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CONTRIBUTIONS TO TOXICOLOGY.

CASES OF POISONING.

WITH REMARKS.

BY

DOUGLAS MACLAGAN, M.D., F.R.S.E.

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CONTRIBUTIONS TO TOXICOLOGY.

THE following cases are selected from among those in which, during the last few years, I have been consulted by the legal authorities. It is presumed that no apology is necessary for their publication. Even when they involve no very new or striking peculiarities, the details of medico-legal cases are important, as contributions to our store of experience.

Arsenic; Imputed Poisoning; Distinction of Arsenic from Antimony.

The last capital conviction in Scotland for poisoning with arsenic, was in the case of Thomas Leith, who was executed at Dundee last autumn, for the murder of his wife in April 1847.

The history of this case has been made known to the readers of the *Monthly Journal*, by a report of the trial in the Number for October 1847. As regards the poisoning of the murderer's victim, although the facts are merely those of an ordinary case of death from arsenic, it may not be superfluous to state a few of the details which are not given in the report in the *Journal*.

Leith, besides being conjugally unfaithful, had for some time pursued a system of cruelty towards his wife, one of the manifestations of which was, his depriving her of money, and thus curtailing her means of feeding herself and her children, from whom he was at the time of her death living separate.

About two months previous to her death, he endeavoured to fasten upon her the accusation of an attempt to poison him, by

mixing arsenic with his tea. His motive in imputing this crime was supposed by Mrs Leith herself to be to get her out of the way, by bringing her under the pains of law for the attempt, and thus to facilitate the adulterous intercourse which he was at the time carrying on with a servant girl; but it more probably was only a part of his deep laid scheme to poison her, for he more than once insinuated after this, that something would occur which would show that his wife was the real trafficker in poison, and not himself. He said to one witness, who had accused him of putting the poison himself in his tea, "Suspend your opinion for a short time, and something will soon take place regarding that woman, which will convince you beyond doubt that I have had no hand in the matter you charge me with, and that it will appear to you all that she has been the cause of all that has taken place."

On the fatal morning Mrs Leith was sorely pressed for money, and applied to her stepmother to procure for her a supply from her husband. Having received a small sum, she purchased some oatmeal and made porridge for herself and her children; but the quantity being insufficient, she had recourse to some barley-meal which had been for some time in the house, and she made it into porridge also. This barley-meal had been used for baking *scones* on a former occasion, and had been thought bad because it was sandy, but it produced at that time no effects resembling those of poison. Her motherly care seems to have led her to retain for her own use the porridge made of this inferior meal, and to give the newly purchased oatmeal to the children; and it was with this barley-meal, to which it was proved that Leith had access some days previously, that the arsenic had been mixed. She herself breakfasted on the barley porridge, but she left a little, and it was tasted by her four daughters. Her son, however, who came home from his work to breakfast, did not taste any of the barley-meal, but breakfasted on the oatmeal porridge alone.

The barley-meal was easily discovered to be the poisonous article; for, whilst the boy escaped who had eaten none of it, all the others who had partaken of it were more or less affected, and to an extent proportionate to the amount of it which they had eaten—Mrs Leith being worst, and her daughter Helen, who had eaten more than the others, being worse than any of her sisters, who escaped with comparatively slight symptoms.

The well-known observation of Christison, that no peculiar taste is in general perceived by the victims of arsenical poisoning, was amply confirmed in this case. Not only was no complaint on this point made at the time by any of the five individuals; but when the question was directly put in precognition to one of the daughters, she answered, that she did not "feel any ill taste that they (the porridge) had."

The interval that elapsed between the taking of the poison and commencement of the symptoms was not ascertained with pre-

cision; but it was amply within limits which make it a perfect example of that most important part of the general evidence of poisoning, the commencing immediately or soon after a meal. The impression on the minds of the sufferers was, that the symptoms had commenced in ten minutes, and they stated so to the medical attendants. But this statement can hardly be relied upon as fixing this time with precision. The girls, all under eleven years of age, might easily be in error as to the precise lapse of time, and the mother was not in a condition to be very clear in her statement to the doctors; for by the time they saw her she was "apparently moribund," "nearly speechless, and complaining of loss of sight, pain, and confusion of head." The interval was more probably longer, as the following narrative will show. Mrs Leith called on her stepmother Mrs Welsh at half-past seven A.M., and their interview does not appear to have lasted longer than was necessary for persuading the latter to call upon Leith and ask him to send some money to his family. Mrs Welsh's interview with Leith does not seem to have been of any great duration, and she returned straight from his shop to the house, and then found Mrs Leith supping the porridge. Even supposing each of these conversations to have lasted half an hour, which is certainly more than was the case, Mrs Leith must have eaten the porridge at little later than half-past eight. At a few minutes after nine her son Andrew came in for his breakfast, and at that time his sisters were out about the back of the house, and his mother was not making any complaint of illness. Before, however, the boy had begun to take his breakfast, which was waiting ready for him, his sisters came into the house, "spitting and complaining about the barley porridge, and some of them said they had been vomiting." To this Mrs Leith replied, that it was she who might spit and complain, as they had only tasted the porridge, meaning obviously by this, not that she felt any bad effects, but that she supposed that they were complaining of the quality of the meal, which they had tasted and condemned as being sandy three weeks previously. The boy remained at home till ten A.M., when he went to his work. His mother had begun to complain before his departure, but he saw nothing serious before he left, and his mother merely told him that she thought she was taking influenza.

The symptoms here manifested themselves earliest in the more irritable systems of the children, although they took the poison after their mother, and swallowed comparatively insignificant doses of it, one of them having taken no more than two spoonfuls. Previous repletion of the stomach seems to have had no effect in delaying the action of the poison. They who were first affected had immediately before taken their breakfast of oatmeal porridge; whilst the mother, who was the last to complain, had taken nothing but the poisonous food.

It appears then probable, in this instance, that the symptoms in the children had commenced in less than half an hour from the tak-

ing of the poison; that in the mother, the illness did not commence at all till at least an hour, and that no serious symptoms had manifested themselves when the boy left, about an hour and half after the time when she appears to have supped the porridge.

