner surface of duodenum in the same state; of the rest of intestines, greyish and softened; vessels of brain and lungs of right side of heart and the venous trunks, strongly congested.

No.	Authority and date of occurrence.	Dose taken and symptoms observed.	Result.—Appearances after death.
20	Kleinert's 'Repertorium v. Jahrg.,' 1831, 9 H., p. 16. Heller's 'Archiv.,' 1846, p. 107. (Dr. Driver.) A female, æt. 40.	Forty grains in two ounces of water, one half at one dose, of the rest a table-spoonful every quarter of an hour. Vomiting first set in an hour after the last dose; she then fell into a state of asphyxia, and when restored from this, she complained of severe pain in the body. There were several involuntary motions, with much mucus and dead worms. In twenty-four hours there were tetanic spasms affecting the legs.	Recovery.
21	'New York Med. Journ.' Beck's 'Med. Jur.,' ii, 603. (Dr. C. Lee.) A child, a few weeks old.	Fifteen grains in solution. Vomiting; purging; and convulsions.	Death. No report of appearances.
22	Wharton and Stille's 'Med. Jurisprudence,' p. 455. (Dr. M'Creery, U.S.N.) A man.	Half an ounce (240 grains). In half an hour, nausea, followed by distressing vomiting and purging, with violent cramps in legs and wrists. Treatment.	Recovery in a few days, but great prostration remained.
23	Ibid. Canstatt's 'Jahresbericht,' 1851, iv, p. 270. A woman.	Twenty grains. Strength reduced by its violent action.	Death in the course of a year, from irritant effects on intestinal canal.
24	Traill's 'Medical Jurisprudence,' 113. A man, æt. 24, in 1837.	Three drachms (180 grains). Symptoms not described.	Death.
25	Ibid. A child.	Dose not stated.	Death.
26	'London Medical Gazette,' vol. xlv, p, 801. (Dr. Pollock.) A man, æt. 30, Jan., 1849.	One drachm (60 grains). Early and violent vomiting; in two hours, retching at intervals; heat and constriction of throat; pain in stomach; breathing frequent; pulse rapid and small; skin perspiring; bowels moved twice. In seven hours, motionless; insensible; respiration slow; mouth spasmodically closed; surface warm and dry; pulse small, 130; no vomiting or purging; no power of swallowing. Treatment.	Death—tranquil, without convulsions—in ten hours after the poison had been swallowed. No inspection.[1]

[1] I have a note of another case in which fifty grains proved fatal in fifteen hours.

27	'Lancet,' May 22d, 1847. (Mr. Freer.) A man, æt. 28.	Two drachms[1] (120 grains). In half an hour, vomited once; involuntary aqueous purging; mustard and salt produced violent vomiting of bilious matter. In one hour, pulse imperceptible; countenance cold and livid, bathed with clammy perspiration; tongue dry and red; violent pain in stomach and over the whole abdomen. Cramps, vomiting, and aqueous purging continued for six hours. Profuse night perspirations.	Recovery.
28	'Western Journal Med. and Surgery.' 'Med. Times,' Jan. 24th, 1846, p. 127. (Dr. Gleaves.) A man.	A table-spoonful (478 grains). In an hour, speechless, pulseless, and apparently dying; vomited only two or three times in three hours. Violent purging in two hours. In seven hours this ceased; there was great thirst, with burning pain in throat, gullet, stomach, and bowels; vomiting the next day; matters tinged with blood; fauces covered with pustules. On third day, the whole body covered with genuine tartar emetic pustules; copious secretion of urine; pain in passing it.	Recovery, in about two weeks.
29	'Lancet,' April 25th, 1846, p. 460. (Mr. Hartley.) A boy, æt. 5.	Ten grains in powder, mixed with sugar. In twenty minutes, violent vomiting and purging, and great prostration of strength; great thirst; convulsions and tetanic spasms.	Death in eight hours. Effusion of serum in right pleura; redness of right lung; mucous membrane of stomach much inflamed at larger curvature and cardiac orifice; that of duodenum also. Stomach contained a dark, bloody, or brownish liquid; duodenum contained a whitish-yellow viscid secretion, found throughout intestines, but of a deeper yellow in large intestines; peritoneum of stomach and intestines inflamed; no ulceration; great congestion of brain and membranes, but no effusion of serum or blood.

[1] In a letter, Mr. Freer informs me that the quantity was half an ounce, or 240 grains.

No.	Authority and date of occurrence.	Dose taken and symptoms observed.	Result.—Appearances after death.
30	Ibid. (Mr. Hartley, 1846.) A girl, æt. 3.	Ten grains in powder, mixed with sugar. Symptoms similar to those observed in preceding case.	Death in thirteen hours. Appearances similar. Patches resembling scarlatina on skin of arms, leg, and neck. On mucous membrane of stomach, where inflammation was greatest, several white spots—the commencement of ulceration. No antimony found in stomach in either case.
31	'Lancet,' Jan. 21st, 1854. A girl, æt. 16.	From forty to sixty grains. Severe vomiting in a quarter of an hour, followed by purging, continuing three hours; pain; burning sensation in gullet. The next day symptoms abated; relapse in the afternoon; she threw her head back and screamed; skin warm and moist; pupils dilated; knees drawn up; delirium for six hours.	Death in thirty-six hours. Throat swollen; lungs congested; stomach contained a bloody fluid; coats softened; blood effused under mucous membrane; small intestines contained a similar fluid, with mucus. There was no inflammation. Lungs slightly congested; heart contained fluid blood. Only slight traces of antimony detected in contents of stomach.
32	'London Medical Gazette,' July 11, 1835, vol. xvi, p. 521. A child.	Fifteen grains (?), taken in the morning. In half an hour violent vomiting and purging; at 12 o'clock, skin cold, covered with clammy sweat; pulseless; rapidly sinking.	Death—at one o'clock—in six hours (?). Mucous membrane of stomach (posteriorly) dull, rosy appearance; gall-bladder full; mesenteric glands enlarged; effusion in left ventricle of brain; substance of brain soft. No antimony found in contents of stomach.
33	'Journal de Chimie.,' 1847, p. 472. (M. Charier.) An infant recovering from measles.	Three quarters of a grain, prescribed for some disorder of stomach.	Death in an hour.

34	Ibid. An infant, recovering from measles.	Three quarters of a grain, as a medicine.	Death.
35	Ibid. (M. Richelot.) A child, æt. 4, recovering from hooping-cough.	One third of a grain in solution prescribed. Vomiting five or six times, followed by fainting and severe collapse.	Recovery on withdrawal of the mixture.
36	Ibid. (M. Thirial.) An infant recovering from disease.	Dose not stated, followed by serious symptoms, which nearly caused death.[1]	Recovery on withdrawal of medicine. In eight days the cuticle fell from the hands.
37	Andral's 'Clinique Médicale,' Spillan, 1836, p. 698. A medical student, æt. 28.	Two grains (at four p.m.) in two half glasses of water, prescribed for gastric disturbance. In the night, profuse vomiting and purging; the next day, great depression; anxiety. On the second day, cold extremities, thready pulse; unconsciousness.	Death in forty-one hours. Infiltration of blood in spots in mucous membranes of stomach, close to cardia (petechiæ); mucous surface of large and small intestines pale; liver pale, structure friable; spleen enlarged and soft; kidneys reddish; brain and membrane reddish; reddish serum in ventricles; substance of brain soft; lungs gorged; heart contained liquid blood. Livid discoloration of skin of chest.

[1] The dangerous or rather *poisonous* effects produced by tartarized antimony on infants and children, have been pointed out by Mr. Goodlad, Mr. Noble, and Dr. J. B. Beck. Mr. Noble states, that among four cases in which ordinary doses were given, prostration and collapse followed, and two of the children died from the effects of the medicine (poison?). Dr. Beck remarks that the medicine should not be given to delicate children or to those of a scrofulous habit. The younger the subject, the more likely the medicine is to do harm;—in children under a year, as a general rule, it ought not to be used. During that period, the powers of life are too feeble to bear so active a remedy. Its tendency is to produce fatal collapse.—'London Medical Gazette,' vol. xl, p. 351.

The above table of thirty-seven cases will serve to show whether there is not already sufficient experience to establish the noxious medicinal action or poisonous nature of this drug. Out of thirty-seven cases here recorded, taken indiscriminately from authentic sources, sixteen proved fatal, and twenty-one recovered.[1] While among the fatal cases, some of the patients were not in a healthy condition, it is clear that among the recoveries, many would have died but for medical treatment, and early and copious vomiting or purging, or both. In some, death took place even in spite of these favorable symptoms (No. 26), showing that we have to deal with a substance which acts powerfully on the system by rapid absorption; and that when once absorbed, no treatment may avail to save the life of the patient.

In Case 17, we have a singular instance of the poison being swallowed under such circumstances as not to come in contact with the mucous coat of the stomach. The poison was probably in this case imbibed and absorbed through the pores of the paper. The local effects produced by this substance are manifested in Cases 16 and 19, in the softening and corrosion of the mucous membrane.

With respect to the *time of occurrence* of symptoms, this has no relation to the quantity of poison taken. In several of the cases we have no observation of the time. In Cases 5, 6, 7, 9, 12, and 26, the symptoms appeared early, or within a few minutes, the quantities taken being respectively, in grains, 20, 30, 27, (No. 9, unknown), 36, and 60. In Cases 11 and 18, the symptoms appeared in ten minutes, the doses being respectively, 54 and 20 grains. In No. 31, in a quarter of an hour, dose from 40 to 60 grains. In Nos. 29 and 30, in twenty minutes, the doses being the same in the two cases —10 grains. In Nos. 17, 22, 27, and 32, in half an hour, the doses being 6, 240, 120, and 15 grains. In Case 13, in which some hours are stated to have elapsed, six grains and a quarter were taken; the poison did not here act as it usually does. In Case 37, which is peculiar in the smallness of the dose (2 grains), and the state of disease of the patient, the

[1] Various deaths of patients under the antimonial treatment for pneumonia have been elsewhere referred to, ante, page 397, et seq. These have been chiefly cases of chronic poisoning by tartarized antimony.

usual symptoms did not appear for some hours. These variations obviously depend on the natural constitution of the person (idiosyncrasy), on the state of health or disease, on age, and on the state of the stomach and bowels at the time the substance is taken.

With respect to the *period of death* in the fatal cases. In No. 33, a child died in an hour from a dose of three quarters of a grain; in No. 32, in six hours; in No. 29, a child, in eight hours; in No. 30, a child, the period was thirteen hours; in No. 31, thirty-six hours; in No. 37, forty-one hours; in Case 12, four days; Case 15, five days; in this, however, it was caused by disease of the brain. In the other cases, the time has not been noted. Case 23, presents a peculiarity, as the patient here appears to have sunk many months afterwards, under the secondary effects of the poison, a result occasionally witnessed in cases of poisoning by the mineral acids and alkalies.

In reference to the *fatal dose*, it is rather to the *effects* produced than to the *actual quantity* swallowed, that we are to look. As vomiting and purging generally occur speedily, and the poison is known to be ejected, it would be irrational to assume that the dose swallowed remained unaltered in the body. It is important, too, not to fix this by actual weight. A quantity which may destroy an infant, will not destroy an adult female, and a dose which may kill a delicate woman, or an old person, might not act fatally on a strong and healthy man. A person labouring under disease may be more easily destroyed than one who is healthy, and lastly, there is that ever-varying condition of idiosyncrasy, in which, as it is well known, there is a state of constitution that renders a person more liable to be affected by antimonial compounds, than other individuals apparently in precisely the same conditions as to health, age. (See *ante*, p. 400.)

Then, again, a dose of ten grains administered at once, may not be attended with the same amount of danger to life as the same quantity given in small doses over some days or weeks. Let the reader observe and compare the effects produced on Mayerhofer (*ante*, page 383), by doses so small as a few hundredths of a grain; and then he will perceive that, within certain limits, the noxious action of the drug does not depend so much on the quantity placed in the stomach as on

the amount which finds its way into the organism, and the specific effects which it produces on the blood and organs when the system is contantly kept under its influence. I have elsewhere referred to the remarkable astringent effects observed by Dr. Billing, in doses so small as the one sixteenth of a grain every two hours.[1] Dr. W. Balfour, who wrote on this subject forty years ago, relates the case of a lady, aged 50, who laboured under difficulty of breathing, for which she was treated with antimony. He found that the minutest quantity of the ordinary medicinal solution of tartarized antimony produced nausea in this patient, and that it sometimes proved emetic. It was taken twice or thrice a-day, in doses so small that the whole quantity taken in three weeks did not exceed three grains.[2] Let us contrast this with a case which I have elsewhere quoted,[3] in which a robust man, aged 40, labouring under acute rheumatism, took this substance, first in a dose of eight grains, gradually increased, so that in ten days he had taken three drachms, or 180 grains, without any disorder of the intestinal canal, or other bad symptom. It is clear, therefore, that a dose which may be fatal to one person will not prove fatal to another. There are diseased conditions of the body, already pointed out,[4] in which large doses may frequently be borne without injury.

The smallest fatal dose in the preceding table, is (No. 33) in an infant, in which *three quarters of a grain* destroyed life in an hour; in an adult, *two grains* (No. 37), which destroyed life in forty-one hours. There was in this instance disease, but not of itself sufficient to account for death. It is proper to state, however, that the poisoning of a diseased person, if death can be clearly traced to the substance administered, involves a person in as great a responsibility as the poisoning of a healthy person. The acceleration of death is murder or manslaughter, according to the circumstances proved.

Two children died from the effects of ten grains, in eight

[1] *Ante*, page 379.

[2] 'Treatise on Emetic Tartar,' by Dr. W. Balfour, second edition, London, 1819, p. 144.

[3] 'On Poisons,' p. 483; and 'Medical Gazette,' vol. xxiv, p. 126.

[4] *Ante*, page 396.

and thirteen hours respectively (Nos. 29 and 30.) Fifteen grains destroyed one child in six hours (No. 32.) Sixty grains destroyed a healthy adult in ten hours (No. 26.) Doses of thirty-six and thirty-seven grains have killed adults in four and five days (Nos. 12 and 15.) Taking the facts here collected, it appears probable, that under circumstances favorable to its noxious operation on the system (indicated by failure of pulsation and collapse), a dose of from *ten* to *twenty grains*, taken at once, might destroy an adult, and if taken in divided doses, a smaller quantity than this might suffice. Large doses are very uncertain in their operation. In two instances in this table (Nos. 27 and 28), persons have recovered after taking doses twice, and even eight times, as great as the quantity which has proved fatal to a healthy man—namely, in No. 27, 120 grains, and in No. 28, 478 grains.

In the greater number of cases in which this substance is taken, either accidentally or designedly, timely warning is given by the early symptoms, and the persons recover under treatment. Tartarized antimony is not often selected by the suicide; one case is reported in the table (No. 26.) As a means of perpetrating murder, it is occasionally used; and sometimes, without such evil intention, it has been administered in small doses in articles of food, with a view of curing persons of habits of drunkenness. In the two following cases referred to me from the Eastern counties, in 1851, the intention to destroy life was clearly manifested by the quantity used, and the vehicle selected for administration. A mother and child breakfasted as usual on milk, the child having bread mixed with the milk. In less than a quarter of an hour after they had taken the milk, they were seized with violent vomiting and purging, burning heat in the throat and mouth, accompanied with a constant craving for cold water or fluids of any kind. The child was cold and prostrate as death itself, and pulseless, for *two or three hours*. The mother was similarly affected, but in a milder degree. A mixture of albumen and milk was freely given, but it was speedily ejected. These symptoms continued in both, more or less, throughout the day, and only abated towards evening. The child did not recover for twelve hours. It required stimulants and warmth

to restore it. Neither patient complained of much pain in the stomach and bowels.

The milk when examined was acid. It had a stong metallic taste. I found that it contained a quantity of tartarized antimony in the proportion of twenty-four grains to the ounce, making 192 grains in the eight ounces of milk. In addition to this, there were fourteen grains as a sediment, undissolved. The quantity taken by each patient was unknown.

The following case, in which there was an absence of the usual depression, was communicated to me by a friend. A young assistant-surgeon in the Crimea, took by mistake for a seidlitz powder, two drachms (120 grains) of tartarized antimony. In three minutes he experienced a burning sensation in his throat, and at the pit of the stomach. He then took an emetic of ipecacuanha. Some attempts were made to introduce the stomach-pump, and this caused violent vomiting. The patient drank a great quantity of decoction of bark, but he suffered for ten hours from severe vomiting and purging. A dose of opium procured for him a comfortable night, and the next day he was better. In contrasting the symptoms in this case with that of No. 27 in the table, in which the same quantity was taken by a young man, it will be perceived that there was a striking difference. In that case, there was great depression, with tetanic convulsions; in this, an absence of depression, probably from the more early and complete evacuation of the stomach.