There was nothing in the subsequent progress of the case requiring recapitulation here. The children all recovered. Mrs Leith died at three P.M., retaining her mental faculties till within a short while of her death. No treatment was followed beyond washing out the stomach by the pump, as, by the guilty delay of Leith, the medical men were not called till she was in the hopeless condition mentioned above. At the period of their mother's death, the three eldest of the daughters were still vomiting, but nothing further of their history is on record after that.

Of the moral and general evidence bringing the proof of the crime home to Leith, I need say nothing here, as an excellent abstract of it has been given in the former report in this Journal. It may not be amiss, however, to give a little more detailed consideration to the attempt made by Leith to fix upon his wife the imputation of trying to poison him some weeks previously.

It was quite obvious, both from the general, moral, and medical evidence, that, to use the words of the reporter of the trial, "it is one of the established facts of the case, that he put the poison himself in the tea."

Leith, at the time of this imputed crime, lived in a great measure separate from his wife; but his victuals were cooked in his own house, and sent down to him to his shop, where he generally stayed. On the occasion in question, tea was sent to him in a flagon. It was prepared, as usual, by his wife, and sent to him by the hands of one of the children. He was seen by his shopboy to drink about a cupful of the tea when it was first brought to him; but immediately thereafter he ordered the boy to take down some articles which were hanging at the shop-door, and during this proceeding he carried the tea with him into the back shop. He thus did not lack opportunity of putting poison, if he had it, into the tea. About half an hour after this the shopboy's father called on Leith, and found him in his back shop. He was retching at the time, but this witness saw only marks of spitting on the floor, but no traces of vomiting. Leith said he had pain across his chest, but made no complaint of being sick, or of having pain in the stomach; and he did not actually vomit till he had chewed some tobacco and taken some warm water. His having tobacco in his possession at all was an unusual circumstance, for he was not in the habit of using it. To this witness he did not appear anxious or alarmed, nor did he receive the proposal to send for medical aid with that avidity which would have been manifested by a man who thought himself poisoned. He stated that he had taken nothing but the tea, and that if any thing had done him harm it must have been that. The shopboy's father then looked into the flagon, and saw "white ticks floating on the top,"

and, on pouring off the fluid, found a white stuff lying at the bottom.

It is well known to every one who has made solutions of arsenious acid, that a considerable amount of the fine particles floats for some time on the surface of the liquid, and does not subside until the fluid has been well agitated. It would be wrong to assume that it was impossible that any should remain floating, after the agitation to which the tea must have been subjected whilst it was being carried by the little girl from the house to the shop, had the poison been mixed with it previously; but the fact of so much remaining on the surface as to attract the immediate observation of the witness, may be taken as corroborative evidence that the arsenic had been recently put into the fluid; and it is remarkable that it should not have been observed by Leith himself, especially as his pretended belief, that his wife intended to do him some mischief, ought to have made him more than usually vigilant.

A medical man, Dr Lyall, was at last brought to Leith's assistance by the shopboy's father. To the doctor, Leith stated that he had pain in the stomach and bowels—most probably in reply to questions; for he had not complained of these symptoms previously, nor did he at any time manifest any symptom of diarrhœa or tenesmus. He stated that he had drunk about a cupful of the tea; that he had then gone to wait upon some customers, which detained him half an hour; and that then he began to be sick. Dr Lyall, on looking at the tea, found a white powder at the bottom, which afterwards proved to be between forty and fifty grains of white arsenic.

It must be observed that, even with all this quantity in the vessel, he might have, after all, had only a very small dose of the poison, from the sparing solubility of arsenious acid in such a fluid as tea—a cupful of which, at a temperature of 200°, in one experiment by Christison, did not dissolve two grains in half an hour. Still, had the arsenic been in the tea as he pretended, Leith must have taken enough to have caused more decided symptoms than those which he manifested, especially as the tea was purposely made weak, to suit his taste, and ought, therefore, to have dissolved more of the poison than usual. If the symptoms were not equal in degree to what might have been expected, neither were they in duration. The vomiting had ceased before Dr Lyall came, and, although he ordered an emetic, it does not seem to have been taken, for Leith vomited no more after that; and when the doctor called to inquire for him two hours afterwards, he was free from symptoms, described himself as being much better, and was speaking with his accused wife, who, on hearing of his illness, came down to inquire for him. This rapid disappearance of symptoms—sometimes a most important sign of feigned illness—affords a remarkable contrast, even allowing for differences due to age, to the subsequent cases of the children, one of whom, at least, had taken only two spoonfuls of the poisoned porridge, and yet continued very ill from nine A.M. to at least three P.M.

No one on reviewing these symptoms will hesitate to conclude, that Leith had not taken the poison which he pretended to have got, and that the vomiting, which formed after all the only palpable sign of illness which he presented, was the premeditated result of his chewing the unwonted tobacco, and subsequently swallowing warm water. The moral evidence, into which it is not my province to enter at length, strongly corroborated this view of the question. Instead of preserving the vomitings for the inspection of the doctor, Leith ordered them to be thrown out. Instead of being anxious for medical aid, he seemed indifferent to it, and was not so alarmed as his visitor, who found him sick in his shop. His wife, instead of preparing the tea in a secret or mysterious manner, took a portion of that which she and her children had used, added water to it, because he liked it weak, took down the flagon in presence of a female neighbour, looked into it to see that it was clean, and in doing so, held it, by chance, so near the other woman that she could see into the vessel, and immediately sent it away by the hands of her little daughter. That the latter could have put the poison in the tea was not insinuated. Leith, previous to the "tea story," was proved to be in possession of poison—his wife was not known to have had any dealings with such an article. She, instead of shunning her pretended victim, at once went to see him when she heard that he was ill. She, whilst she strongly protested her innocence, an assertion which she solemnly repeated to the clergyman when on her deathbed, and though distressed to tears by the accusation, yet urged him, in presence of witnesses, to find, if he could, proofs of her guilt. He, on the contrary, although he often repeated the accusation himself, showed great anxiety that the doctor, the police, and the neighbours, should make no further inquiries regarding it. Lastly, the respective characters of both parties operated most powerfully in forming public opinion regarding the transaction. No one seems for a moment to have thought that Mrs Leith was capable of such a nefarious attempt—every one, on the contrary, who spoke to him about it, seemed to jump to the conclusion that it was himself who put the poison in the tea. The doctor, it is true, knowing nothing of the previous history of Leith and his wife, seeing only a man complaining of symptoms of poisoning from taking tea prepared by his wife, and found to contain arsenic, was led to form, at first, an opinion against her; but this he soon gave up on seeing her composed demeanour. Perhaps the very greatness of the quantity found in the tea, may be taken as unfavourable to the supposition that Mrs Leith put in the poison; for, although murderers do not in general trouble themselves with any nice inquiries as to the solubility of toxic agents, it is but reasonable to suppose that, in putting poison into a fluid like tea, and into a limited supply of it which she might calculate on being all consumed, the murderer would have thought of observing whether such a quantity as forty or fifty grains—about the third part of a teaspoonful, according to Taylor—might not be

lying at the bottom undissolved. It is probably from the very fear of discovery in this way, that murderers generally employ thick fluids, such as gruel or soup, as vehicles for the administration of arsenic.