In another instance, a young man swallowed inadvertently thirty grains of tartarized antimony dissolved in gin. In about ten minutes, there was a feeling of faintness, so that on attempting to walk, the patient fell. There was severe pain in the abdomen, with spasms. There were cramps in the calves of the legs, lassitude, with copious perspiration, and after a time, a free evacuation.

4. Summary of symptoms in Acute poisoning by Tartarized Antimony. Symptoms compared with those of Chronic poisoning.

In acute poisoning we find nausea and early vomiting of a violent kind, until the stomach is cleared and for some time

afterwards, as a result of the local irritation caused by the poison; pain in the stomach and bowels, followed by purging more or less violent; sense of burning heat and constriction or choking in the throat, extending through the whole length of the gullet to the stomach, difficulty of swallowing, soreness of the mouth and throat, followed by the peeling off of the lining membrane or the formation of aphthous crusts, at first whitish, but becoming subsequently discoloured, brown and black. (When this symptom occurs, it is probable that the same condition of the mucous membrane exists in the gullet, stomach, and part of the intestinal canal). In some cases there is great thirst, or increased flow of saliva. The vomited matters consist of a white stringy mucus, locking up solid portions of the poison, but sometimes tinged with blood or bile—motions liquid and bilious; cramps in the arms and legs; sometimes there are severe tetanic spasms; coldness of the surface, with clammy perspiration, attended with flushing, and a congested state of the head and face, a feeling of extreme depression, loss of muscular power, pulse small, contracted, and feeble; in advanced cases fluttering, and barely perceptible; respiration short and painful; livid or dusky appearance of lips and face, especially around the eyes; loss of voice, complete incapacity for any exertion; an eruption resembling that of smallpox occasionally showing itself on the skin; loss of consciousness and wandering or delirium.

These symptoms are not met with in every case; thus, vomiting and purging may coexist, or one may be vicarious of the other. In certain cases, neither of these symptoms may be present, and then those affecting the nervous system are generally more prominent. The intensity of the symptoms, the rapidity of their progress, and the speedy access of collapse, chiefly distinguish those of the acute from the chronic form. In the latter variety there is nausea, a loathing of food and incessant retching, without actual vomiting until food is taken. The vomited matters are sometimes white (mucus), but at a later period coloured by bile, and the symptoms recur with severity after each administration in food or medicine,—the prostration of strength being great in proportion to the frequency of this recurrence. There has been noticed a greatly increased secretion of urine. In no instance has

suppression been observed, as in cases of arsenical poisoning. Antimony appears to be carried off abundantly by the urine. In the acute form of poisoning, the presence of poison in the food may generally be perceived by the taste; in the chronic form, from the smallness of the quantity, there may be no taste.

One of the remarkable characters of the acute form, is that, in spite of the violence and severity in the symptoms, even when the collapse and depression appear to indicate impending dissolution, there is an astonishing power of recovery. When one large dose only is administered, the case proceeds steadily to recovery or death, generally the former if the case is placed early under proper treatment. In this respect, acute antimonial is distinguished from acute arsenical poisoning. In the latter, in spite of early treatment and the removal of the whole or the greater part of the poison, the case frequently terminates fatally. Should, however, another dose of antimony be taken at or about the time at which recovery is taking place from the effects of the first, it will be easily understood that the person will sink under the effects of the poison. If any doubt exist concerning the cause of the symptoms, *i.e.* whether they be due to bilious cholera or some form of gastritis or gastro-enteritis, then an examination of the urine should be made. If this be examined at intervals, it will be found to contain antimony, should the case be one of antimonial poisoning. An analysis directed to the matters vomited and the excreta, will also aid the diagnosis.

5. Summary of appearances after death in antimonial poisoning.

There may be found congestion of the membranes of the brain, with softening and congestion of the substance of this organ. An inflamed or aphthous state of the mouth, fauces, and gullet, extending throughout the whole, or confined to the mucous membrane of the fauces and the cardiac end of the gullet.[1] The mucous membrane of the stomach is more

[1] In the medicinal use of antimony for pneumonia in large doses, Boudet observed that there were local irritant effects on the fauces in twenty-six out of one hundred and forty-four cases.

or less reddened in patches or spots as a result of inflammation, the membrane softened or corroded, and easily removed by friction, sometimes covered with false membrane or aphthous crusts; the surface darkened, inflamed, and ulcerated; small ulcers with pustular exudations occasionally found; the contents of the stomach of a dark brownish colour, consisting chiefly of mucous matters, coloured either by blood, bile, or by a mixture of both. The peritoneal or external coat of the stomach has been found inflamed; the intestines present similar appearances, the inflamed portions of mucous membrane being seen chiefly in the duodenum, cæcum, and rectum; the contents of the intestines bilious or bloody, with much mucus; aphthous ulcerations in the glands of the small intestines, the lungs showing more or less congestion in portions of the lobes; the heart empty, or if blood be contained in its cavities this is dark-coloured and liquid; the blood liquid throughout the body. In cases of chronic poisoning, the liver enlarged, softened, and its structure easily broken. The organs of the body have been found well preserved.

These appearances will necessarily vary according to the duration of the case. When life is protracted, there may be the appearances of gastro-enteritis in a severe form.

The effect of antimony on the liver is worthy of observation. It is stated that this mineral causes an enlargement of the organ, and at the same time renders its structure brittle. In the tabulated cases this condition of the liver is only particularly noticed in No. 37. It is an appearance rather connected with the chronic than the acute form of antimonial poisoning. These changes in the liver, as the result of antimonial poisoning, were first observed by Magendie. In animals killed by a repetition of small doses (one grain at a dose), he found the liver changed in colour and consistency.[1]

This effect of antimony on the liver has been specially adverted to by MM. Millon and Laveran in their recent experimental researches.[2]

[1] 'De l'Influence de l'Emétique sur l'Homme et les Animaux,' p. 1813, p. 58.

[2] Bouchardat, 'Annuaire de Thérapeutique,' 1847, p. 136.

This condition of the liver in a dead body may probably serve to aid the medical practitioner in forming an opinion whether the antimonial poisoning is of the chronic form. M. Morin states that the poultry-keepers of Alsace adopt the practice of

6. Chemical processes for the detection of Antimony in the body in a free and in an absorbed state.

A few remarks may be made on this subject, as it constitutes an important branch of medical evidence. It is unfortunate that the chemical evidence has been either overlooked or neglected, in the majority of cases of antimonial poisoning that have hitherto occurred. Among the sixteen fatal cases recorded in the table (*ante*, page 409), antimony is stated to have been sought for in four only; and in these the analysis was simply confined to the *contents* of the stomach. In some instances, there was no inspection, and therefore no opportunity for the search. In Nos. 29 and 30, the cases of children that died in eight and thirteen hours respectively after having taken ten grains of the poison, it is stated that no antimony was found in the stomach in either case. In No. 31, from forty to sixty grains were taken, the person died in thirty-six hours, and slight traces only of antimony were detected in the *contents* of the stomach. In No. 32, a child, death occurred in the short period of six hours, after fifteen grains had been administered, and the analysis of the contents of the stomach was performed by a skilful chemist, Mr. H. H. Watson of Bolton, with the result that no antimony was present. I have elsewhere reported (see *post*, p. 450) a case in which three grains were taken in solution by a man, and he died from another cause about twenty hours afterwards; not a trace of antimony was found in the stomach, the intestines, or their contents. Hence it appears that this poison passes more rapidly out of the stomach and bowels than arsenic. These facts are of importance in considering the absence of tartarized antimony from the contents of the stomach and intestines, or its presence in very minute proportion, in cases in

adding sulphide of antimony to the food on which the geese in that district are fed. This causes an enlargement of the liver, and increases the fatty deposit. The livers thus morbidly fattened are employed for making the well-known *Pâtés de foie gras* of Strasburg, so highly prized by gourmands. M. Morin has analysed the pâtés, and has discovered antimony in them, but the quantity is not sufficient to produce noxious effects. This, however, indicates one channel by which antimony may be insidiously introduced into the human body and temporarily incorporated with the tissues. See 'Journal de Chimie,' 1849, p. 261.

which criminal poisoning by this mineral is alleged. The absence of the poison or its presence in small quantity, is supposed to create an enormous difficulty in medical evidence, but the difficulty, if it be one, is of nature's own creating. If a poison possesses highly emetic and highly purgative powers, it must be thrown off to a greater or less extent as a result of its own operation, so long as the person lives.

Nevertheless, it is laid down as a positive rule by those who think that fixed laws must govern these effects of poisons, that if on an analysis of the stomach and bowels, as well as their contents, either no *free* antimony is obtained by the analyst, or the quantity procured is so small that it is not sufficient to poison another person, it is impossible that the person can have died from antimonial poisoning ! The fallacy of this reasoning, opposed as it is to the laws of physiology and chemistry, it is scarcely necessary to point out.

With respect to the detection of *absorbed* antimony, the processes for this are of comparatively recent discovery. The process of Marsh was suggested and used by Orfila in 1840, and the process of Reinsch was employed in 1846. In none of the fatal cases in the table, was *absorbed* antimony sought for, or probably some would have been found deposited in the liver and other organs.

1. *Chemical tests in the pure state.*—Tartarized antimony is very soluble in water (*ante*, page 378), and may be obtained from a few drops of this solution in crystals of mixed octohedral and tetrahedral forms. It is not volatile; when heated on mica in air, it is charred, and there is an odour resembling that of burnt tartaric acid. It leaves a carbonaceous residue. When heated in a close tube, it is charred without fusion, and no metallic sublimate is evolved. One test is sufficient to identify the presence of, and to separate the antimony, the active ingredient, namely, a current of sulphuretted hydrogen gas. The antimony is precipitated as an orange red, or deep red compound,—hydrated sulphide of antimony. When this is well washed on a filter, dried, and weighed, it will enable the operator to calculate the quantity of antimony present. The peculiar orange red colour of the hydrated sulphide of antimony distinguishes it from other metallic sulphides; but it is

proper to employ corroborative tests to determine its nature. These are: 1. The precipitate is not dissolved by a few drops of weak solution of ammonia. 2. When dried and warmed with a few drops of strong hydrochloric acid, it is immediately dissolved. The liquid should be boiled until it is colourless. If it be then added drop by drop to a quantity of water, a white precipitate (oxychloride) is thrown down. By precipitation, under these circumstances, antimony is known from all metals excepting bismuth; but the bismuthic precipitate thus formed, is blackened by sulphuretted hydrogen, while the antimonial precipitate acquires a yellow or orange colour.

2. *Process for organic liquids.*—In testing the liquid contents of a stomach, or liquid articles of food, it is desirable that a portion should be filtered. The discovery of antimony in the filtered liquid will show whether any antimonial preparation (tartarized antimony[1]), is dissolved. A similar experiment should be made with the fluids of the intestines. A question of this kind is sometimes of importance on trials. Unless this preliminary examination be made, an analyst may not be able to say whether he is dealing with tartarized antimony, or some small particles of antimonial powder.

If the antimony is dissolved in sufficiently large quantity in the organic liquid to give a precipitate with sulphuretted hydrogen, the chemical question is easily solved. The precipitate is treated as above described, and the presence of antimony is thus placed beyond doubt.

Tartarized antimony may, however, be present in an organic liquid, (*e. g.*, the urine), but in a proportion so small as not to be precipitated by a current of sulphuretted hydrogen gas. There may be no change of colour, and the analyst may be inclined to suppose that the metal is not present. In this case, Reinsch's process should be employed. The liquid is concentrated to a small bulk, and then from one sixth to one seventh of its volume of *pure* hydrochloric acid is added to it. It is

[1] The only other soluble antimonial compound met with in pharmacy and chemistry is the chloride. This is, however, known by its powerfully corrosive action, and its decomposition by liquids. Hence, if the filtered liquid contain antimony dissolved, and there are no signs of the corrosion of the tissues, it is a fair inference that it exists in the form of tartarized antimony.

boiled, and while boiling, a small piece of thin copper foil freshly brightened, or a piece of fine copper gauze may be introduced. Sooner or later, according to the quantity present, antimony is deposited on the copper, producing a grey deposit, with a reddish-violet, or purple tint, if the quantity be small, or iron grey or black, if comparatively large. If no deposit is observed at first, the whole of the liquid must be boiled down on the copper before the inference is drawn that antimony is absent. If the copper be removed without any metallic tarnish or deposit upon its surface, there is no antimony present. If it has acquired a metallic deposit, then, after well washing and drying it, further steps must be resorted to in order to determine that it is really antimony with which the copper is coated.

Hugo Reinsch, who made the discovery of this simple process in 1843, considered that antimony was sufficiently indicated: 1, by the colour of the deposit being violet; 2, by the copper foil, when heated, yielding no distinct crystalline sublimate like arsenic; but it was long felt by chemists that these characters, affirmative and negative, were not sufficient for medical evidence. In some researches on the subject in 1855, I found that by deflagrating the coated gauze by small portions, with a small quantity of fused nitrate of soda or potash in a platina or porcelain capsule, that the deposit was immediately removed from the copper; antimoniate of soda was formed if the deposit was antimonial; and by acidulating the liquid with hydrochloric acid and passing into it a current of sulphuretted hydrogen, hydrated sulphide of antimony was procured.

A better method of corroboration has been suggested by Dr. Odling.[1] The copper with the supposed antimonial deposit is boiled in a small quantity of water, rendered feebly alkaline by pure potash, and coloured of a light crimson or pink tint, by the addition of a few drops of a weak solution of permanganate of potash. In a short time, the copper loses the whole of the metallic deposit; the liquid becomes colourless, and a brownish substance, (hydrated peroxide of manganese), falls down, which should be separated by filtration. A few drops of hydrochloric acid are added to the filtered liquid, and

[1] 'Guy's Hospital Reports,' October, 1856.

a current of sulphuretted hydrogen passed through it. If the deposit were antimonial, antimoniate of potash would be first formed, and the antimony would be thrown down in the last stage as hydrated orange-red sulphide. Here then, permanganate of potash is substituted for nitrate as an oxydizing agent, and undoubtedly with advantage, as no sulphur is separated with the sulphide under these circumstances. Mr. Watson, of Bolton, has since suggested a still more simple plan, rendering it unnecessary to employ the permanganate of potash. He suggests that the coated copper should be boiled in a weak solution of potash only, the metal being partly exposed to air by drawing it out of the alkaline liquid, and then again returning it. In this way, the antimony is oxidized by the air in contact with an alkaline solution, and antimoniate of potash is formed. In about five or ten minutes the copper will have lost the deposit, and the liquid may then be filtered, acidulated with hydrochloric acid, and treated with sulphuretted hydrogen. The orange-red sulphide of antimony, of its characteristic colour, is thrown down either immediately or on allowing the liquid to stand for a short time. This corroborative test for Reinsch's process can be universally adopted, as potash is procurable when the permanganate may not be forthcoming. I have tried these modes of testing the deposit on copper obtained by Reinsch's process, and find them to be quite satisfactory, even for very small quantities. The precipitated sulphide obtained, may be, however, too small to allow of the subsequent solution in hydrochloric acid, and precipitation by water. This additional corroboration is not necessary under the circumstances. Potash may contain oxide of lead, and hydrochloric acid may contain antimony. These liquids should therefore be tested, and their purity clearly ascertained before they are employed for the purpose above mentioned.

If the permanganate of potash be employed in a medico-legal analysis, this must also be tested in order to exclude the possibility of antimony being introduced by the chemical reagents,—a proof rigorously insisted on when the quantity found is very small.

The presence of antimony as an impurity in hydrochloric acid is not common; but in the year 1856, I had a sample

sent to me from a provincial town, which contained so much antimony, that on mixing it with water, it gave an abundant precipitate of oxychloride. The acid had been employed with carbonate of soda in making unfermented bread, and it had produced a large amount of sickness, the cause of which could not at the time be explained.

Although antimony is not found to be a normal constituent of the healthy human body, it is obvious that by this and other means, it may occasionally find its way into the system. Hence the great importance of not relying too much on the chemical evidence of its presence in small quantity, when there is no knowledge of symptoms preceding death, or of appearances in the dead body.

3. *In the tissues and organic solids. Absorbed antimony.* —It was long since stated by Orfila that antimony and arsenic were deposited in the organs, *e. g.*, the liver, in a form to be partially dissolved by water. I have verified this statement by experiment in cases of poisoning. A few ounces of the liver of a person who died from the effects of tartarized antimony were boiled for an hour or longer in water; the aqueous decoction was filtered, and the filtered liquid tested. Antimony was separated by Reinsch's process from the filtered aqueous decoction. When hydrochloric acid is added to the water, the tissue yields antimony in much larger proportion; a fact which shows that the antimonial compound is, at least in part, intimately associated with the tissue of the organ. The proportions of acid and water required are, one part of strong acid by measure, to six or seven parts, by measure, of water. Incineration, or carbonization by sulphuric acid, are not required for the detection of antimony in the liver or other organs by Reinsch's process.

Marsh's process has also been employed in the search for antimony in the tissues. A part of the liver or other organ is cut into small pieces, and mixed with about half its weight of concentrated and *pure* sulphuric acid. The mixture is then heated to carbonization. The dry carbonized residue is treated with a small quantity of pure and strong hydrochloric acid. This acid liquid, drained from the carbonized mass, is introduced into Marsh's apparatus, and the gas

proceeding from it, tested. 1, Previous to kindling, the antimonuretted hydrogen reduces in the cold nitrate of silver in solution; 2, when kindled, it burns with a pale, lemon-coloured flame, evolving a white smoke (oxide); 3, a piece of glass acquires, when so placed as to intercept the flame about its centre, a deep coal-black deposit, with grey rings; the bright metallic lustre of antimony appearing on the reverse side of the glass. The coal-black colour distinguishes this deposit from that of arsenic, which is hair-brown, but a better corroborative test is to pour on the deposit a few drops of sulphide of ammonium, and evaporate slowly to dryness. If antimony be present, an orange-red stain is left on the glass, not easily dissolved by weak solution of ammonia.

This is said to be a more delicate process than that of Reinsch's. Assuming that this is the case, it may be observed that in medico-legal researches, it is not so much delicacy as *certainty* which is required for evidence; and certainty is abundantly supplied by Reinsch's process, up to very minute fractions of a grain. Beyond this, whether Marsh's or any other process be relied upon, it is not desirable to go.

Antimony, even in a soluble form, does not readily disappear from the dead body after interment. If a person dies with absorbed or free antimony in his body, some portion of the metal may be extracted, probably so long as the viscera remain. In the case of Ann Palmer, the body had been interred for a period of nearly fifteen months, antimony was found in the free state in all parts of the alimentary canal, and in the absorbed state, more or less in all the organs. One ovary alone yielded the fiftieth part of a grain. The antimony had partially undergone a chemical change, as a result of putrefaction. In the stomach, a portion had been converted to orange-yellow sulphuret, which dyed the coats in a streak or stain from the inside to the outside. In the rectum it was also partially changed to sulphuret. In this case, antimony manifested an antiseptic property like arsenic, for all the parts in which the metal was found were well preserved. In the case of Ann Bacon, whose body was exhumed in 1857, after twenty-one months' interment, antimony was found in the intestines. The presence of the metal was here traced to some small doses of antimonial medicine which had been

given to deceased during her last illness, and shortly before her death.

The plan adopted by MM. Millon and Laveran for the detection of antimony in organic liquids and solids, consisted in the immersion of a freshly scraped bar of pure tin into the cold liquid, acidulated with about one tenth part by measure, of pure hydrochloric acid. Antimony, if present, was deposited on the tin in a black powder.[1]

As much confidence has been placed in their experimental results on absorption and elimination, it would have been more satisfactory had they employed one of the two processes above described, or at least corroborated their results by a further analysis of the black deposit.

There are two circumstances connected with the chemical evidence which require notice; 1, as to the *quantity* of antimony found in a dead body; 2, as to its *diffusion* by imbibition after death. It has been already stated that in the cases of antimonial poisoning hitherto examined, the quantity found in a *free* state in the contents of the stomach and bowels, has been only a minute fractional proportion of the quantity swallowed. The amount of *absorbed* antimony found deposited in the organs is always small. In general, from one grain to three or four grains would probably be the whole amount that would be separated by chemical processes from those organs and parts of the body which are usually submitted to analysis for absorbed antimony. In drawing any inference, therefore, from the quantity of absorbed antimony detected in a given case, for or against the question of death from antimonial poisoning, it is important to attend to the following points:

1. Whatever quantity may have been taken, the organs only retain a certain portion, always small, and constantly decreasing by elimination, so long as the patient survives.

2. The poison penetrates by absorption all parts through which the blood is circulated. According to Millon and Laveran, it actually goes into the bones and fat! It is extensively diffused and deposited through the whole muscular system. The analyst, for the purposes of evidence, generally confines

[1] 'Comptes Rendus,' 1856, xxi, p. 637; 'Annuaire de Chimie,' 1846, p. 715.

his research to the viscera of the abdomen and chest, or to parts of them. Hence it follows, that the antimony which he extracts is really only a small proportion of that probably existing throughout the body of the deceased. In a body weighing one hundred and fifty pounds, the analyst may have extracted the metal out of only five to ten pounds of the organic solids. To assume, therefore, that *that* which he extracts and produces, is all that remains in the body, is evidently an error. If so much importance is attached to the absolute quantity of antimony obtained in a chemical analysis, it is only proper for the purposes of justice that the analyst should be authorised to extend his operations to the whole of the body, including the flesh and skeleton, and that the great length of time and skilled labour which would thus be exacted of him should be liberally compensated. At present, the 'Medical Witnesses Act,' limits the analysis to the *contents* of the stomach or intestines, and the fee to the sum of two guineas.

It may, however, be reasonably inferred from facts already known, that the whole of the absorbed antimony, if extracted from the body, in a case of antimonial poisoning, would not make up a quantity sufficient to constitute what is called a *fatal dose;* and, as we have already seen, this quantity can rarely be found in the contents of the stomach or bowels. Hence it is obvious that the chemist is virtually called upon to supply *ex naturâ rei,* impossible evidence. The discovery of the poison in the body by its properties in a clear and unmistakeable form, should of itself be sufficient for the chemical proof; the actual quantity either separated or calculated to exist is immaterial in judging whether death has taken place from the poison or not. The small quantity found may be the residue either of a large or of a small dose, and yet the medical facts of the case may show conclusively, either that the deceased died from its effects, or that it was innocently taken as medicine, and that it did not cause death. In one clear case of antimonial poisoning, less than four grains of antimony, free and absorbed, were found in the viscera of the chest and abdomen: in two other cases the quantity found did not exceed a grain and two grains respectively. Is the fact of death from antimony to be absolutely negatived because the

quantity found is small? Assuredly not, for antimony does not kill suddenly like prussic acid, and there is generally time for the greater part of the poison dose swallowed to be expelled from the body. That which is found by the chemist is simply the residue which may remain in the body at the time of death.

The correctness of this reasoning would be immediately tested by the law laying down, from medical evidence, in precise language, what it understands by a *fatal dose* of tartarized antimony, and declaring that on any charge of murder by antimonial poisoning, this quantity of the substance (say *twenty grains*) must be extracted by chemical processes from the body of the deceased, or the question of death from this poison cannot be entertained. As children have been killed by ten grains and less, and persons labouring under disease have died from smaller quantities than this, it would be necessary, on this principle, to have a scale of fatal doses determined by age and bodily condition. The present mode in which this serious question is dealt with at inquests and on trials, is absurd,—inconsistent with the well-known laws of physiological chemistry, and only calculated to shelter criminals from responsibility for their acts.

Diffusion.—It has been supposed that the presence of antimony in the liver, heart, spleen, &c., would not show absorption during life, because the presence of the poison in these organs might be owing to imbibition or diffusion after death. This implies, however, either that the poison must be somewhere in the body at the time of death, or that it must have been injected afterwards. The latter supposition appears untenable, because there would be an absence of evidence from symptoms and appearances, without which the mere discovery of antimony in a body would not indicate antimonial poisoning. If the person dies with tartarized antimony in some part of his body, then this is a fact which must be accounted for; but it alone will neither establish poisoning, nor fix a crime upon an individual. I believe, from the examination of the dead body, that this objection to medical evidence is hypothetical, and based upon fallacious experiments. If the antimony thus radiated to all parts by imbibition from the stomach, the metal would be found in greater proportion in parts near to or in contact with the stomach, and in a decreasing proportion according to dis-

stance. In no case can we conceive that every particle of antimony would pass from the interior of the stomach and incorporate itself with the liver, rectum, or other remote parts. It has, however, been found in these organs when it has not existed in the stomach, and the proportion found has borne no relation to the vicinity or contact of the organ with the stomach. In the case of a dead body which had been lying in the grave nearly two years, I found antimony in the intestines, but the cellular membrane, fat, and mesentery adjacent, contained none. A larger proportion is generally found in the liver than in the spleen; and in a dead body (a case of antimonial poisoning) I found more in the rectum than in the stomach! The facts of a case properly investigated will show that this objection to the evidence of absorption during life, derived from the presence of antimony in the organs, is without foundation. Imbibition doubtless goes on to a small extent in a dead body, but not so as to affect inferences based on proper observations.[1]

7. The Absorption, Deposition, and Elimination of Antimony.

The fact that antimony was absorbed into the blood was determined by Magendie, in a set of physiological experiments, in the year 1813, but the metal was not chemically detected in the blood and viscera until Orfila's researches on this subject, in the year 1839.[2] Tartarized antimony, in the dose of from fifteen to twenty-five grains, dissolved in water, was introduced into the stomachs of dogs, and the œsophagus tied to prevent vomiting. The animals died in a *few hours*. The liver and kidneys yielded a comparatively large quantity, the spleen, lungs, and heart, contained barely traces of antimony. In an experiment in which thirty-one grains, in powder, were introduced into a wound in the thigh of a dog, the animal died in *twenty hours*. The lungs, heart, and spleen, yielded not the least trace of antimony, and the liver gave only a small deposit. Two ounces of urine contained in the bladder

[1] See, on this subject, Orfila, 'Toxicologie, i, p. 384, 1852.

[2] 'Mémoires de l'Académie de Médecine,' tome viii, p. 509, March 10, 1840. See also 'Annales d'Hygiène,' 1840, i, p. 474.

yielded a large quantity. In other experiments in which the powder was applied to wounds in quantities varying from two grains to six, the following results were obtained. In one dog, destroyed *an hour* after the application, there was no antimony in six ounces of blood, and only a small quantity in the liver; in another, destroyed in *four hours*, six ounces of blood taken from the aorta, and six ounces taken from the vena cava, gave respectively no indications of antimony. The liver gave a great number of antimonial deposits, and the urine from the bladder also gave numerous deposits. In a third experiment, the dog died in *seventeen hours*; the liver gave only traces of the metal, while the urine yielded numerous large deposits. Two grains of tartar emetic had been applied to the wound in this case. In a fourth experiment the same dose was applied, and the animal died in *thirty-six hours*. The liver yielded no antimony; the urine contained it abundantly. From these results, Orfila came to the conclusion that antimony was rapidly absorbed and as rapidly carried out of the body by the urine, so that after ten, twelve, or fifteen days, none would be found in the liver and kidneys. MM. Millon and Laveran proceeded differently, and obtained different results. 1. A dog was fed for ten days with food containing a daily dose of four and a half grains of tartar emetic, making, in the whole, forty-six grains. The dog died *six days* after ceasing to take the antimony in its food, and obviously from the effects of that substance which some loosely call a medicine, and not a poison. The metal was found in the liver, muscles, coats of the intestines, the lungs, and the brain. 2. A second dog similarly treated died *thirteen days* after the withdrawal of the antimony. The metal was found in the various organs, but the brain appeared to be the most strongly impregnated. 3. A third dog, which recovered from the antimonial treatment, died suddenly *six weeks* after its cessation. The antimony was found in appreciable proportion in the liver and fat, but it had especially accumulated in the *bones, i. e.*, in a tissue in which its presence is quite compatible with the healthy exercise of the bodily functions. 4. A fourth dog, was killed *three months and a half* after the withdrawal of the antimony. On analysis, the metal was chiefly found in the fat. The liver contained a small quantity,

as well as the bones and other tissues, but the fat contained ten times the proportion found in all the other parts. 5. In this experiment the dog was killed *four months* after the antimony had been withdrawn: in this the antimony was chiefly accumulated in the bones; the liver also contained a great deal, the other tissues contained very little. 6. A young bitch took tartar emetic for five days, about fifteen days before parturition. The animals were killed, and the livers of the pups yielded antimony.[1] Dr. Birkbeck Nevins has obtained some useful results by experiments on rabbits. The antimony was given in doses varying from half a grain to one or two grains, over a period of several days; the total quantity given varying from twelve to seventy-two grains. The absorbed metal, like arsenic, was found by chemical analysis to be widely diffused throughout the body. It was most abundant in the liver and the kidneys. In the blood it was sparingly found at any time, and in the muscles only a trace after the longest continued administration. It was also found in the livers and kidneys of the immature fœtuses of one rabbit, as well as in the placentas. It appeared to exert a fatal influence on the fœtuses in utero. 1. A rabbit which had taken, in divided doses, four grains during twenty-four hours, was killed *four hours* after the last dose. Antimony was found in the stomach, but not in the large and small intestines. The liver contained a faint trace, but there was none in the blood or in any of the other parts examined. 2. Five grains were given in three days, and the animal was killed four hours after the last dose. Some antimony was found in the stomach and large intestines, a trace in the kidneys,—a copious deposit was procured from the liver, and a well-marked deposit from the blood. 3. A rabbit died, poisoned by twelve grains, about *sixteen hours* after the last dose. Antimony was detected in small quantity in the stomach, intestines, kidneys, lungs, and blood; it was most abundant in the liver and in the urine. 7. This animal died poisoned *seven hours* after the last dose, the whole quantity administered having been fifty-one grains, given in fifteen days. Antimony was found in the large and small intestines; copiously in the liver, in the spleen, and

[1] 'Comptes Rendus,' 1846, i, p. 1043; Orfila, 'Toxicologie,' 1852, i, 628; Bouchardat 'Annuaire de Thérapeutique,' 1847, p. 134.

urine; less in the kidneys and lungs. 9. This animal was killed fifteen days after the last dose, twenty-three grains having been given during a period of fifteen days. No antimony was found in the stomach and intestines; there was not a trace in the liver, but the metal was found in the bones. 10. Thirty grains were given over a similar period, and the animal was killed fifteen days after the last dose. A trace of antimony was found in the stomach, cæcum, kidneys, and lungs; none in the liver; the presence of the metal was very decided in the bones, urine, and excrement. 11. In this experiment fifty-one grains were given in fifteen days, and the animal was killed *one month* after the last dose. There was no antimony in the stomach; only a slight trace in the liver and lungs; more in the kidneys. The largest proportion was in the bones. Twenty-one days after the last dose, the urine and excrement gave decided traces of antimony.[1] From these experiments it appears, that the antimony was found in the bones on the fifteenth day after the last administration, and was still present on the thirty-first day in another experiment.

Dr. Mayerhofer, of Munich, gave to a healthy dog fifteen grains of tartar emetic, dissolved. Seven hours afterwards, six grains, in solution, were rubbed on the thighs and abdomen. The animal died in fourteen hours, and shortly before death two grains were given by the mouth. On analysis, antimony was found in the stomach in a soluble form, probably from the recent administration. The metal was also detected in the blood of the heart, of the portal vein, in the liver, lungs, brain, intestinal canal, as well as in the urine passed during life.[2] To some sheep affected with pneumonia, one drachm of tartar emetic was given medicinally (March, 1857). They were killed within about twelve hours of taking the medicine; and, on analysis, I found, in the fleshy parts of the legs of the animals, a considerable deposit of antimony.

This metal appears to be eliminated through the *milk*. A writer in the 'Medical Times and Gazette' (May 23d, 1857, p. 517), states that he administered to a cat which had given birth to five kittens, one third of a grain of tartar emetic twice at an interval of eight hours. These doses caused vomiting,

[1] 'Liverpool Medical Journal,' 1857, No. 1, p. 46, et seq.

[2] Heller's 'Archiv,' 1846, iii.

and so much prostration, that the course was changed to one twelfth of a grain, which dose was repeated twice daily. Three days after this, one of the kittens was drowned, and its viscera subjected to analysis, with the result of detecting distinct evidence of the poison. Three days later, the mother still receiving the poison, two of the other kittens were killed. In these the poison was detected in the heart, including its contained blood, and lungs taken together; in the liver and kidneys taken together, and in the stomach and intestinal canal, with their contents.