I now revert to the history of the fatal poisoning of Mrs Leith. I need say nothing of the morbid appearances, the essential details of which are given in the report of the trial in this Journal. They were quite correspondent with the supposed cause of death. The nature of the poison was also amply substantiated by chemical proof. Mr Hamilton, chemist at Dundee, assisted by Dr Nimmo, and in presence of Dr Crichton, detected arsenic, by all the usual methods, in the barley-meal, in the contents of the stomach *post mortem*, and in the matters removed from the stomach during life by the pump.

The various articles were subsequently sent to me for a corroborative analysis, without the results obtained at Dundee being made known to me, and I made the following report upon them to the authorities :—

"I certify that, on Thursday 29th April 1847, I received from Mr Wilson of the Crown Agent's Office a box, containing articles for chemical examination in the case of Thomas Leith, together with an inventory of the contents of the box. The box was opened in presence of Mr Wilson, and found to contain four bottles, a wide-mouthed glass jar, and two paper packets, corresponding with the inventory. The bottles, jar, and packets, were duly sealed; the seals were unbroken. The jar, on being opened, was found to contain the larger portion of the œsophagus, the stomach, and the greater part of the small intestines of a human adult. The mucous membrane of the stomach and bowels throughout, presented appearances indicating extensive inflammation. The surface of the mucous membrane of the stomach, which had previously been opened, had a tenacious mucus adhering to it, among which there were found minute crystalline grains, having the form and appearance of arsenious acid. The viscera were free of putrid smell. The jar likewise contained about three fluid ounces of a ropy bloody fluid, with a white mucous deposit at the bottom. This fluid, with the deposit, was examined chemically for arsenic. The process followed was that of Reinsch. [The process was here described in the report.] The copper, on being removed from the fluid, was covered with a steel grey crust. It was washed, dried, and heated in a glass tube, with free contact of the air. The heat produced a copious crystalline sublimate, the appearance of which, under a magnifying glass, sufficiently showed it to be white arsenic; but this was unequivocally established by dissolving the sublimate in distilled water, and subjecting the solution to the tests of the ammonio-nitrate of silver, ammonio-sulphate of copper, and sulphuretted hydrogen—all of which gave at once the reactions characteristic of arsenic.

"The presence of arsenic in the contents of the jar being so indubitably established, I deemed it unnecessary to make any experiments with the textures of the stomach and intestines.

"The bottle marked No. 1 in the inventory, and labelled as containing what was removed by the stomach pump from the stomach of Mrs Leith, was uncorked, and found to be full of a pale yellow slightly turbid fluid, with a feeble sour smell, and an acid reaction. Twelve fluid ounces of this were mixed with pure muriatic acid, and boiled with a piece of polished copper. The copper, after boiling, had a distinct grey crust, and when heated in a tube, as described above, gave also a crystalline sublimate of small amount, but sufficient, when dissolved in distilled water, to give all the characteristics of arsenic with the tests formerly mentioned.

"The paper packet, No. 6 of inventory (labelled as containing barley-meal found in Mrs Leith's house), was found to contain about half an ounce of a white powder, abounding in starch, and therefore apparently flour or barley-meal. About an eighth part of this powder was subjected to Reinsch's process, and gave a very copious crystalline sublimate, which, when dissolved in water and tested, gave the reactions characteristic of arsenic.

"I did not think it necessary, after the above results, to subject any of the other articles to experiment."

The other articles were merely more of the matters removed by the stomach pump, the washings of the tub in which the vomitings had been put before they were thrown out, and the bag in which the barley-meal had been contained.

The appearance of the stomach and intestines before any analysis was commenced, decidedly pointed towards arsenic, and led to that poison being at once specially sought for. The bright red inflamed appearance of the viscera, the absence of corrosion, softening, or blackening, and the complete absence of all appearance of decomposition after eight days of tolerably warm weather, indicated irritant poisoning, and the peculiar irritant to be arsenic. The antiseptic powers of arsenic are now thoroughly established, and constitute one of its most marked peculiarities. In this instance there was not only no positive putridity, but even that feeble but somewhat persistent cadaveric odour, which is familiar to every one who has dissected fresh bodies or organs, was awanting. As a general rule, where viscera with signs of inflammation are firm in texture, and in an unusually good state of preservation, arsenic may be suspected to be present, and to be in considerable quantity.

Before quitting the present instance of arsenical poisoning, I beg to offer a few remarks on the two most approved processes, those of Reinsch and Marsh, now in use for detecting arsenic in medico-legal analyses. The former may be said to be distinguished for its facility and celerity, the latter for its delicacy.

In any case, such, for example, as the present, where there is reason to expect a considerable proportion of arsenic, and where we have plenty of material to work upon, it is always best to have recourse at once to Reinsch's method, on account of its easy and rapid execution. As I have frequently found, not only in experiment, but in actual medico-legal investigations, the whole process, including the preparation of a tube for the experiment, may be satisfactorily done in less than half an hour. Where, however, the quantity of material at command is small, and the proportion of arsenic probably minute, the more delicate method of Marsh ought to be employed at once. Reinsch's method cannot be said to be remarkably delicate. I have failed to obtain any satisfactory evidence of the presence of arsenic when it was applied to a thousandth of a grain in two fluid ounces of liquid. Dr Christison says, that it will detect "at least a 250,000th part of arsenic in solution;" but this applies to the state of dilution, without reference to the quantity of arsenic present. Mr Taylor says it will act when a 3000th of a grain is used under a dilution of

90,000 times its weight of water; but the action in his experiments appears to have been limited to the mere production of a stain on the copper. This is acknowledged to be no true characteristic. The bright copper is frequently tarnished when there is no arsenic present, and where all the necessary precautions in conducting the experiment have been attended to. The circumstances which occasionally lead to the formation of a stain very like that of arsenic, do not seem to be accurately determined. It will always almost occur in presence of organic matters, if the copper is put into the acidulated fluid before it is duly heated. Reinsch's process cannot be said to have acted satisfactorily for medico-legal purposes, unless it produces first a stain on the copper, and then a distinctly recognisable white sublimate. It is, however, a method capable of demonstrating very small quantities of arsenic. Mr Taylor detected the 144th of a grain in two fluid drachms of liquid. I have obtained all the indications of the presence of arsenic from 100th of a grain in two fluid ounces of thick soup.

The length of time during which the ebullition should be continued, has been, I think, rather overstated by both Christison and Taylor. The former says (4th edition, p. 272), "In the feeblest solutions, from ten to fifteen minutes elapse before arsenic is visibly deposited, and forty minutes should be allowed for complete deposition; but in strong solutions the action takes place in a few seconds." Mr Taylor says (on Poisons, p. 353), "one caution is to be observed, *i. e.*, not to remove the copper from the liquid too soon. When the arsenic is in minute quantity, the deposit does not take place sometimes for a quarter of an hour." As the amount of arsenic meant by the terms "feeblest" and "minute," has not been specified, I may mention an experiment bearing on this point, made with a definite quantity of arsenic, not, however, probably so small as to bring it strictly within either of these categories.

One hundredth of a grain of arsenic in two fluid ounces of acidulated water, was boiled in the usual way with a piece of copper. After having been boiled for four minutes, the copper was found to have a slight grey crust, in eight minutes the crust was distinct, and in ten minutes the process was stopped. It was found, after this amount of boiling, not only that the copper afforded distinct evidence of arsenic, but that the whole had been removed, as none could be detected in the liquid by Marsh's method. A similar experiment, made with the same amount of arsenic in an equal quantity of thick broth, gave equally satisfactory results after ten minutes' boiling.

There does not appear, however, to be any practical disadvantage in prolonging the boiling. The mere coloration of the copper by the prolonged action of the acid, is, as Mr Taylor has accurately stated, not a source of fallacy, and the scaling off of deposited arsenic by prolonged ebullition, has appeared to me to occur only when the arsenic was in large quantity; and in such a case the long boiling is not

required. In any case, where, after ten minutes' boiling, I find, on examining the copper, that it does not appear coated with arsenic, I remove the copper, boil the materials with the acid for some time longer, filter off the fluid, and transfer it to a Marsh's apparatus.

The peculiar form of the piece of copper, provided it be bright and clean, is not a matter to which I attach any importance. I give the preference to a piece of copper wire, of about the size called No. 24 by the dealers, made bright by rubbing it with a piece of sand-paper, and rolled into the form of a loose spiral coil, of about an inch long, by twisting it round a small pencil or glass rod. When of this form it is more easily caught and removed when it is immersed in a thick mixture of organic matters than a "slip of copper foil or wire" [Taylor], or "copper worn thin by the action of nitric acid" [Christison]. It affords, in a piece of moderate length, an extensive surface for the deposition of the arsenic, and thus expedites the process; and it is more readily washed, and seen to be free from adhering organic matters than copper gauze. In operating by Reinsch's method, I never make any preliminary filtration of the decoction, but boil the whole solids, if any be present, broken down as much as possible, with the acid, adding water if necessary, and at once immerse the wire coil in the mixture.

Marsh's process is, by universal consent, the most delicate method of ascertaining the presence of arsenic. It is no part of my object to comment upon the innumerable forms of apparatus which have been devised. By far the most convenient is the common Döbereiner's lamp, as figured by Christison.

The purity of the acid, sulphuric or muriatic, and of the zinc and water, having been duly ascertained, and the stop-cock and ground neck of the apparatus having been found by experiment to be air-tight, so as to avoid any risk of loss of the gas, the suspected materials are to be boiled in water along with a portion of acid, and filtered through a piece of well-washed calico. It is then quite fit, in almost every instance, for being placed in the apparatus. The proportion of acid should not be great—the slower the gas is evolved the better. It is convenient to set the process going at the end of the day, and leave it all night. The apparatus is found full of gas, and ready for the decisive trial in the morning. The frothing up of the fluid, which has been such a bugbear to many experimenters, and has led to the troublesome and hazardous process of incineration, is productive of no practical inconvenience if this precaution is attended to.

The gas is now ready for being decomposed, so as to separate the arsenic. If the arsenic be in large quantity, it is of little consequence by what method the reduction of the arseniuretted hydrogen is accomplished. When the amount is minute it is best to adopt the method first proposed by Berzelius, of passing the gas slowly along a small glass tube, raised at one part by a spirit lamp to a low red heat, and thus obtaining a metallic ring, or more correctly incrustation, for it is seldom truly annular, in the interior of the tube.

In procuring stains on glass or porcelain, without considerable dexterity on the part of the operator, the arsenic, if in very small quantity, may be entirely lost; but in the use of the tube, if the gas is only passed along with moderate slowness, no loss can be experienced.

The most convenient tubes for this purpose are of German hard glass, about a twelfth of an inch in bore, and need not be more than five inches long. They are drawn out and turned up at the point, leaving in the apex a very small orifice, at which the disengaged hydrogen may be burned, and thus afford, by the size of the flame, a criterion of the rate at which the gas is passing. The reduction tube is connected with the nozzle of the apparatus by a portion of wider tube about two inches long, filled with dry cotton wadding, as recommended by Christison. The tube is to be heated at a little beyond its middle, till it appears feebly red when in shade. The tube, if of good glass, ought not to bend, and any tube which does so readily, or blackens when simply heated, from being made with lead, ought to be rejected. This method of operating, the simplification of which is due to Dr Christison, is so simple, easy, and sure, that all porcelain plates and watch glasses, and the ingenious tube devised by Dr Christison himself, for burning the gas and collecting the products of combustion, may be dispensed with.

It is however notorious, that the duty of the medico-legal analyst does not terminate with the procuring an incrustation on his tube or porcelain plate. What has been done is merely the elimination of something, the arsenical or non-arsenical nature of which remains to be determined.