From the experiments of Dr. Brinton, of King's College, it appears that antimony in certain cases in which it has not been introduced into the *stomach*, is eliminated from the system by the mucous membrane of this organ. He injected into the superficial femoral vein of a large dog, ten grains of tartarized antimony, dissolved in four ounces of water. The animal instantly fell into a state of collapse without vomiting or purging. At the end of fifteen minutes it was killed, and the contents of its stomach, then in the act of digestion, were collected. They were found to contain tartar emetic in large quantity (the quantity not stated). Dr. Brinton thought that the proportion present in the gastric fluids, exceeded that in which it was mixed with the blood of the animal; in short, that the poison was not only transferred from the thigh to the stomach, but that it was concentrated as well as eliminated in this latter cavity.[1] It is unfortunate that this chemical question was not determined by experiment. It would have been an interesting fact to have ascertained, as the quantity injected into the blood was accurately known, what proportion of antimony was contained in the gastric fluid as well as in the fluids of the intestines, how much remained in the blood, and how much was deposited in the liver and other organs. The result as it stands, simply shows that some portion of antimony is eliminated by the stomach, within the short space of *fifteen minutes* after it has been injected into the blood of the femoral vein. Orfila ascertained with respect to arsenic, that the alimentary canal contained a portion of the poison in a dog killed in four hours by three grains applied in a solid state to the cellular tissue. It has been supposed that these results are adverse to

[1] 'Medical Society of London,' 'Lancet,' May 31st, 1856, p. 591.

any conclusion respecting recent administration, when antimony is found in the contents of the stomach; but this objection could only arise in those cases, in which the person alleged to have been poisoned by antimony, had received the poison by injection into the blood—or by direct application to a wound or ulcer. Such a case as this has, I believe, never yet presented itself on a charge of poisoning; the poison has always found its way into the body, either by the stomach or by the rectum, and the question, therefore, practically resolves itself into this:—How long can tartarized antimony, when swallowed, remain in the stomach? The answer must depend on the circumstances proved in each case. I am not aware of any facts showing that the stomach is a medium of elimination for antimony, when the metal has been once removed from it and deposited in the liver and other organs as a result of absorption from the stomach. It would be necessary to assume that the stomach and its contents had first been entirely cleared of every trace of the poison, and that the poison subsequently returned to this organ, from the parts to which it had been conveyed, and was again deposited in the contents! Adversely to this assumption, however, it has been found after death, that the stomach has frequently contained no trace of antimony, while the poison has been found rather strongly deposited in the liver and other parts. This negatives the assumption that when the stomach is once cleared of the poison, its mucous surface becomes in the *human body* a medium of elimination.

It is an important fact in reference to this question that in instances of poisoning by it, in which there has been an opportunity of making an analysis, antimony has *not* been found in the stomach, while it has been found abundantly in the liver, spleen, and kidneys. The cases Nos. 29, 30, and 32 in the table (p. 413), show that this theory as applied to the human subject is erroneous. Two children were poisoned by ten grains, and one by fifteen grains of tartarized antimony. They died respectively in eight, thirteen, and six hours. No antimony was found in the stomachs or intestines. It cannot be doubted, as they died from the effects, that some portion had been absorbed and deposited in the tissues of the organs.

The absence of antimony from the alimentary canal, in a

case of antimonial poisoning, is a clear proof that the mucous surface is not an eliminating medium, or some antimony would be found there. In the case of M'Mullen (Liverpool Summer Assizes, 1856,) it was distinctly proved that the deceased had died from antimony. Mr. Watson, of Bolton, made the analysis, and found no antimony in the stomach or contents, while he found it most abundantly in the liver, spleen, and kidneys. Such a result is inconsistent with the supposition that the stomach is an eliminating surface for antimony deposited in other organs. In fact, if that were so, as long as there was any antimony in the body, it ought to be found in the stomach. When human beings are poisoned by injecting tartarized antimony into veins, or thrusting the powder into wounds, the results may be different; but experiments so conducted are not applicable to ordinary cases of poisoning in the human subject.

Less reliance in proof of recent administration by the stomach or rectum, can be placed on the discovery of antimony in the intestinal canal. Antimony is eliminated in the bile, and as this liquid traverses the whole of the intestines, the metal found may have been derived from this secretion. If, however, the poison be present in the intestines in proportionally large quantity,—if it be in a solid form,—if there be no poison in the bile taken from the gall-bladder, if the poison in the intestines be mixed with blood, mucus, or food, and not with bile, then this theory would not explain its presence in the intestines. Assuming that the intestinal mucus itself may become, in certain cases, a medium for the elimination of the poison from the body, some of the above-mentioned conditions would be inconsistent even with this supposition.

Observations regarding the absorption and elimination of antimony in the human body, are at all times more valuable than those derived from experiments on animals, but, unfortunately, these are few in number, and the facts as yet known scarcely admit of a satisfactory generalization. Their importance, however, cannot be over-estimated.

Orfila has collected the following facts: 1. In a patient affected with pneumonia, eighteen grains of tartarized antimony were given in twenty-four hours. Four ounces of urine collected during this period, yielded metallic antimony. Much urine was lost, and there had been much purging. 2. In another case,

nine grains were taken, dissolved, during the same period. About five ounces of urine, passed twelve hours after the last dose, yielded as much antimony as Case 1. 3. The urine of four patients affected with pneumonia, to whom from twelve to eighteen grains of tartar emetic had heen given during twenty-four hours, yielded antimony; but the same process did not reveal the presence of any antimony in one patient who had taken only nine grains during that period. Some of these patients had had alvine evacuations. Martin Solon detected antimony in the urine of a patient who had taken only four grains of tartarized antimony, and who had had neither vomiting nor purging. 4. Tartarized antimony was prescribed in large doses for a patient. The urine collected *three days* after the last dose had been, taken yielded no antimony. 5. Antimony was found deposited in the liver, spleen, and kidneys of a patient who died *fifteen hours* after she had taken about eight grains of tartar emetic. This had caused some purging but no vomiting.[1]

From the researches of MM. Millon and Laveran, it appears that there may be intermissions in the elimination of antimony. In giving to their patients from one grain and a half to five grains of tartarized antimony, they remarked that it was eliminated by the urinary secretion, but in some instances slowly and unequally. They therefore examined the urine, not only several days after the introduction of the medicine, but for some days after it had ceased to appear in this secretion. They then found that its elimination underwent a well-marked intermission, and that, in a most unexpected manner, it appeared to remain for a certain period fixed in the body. In two patients they detected traces of it twenty-four days after its administration. In the body of one who died of phthisis, they found antimony in the liver. In a third case, antimony was detected in the urine after twenty days; in two others after nineteen days; and in three others after sixteen, seventeen, and eighteen days respectively[2]. The fact of the *intermittent elimination* of poisons is of importance, as it tends to show that, even when traces of poison cease to appear in the secretions, it does not in all cases follow that the substance is entirely expelled from the body.

[1] 'Memoirs of the Academy of Medicine,' April 7th, 1840.

[2] 'Comptes Rendus,' 1845, ii, 638.

Among medico-legal cases which may be cited in illustration, are the following: A woman, æt. 41, died under suspicious circumstances, in February, 1845. About a week before death, some doses of tartarized antimony (some centigrammes (0·154 gr.), had been prescribed for her by her medical attendant. The body was exhumed and examined on the 18th February. Traces of arsenic were found in the contents of the stomach and of arsenic and antimony in the stomach and bowels, but no trace either of arsenic or antimony in the liver, lungs, and blood.[1] A patient of M. Marchal's, in a Parisian hospital, was treated with tartarized antimony in large doses. He died eight days after the cessation of the antimony. The result of a chemical examination was, that the liver contained a considerable quantity of antimony, that the kidneys contained a smaller quantity—that the blood also yielded traces of the metal, while the brain contained much less than the other organs and the blood.[2]

A child, eighteen months old, died twelve days after certain medicines, including tartar emetic had been given to it. As there was some suspicion that death had been caused by mineral poison, three fourths of the intestines were minutely examined, but not a trace of antimony was found therein.[3] The case of M'Mullen,[4] who died from the effects of small doses of tartarized antimony, administered at intervals during a period of four months, presents us with the results of an analysis *four days* after the withdrawal of the antimony. The metal was most abundantly found in the liver, spleen, kidneys, urine, and fæces. The quantity was very small in the heart, lungs, and rectum. It was *not present* in the stomach or contents. There were traces in the blood. The other parts of the body were not examined for it. In a case reported by Dr. Haldane, in which a man had taken, for the treatment of pneumonia, from forty to fifty grains of tartarized antimony, death took place on the fourth day. A considerable quantity of antimony was found in the liver, and there was antimony in the affected lung, but less than in the liver.[5]

[1] 'Ann. d'Hygiène,' 1846, i, p. 155.

[2] 'Journal de Chimie Médicale,' 1853, p. 358.

[3] Casper's 'Leïchen Oeffnungen,' 1853, part ii, p. 156.

[4] Liverpool Assizes, 1856.

[5] 'Edinburgh Monthly Journal,' August, 1854, p. 184.

Among cases which have occurred to myself, I have found traces of antimony in the liver, when death had taken place in about fourteen hours after a dose of three grains of antimonial powder had been taken.[1] In February, 1853, a case was referred to me by Mr. Wakley, in which a man died twenty-four hours after he had taken three grains of tartar emetic in solution. No trace of antimony was found in the stomach, intestines, or their contents. In 1856, I made a a complete examination of the whole of the viscera of a man who five weeks before his death had taken a solution of tartar emetic in ordinary medicinal doses. No part of the viscera gave the slightest trace of antimony. In 1857, a similar investigation was made of the body of a female, who had taken, within three days of her death, four grains of James's (antimonial) powder and two grains of tartar emetic in solution. Antimony was found in the small and large intestines, but there was no satisfactory evidence of it in the liver or other viscera. In a case in which I was consulted, in March, 1857, a gentleman died two hours after three quarters of a grain of tartar emetic had been administered to him in solution. The viscera generally were carefully examined by MM. Tardieu and Lassaigne with the result that they found therein no trace of antimony or of any other mineral poison.

In April, 1857, a physician in this metropolis died under somewhat suspicious circumstances. In about two hours after his dinner he was seized with distension, pain in the abdomen, and vomiting. The bowels were constipated, the vomiting and pain continued throughout his illness, which terminated fatally on the fourteenth day. The stomach was so irritable that nothing could be retained on it. The vomited matters were of a yellow or greenish colour. After death the intestines were found highly inflamed externally and internally. It was suspected that poison might have been administered to him on the day of his illness. The viscera were brought to me for analysis; antimony was found in the stomach and intestines, but there was no trace of it in one of the kidneys. Dr. Marcet, who examined the liver, detected no trace of it in that organ. It was found on inquiry that three grains of tartar emetic in powder were given to the deceased six

[1] 'Guy's Hospital Reports,' Vol. VII, part i, Case xix, May, 1850.

days before he died. Thus, then, in this instance, the antimonial medicine had not entirely quitted the alimentary canal. It was impossible to ascribe its presence here to elimination from the mucous surface, because there was no evidence of any deposit in those organs in which it is commonly found. The symptoms from which deceased suffered, and the appearances taken as a whole, were unlike those of antimonial poisoning, and the presence of the metal was satisfactorily accounted for by its having been prescribed medicinally.

Taking these results generally, it would appear that antimony given in a large dose, or repeatedly in small doses, is rapidly absorbed and eliminated chiefly by the urine. It is at the same time deposited in greater or less quantity in the tissues and organs. That under recent administration, if in sufficient quantity, it may be found in the stomach and bowels, and little or none may be present in the liver; that after a variable time it disappears from the stomach and bowels, although it may be present in the fæces, while the liver, kidneys, and spleen, may contain it in large, and the other organs in small quantity. That some weeks or even months after its introduction (in animals), the metal if not entirely eliminated, may be found chiefly deposited in the fat and bones; the liver, fæces, and urine, may also contain traces until a late period. With regard to its presence in the blood in the human subject, slight traces of it were found in M'Mullen's case, four days after the cessation of the antimony, and in M. Marchal's case, after eight days. On the whole, the blood appears to retain the metal in smaller quantity, and for a shorter period than the other fluids and solids. In certain diseased states of the system, the complete elimination of the metal may require a period of twenty-five or thirty days or longer, and antimony may therefore in some instances be found in the liver and urine at this date; but in a healthy subject, to whom only ordinary medicinal doses have been given, the antimony is quickly expelled. In accordance with Orfila's experiments, there is no reason to believe that it would remain longer than fifteen or twenty days after the last administration in organs important to life.

In the case of Cook (who died from strychnia administered to him by William Palmer), Dr. Rees and I found antimony in

the *blood,* in the coats of the stomach, in the intestines, in the liver, the left kidney, and the spleen. With a knowledge of the facts regarding absorption and elimination, already related, before us, we affirmed that this extensive diffusion and deposition of antimony in the body of the deceased was only reconcilable with the view that it was of *recent,* and not of old introduction; and that some portion at least had been taken within a few days of death, and probably within a fortnight of his death. The presence of the metal in the stomach and intestines, as well as in the blood, was inconsistent with the view that the antimony could have been in the body of the deceased for months or years. The whole quantity found, was estimated at half a grain. We had clearly ascertained that antimony had not been prescribed by any medical practitioner in attendance on the deceased.

On these points, the following questions were put to me by Sergeant Shee, in cross-examination at the trial:

"Q. Have you not told me to-day that the quantity of antimony that you found in Cook's body, was not sufficient to account for death? A. Perfectly so: but what was found in Cook's body was not all that he took: if a man takes antimony—— Q. Do you wish to add to your testimony? I do; because I see it is only a little misunderstanding: if a man takes antimony, it produces this effect; first he vomits, by which some passes out of the body; some may escape by the bowels; there is a great deal that passes off at once by absorption, and is carried out by the urine. I find by the experiments of Orfila, whom we are all inclined to rely upon, that in from four to seventeen hours, antimony is found to be passing out by the urine. Q. Do you mean, on your oath,[1] to say from such traces of antimony as you found in Cook's body, you were justified in stating your opinion that his death may have been caused by antimony? A. Positively and decidedly so; the amount found in his dead body, is not the slightest criterion of what he may have swallowed while living.[2] I have sometimes found in a body less arsenic than would account for death. Q. But if the amount found is not the slightest criterion of what may have been administered, how does that justify you, as an analytical chemist, in stating

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[1] I was then stating upon oath, and without that "mental reservation" which the Sergeant's mode of putting the question implied, the scientific facts as they were within my knowledge. In a desperate defence, and where the struggle is against truth, a medical witness must be prepared for a covert attack of this kind. The sole object of counsel, in certain cases, is not truth, but victory at any cost. It is part of the "considerable scope" which is allowed to counsel engaged in a defence.

[2] A man has recently been convicted and executed at Lancaster, for poisoning his wife with tartarized antimony. The quantity found in her body was from half to three quarters of a grain! (See Case of Hardman, *post.*)

your opinion that so small a quantity may have caused death? A. I have not said what quantity may have caused death. I have said a certain quantity was found in the body, which may have been the residue of what had caused death,"[1]

The fallacies connected with this line of examination must be apparent, from what has been stated in a preceding page (*ante*, page 431). In no death from antimony yet recorded, has such a quantity of the poison been found in the body as would suffice to kill another person. When given in divided doses, as the evidence rendered it probable that it had been given in the case of Cook, and there has been violent vomiting in the intervals, it is not in the nature of things that small doses should accumulate and remain in the stomach and intestines for a week! Such questions, therefore, are only calculated to conceal the truth, and mislead a jury. Let it once go forth to the public, with respect to this, and of course, to all other poisons, that unless a chemist extracts from a dead body, that very indefinite quantity—"a fatal dose"—the medical inference of death from poison cannot be legally received, and the result will be, that murder by poison may be perpetrated with impunity.

The period of elimination of antimony from the living body, also gave rise to a series of questions in this case. After having quoted as Orfila's experiments, experiments which Orfila had not performed, but which he quotes from other authorities, the learned counsel drew from them an inference, with a view of defeating our conclusion respecting the administration of antimony to Cook recently before his death. These experiments are elsewhere quoted (*ante*, page 435). My attention having been called to the statements of MM. Millon and Laveran, that after the cessation of the administration of antimony for a period of *three and a half and four months* (see Experiments 4 and 5, *ante*, page 435), the liver contained "some" of it (antimony)—the facts that the antimony was chiefly accumulated in the bones and fat of the animal, and was *not* present in *the stomach, intestines,* or *blood,* having been carefully suppressed by the learned counsel—I was called upon to reconcile these half-quoted results with the opinion given by Dr. Rees and myself. Fortunately, I was sufficiently ac-

[1] The Queen *v.* Palmer. 'Report of Trial,' p. 143.

quainted with the works of Orfila to perceive that there had been both a mis-statement and a suppression of facts. They were not Orfila's results at all; and only so much of them had been quoted, as might appear to conflict with our evidence.

1. As much as *forty-five grains* of antimony had been given in divided doses, over a period of eight or ten days, to dogs. Assuming that elimination goes on at the same rate in a dog and a man, and that the relative difference in the size and weight of the bodies, as well as the absolute quantity of antimony taken, exercises no influence whatever on the amount diffused and retained by the organs, we had expressed no opinion on the quantity actually given to Cook. It might have been one tenth part of the quantity given to the dogs.

2. Dr. Rees and I had clearly detected antimony in the *stomach, intestines,* and *blood* of Cook, as well as in the liver, &c. On these important facts, we felt justified in basing our opinion of recent administration.[1] The learned counsel, with the book before him, well knew or ought to have known that antimony had *not* been found in these canine experiments in the stomach, intestines, and blood, and the results, therefore, in this respect, admitted of no honest comparison.