Various matters have been indicated as being capable of producing deposits which may be mistaken for arsenical stains; but most medico-legal writers are now agreed, that antimony is the only one which offers any really practical source of fallacy, and hence a variety of methods have been described for distinguishing with rigorous precision antimonial from arsenical stains.

When the metallic stain is large this question is easily settled. Sublimation will in such a case yield enough of arsenious acid, if the deposit be arsenical, to afford precise characters by the liquid tests. But we may have to distinguish between arsenic and antimony, where the quantity would not furnish enough of solution for testing with two or three separate re-agents. The action of nitric or nitro-muriatic acid is that which has commonly been had recourse to for distinguishing stains of small extent. This, as is well known, converts the metallic arsenic into the very soluble arsenic acid, which gives a brick-red precipitate with nitrate of silver; whilst antimony so treated gives an insoluble product, and makes a grey stain with the silver test. But this proceeding is not easily applied, except to stains on a flat surface; and in procuring these there is the risk of a considerable or total loss of the arsenic, if the quantity be very minute, and the operator not very dexterous. The most complete me-

thod of distinguishing arsenic from antimony is that of Devergie [Ann. d'Hygiène, xxxvi. 121], which may be applied to stains either in a tube or on a flat surface, and has the advantage, that the whole series of reactions may be applied to a single stain without the necessity for dividing it, for the purposes of experiment, into separate portions. This method consists in, 1st, exposing the deposit to chlorine gas, which causes the arsenical stain to disappear by converting it into chloride of arsenic. 2d, The chloride so formed is exposed to sulphuretted hydrogen, which produces the pale yellow sulphuret of arsenic. 3d, This is treated with a very weak aqua ammoniæ, which makes with it a colourless solution; and this in its turn, being gently heated, reproduces the yellow sulphuret as the ammonia volatilizes. 4th, This yellow sulphuret is treated with a few drops of nitric, containing one drop of muriatic acid, and on evaporating this to dryness, white rings of arsenic acid are left, which, from their deliquescing under the moisture of the air, speedily become invisible. 5th, The spot moistened by the deliquesced arsenic acid is touched with nitrate of silver, which produces the dirty red stain of arseniate of silver.

This series of actions, if successfully evolved, is entirely conclusive for distinguishing a purely arsenical from a purely antimonial stain; but by M. Devergie's own showing, its success is a good deal dependent on the dexterity and nice manipulation of the operator. Devergie has, to a considerable extent, rebutted some of the objections which have been urged against his method. They are hardly valid where the stain is tolerably large; but he has given no positive statement as to the delicacy of his series of tests, or of how small a quantity of arsenic or antimony may be distinguished with certainty by its use.

There is one distinction between arsenic and antimony to which enough of attention has not been paid, and by which, I believe, they may be easily and readily discriminated, even in very minute quantity, viz. the difference of temperature at which they respectively undergo sublimation. That such a difference exists, is alluded to in general terms in most medico-legal works; but I am not aware that the comparative effects of a regulated temperature on the metallic stains has been adopted as a means of distinction, and adduced in evidence, except by Mr H. H. Watson, in the case of the *Queen* v. *Johnston*, Liverpool Lent Assizes, 1847. In the quotation of this evidence, as given by Mr Taylor in his appendix, Mr Watson says —"I also exposed some of these metallic deposits on glass, to a temperature ranging from 355 to 565 degrees, by which they were volatilized and left the glass. This is another proof that the metal is not antimony, but arsenic; antimony does not volatilize at the temperature mentioned, but remains permanent, while it is one of the properties of arsenic to become volatilized at that temperature."

It appears to me that, when this property is satisfactorily observed, there can be no possible mistake as to the stain being arsenical, and

not antimonial. Mr Watson does not state how he applied and regulated the heat; but I presume that it was by the oil bath. My experiments lead me to the conclusion, not only that it is the easiest and simplest way of distinguishing arsenic from antimony, but that it is a perfectly satisfactory method of separating them, and that they can thus be distinguished and separated in an unmistakeable manner, whether the stain be large or small.

The exact point of the thermometer at which metallic arsenic and arsenious acid sublime, is still *sub judice*. The arsenious acid is commonly stated to sublime at 380°, but, according to Dr Mitchell of Philadelphia, it requires a temperature of 425°. My own observations lead me to fix on 380° as the temperature at which, in a narrow tube, open at one end, arsenious acid begins to sublime. The metallic arsenic, commonly said to sublime at 356°, does not, according to Mitchell, volatilize except at a low red heat, luminous in the dark. I have not made special experiments for determining this point; but I have never been able to observe it sublime below 500°, unless it became oxidated. In a medico-legal point of view, however, this is not the present question. What we have to consider is, if we can, by a simple means, obtain a regulated heat at which metallic arsenic will sublime and become oxidated, whilst antimony will undergo no such change.

This we can easily accomplish by means of a bath of olive oil, which may be urged even to its boiling point without at all affecting an antimonial stain, whilst the heat so employed will entirely sublime an arsenical crust into a crystalline sublimate of arsenious acid. It will always be best, if it is possible, to have a thermometer in the oil bath, that the extreme temperature employed may be stated in evidence if asked for. But this is not indispensable; olive oil does not begin to boil till the heat rises above 600°; and this heat, however long applied, does not cause antimony to volatilize. Stains which are so faint as not to appear distinctly metallic till the tube is held over a sheet of white paper, may be distinguished in this way. The pure arsenical metallic stain entirely disappears from the spot where it was deposited, the pure antimonial remains unchanged; whilst the mixed arsenical and antimonial becomes visibly less, a portion has undergone sublimation, and the residue, however long the heat may be prolonged, remains fixed. If, in addition to the disappearance of the stain from the portion of the tube immersed in the oil, we can observe the formation of a crystalline sublimate in the upper portion of the tube, the proof may be said to be absolute. Very small quantities of arsenic may be rendered distinctly visible in this form. I have operated upon stains produced from a Marsh's apparatus, which contained less than a thousandth of a grain of arsenic, and have yet been able to see distinctly the crystalline character of the sublimate. The gentle and gradual way in which the heat is applied in the oil bath, causes the sublimate to deposit itself in fewer but much larger crystals, and thus makes it much more appreciable

by the eye or lens than could be supposed by those who have been in the habit of subliming small stains of arsenic by a spirit lamp flame. In the case of some poisoned swine which I examined, and where, from one of the articles, I could obtain in the tube a mere shade of brown, and when, by the spirit lamp, this was sublimed into a mere white cloud, I was able, by again heating in the oil bath, to obtain a sublimate distinctly of crystalline appearance to the naked eye.