3. We could not even surrender the liver, in Cook's case, as an instance of remote administration. We found the liver of Cook firm and healthy; it had in no respect whatever undergone that change which is stated to have been produced by the long continued use of antimony in large doses (see *ante,* page 423). MM. Millon and Laveran, more than ten years ago, had pointed out this as one of the remarkable results of their experiments (*ante,* page 423). This fact, however, was suppressed, because, probably, it would have interfered with the application of the canine experiments to the results obtained by Dr. Rees and myself from our examination of the body of Cook.

No one who peruses the evidence given at the trial, can doubt that Cook was dosed with tartarized antimony before he was poisoned by strychnia. This dosing is proved by the symptoms to have begun on the 14th of November; and

[1] Imbibition was out of the question, as death was quite recent; and elimination by the stomach was inadmissible, as there was no suggestion that tartarized antimony had been injected into the blood, or thrust in the solid state into a wound.

there is reason to believe, that it was continued up to within forty-eight hours of death. The antimonial poison did not act with sufficient speed and certainty, and within twenty-six hours of death, the first dose of strychnia was substituted for it. Our opinion, therefore, that the deceased had had antimony within a fortnight, and probably within a few days, of his death, was fully confirmed by the medical and general evidence given at the trial.

In allowing that which a learned judge has designated a "considerable scope" to a defence, it may be a serious question whether, under this head, should be included the *suppressio veri* and the *suggestio falsi* in the misstatements of experiments and misquotation of authorities. If a medical authority is quoted on a question of science to support a certain view, the *whole* of his results bearing on the particular question should be taken together. It may happen that a medical witness under examination, is not well acquainted with the work quoted, and by this mode of dealing, therefore, his opinion, although well founded, may be easily made to appear inaccurate.[1]

8. Cases of Imputed Poisoning by Tartarized Antimony.

Poisoning by tartarized antimony may be wrongly imputed, and the reputation of a medical practitioner may be seriously involved in the inquiry. One object of this paper has been to show that we are not justified in imputing wilful poisoning by this substance, merely because there is proof that it has been taken, and that it has been found by chemical analysis in the organs of the body. It may have been prescribed *bonâ fide*, and death may have arisen from some other cause.

[1] From some experience in these matters, I would advise a medical witness not on any account to assent an opinion or experiment quoted from a book, until he has had an opportunity of examining and reading the quotation. This will always be conceded to him by the Court. Statements in my work on 'Medical Jurisprudence,' have been quoted as adverse to an expressed opinion. On two occasions of this kind, I found, in one instance, that a learned counsel, and in the other, a solicitor, had stopped at a comma! I need hardly inform the reader, that the last clause of the sentence (suppressed) considerably modified the first clause, which alone it had been found convenient to quote!

Such cases demand careful investigation in all their medical circumstances, or irreparable injury may be done. Antimonial preparations are frequently prescribed and used as medicines, and it is by no means uncommon to find antimony in a dead body, as the result of such administration.

In 1847, I was consulted in a case involving medical responsibility, in which it was alleged that a child labouring under disease of the lungs had been killed by an overdose of tartarized antimony. The child took two doses of a common antimonial mixture, each dose containing, as I found by a quantitative analysis, only one quarter of a grain. There was a sudden access of pain after taking the medicine, but no vomiting, purging, or any other symptom to lead to the suspicion that the medicine had destroyed life. There was no sign of collapse. The child died twenty-four hours after the last dose. An opinion was given, that half a grain in divided doses had not killed the child under the circumstances. Death was assigned to natural causes. In fact, no effects indicative of a noxious action were produced by the medicine, and in the absence of such effects, it would have been improper to have assigned death to antimonial poisoning.

Another case, in which a similar question arose on the poisoning of an adult by a small dose, was referred to me for examination by Mr. Wakley, in February, 1853. The question was here more difficult, and gave rise to a difference of opinion. The deceased, a man of middle age, had suffered for three or four years from asthma and cough, and had been very ill three weeks before his death. The chief symptoms were pain in the chest and difficulty of breathing. He was attended by two medical practitioners, who did not meet in consultation, and appeared to take different views of his case.

One of these having found that emetics had given relief in former attacks, prescribed for deceased, on the 9th of February, an emetic of sulphate of zinc and ipecacuanha. As this had no effect, antimonial wine was prescribed, and a wine-glass, divided into two equal doses, was given at an interval of ten minutes. There was then only slight vomiting as a result of the throat being irritated by a feather. It appears that chloroform vapour had been administered to him for the relief of pain before the emetics were taken, and chloric ether had been

prescribed. The antimonial wine was taken about 4 o'clock p.m. At 5 o'clock, the patient was seen by the medical gentleman who did not prescribe the antimony, and he then found him much worse and in a state of collapse. He was again seen at 9 o'clock, and was found to be better; his pulse was improved. He had three liquid motions during the night. This gentleman did not see him again until the following day (the 10th), shortly before his death, at 2·15 p.m. His appetite was then so far restored that he asked for food, and sat up to eat it, when he suddenly died. An inspection was made by Mr. Fergusson, who found slight congestion of the right lung, and the bronchial tubes in both lungs were filled with mucus. The stomach and duodenum, with the contents of the stomach and small intestines, were delivered to me for analysis. There was slight redness of the mucous membrane in its middle portion, and congestion of the vessels of the stomach at its cardiac end, with minute ecchymoses—the membrane around being pale. The greater part of the surface was smooth, pale, and covered with a thin mucus. There was no appearance of inflammation, ulceration, softening, gangrene, or other disease. The duodenum presented no remarkable appearance. The stomach contained five ounces of a gruelly-looking liquid, unmixed with blood or any undue amount of mucus. Digested animal food (muscular fibre) was found therein. The contents of the intestines were similar; they presented nothing unnatural. On analysis, not the slightest trace of antimony was found in the contents or tissues of the stomach and intestines. Considering—1, that the symptoms on the day preceding death might have been due to the disease under which the man was labouring, as he was very ill on the Wednesday morning, before he had taken any antimonial medicine; 2, that there were no symptoms on the Thursday morning, the day of death, which could be specially referred to antimonial poisoning; 3, that he asked for food, and was eating it at the time of death; and, 4, that no antimony was found in the stomach, intestines, or their contents—Mr. Fergusson and I came to the conclusion that there was nothing to justify us in giving an opinion that he had died from three grains of tartarized antimony, taken twenty hours before death. As no antimony was found in the body, and the medi-

cine was taken in a liquid state, it is probable that the greater part had been ejected by the vomiting which followed. At the same time, it was a question whether the antimony had not accelerated death from disease. We felt that this was a question to which only a speculative answer could be returned. It appeared probable that the death of the man was owing to exhaustion, resulting in sudden syncope, in the act of sitting up; and the fact that he had asked for food, and had sat up to eat it, was adverse to the view that he was then dying from the effects of antimony. In short, it appeared to us that he might have died at the same time, and under the same circumstances, had no antimony been administered to him. The verdict of the jury was in accordance with this view. The medical gentleman who did not prescribe the antimony thought that by its depressing effects it had accelerated death; but, as he had seen deceased three times after the antimony had been administered, and had done nothing to support his strength or produce reaction during the twenty hours that he lived, the jury did not adopt this view; and the fact that the patient was not beyond the reach of such aid, was shown by his having taken food after his medical attendant had left him.

The administration of three grains of tartarized antimony to a person whose system is already lowered by protracted disease, would be at all times a dangerous procedure. At the same time, it is not justifiable to refer death to the medicine, unless the symptoms and appearances in the body, in addition to the detection of antimony in the organs, are such as to leave no reasonable doubt on the mind. When a person is already labouring under severe disease, scrupulous care is required in drawing a distinction between the natural effects of disease and the effects of the remedies administered.

A question of a somewhat similar kind, involving the reputation of a medical practitioner, was referred to me in March, 1857. A gentleman, addicted to habits of drinking, and suffering occasionally from attacks of epilepsy and delirium tremens, met with an accident in Paris, by falling from a carriage on his face and hands. He was taken up in a state of insensibility, but recovered on reaching home, and remained well the following day (Monday). On the Tuesday he was attacked with a fit of epilepsy; on the Wednesday, Thursday,

and Friday, he suffered from delirium tremens in a violent form. He died on the Friday, at 12·30. His violence was so great during the latter part of his illness, that he had been placed in a straight-waistcoat on the day before his death. On the Friday morning he was seen by an English physician who had been in the habit of attending him on previous occasions, and who had prescribed for his epileptic seizures, small doses of tartarized antimony, as he stated, with benefit. At 10 o'clock on Friday morning, *i. e.*, two and a half hours before death, while deceased was thus confined, and lying in a semi-conscious state, this physician prescribed and administered to him a white powder, which he said consisted of *three quarters of a grain* of tartarized antimony, mixed with a little sugar. According to the evidence, no effects followed, although it is stated by the other medical man in attendance that deceased vomited once. The physician who administered the powder was charged with poisoning his patient; the body was inspected, and the stomach and other viscera were removed for an analysis which was subsequently made by MM. Tardieu and Lassaigne. The principal morbid appearance was a large effusion of serum, tinged with blood, between the membranes of the brain, with general congestion of the brain. This had no doubt been produced as a secondary result of the fall, and it was quite sufficient, in the opinion of the examiners, to account for death. No antimony was found in the organs or tissues, but only a preparation of zinc, which had been used in the form of chloride, for the purpose of embalming the body. The analysis, however, was found to be incomplete, for although one of the examiners saw the stomach removed from the body, and placed in a jar, and properly sealed and labelled, yet when the jar was opened the stomach was no longer there. Some one had stolen it, or had taken an opportunity, unperceived by the examiners, of replacing it in the body.[1] This was an unfortunate circumstance for the English physician. He was charged with having administered

[1] This should convey a caution to medical practitioners in removing viscera for analysis. At any medico-legal examination of a body, only those required to make it and report on it, should be present. The admission of spectators, or of persons who (unknown to the examiners) may have an interest in removing or cutting to pieces the stomach for the purpose of destroying evidence, is a reprehensible practice. Palmer's case furnishes a good example of this.

from his waistcoat pocket a dose of poison, and the evidence of its composition then rested only on his statement. As the powder had been administered so recently before death, the stomach was the only organ in which it would probably have been found. The removal of it, therefore, left it open to be suggested that strychnia or morphia might have been given, or a much larger dose of tartarized antimony than three quarters of a grain. I examined a portion of that which was said to be the same sample of powder, and found it to consist entirely of tartarized antimony.

Wilful poisoning was imputed. Two actions for libel were brought by the physician, and one of the questions to be solved was—Did the dose of antimony admitted to have been given by the English physician actually cause death, or accelerate death from epilepsy, or delirium tremens supervening on an accident to the head? The answer returned was in the negative. The dose administered was small; no ill effects followed the administration, for the single act of vomiting, deposed to by one witness, was denied by others who were present. There was no evidence of depression of the pulse; no collapse; and, in fact, no proof of any change in the character or course of the symptoms as they were observed in the morning before and after the administration of the powder. The condition of the body showed no indication of poisoning by antimony, and, in the opinion of Mr. Partridge, of King's College, and myself, the conclusion of the French medical reporters was correct, namely, that the state of the brain, taken in connection with the accident, most satisfactorily and completely accounted for death. This loss of the stomach might have created a difficulty, had not the other circumstances furnished sufficient proof that the charge of poisoning was wrongly imputed. One of the actions was referred; and, on the trial of the other,[1] the physician recovered a verdict, with damages. The imputation on the English physician was scandalous, unjust, and untrue. The question whether it was proper to give a dose of three quarters of a grain of tartarized antimony to a patient situated like the deceased, did not arise. Physicians and surgeons are allowed by law a freedom of opinion

[1] Jones *v.* Young, Kingston Lent Assizes, 1857; and Jones *v.* Hales, Common Pleas, July, 1857.

on the remedies and doses which they employ: it is only where, in the prescription and administration, injury is produced by gross carelessness and unskilfulness, that a medical man will be held responsible for the result. If there were any other rule on this subject, how many physicians of the Rasorian school might not immediately be put upon their trials for killing their patients by administering to them enormous doses of antimony; thus acting contrary to the views of a large number of practitioners.

9. Cases illustrative of the Criminal administration of Antimony.

Medical History of the Case of Ann Palmer.

The deceased was twenty-seven years of age, and, although not of strong constitution, had generally enjoyed good health. In the summer of 1854, she had been examined by Dr. Knight, of Stafford, for a life-assurance office, and he then found her perfectly healthy: she had no disease.

Monday, September 18th, 1854. The deceased, being in her usual state of health, went with her sister-in-law on a pleasure-excursion from Rugeley to Liverpool.

Tuesday, Sept. 19th.—She remained at Liverpool with her sister-in-law, who was in her company the whole of the time. On Tuesday evening she attended a concert: she was thinly clad, said she felt tired on returning home, and complained of having caught cold. She retired to rest as usual.

Wednesday, Sept. 20th.—The deceased, on the afternoon of this day, returned with her companion to Rugeley. She and her companion had cold beef for their luncheon at Liverpool at twelve o'clock. The journey occupied from one o'clock until about half-past five in the afternoon; they had no refreshment of any kind during the journey. Nearly six hours had then elapsed; and up to that time it clearly appeared from the evidence of the sister-in-law, that the deceased lady had complained of no sickness, pain, or other symptoms of illness. She had not vomited, and there had been no purging. When she arrived at Rugeley, she walked home from the station. One witness, who walked with her part of the way, stated that she complained of feeling sick; but as he left her to find her way home without his assistance, it is evident that there could have been nothing in her condition at that time to excite particular attention. She reached her house on foot between five and six o'clock, and was admitted by the female servant (the only servant in their establishment.) She was well able to walk, and complained of no illness. The servant prepared some tea for her, which the deceased took: deceased went to bed at 9·30, and so far as the servant knew, she was not sick or ill during that night. Palmer had been out the whole of the day, and returned home about nine o'clock in the evening.

Thursday, Sept. 21st.—The servant prepared breakfast (tea, &c.), for deceased as usual, but it was taken to her by Palmer. She prepared only tea and gruel for her

during her illness, excepting on one occasion, when, at deceased's request, she prepared a little arrow-root and sago: the food prepared by the servant was always taken to deceased by Palmer. The servant gave neither food nor medicine to deceased on this or any other occasion during her illness. No one was in the house at this time, excepting the female servant, deceased, and Palmer. Up to Monday, the 25th, Palmer occupied the same room with his wife. The female servant first knew that deceased had been sick (had vomited) between ten and twelve o'clock on this day. She emptied the vessels. The vomited matter was at first in small quantity, white, and had a watery appearance. According to her statement, there was no purging until a day or two after deceased had returned from Liverpool. No one attended on the deceased on this day but Palmer and the servant. The servant saw the deceased four times: she continued sick all day at intervals, but she was not heard to complain of any particular pain. She had no knowledge that deceased had taken any medicine, and she saw no medicine until after Mr. Bamford had been called in to see her on the Sunday following.

Friday, Sept. 22d.—The deceased continued in much the same state. The servant saw no medicine in Mrs. Palmer's room. No one but the servant and Palmer attended on her this day.

Saturday, Sept. 23d.—The deceased continued ill, and kept her bed. According to the statement of the sister-in-law, who saw her, deceased complained of a pain in her stomach and chest: she felt sore in her chest, and ill all over. She appeared very ill.

Sunday, Sept. 24th.—Deceased was seen by Mr. Bamford in bed. She was in such a state of debility that it appeared painful to her to return an answer to a question. At the time of his visit she complained of a great deal of nausea, but she was not actually sick in his presence, and she was not purged. He was informed by Palmer that her bowels had not been moved for twelve or fourteen hours before he saw her. He prescribed two aperient pills, consisting of one grain of calomel and two and a half grains of colocynth in each, and an aperient draught containing tartrate of potash, powdered rhubarb, mint water, and aromatic spirits of ammonia. He advised an injection. Six pills were afterwards ordered (one half grain of calomel and two and a half grains of colocynth in each), one to be taken every three or four hours until the bowels were opened. (These were not taken.) The draught which was taken was immediately rejected. In spite of the aperient medicines, he was informed that nothing had passed through the bowels. He considered the deceased to be then sinking: she was much exhausted. There were no symptoms of bilious cholera when he saw her. The prominent symptoms were nausea, great debility, and constipation of the bowels. Palmer informed him that deceased had vomited, and had been purged: but she had since been constipated for two days. He did not prescribe tartar emetic; and, considering the condition deceased was in, he would not have prescribed it. Such a medicine would have been improper. He advised that Dr. Knight should be sent for and consulted. (Dr. Knight is a physician of Stafford, and was guardian to the deceased.)

Monday, Sept. 25th.—Deceased was seen by Dr. Knight about three o'clock, p.m. Dr. Knight found her in a very weak and dangerous state. Was told by Palmer that she had got an attack of English cholera at Liverpool, and had come home ill. She vomited incessantly, and could retain nothing on her stomach. Palmer informed him, in the presence of his wife, that she had had distressing vomiting,

griping, and purging. She did not vomit in his presence, but the retching was severe. Asked to see the evacuations, but was told they had been thrown away. As far as he could then form a judgment from the information given to him by Palmer (a medical man), he thought she was suffering from a severe form of English cholera: he considered the deceased to be then sinking, the prominent symptom being extreme exhaustion. She was unable from weakness to answer questions: she spoke in a whisper. He prescribed prussic acid, saline draughts, and an opiate solution. There was no antimony in any of the medicines which he prescribed. He would not have prescribed tartarized antimony, because it produces great depression of the vital powers, and would have aggravated the symptoms. He took his leave, with an assurance from Palmer, that, if deceased did not improve, he should be again sent for. He was not sent for, but he heard on the following Saturday that she was dead.

A nurse (Bradshaw) came to her on the evening of this day, and remained with her until her death. Soon after Dr. Knight left, the sickness returned. Deceased did not complain of pain, but chiefly of the sickness which exhausted her. There was *no purging*, while she was with deceased, except on the morning on which she died. She was very weak and low. She was sick three and four times in the day after she had taken anything. The matter which she vomited was of a yellowish colour, and appeared like bile,—it was watery, not so thick as gruel. She vomited shortly after taking food, sometimes the quantity amounted to as much as a quarter of a pint. Deceased had no solid food while witness was with her. She said she could not take anything. She said her throat felt sore, and she thought that she had strained it by vomiting: she complained of her mouth being dry at times, but she was not particularly thirsty. During the time she was with her, she took only two pills and a mixture, besides some effervescing draughts given to her by Palmer. She had no injection while she was with her. Palmer himself made broth for deceased during her illness.

Tuesday, Sept. 26th.—Seen by Bamford [Bamford's statement] in the morning. She then refused all sustenance, and appeared to be sinking fast. This was the last time he saw her alive. She was seen dozing on this day by her sister-in-law, but she did not again see her alive.

Wednesday, Sept. 27th.—The only knowledge of her condition on this day is that obtained from the evidence of Bradshaw as described above. No medical man saw her or was called to her.

Thursday, Sept. 28th.—Seen by Thirlby, a druggist, on this day. He acted as assistant to Palmer. She was in a frightfully exhausted state, and said she felt as if she should sink through the bed. She was so weak that it was difficult to get her to answer questions. The nurse informed Palmer, that deceased's bowels had not been moved, and he said he thought it was better for her as she took no support.

Friday, Sept. 29th.—Her bowels were moved for the first time since Monday. She was purged several times, and this continued up to her death, about one o'clock on this day. As soon as her bowels were moved, the sickness abated: she survived only three or four hours. She died in a composed manner, quite low and exhausted: there was no spasm or fit, and she was sensible to the last. No particular observation was made as to her breathing. The nurse was alone with her when she died. Palmer had been frequently in and out of the room that morning. The

last thing deceased took was a little grape juice, about three hours before she died.[1] This probably brought on the purging.

The body of deceased was laid out about an hour after death, by the nurse and a woman who assisted her. It presented no peculiar appearance. The limbs were not stiff until she was cold.

[There are entries in Palmer's 'Diary,' representing that the deceased was "ill in bed" from Sept. 21st to Sept. 25th, after which date there are daily entries until the day of her death, to the effect that she was "very ill in bed."]

Founding their opinions on the information given to them by Palmer, and trusting implicitly to his statements respecting the symptoms, and the nature of the illness of the deceased, the two medical gentlemen, who had each seen the deceased once, gave certificates of the cause of death. Mr. Bamford's certificate to the registrar (for the burial of deceased) was as follows:

"I hereby certify that I attended Ann Palmer, aged 27 years last birthday, that I last saw her on the 29th September, 1854, that she died on the 29th Sept., and that the cause of death was—

Cause of death.	*Duration of illness.*
Choleraic.	One week.

(Signed) W. Bamford."

It is clear from the entries in Palmer's 'Diary,' as well as from the other evidence, that this gentleman saw deceased only *once* during her severe illness, namely, on Sunday, September 24th; and at that time there were no symptoms about her indicative of bilious or summer cholera. Her bowels were constipated, and she was suffering from nausea and great debility. He did not see her again *alive*. The entry in the certificate, therefore, to the effect that he last saw her on the 29th of September, must imply that he saw her dead body. Such a certificate was valueless for the accurate registration of the cause of death, and it cannot in the slightest degree affect the inference that the deceased died from poison.

It is obvious that some change is required in the form of this certificate if we wish to prevent the concealment of murder by poison. As in certifying to the state of insanity of a person, the period of attendance, and the number of visits made, should be more clearly described; and in assigning a cause of death, it should appear whether the medical opinion is based on facts observed by the practitioner, or on *facts communicated to him by others*,—the information, as well as the name of the informant being given.

The certificate of Dr. Knight to the Life Assurance Company, was as follows: "I certify that I attended Mrs. Ann Palmer, of Rugeley, who died on the 29th Sept., for the term of one visit, on Sept. 25th, immediately previous to her decease, and that her disorder appeared to me to be English cholera of the most dangerous kind, caused by a recent visit to Liverpool."

Dr. Knight here states distinctly that he saw the deceased only *once*, and gives the date when he saw her living, as well as the date of her death. It will be seen by the evidence which he gave at the adjourned inquest, that his opinion of the

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[1] Memoranda from notes of the evidence taken by me at the inquest on the 13th and 14th January, 1856.

cause of death was not based on what he saw, but on the information given to him by Palmer.

In consequence of the certificate given by Mr. Bamford, the deceased was buried on Tuesday, October 3d, 1854, four days after death. No suspicion was then entertained, and no examination of the body was made. After the lapse of *fifteen months*, namely, on the 22d December, 1855, the body of the deceased was exhumed under legal authority, and carefully inspected by Dr. D. H. Monckton, of Rugeley. The following is the substance of his report:

Appearances of the Body.

When the coffin was opened, the general appearance presented by the body was that of a mummy. The upper part, including the arms and hands, was dry and dusty on the surface, apparently from the decay of the grave-clothes, while it was in state of moist decomposition beneath. The hair was plentiful, long, and thick, of a light brown colour; the cuticle had not separated, and it was not moveable under the finger. In opening the chest and abdomen, the muscular layers presented a natural appearance, and the internal organs were so free from decomposition that they appeared in the state in which they are found in bodies that have been only a few weeks in the dissecting room.

The *lungs* were slightly emphysematous; collapsed; dark-coloured, and nearly covered in the thorax by a large quantity of bloody fluid collected in each pleural cavity; they seemed saturated with this fluid. There were no adhesions of the lung to the walls of chest; no consolidation; no tubercular deposit or cavity in the left lung.

The right lung was reserved for analysis. Frothy fluid exuded on section of the lung-substance.

It was noticed that adipocere was deposited on the upper surface of the diaphragm and on the lungs at places, but only above the level of the fluid in the thorax.

The *heart* was empty and collapsed; its walls exceedingly thin and membranous; a considerable quantity of fat coated the outside of the heart, being deposited along the line of the septa.

There was some fat in the omentum, but little elsewhere.

The *liver* was of ordinary size and appearance. It was removed for analysis.

The *stomach* was to all appearance empty; it was removed unopened. The duodenum was also secured by ligatures, and left attached to the stomach.

A portion of the small intestines was secured and reserved for analysis. The remainder was carefully opened, cleansed, and examined in its whole length, and showed no evidence of disease of any kind either of the mucous membrane or other coats. There was a moderate quantity of digested food in them of the consistence of thick gruel, and mixed with a normal amount of bile.

The cæcum and rectum were secured and reserved for analysis. The remainder of the large intestines was opened, cleaned, and examined; they exhibited a perfectly normal appearance inside and out, and contained a quantity of a similar fluid to that found in the small gut, but rather thicker and more fæcal. The rectum contained no hardened fæces, but a large quantity of fæcal matter.

The bladder was collapsed and empty. The uterus was unimpregnated and healthy.

The *ovaries* were normal, and showed several corpora lutea; on one, a superficial

deposit was found, apparently a thin, osseous lamina, (deposits of earthy phosphates from decomposition.) This ovary was tied in a piece of bladder and reserved for analysis.

The *kidneys* showed no evidence of disease; one was reserved for analysis, and the other, when opened, appeared as healthy internally as it did externally.

The membranes of the *brain* were entire and normal; exsanguine; brain in a state of extreme decomposition, and thoroughly unfit for examination.

All the *blood* found in the body was that collected in the pleural cavities; little or none was found in the hollow or solid viscera.

The *spleen* was of the normal size and consistence. This was reserved for analysis.

On Monday, December 24th, 1855, the portions of the body of the deceased thus removed for analysis, were received by my colleague, Dr. Rees, and myself, at the chemical laboratory, Guy's Hospital.

Report of Analysis in the Case of Ann Palmer, deceased.

Three *jars* were delivered to us, sealed and otherwise well secured, and labelled "Ann Palmer."

No. 1, Contained the stomach and duodenum.
„ 2, Portions of the large and small intestines, and one kidney.
„ 3, The liver, spleen, heart, and right lung, and one of the ovaries.
„ 4, Part of the lining of the coffin.

No. 1. *Stomach.*—The coats were firm and well preserved, considering the length of interment. Externally, they presented nothing remarkable, except a slight reddish-yellow streak near the greater end. This had the appearance of mineral matter in the coats, such as might be produced by arsenic or antimony. When the stomach was opened, a highly offensive gas escaped. There were no liquid or solid contents; but a thin, pasty-looking substance, of a coffee-brown colour, was spread over the whole of the lining membrane. The whole quantity of this pasty matter was estimated at about half a tea-spoonful. The mucous coat presented slight patches of redness, but there was no ulceration, perforation, or organic disease of the stomach.

No. 2. *Large and Small Intestines.*—The *duodenum*, part of the *ileum*, *cæcum*, and *rectum*, or lower bowel, were examined. They presented no appearance of disease. The small intestines were empty, but covered on the inside with a thin, brownish-yellow coloured substance. The inner coat of the rectum was covered with a deep orange-red substance, closely adhering to it. On removing this, there was no appearance of ulceration on the surface, or of any disease. The intestines, like the stomach, were, comparatively speaking, well preserved, and the coats, though thin, were firm.

The *kidney* enclosed in this jar, was minutely examined, and found to be quite healthy.

No. 3. *The Liver, part of the Lungs, Heart, and Spleen.*—These organs were found to be in a healthy condition. They had undergone some changes as the result of putrefaction. The gall-bladder contained bile, which was thickened to the consistency of a brown paste. The cavities of the heart were empty; the valves were firm and free from disease. The lungs and spleen were softened from putrefaction, but they presented no appearance of disease. The whole of these viscera were in a remarkable state of preservation.

A *chemical analysis* was made of the following parts:

1. The brown, pasty *contents of the stomach* removed from the surface. They were found to contain, in rather large quantity, a preparation of *antimony*. A very minute portion of arsenic was also detected; but as arsenic was not found deposited in the viscera, and is said to be an occasional impurity in ordinary tartar emetic, we consider that the presence of this minute trace of arsenic in the stomach of the deceased, may have been owing to such impurity. There was no indication of the presence of any other poison.

2. The *coats* of the *stomach* were examined, and yielded antimony.

3. The large and small intestines (duodenum, ileum, and cæcum) were found to contain antimony.

4. The orange-red deposit on the *rectum* was removed and separately examined. Antimony was found in this in larger proportion than in the stomach or other parts of the body. The colour of the substance was found to be owing to the partial conversion of the mineral to sulphuret of antimony, as a result of putrefaction. The coats of the rectum also yielded antimony.

5. The thickened *bile* removed from the gall-bladder, and separately tested, yielded antimony in a proportion nearly as large as that found in the rectum.

6. About two ounces (*i. e.*, about one twentieth part) of the *liver* yielded antimony in well-marked quantity.

7. The spleen contained antimony, but in smaller proportion than the liver.

8. The *kidney* contained a small quantity of antimony.

9. Antimony was detected in the inner substance of the *heart*.

10. Antimony was also detected in the substance of the *lungs*, but in smaller proportion than in the other viscera.

11. The drainings of the jars 2 and 3, consisting chiefly of *blood*, were tested, and found to contain antimony.

12. A portion of the lining of the shell and part of the dress of deceased, was examined. It yielded no trace of antimony, or of any poison.

In this investigation, fifteen different analyses were made, occupying us from the 26th to the 31st of December, and the conclusions which we draw from the results are:

Conclusions.

1. That all parts of the body of deceased examined by us contained antimony. In the (contents of the) stomach and intestines, the antimony was partly in a soluble form (soluble in water), while in the liver, heart, spleen, kidney, and lungs, it had been deposited as a result of absorption during life.

2. The largest quantity of antimony was found in the rectum and its contents, next in the stomach and its contents, then in the bile taken from the gall-bladder, and the smallest quantity was found in the lungs. [We estimated that about one grain of antimony was contained in the duodenum and rectum, the greater portion being in the coloured substance on the surface of the rectum; that the contents of the stomach and its coats held three quarters of a grain; and that two grains were deposited in the liver and other viscera, the greater proportion being in the liver. There were, therefore, about four grains of antimony, more or less, in the portions of the body examined. The weight of animal matter employed in the analysis, might be taken at about seven pounds. The quantity diffused in other parts of the body not analysed, would of course add to the amount present at the time of death.]

3. The presence of antimony in the *contents* of the *rectum* proves that the *discharges* from the bowels of deceased contained antimony up to the *time of her death;* that she was passing antimony by purging when she died; and the presence of this mineral is sufficient to account for the vomiting or diarrhœa, or both, from which deceased is stated to have suffered during her last illness.

4. From the discovery of antimony in the *contents* of the *stomach*, we infer that a preparation of antimony must have been taken by deceased within a few hours of her death.

5. From the discovery of antimony in the stomach and intestines, especially in the rectum (as well as in the absorbed state in the other viscera), we infer that the antimonial compound, if not taken by deceased as the result of a series of accidents, was improperly administered to her either through ignorance or by design.

6. That in our opinion, the antimony found by us in the body of deceased, has not been the result of one large dose, but of several doses, taken at intervals some days before death, and to within a few hours of her death.

7. That the antimonial preparation taken by the deceased, was what is commonly called *tartar emetic* (tartarized antimony), and this may or may not have acted as a poison, according to circumstances.

8. It may or may not have been the direct cause of deceased's death. In the event of the existence of any natural cause for the illness of deceased, it may have accelerated her death, by producing great depression and exhaustion of the powers of life.

9. In the examination of the stomach, bowels, or other organs of deceased, we could not detect any changes as the result of natural disease. There was nothing to account for death. On the other hand, there was nothing in these appearances inconsistent with the death of the deceased from frequent doses of tartar emetic.[1]

ALFRED S. TAYLOR.
G. OWEN REES.

Chemical Laboratory, Guy's Hospital,
January 4, 1856.

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[1] A few additions in brackets have been made to the conclusions of this report, in order to explain a little more fully the results of our analysis, and the grounds for the inferences drawn. It may be observed in this place, that the glaze of the jars (white earthenware) was analysed, and it did not contain any antimony.

The processes of Reinsch and Marsh were used in this analysis, and both concurred in proving, in the most satisfactory and conclusive manner, the presence of antimony in all the parts examined. If the total amount of antimony separated by us from about one fifteenth part of the weight of the body, *i. e.*, four grains (and the remaining fourteen fifteenths were assumed to contain no antimony) would not be sufficient to prove fatal to another person, we still felt ourselves justified in drawing the conclusion that the small quantity might represent the residue of a larger dose or of several doses, which might have proved fatal to the deceased.[1]

A portion of the liver was analysed by carbonization with sulphuric acid, and the subsequent extraction of the antimony from the dry ash by nitro-hydrochloric acid. Chloride of antimony was thus procured, precipitable by water, and possessing the other chemical properties of that compound.

At a subsequent period the *ovary* was analysed, and this was found to yield a quantity of antimony equal to the fiftieth part of a grain.

On the 13th and 14th of January, 1856, Dr. Rees and I attended the adjourned inquest at Rugeley, in the case of Ann Palmer. I then handed to the coroner the report of our analysis, and having heard the evidence, gave the following additional testimony.