In order to test practically the value of this method of distinguishing arsenic from antimony, I made the following experiment, in which I was kindly assisted by my colleague, Dr Anderson. I requested him to prepare for me, in tubes, a series of stains from Marsh's apparatus, some of which should be arsenical, some antimonial, and others a mixture of both, and I proposed to distinguish these by the unaided operation of the oil bath.

Dr Anderson accordingly prepared for me six such tubes, which he duly numbered and noted.

No. 1 was accidentally mismanaged. Unreasonably trusting to my friend having taken the trouble to seal the tubes, I plunged this one into the oil with the point open, and it was of course filled with oil. Had such a misfortune occurred in a medico-legal investigation, it would have been easily rectified by immersing the tube in pure ether, which would dissolve out the oil; but as the crust in this case was large, probably the fiftieth of a grain, I felt so confident of success that I contented myself with merely blowing out the oil from the tube, then sealed up the point, and again placed it in the oil. The distinct crystalline sublimate, which speedily formed, showed at once that it was arsenical, and as it in time entirely volatilized, I pronounced against the presence of antimony.

Tube No. 2 presented a faint brown stain about two lines in length. Its brown metallic appearance was distinct only when it was held over white paper. It was pronounced to be arsenic alone, because it entirely disappeared, but it was so small as not to afford an unequivocally crystalline sublimate.

No. 3, on being heated for about ten minutes, presented at the upper part of the tube a faint crystalline sublimate, but a large metallic stain remained below. It was subjected to a prolonged heating, and no more sublimation could be observed. It was pronounced to be antimony with a small proportion of arsenic.

No. 4 gave a copious distinctly crystalline sublimate in a few minutes, and the whole stain eventually sublimed. It was recognised as a large arsenical stain, as in No. 1.

No. 5. The stain in this tube was so faint as to appear greyish-white when held to the light, but it was observed to have a faint brown tint when held over white paper. It was heated for a length of time, but underwent no apparent diminution. It was pronounced to be a trace of antimony.

No. 6, a large stain was not affected by heating for above half an hour. It was evidently a large antimonial stain.

In each of these instances I found that I had pronounced correctly. The minute quantity distinguishable by these simple means, may be inferred from this, that, in No. 5, the Döbereiner's lamp contained only three-thousandths of a grain of tartar emetic, and as this salt contains only 35·9 per cent. of metallic antimony, there could not have been in the tube more than a-thousandth of a grain of metallic antimony. But as only one charge of gas was used, it is most probable, from the faintness of the stain, that only a portion of this was collected. In order, therefore, to determine whether a stain be arsenical or antimonial, all that is required is to operate with Marsh's apparatus and the narrow glass tube; if a stain is procured, to seal up the point, immerse it in the oil bath, and heat this steadily. The heating does not require to be prolonged. Ten minutes after the temperature has risen to about 500, will have affected the stain if it is arsenical. It is well remarked by Taylor, that, in such investigations, we have to determine the presence of arsenic in antimony, not of antimony in arsenic; and therefore, if any sublimation in the oil bath can be observed at all, the question as to the presence of arsenic is settled. To enable us to observe this more readily, it is a good plan to make a small scratch on the tube at each limit of the stained portion before heating it, and thus, by its diminution, we may pronounce upon its nature, although no sublimate should be distinctly visible. Should any peculiar case occur, in which it might be of importance to determine that antimony was present, as well as arsenic, the heat must be continued for a longer period. I have found that a large pure arsenical stain, weighing on a delicate balance 0·036 grain, required an hour and a half of heating at 500 in a narrow tube to sublime it entirely. But long before one-third had been sublimed, the tube was lined with splendid crystals of arsenious acid. The heat, to sublime the whole arsenic, need never be raised beyond 520°, but, even if the oil boils, it does not affect the correctness of the experiment.

I believe, therefore, from what I have been able to observe, that the nature of a metallic stain may, in this way, be accurately determined without the employment of any chemical re-agent whatever.

Acetate of Lead; Attempted Suicide; Imputed Poisoning.

Elliot Millar, cloth-finisher, Galashiels, and his wife, had been married for about thirteen years, but for two or three years had lived very unhappily together. One of the parties had communicated syphilis to the other, and, considering the otherwise indifferent character of the husband, there seems to be little room for doubt that he was the culprit in this matter.

Millar's bad usage of his wife had on several occasions induced her to leave his house, and seek an asylum under the roofs of her relatives, and had led her about two years previously to attempt to poison herself with sugar of lead. On Saturday, 3d July 1847,

she again resolved to destroy herself, and for this purpose sent one of her sons to a laboratory to purchase a pennyworth of sugar of lead, the whole of which she dissolved in water, and swallowed before going to bed. The boy was instructed to say that the sugar of lead was to be applied to a sore; the quantity furnished to him was half an ounce; it was wrapped in paper, and labelled "Sugar of lead. Poison." This paper she put into her pocket, after swallowing the drug. During the night and following morning, she was sick, and vomited, but suffered no other inconvenience. On rising next morning, Sunday 4th July, she threw out the vomitings, and, as she slept in a separate apartment from her husband, he was not aware of what she had done.

She then prepared coffee for her own and her husband's breakfast. He drank two or three cupfuls of the coffee, she herself drank two cupfuls at the same time, and another after he had finished his meal. This interruption to her breakfast, arose from his having reproached her with being more active at taking her meat, than in attending to her household duties. This was the beginning of a fresh altercation, in the course of which she remarked, that had she been that morning where she intended, she would not have been there to bear his abusive language, and thereupon she showed him the paper marked "sugar of lead, poison," and told him of her suicidal attempt. He made no further remark at the time than that he did not believe she had attempted suicide, and he left the house. He went up to the house of his brother, who lived above him, and told him of what his wife said she had done, and then said to him that he felt unwell, and believed that he had himself got the poison. His brother advised him, if this were the case, to go to the laboratory and procure a vomit. He accordingly went to the chemist's, showed the labelled paper, again expressed his belief that he had got the poison, and was accordingly furnished with a scruple of ipecacuan, and a grain and half of tartar emetic, with directions to return in half an hour if it did not operate. He went home, mixed the emetic in water in presence of his wife, and carried it into an adjoining room, where he said he swallowed it. He then went up again to his brother's house. The emetic said to have been taken by him, not having operated, nor produced even an appearance of nausea, he was advised by his brother and father to go back to the laboratory again, which he accordingly did, but not for more than an hour after the time when he got the first emetic. The druggist's assistant on this occasion asked him if he "felt a pain in his bowels, and a sweet metallic taste, and if he felt sick," when he said he felt the pain in his bowels, and a slight taste, but not sick. At this moment a medical man, Dr Hutton, happening to pass, was asked to give him the benefit of his advice. Millar, according to the druggist's statement, did not seem apprehensive of himself, nor did he appear to be suffering; when, however, Dr Hutton came in, he seemed "a little

afraid." The doctor inquired as to his symptoms; but he said now he had none; "no headache, no pain, no spasms, no sickness; indeed, no symptom whatever." The doctor seems very properly to have attached no importance to the case; he bade the apothecary repeat the emetic, and left him.

Millar carried home his second emetic, and along with it some vinegar, part of which he drank himself, and he made his wife drink some also. This extraordinary antidote for acetate of lead seems to have been a prescription of his own. This second emetic was undoubtedly swallowed, and it operated, speedily producing so much nausea as to oblige him to lie down on his bed. He vomited into a basin, and this, with its contents, he placed, apparently for concealment, in a tub under a bed in a closet, where they were seen by his wife next day, and left untouched by her. At the time when Miller first accused his wife of having poisoned him, and when the breakfast things were still standing on the table, he took the coffee-pot, and poured out a little of the coffee which remained into a cup. This he placed in a drawer, which he locked, and put the key in his pocket. To all his accusations, his wife protested strongly that she was entirely innocent of poisoning him, as she had no poison in her possession, except that which she had swallowed the previous night. Next day, Monday, July 5, a constable, who had been informed of Mrs Millar having attempted to poison her husband, came to the house, found Millar and his wife there, and got from the former the portion of coffee which he had locked up. The constable returned again in the evening, and then got the vomitings. Both of these he put into bottles, and, having secured them, marked them for identification. On the succeeding day, Tuesday, the procurator-fiscal came, and he, having made some inquiries on the subject, a warrant was obtained, and Mrs Millar committed to prison on the charge of having attempted to poison her husband.

The usual inquiries were now instituted by the authorities, with a view to bringing her to trial for her alleged crime. The prisoner, as usual in such cases, was herself examined on Tuesday the 6th July, and her declaration taken down, and afterwards signed by her. It was again read over to her on the succeeding day, some additional particulars added, and adhered to by her. It contained merely a statement of the facts mentioned in the above narrative, so far as known to her, and a strong protestation of her innocence. Her apparently candid and straightforward manner under examination, had impressed the procurator-fiscal and justice of peace who examined her, very favourably towards her; so much so, that the former, in reporting the case to another of the authorities, actually states his suspicion, that the sugar of lead, which by this time had been tested for, and found in the vomitings and coffee, may have been put into them after they were set aside.

Elliot Millar himself was on the same day, 6th July, examined

in precognition as the principal witness against his wife. This evidence was a repetition of his statement as to her having given him the poison in his coffee, admitting, however, the fact, so favourable to the accused, of her having at the same time herself partaken of the coffee. He ascribed their domestic quarrels to her inattention to her domestic duties, and especially to her having contracted and communicated to him venereal disease. He admitted having struck her; but his whole evidence tended to gloss over his brutality towards her, and to magnify all the faults which he imputed to her. He assigned to the magistrates at this examination, as the ground of his belief of the present crime, her having tried to poison him with sugar of lead about two years previously. This statement, which pointed to the former occasion when she had attempted to destroy herself, was clearly an untruth. At that time he accompanied her to a medical man, Dr Weir, for the purpose of procuring antidotes to the poison which she had taken; but he never breathed a syllable as to her having given any poison to him, and he sought no advice for himself, but only for his wife. Moreover, having occasion to see Dr Weir soon after the present precognition, when his wife was in jail, he gave to the doctor a quite different reason for believing her guilty. He made no allusion to any attempt with sugar of lead two years previously, because he knew Dr Weir to be cognizant of the facts as they then occurred; but he said that she had tried to give him prussiate of potash in his porridge some months before, his acquaintance with this salt arising from his knowledge of its employment as a dye-stuff. Dr Weir at once set down this story as a falsehood; but the inconsistency of his statements to the doctor in private, and to the magistrates at their examination, was not known at the time. Nevertheless, the general character of the statements made by Millar at his precognition, inspired the procurator-fiscal who examined him, with a want of confidence in their truthfulness. Among other suspicious circumstances eliminated, was the fact, that he had himself been in possession of sugar of lead as an application to his venereal sores shortly before this time; but he alleged, that, as he had found it useless to him, he had put it into the fire. The procurator-fiscal, struck with the peculiarity of the whole case, did not think it right to proceed further without consulting the legal advisers of the crown; and therefore he transmitted the various documents to crown-counsel for their opinion. In consequence of instructions from them, he again on 15th July examined Elliot Millar, who adhered to his former declaration of the 6th, and made one unimportant statement in addition thereto.

This being reported to the authorities in Edinburgh, instructions were sent to the procurator-fiscal, to subject Millar to a further examination still, which took place on 31st July. His former declarations were read over to him; but he declared at the outset, obviously with a view to cutting short his examination, that

this was unnecessary, as he perfectly remembered all that he had said. To all the questions put to him he answered promptly and decidedly, and he showed very manifestly throughout, the desire to make out a case as strong as possible against his imprisoned wife. At length, towards the close of the examination, the procurator-fiscal asked him directly, if he did not himself put sugar of lead into the coffee on the Sunday morning. He said he did not. The question was pressed a second time, when, after some shuffling and equivocation about his telling nothing but truth, he at length confessed that, having still in his possession a portion of the sugar of lead which he had been using for his venereal sores, and which he had declared he had burned, he had, during his wife's temporary absence from the house, put a pinch of it into the coffee which he had locked up in the drawer, and thrown the rest among his own vomitings.