I have no reason to alter the conclusions I have drawn from the evidence I have heard. Had tartar emetic been substituted by Mr. Bamford for tartrate of potash, other and more serious symptoms would have suddenly shown themselves in deceased than those which I have heard described in evidence. It is my belief deceased had had tartar emetic, and was suffering from its effects, before Mr. Bamford saw her; that is to say, assuming he first saw her on Sunday, the 24th September, 1854. Tartar emetic would not be tasted in small doses, and would not be tasted if taken in articles of ordinary food. The killing of a person by antimony depends as much on the manner in which it is given, as on the quantity. Ten grains in one dose given to a child caused death. Antimony, in ordinary doses, does not produce constipation of the bowels generally. I should think this antimony was given to the deceased in (ordinary) medicinal doses. From the medical evidence as to the condition of

[1] See the case of Hardman, *post*.

deceased during the last eight days before her death, and from the discovery of antimony in the bowels, stomach, and all parts of the body, it is my opinion that she died from the effects of antimony, and not from any natural disease. I should think antimony (given fairly in ordinary medicinal doses) would disappear from the living body in about fifteen or twenty days after its withdrawal. The quantity of antimony found deposited in the viscera of the deceased (considered in relation to the symptoms), I believe was inconsistent with life (see 7th conclusion). That which gets (by absorption) into the blood and system destroys life, while the portion found in the stomach and bowels (unabsorbed) is the surplus of that which has destroyed life. Antimony is often given in small doses in cases of cold attended with fever. (It would not have been a proper medicine for the deceased in the condition in which she is described to have been.)

Dr. Rees corroborated this testimony, stating that he concurred in every statement respecting the analysis and the cause of death. He further said, "From the history of the illness of deceased, given by those who attended her, from the examination of the organs after death, and from the fact that antimony was discovered as described in our conjoint report, I am decidedly of opinion that the deceased died from the effects of antimony administered in small doses, and repeated at intervals."

Dr. Monckton, who conducted the inspection of the body, stated it to be his opinion, "that the appearances were not consistent with the deceased having died of English cholera, because English cholera, going to the extent of causing death by exhaustion, would have much more freely evacuated the intestinal canal. The deceased might have died from excessive vomitings causing exhaustion, but this would not be English cholera."

Dr. Knight, having been recalled, stated that the deceased had no symptoms of fever when he saw her. He formed his opinion of the cause of death from the description of her symptoms given to him by Palmer. After the evidence he had heard, he thought he was mistaken, and that the true cause of deceased's death had been stated by Dr. Taylor and Dr. Rees. He now believed that the deceased was suffering from the effects of antimony when he saw her on the 25th September, 1854. The evidence of Dr. Monckton respecting the appearances in the body, led him to believe that the deceased did not die of cholera, as he had at first supposed. His

opinion now was that deceased did not die from vomiting produced by natural causes. An examination of the body and an analysis were sometimes necessary to determine the true cause of death. It was not always possible to form an accurate opinion of a case without a statement of symptoms by the patient. He obtained his information chiefly from Palmer, as he could not ascertain anything from Mrs. Palmer on account of her extreme exhaustion, and her inability to answer questions.

Mr. Miller, a surgeon, stated that he had examined the deceased in January and February, 1854, for the purpose of life-insurance, at least four times. She was of sound constitution, and he considered her a proper life for insurance. Having heard the description of the symptoms, of the appearances of the body, and the analysis, he thought death had been caused by small doses of antimony.

Upon this and other evidence of a general kind, the unanimous verdict of the jury was that, "Ann Palmer died from the effects of tartarized antimony, and that such antimony was designedly administered to her by her husband William Palmer."

There are two questions in this case, one medical and the other purely legal: 1. Did the deceased die from the effects of tartarized antimony? 2. If she did, was it taken by any accident, or administered to her by criminal design?

On the first question, the various facts connected with antimonial poisoning, will help the reader to a judgment. Apart from the consideration of the presence and extensive diffusion of antimony in the dead body, was there any natural disease to which the symptoms and appearances could be ascribed? To Dr. Rees and myself there appeared to be no disease which would explain all the medical facts of the case. Subsequently to the inquest, we were called upon to consider and reply to the following questions:

1. *Can the symptoms and appearances be referred to any natural causes?*

The prominent symptom, during the illness of deceased, from Thursday the 21st September, until her death on Friday,

the 29th, were nausea, retching, and vomiting; the latter occurring at intervals soon after taking soothing articles of food, such as tea, gruel, arrow-root, &c., and continuing more or less throughout the whole of her illness. The only two medical men who saw her, one on the fourth and the other on the fifth day after the commencement of her illness, found her affected with nausea, distressing retching, extreme debility, and complete exhaustion. There was *no purging*; on the contrary, when Bamford saw her on the 24th, her bowels were constipated, and from the time when deceased first fell under the care of the nurse on the 25th, the bowels were not moved until the 29th, the morning of her death, and this action was apparently produced by grape-juice.

All that can be learnt respecting the vomited matters is, that in the commencement of the illness they were white or watery, while in the latter part, they were yellow or coloured by bile. The deceased could retain nothing on her stomach, and took no solid food during the whole of her illness.

On inspection, all parts of the stomach and intestines were so well preserved, as to allow of an examination, and an opinion of their condition. There was no disease of the pylorus—no ulceration, scirrhous disease, or any morbid condition of the stomach, which could account for the violent symptoms. What led to the nausea, retching, and incessant vomiting, after taking every liquid article of food, of the blandest and most soothing kind, to the prostration of the vital powers—shown by the debility, pulselessness and loss of voice? She was sinking on the fourth day, and one of the medical men then thought that she could not recover. We knew no natural causes which could have produced symptoms of this severe and continuous kind, commencing so suddenly from a comparative state of health, in a woman in the prime of life, enjoying average health, and whose bodily condition had been only recently examined by a skilful physician, with a view to the insurance of her life, and approved as perfectly healthy. We could name no disease in the whole catalogue of nosology, which could have produced such a series of symptoms proving fatal in seven days, that would not have been indicated by some morbid or diseased condition of the stomach or other organs. Some of the symptoms might, it is true,

have been referred to *gastritis* or inflammation of the stomach; and it might have been suggested that traces of inflammation in this organ would not have been visible after so long an interment. I have, however, had an opportunity of seeing well-marked inflammation of the stomach from irritant poison, in a dead body after nineteen months' burial, where the viscera were all well preserved, as in this case. Assuming the proposition to be correct, there were other circumstances inconsistent with an attack of gastritis or gastro-enteritis. There was throughout an absence of pain in the stomach and tenderness in the abdomen. The vomitings were not attended with pain. There was also an absence of fever. Even supposing that there had been symptoms and appearances indicative of gastritis, it would have been still a question whether as this is one of the effects of tartarized antimony, and the mineral was found in the stomach and bowels, the gastritis was not really a result of the action of the poison. It is well known that idiopathic gastritis (from causes irrespective of poison) is very rarely seen.

As we had found in the fluids of the stomach and intestines from the duodenum to the rectum, in the liver, spleen, kidney, ovary, lungs, and heart, a preparation of antimony, it appeared to us only reasonable to refer the symptoms to the action of some antimonial compound taken during life. They were consistent with the action of antimony, but they were not consistent with any natural cause with which we were acquainted. It is very true that in drawing this inference some person might be implicated in a charge of having caused the death, but that could only be by acts or deeds on his or her part with which we had not to concern ourselves. The symptoms and the discovery of antimony in the stomach, were medical facts which stood in the relation of effect and cause, and no other reasonable cause for them could be assigned. To entirely ignore the presence of antimony in all the organs of the body, and to assign the symptoms to some new form of undiscoverable disease which had run its fatal course, and left no trace of its existence in the dead body, might suit the purposes of an ingenious defence; but it would have been inconsistent with the duty of those who were bound conscientiously to report on the medical and scientific facts of the case utterly regardless of consequences.

A second question which we were required to answer specially, although included in the preceding, was—

2. *Could the symptoms and death of the deceased be referred to a fatal attack of English Cholera?*

Palmer had informed Dr. Knight, on the 25th September, that deceased had "caught the cholera at Liverpool, and had come home ill." On Sunday, the 24th, the fourth day of her illness, he had informed Bamford, then first consulted, that her bowels had been constipated, and thus Bamford was led to prescribe purgative medicines. There does not appear to have been at an early period of her illness much purging, and certainly none for the last five days of her life. There was therefore an entire absence of that prominent symptom of English cholera, violent and frequent bilious purging. The bowels were not empty when the body was examined. In English cholera the vomited matters from the first assume a bilious character; here it was not until after the fifth day of her illness, that this condition was seen. In the early part they were whitish; there was frequent nausea with violent retching, and when the vomiting had taken place no tendency to relief or recovery, but a continued decline of strength. There was soreness of the throat with pain in the chest. All these conditions are consistent with antimonial poisoning, but they are not consistent with the ordinary course of English cholera.

Assuming, however, that deceased had laboured under bilious or English cholera of the most dangerous or severe kind, then the recent administration of tartarized antimony in a quantity sufficient to account for that which was found in the body, would, by causing nausea, vomiting, and extreme depression, tend to weaken her still more, and to render this or any lingering disease certainly fatal. The two medical men who attended her stated that they did not prescribe this drug, and on no account would they have prescribed it for a patient in her condition.

Under some vague idea that the symptoms during the fatal illness might have been due to pregnancy, an application was made to Lord Campbell that the ovary, which had been preserved by us should be examined by two distinguished physicians, for the purpose of solving this question. Dr. Copland

and Dr. Carpenter were appointed for this purpose. This was in May, 1857 : twenty months after death, and five months after the disinterment of the body and exposure of the remains. The ovary was scarcely recognisable. Had corpora lutea been then visible upon it, as described by Dr. Monckton in his report, this could not have reasonably accounted for any of the symptoms under which the diseased laboured. Dr. Monckton, indeed, had expressly stated that, "the uterus was unimpregnated and healthy."

3. *Could the antimony found in the body be referred to the accumulation and deposit of this metal as a result of medicinal doses, taken at a period long preceding the last fatal illness?*

We were informed that, on the part of the defence, there was medical evidence to prove the affirmative of this proposition. Our reply was to the following effect :

Antimony could not have been taken in numerous medicinal doses, at intervals during the whole term of life, without producing symptoms such as nausea, vomiting, &c., of which there is no evidence prior to the day following deceased's arrival at Rugeley, namely, Thursday, September 21st, 1854.

Although persons may acquire what is called a "tolerance" for antimony in large doses, just as they acquire it for opium,[1] the deceased certainly did not manifest this state ; for, excepting the absence of purging, she died under symptoms such as antimony acting as a poison would produce, and antimony in a soluble form was found in the stomach after death.

Assuming that antimony had been taken in medicinal doses over the whole of life, and that it would have exerted no poisonous action although absorbed, there is no reason why the lungs, heart, kidney, and spleen, should not have been as much impregnated with the metal as the liver ; but this was not the case. This fact is explicable on the supposition of recent administration, since the metal would be deposited more

[1] The constipation from which deceased suffered was supposed by some to have been due to antimony ; but this state can hardly be assumed to indicate "tolerance" when nausea, vomiting, and depression continued in so severe a form. The continued constipation may have been owing to the astringent effect of the antimony, or to other and natural causes. There was simply an absence of purging as one of the symptoms of antimonial poisoning.

rapidly and abundantly in the liver than in the other organs.

The large quantity which existed in the bile or the gall-bladder, points to the rapid elimination of antimony by the liver. The liver of deceased was perfectly healthy. In animals, to which doses of tartarized antimony had been given at intervals (forty-six grains in divided doses during a period of ten days), and the animals had died, the one in fifteen and the other in twenty-one days, *poisoned* by the antimony, the liver was found very much enlarged, very brittle, and its weight increased threefold. This was the only appearance, and as it was found in both dogs, which were previously healthy, it is clear, if the observation be correct, that it presents a means of testing the question of the period of administration.

In the case of the deceased, the liver was perfectly healthy, it was not enlarged, not brittle, and had undergone no other changes than those which the liver of a healthy person would have undergone after the body had been buried fifteen months.

The absence of symptoms, the unequal distribution of antimony throughout the organs of the body, and the healthy state of the liver, are therefore adverse to the supposition that the antimony deposited in the soft organs, was the result of small doses given at intervals during the whole term of life. The presence of soluble antimony in the stomach, its diffusion through the whole of the bowels, its presence in the contents of the rectum, taken together with the symptoms preceding death, point to *recent administration*, and the quantity deposited in the soft organs, as well as the presence of antimony in the bile, are strictly in accordance with this view.

In fact, it must be obvious from that which has been elsewhere stated, respecting the elimination of antimony (*ante*, p. 75), that in no instance has it been proved that antimony could be retained in a soluble form in the contents of the *living* stomach for years, months, weeks, or even days. Assuming that the liver may retain it for a longer period than Orfila and Flandin have found in their experiments (*i.e.* about fifteen days), it can hardly be suggested that the stomach, through which food and other liquids are continually passing—which is also liable to have its contents discharged by the act of

vomiting, can retain a soluble preparation of antimony for weeks or even days. As a fact, I have ascertained in the dead human body that not a trace could be found in the contents of the stomach, when three grains dissolved in liquid had been given only twenty hours previous to death. The presence of soluble antimony in the stomach of Ann Palmer, therefore, fixes the administration of at least a part of the poison recently before death. The quantity found in the liver and other organs, is also consistent with recent administration, while there is not a single fact in the life of the deceased to show that she had taken antimony at any antecedent period. The irrelevancy of the experiments on dogs by Millon and Laveran, quoted adversely to this conclusion (*ante*, p. 78), has been already pointed out. The contents of their stomachs held no antimony, while it was present in the stomach of deceased; the pathological and chemical facts were wholly different, and admitted of no comparison.

The theory of *gastric elimination*, to account for the presence of antimony in the stomach, is equally inadmissible. The antimony must have entered the body of deceased by some channel. No one has suggested that it was injected into a vein, or thrust into a wound in the skin. Hence it must have entered the body either by the stomach or the rectum. While it might pass from the stomach to the rectum, it is not likely that it would ascend from the rectum to the stomach; and there is no good reason to suppose that it was taken up by the absorbents from the contents of the rectum, and transported and deposited especially in the stomach. It is at any rate more probable that the antimony found there, reached that organ by the ordinary process of deglutition, and that it was not injected into the rectum at all. No injections were at any time administered to the deceased. Whether in addition to the portion which entered the stomach by the œsophagus, any other portion removed from that organ by absorption, was subsequently re-deposited in it, through the mucus secreted from the blood, is a question of no practical importance in relation to the cause of death, or the criminality of the person administering the poison. It is an hypothesis not merely improbable, but actually conflicting with facts already observed and recorded in reference to the dead human body.

The theory of *cadaveric imbibition* during the long period of interment, would not affect the cause of death, or the fact of administration during life. It starts with the supposition that the poison is *in* the stomach. There is nothing in the facts of the case to lead to the suggestion that Palmer or Bradshaw the nurse, who alone were present at the death of the deceased, then, for no conceivable motive, took an opportunity of injecting some ounces of a solution of tartarized antimony into the deceased's stomach, or rectum, or both. This is the postulatum on which an objection has been taken to the usual inference,—that when antimony is found in the liver or other organs, it has been derived from absorption and deposition during life. But the rectum contained a larger quantity than the stomach, and the whole of the spleen lying in immediate contact with this organ, and therefore especially liable to imbibe the poison under this hypothesis, contained much less antimony than two ounces of the large lobe of the liver entirely removed from all contact with the stomach. The large quantity found in the bile, admits of no explanation on the cadaveric imbibition hypothesis.

It has been necessary to deal with these medical subtleties as they are just sufficient to produce some impression on the public mind, adversely to the conclusions drawn by witnesses in a particular case, when, as in this instance, they admit of no reasonable application, and are wholly inconsistent with the facts proved.

In respect to the conclusions drawn by Dr. Rees and myself, and appended to our report of the analysis in the case of Ann Palmer, I have only one or two remarks to offer (*ante*, p. 92). They were assailed at the time as not warranted by the facts, and, as it was alleged, on high medical authority. We treated this statement as a mere legal device, on the part of persons interested in the defence, for the purpose of obtaining from us materials for a cross-examination at the trial; and, except on one occasion, for the correction of some important misstatements, no notice was taken of them. The nnmerous facts connected with antimonial poisoning, as detailed by accurate and trustworthy authorities, furnish the best answer to the criticisms which appeared during a period of great public and

professional excitement. Every conclusion drawn by us has been borne out either by the evidence which was elicited subsequently to the publication of our report, or by the results of cases previously recorded. The paragraphs 1, 2, 3, are mere statements of facts (*ante*, p. 92). *Conclusion* 4th. That the antimony had been taken within a few hours of death, was based on the fact that, if taken at all, the antimony must have been taken in a soluble form. No powders were given to the deceased during her illness. From that which had fallen within our experience, we knew that antimony dissolved, was rapidly removed from the stomach by vomiting and other means. Three grains had entirely disappeared in twenty hours. Hence it became a question, for how long a time *liquids*, in a case in which there was frequent vomiting, would be likely to remain in the stomach. In our opinion, at the farthest not more than five or six hours had elapsed since she took some portion of antimony; but we left the period undetermined as we were bound to do. The 5th conclusion we considered was borne out by the fact that a larger amount of antimony, in a more extensive state of diffusion had been discovered in this body than in any case that we could find recorded. The medical men called in by Palmer did not prescribe it; it might have been administered by accident, in mistake for sugar in the tea, or salt in the gruel or broth; but then the accident must have been of daily occurrence, and there must have been a double mistake, since it is not likely that the same white powder, either regarded as sugar or salt, would have been used to sweeten or season such various liquids as tea, gruel, broth, and arrow-root. As the antimony was not prescribed by the medical men, and was given without their knowledge, it must have been *improperly* administered to her, but we accused no one. We left it quite open to be proved by evidence whether the administration was the result of ignorance or design. *Conclusion* 6th, is to the effect that one large dose would not account for the facts, but that several doses had been *taken* by deceased, at intervals several days before her death. The illness commenced on Thursday, September 21st, not, so far as can be ascertained, with great violence; there were not the symptoms of acute poisoning by tartarized antimony, there was no pain, spasms, cramps, bloody

vomiting, or purging. These symptoms would have appeared within a few hours after the supposed single large dose had been taken, and their existence must have been known to the servant. The deceased would either have recovered or have died before Sunday the 24th, the day on which Bamford was first sent for. The deceased could not have taken a large dose, either in solution or powder, without being conscious of it. She would most probably have communicated this fact to Bradshaw the nurse. In fact, unless suicide by tartarized antimony was suggested, for which hypothesis there was not the slightest pretence, it is impossible to admit from the evidence that only one dose was taken, and *that* on the Thursday morning, seven days before death. The repeated vomitings after taking tea, broth, and other bland liquids, which generally tend to allay them, and the discovery of soluble antimony in the contents of the stomach, are medical circumstances that point to repeated doses; and they admit of a reasonable explanation only on this assumption. This conclusion does not affect the question of criminal administration, for whether the poison be given in one dose or in several doses, is quite immaterial if given with intent to kill! It might have been suggested that Bamford had made a mistake in the medicine, and instead of one drachm of tartrate of potash prepared by him, in the draught, that he had unknowingly substituted tartarized antimony. This suggestion, however, could not be admitted; the symptoms showed that deceased had already taken antimony for at least three days before Bamford saw her. When he saw her, she was suffering from the effects of antimonial poisoning in a severe form; in fact, she was then sinking. It was proved at the inquest that in Bamford's shop tartarized antimony and tartrate of potash were kept in different bottles and in places remote from each other. He was ordered to make up a similar draught, and having already prepared one by substitution of tartarized antimony, the colour, taste, and appearance were found to be widely different. A large portion of the tartarized antimony in the imitated draught remained as a white sediment at the bottom.

Conclusion 7 is to the effect that the metallic antimony found in the body justified the inference that tartarized antimony was taken by deceased. The antimonial preparation

was in a soluble form in the stomach, duodenum, and rectum. The filtered aqueous solution gave readily indications of antimony. It could, therefore, be only the chloride or the compound which we named. The chloride of antimony could not have been taken, since, apart from the violent local irritation which it would have immediately produced in the act of swallowing, there would have been marks of its corrosive action on the mouth and throat, as well as in the gullet and œsophagus. It could not have reached the rectum in the form in which we found antimony there, and this bowel presented no appearance of its having been injected. Further, the deceased could not possibly have taken it without being aware of it, and it could not have been administered to her by mistake in any liquid. The supposition of the use of the chloride, involved, of necessity, the conclusion either that the deceased committed suicide, or that she was consciously accessory to the taking of the poison.

The medicinal use of antimonial, or James's powder, was also suggested as a means by which the antimony might have found its way into her body; but this would leave unexplained the symptoms and the presence of a notable quantity of soluble antimony in the stomach and intestinal canal. No powder was prescribed for, or taken by, the deceased, during the whole period of her illness, and it is not probable that this powder, which is not an active poison, would have been secretly administered in gruel, tea, &c., either for medicinal purposes, or with criminal intention.

The conclusions 8 and 9 require no observation; they explain themselves.

Assuming that the foregoing facts and remarks satisfactorily prove that Ann Palmer died from the effects of tartarized antimony, and not from any natural disease; and further, that this preparation was not taken by any accident, or with a view to the commission of suicide, the question arises—Who administered this poison to her? The only persons who were about her during her illness, were William Palmer the husband, the female servant, and the nurse Bradshaw, who attended her, as it is assumed, only after the administration of the antimony had actually commenced, and had already produced serious effects.

The same observation may be made respecting Dr. Knight, Mr. Bamford, and Thirlby, Palmer's assistant. It is clear, therefore, assuming the vomiting to have commenced on Thursday, the 21st Sept., that the female servant and Palmer were the only two who had the opportunity of administering the poison to the deceased. Against the female servant there could be no reasonable ground of suspicion. She had been in the service nine months; there was no evidence that she had been on bad terms with her mistress; there was no apparent *motive*; and although, as she prepared most of the liquid articles of food for her mistress during her illness, and therefore had the *opportunity* of administering poison, there was not the least evidence that she ever had the *means*. It is a circumstance too, worthy of remark, that the tea which she made for her mistress on the night of her arrival from Liverpool, Wednesday the 20th September, before Palmer had entered the house, produced no ill effects. It was only when Palmer took to his wife the liquids prepared by the servant, *e. g.*, tea on the morning of the 21st, and other liquids daily, including some broth prepared by himself during her illness; that the nausea, retching, and vomiting appeared. He had, therefore, the *opportunity* of administering poison; as a medical man possessing the drug, (which was found by Dr. Monckton in his surgery,) he had the *means*; and it is suggested that he had a powerful *motive*.

His conduct in invariably taking every article of food from the servant, and conveying it to his wife, during the whole period of her illness, might, it is true, receive another interpretation; it might be supposed to show the anxious attention of a devoted husband to a sick wife. On the other hand, this conduct is not consistent with the fact, that while the entries in his diary show that his wife was "ill in bed," he did not send for Mr. Bamford until the fourth day of her illness, and he did not consult Dr. Knight, a physician of repute and the guardian of his wife, until the fifth day of her illness, and then only upon the suggestion of Mr. Bamford. His diary then shows, day by day until her death, that his wife was "very ill in bed;" and although he promised to send immediately for Dr. Knight, if she did not improve, he allowed her to sink gradually, without either prescribing medicine himself or pro-

curing the medical assistance which was at hand. The two gentlemen who had been called in to see the deceased, saw her once only, pending an illness which, as a medical man, *he* (Palmer) must have known was rapidly carrying her to the grave. The only medicine which he appears to have given to her consisted in some effervescing powders advised by Dr. Knight to allay the sickness. With the single exception of two pills and a draught, Bamford's medicine and advice were disregarded. To Mr. Bamford he stated that deceased was labouring under constipation of the bowels; to Dr. Knight, that she had caught the cholera at Liverpool, and had come home ill; statements proved by the evidence to be inconsistent and untrue. It has been suggested that Palmer, as a medical man, might have privately given to his wife small doses of antimony, in the form of tartarized antimony, as a remedy for cholera! Had this supposed innocent mode of practice been really adopted, there was no reason why, when calling in Bamford and Knight, he did not communicate to them that he was giving this medicine to his wife. They would then have given the opinion which they have since expressed, namely, that it would have accounted for the nausea, retching, and vomiting, which were exhausting the deceased, and that it must immediately be withdrawn. The concealment of such an important fact as this by a medical man well acquainted, professionally, with the properties of the drug, would of course lay his motives for secret administration open to another explanation; namely, that his design was *criminal,* and that his intention in giving the antimony to his wife—not openly as medicine, for she took none prescribed by him—but secretly, in every article of food in which medicines of this nature are not commonly administered, could have been only that of destroying her by poison, under circumstances which, as he then thought, might never be brought to light.

On the question of *motive,* but little need here be said. Palmer was a gambler in life-insurance. With an actual life interest in his wife's property to the extent of only £3000, and within the short period of nine months of her death, he made, or caused to be made, proposals for insuring her life in eight different Offices for an aggregate sum of £33,000! Three proposals, made individually by *himself* to the Norwich Union in December, 1853, for £3000; to the Scottish Equi-

table in January, 1854, for £5000; and to the Sun, in February, 1854, also for £5000, were accepted by these offices, thus making a total insurance of £13,000 to cover a life interest of £3000 on his wife's property, effected in less than three months! The other proposals to the amount of £20,000 were declined by the Offices.[1] Within little more than six months afterwards, the wife died from poison, under his immediate superintendence and care! These large sums were claimed by him, and paid by the offices, after the death of his wife. I am informed that there was great suspicion at the time that there had been foul play; but the general respectability of Palmer, his social and professional position, taken together with the two medical certificates of the cause of the death of the wife, checked any intention which might have existed to resist the payment of the policies. As in the case of most criminals who have succeeded in the perpetration of one act of murder by poison, he was, however, led to the perpetration of another when an equally urgent necessity arose to dispose of a victim, and it was the murder of Cook by strychnia, in 1855, which led to the detection of the murder of the wife in the previous year.

[1] The total premiums paid by Palmer on the three policies amounted to £388; and for the payment of these, he drew a bill which was actually discounted on the security of the policies, so that by this proceeding he contrived to make the policies pay for themselves. As he was in embarrassed circumstances, and unable to meet bills of this kind without becoming further involved, the realisation of the policies, by the death of his wife, became to him a kind of necessity. Our "professional brother," as the 'Association Medical Journal' called him, went a little further than this. Having no interest whatever in the life of his brother, WALTER PALMER, he either made, or induced him to make, proposals for the insurance of his life in various Offices to the extent of £82,000! The Prince of Wales Office accepted the proposals to the extent of £13,000, under certain limitations. On the 16th August, 1855, Walter Palmer died suddenly, under circumstances of very great suspicion, in the presence of his brother and another man, with whom he had placed him as a lodger! The policy had been previously assigned by Walter to William for a nominal consideration; but when William Palmer made application for the amount, the Office refused payment. He subsequently tried, but ineffectually, to insure, to the extent of £25,000, the life of *his groom*, George Bates, described as "a gentleman" of independent means; and advised Cheshire, the post-master of Rugeley, to make proposals on his life to the extent of £5000! Thuggism, as perpetrated by the Hindoos, must be regarded as a venial offence compared with this professional mode of raising large sums of money upon human life. Yet there were those in the professions of law and medicine who, by a distortion of facts and perversion of science, endeavoured to turn loose upon society one of the greatest criminals that ever trod the earth!

Table of Recent Cases of Poisoning by the Criminal Administration of Tartarized Antimony.

No.	Name and date.	Dose and symptoms.	Result and appearances.	Analysis.
1	Ann Palmer, æt. 27, Sept., 1854. (Inquest at Rugeley, January, 1856.)	Administered in repeated doses. Quantity taken unknown. Nausea; vomiting; soreness of throat; vomited matter white, and afterwards bilious; great exhaustion and depression, but little pain or purging.	Death on the eighth day. Appearances fifteen months after death: Parts well preserved; slight patches of redness in stomach; viscera generally healthy.	Antimony found, by processes of Reinsch and Marsh, in all parts examined. About four grains, one half (absorbed) in the liver and soft organs, the remainder chiefly in stomach and rectum.
2	John Parsons Cook, æt. 28, November, 1855. (Trial for murder, Central Criminal Court, May, 1856.)	Administered in repeated doses. Quantity taken unknown. Vomiting repeatedly after taking liquids; purging as the result of medicine.	Death on the sixth day, from a dose of strychnia. Heart empty; blood liquid; patches of redness on the mucous membrane of the stomach and intestines.	Antimony found in coats of stomach and coats and contents of intestines. (Contents of stomach lost.) Antimony found in blood, liver, left kidney, and spleen. Quantity estimated at half a grain.
3	Daniel M'Mullen, æt. 40, June, 1856. (Trial for murder, Liverpool Summer Assizes, 1856.)	Administered in repeated doses, at intervals during a period of three months. Quantity taken unknown. Vomiting and burning pain in stomach after taking food; emaciation; sickness; pain in stomach,	Death in ten days after last severe attack. Body emaciated; stomach and duodenum much inflamed; patches of inflammation in small intestines, also in rectum; liver and one kidney congested; throat	Antimony found chiefly in liver, in one of the kidneys, and in the hard fæces. It was also detected in the urine, and only indistinctly in the blood and contents of stomach. There was a faint indication in the

		like pricking of pins; great prostration of strength; thirst; sallowness of skin, increasing to jaundice; difficulty of breathing; pain on pressure over stomach, not over bowels; gradual sinking; no diarrhœa, but some constipation; no cramps; no constriction of throat, or difficulty of swallowing.	inflamed; lungs slightly emphysematous; right lung congested.	heart, lungs, and rectum. The total quantity found amounted to less than two grains.
4	Ann Freeman (adult), Jan., 1857. (Trial for administering with intent to murder, Drogheda Spring Assizes, 1857.)	Administered, in repeated doses, in articles of food. Quantity taken unknown; burning sensation in stomach; nausea; speedy vomiting and purging; increased flow of saliva; symptoms of gastritis, but accompanied by purging.	Recovery after free vomiting and purging.	Antimony detected as tartar emetic in the vomited matters. About nine grains found.
5	Ellen Hardman (adult), Feb., 1857. (Trial for murder, Lancaster Summer Assizes, Aug., 1857.)	Administered in repeated doses. Quantity taken unknown. Quantity purchased sixty grains. Vomiting; purging; pain in stomach and bowels; frequent retching; vomited matter bilious; headache; restlessness; dryness of throat; great prostration of strength; cold clammy perspiration; pulselessness.	Death in nine days. Body examined fifteen days after death. Parts well preserved; inflammation of lower part of œsophagus; stomach and intestines inflamed in patches, especially duodenum and rectum; blood liquid and dark coloured; heart empty; slight congestion of one lung.	Antimony found in stomach, duodenum, and rectum, in liver, and other organs, altogether not more than from half to three quarters of a grain. In the liver and duodenum combined the one two-hundredth of a grain of arsenic.[1] Arsenic found with antimony in no other part.

[1] The arsenic was considered by Mr. Watson to be probably due to impurity in tartar emetic. The same isolated discovery of minute traces of arsenic was made by Dr. Rees and myself in the analysis of the stomach of Ann Palmer (*ante*, p. 460). Some members of the "faculty" concerned for the defence in Palmer's case, affirmed that arsenic, if really present in the body of Ann Palmer, ought to have been found everywhere with antimony, or not found at all! It is singular that another murder by antimony should have so soon corroborated our result. "Quand l'homme dit que telle chose est, et la Nature dit que telle chose n'est pas, il faut en croire la Nature."

Among the five cases in the above table, three proved fatal, from the effects of repeated doses of antimony. In none of these could it be ascertained what quantity of poison was given in a dose, or altogether; but in No. 3, (Hardman), the quantity purchased by the criminal, about the date of the poisoning, was proved to have been sixty grains. This case, on which I attended as a witness, is further of interest from the fact, that the quantity of antimony found in the dead body was not greater than that found by Dr. Rees and myself in our analysis in the case of Cook; namely, about *half a grain*. The evidence was conclusive that the woman had died from tartarized antimony administered to her by her husband in small doses at intervals. The prisoner was convicted, and executed ~~before his execution~~ at Lancaster on the 29th September, 1857, ~~he admitted that he had thus destroyed his wife~~. This case perhaps furnishes the best comment which can be offered on some of the preposterous statements put forward under quasi-medical authority by the defenders of Palmer—to the effect that no person can be poisoned by antimony in medicinal doses—that if a chemical analysis reveals the presence of only half a grain in a dead body, the person could not have died from poison, and that any medical opinion to this effect would be unjustifiable!

Lastly, the ~~confession~~ conviction of this ~~wretched~~ criminal, the imitator of Palmer's crime, that he really poisoned his wife, shows that the detection of a quantity of antimony in a dead body sufficient to constitute a fatal dose, is *not* a necessary part of the proof of murder. Had it been made so in this instance, on the erroneous grounds allowed to be assumed by the learned counsel in the defence of Palmer, it is certain that ~~this confessed murderer~~ (Hardman) would have been acquitted; and that any criminal who hereafter selected this poison for the purpose of destroying life, might have easily succeeded in setting the law at defiance.

The object of this paper will have been fully attained, if it only has the effect of opening the eyes of the medical men who are not much occupied in medico-legal pursuits, to the great danger of certain dogmas now afloat regarding poisons and the medical proofs of the crime of poisoning.

The safety of society, and the due administration of public justice, demand from every member of the profession, in so far as it lies in his power, the exposure of fallacious medical doctrines, whether they are put forward to save the life of a wealthy criminal, or to lead to the conviction of one who may not have the means to provide for his defence. An error in legal medicine is like a two edged weapon; it cannot be employed to procure the acquittal of a really guilty man, without, on some other occasion, placing in jeopardy the life of one who is really innocent.