This confession speedily made an important change in the relative positions of the parties. Mrs Millar was liberated, and Millar himself was committed to prison, eventually indicted under the wholesome but comprehensive Scottish common law, for "falsehood, fraud, and wilful imposition," and specially, for "wilfully, wickedly, and feloniously, accusing an innocent person to the public prosecutor, as being guilty of a heinous crime, for the purpose of preventing the administration of public justice." He was found guilty on both counts of the indictment, and sentenced to transportation. At the trial, before the Circuit Court of Justiciary, the testimony of the procurator-fiscal, and the rest of the general evidence, was so conclusive, that no important medical or chemical evidence was called for; and I was examined merely to identify my reports, and to prove the fact that there was sugar of lead in the coffee and vomitings.

Millar made an ingenious attempt to get out of the dilemma in which he found himself placed, by the confession of his fraudulent conduct being extorted from him. He forthwith averred that he had said this to the procurator-fiscal merely to get his wife out of prison, and he actually took credit to himself for having procured her liberation. But, unhappily for this pretended conjugal devotion, there was an awkward letter of his in existence, in which he threatened her, if she did not agree to certain requirements of his regarding his children, with being "immediately apprehended for leaving the house when he was at his work, and robbing it of different things which she had no right to carry away." He seems to have had a determined intention to get rid of her by *legal* means, in one sense of the word.

To preserve the continuity of the narrative, I have said nothing hitherto as to the chemical evidence in this case. The coffee and vomitings had been chemically examined on the 5th July, the day after the alleged poisoning, by Dr Macdougal of Galashiels, who reported that both were strongly impregnated with sugar of lead;

and these articles were afterwards transmitted to me for corroborative analysis. A few drops of the liquid part of each sufficed for determining the presence of lead by the ordinary tests of sulphuretted hydrogen, chromate of potash, and iodide of potassium. Although, however, the presence of lead was all that I was called to report on at this time, I did not feel contented with determining its existence in the articles sent to me, but thought it right to ascertain its amount also. I was induced to do so from the consideration, that, as sugar of lead is a substance very frequently kept in families for purposes of domestic surgery, it would be a very likely defence set up by a person accused of using it as a poison, that some such thing as a lotion, or other preparation of it, had been taken or given by inadvertence; and I thought that a comparison of the quantity found in the coffee and vomitings with that in any lotion, supposing the strength of the latter to be approximately known, might furnish some evidence of the guilt or innocence of the accused.

The method which I followed for determining the quantity of lead present was the following:—The vomitings constituted a turbid white mixture, of sour smell, which, by rest, deposited a quantity of white flocculent matter, like coagulated milk, and some pieces of flesh, apparently salted meat, leaving a clear pale yellow liquid above, on which some fat floated. It was in a small portion of this clear liquid, that the tests formerly mentioned, so distinctly showed the presence of lead. The deposit from the vomitings obviously contained much of the metallic salt also, as it deeply blackened under the action of sulphuretted hydrogen. The whole was digested with a considerable proportion of pure nitric acid, and filtered; and to the filtered acid liquor, pure sulphuric acid was added. The sulphate of lead thus thrown down was washed first by subsidence, and afterwards on a filter. The solid matters separated by filtration, were collected and incinerated in a crucible, the ash treated with nitric acid, the liquor filtered, and precipitated by sulphuric acid. The precipitate was united on the filter with that obtained from the liquid portion. It was further washed and ignited, to destroy some adherent animal matter. As a portion of the sulphate was thus reduced to the state of sulphuret, it was carefully heated in contact with some nitric and sulphuric acid, and weighed. The quantity of sulphate of lead thus obtained was 86·77 grains, which corresponded with 109·09 grains of common crystallized acetate of lead—(Pb O $\overline{A}$+3 HO). A similar process was followed with the coffee, which had by rest deposited a heavy brown sediment, leaving a nearly colourless fluid above. The quantity of sulphate of lead obtained from the fluid ounce and a half of coffee sent to me, was 8·22 grains, corresponding with 10·3 grains of sugar of lead.

These results were duly reported to the authorities, who, in consequence of my directing attention to the quantity of the poi-

son, submitted to me some further points for inquiry; the chief of these were the following:—

1. The cup from which Millar took his coffee being sent to me, to determine, what amount of sugar of lead would be contained in three cupfuls of the coffee (the quantity stated to have been swallowed by Millar), assuming it all to be impregnated in the same degree with the coffee analysed.

2. Keeping in view the fact, that the coffee sent to me was the last of five or six cupfuls which were in the coffee-pot, to state whether the cups first drawn off were likely to be more or less impregnated with sugar of lead, supposing a quantity of that salt to have been put into the pot while the coffee was making.

3. Having ascertained the quantity of sugar of lead which three cupfuls would yield, to say, whether the vomited matters show more than could have been derived, or probably were derived, from such a source as the swallowing of the three cups of coffee.

4. On the assumption that any sugar of lead was added to the vomited matters after they were discharged from the stomach, to say, whether any test exists for distinguishing the result thus produced, from the result which would have been produced if the same sugar of lead had been infused in coffee first, and then swallowed and thrown up.

Some other questions were put along with these, but they were unimportant.

In relation to the first of the queries, I found, on measuring the cup sent to me, that when filled up nearly to the brim it contained $6\frac{1}{2}$ fluid ounces; that it could be made to hold $7\frac{1}{2}$ without overflowing; that I should estimate the average quantity which such cups would hold, when liberally filled, at 6 fluid ounces;[1] that supposing 10·3 grains of acetate of lead in a fluid ounce and half, to represent the proportion of that salt contained in the coffee generally, three cupfuls of six ounces each would give 123·6 grains, or about 2 drachms, as the quantity swallowed in the coffee. To this, I added, as reply to the third question, that the quantity contained in the vomitings was rather less than this, being 109 grains, and that the loss might be accounted for by some of the fluid having been used in testing for the presence of lead, as well as by some being absorbed from the stomach, and perhaps some lost in the act of vomiting. To the second query it was replied, that there would probably be rather more lead found in the coffee which remained at the bottom of the pot, than in the portions first poured off, on account of the partial subsidence of the insoluble compound formed by the lead with the vegetable matter of the coffee. That this, however, could not be to any great extent, because, if the coffee

[1] This estimate was founded on the supposition, that the cups would not be uniformly filled to overflowing, and that allowance must be made for the addition of milk, &c.

had been allowed to settle down thoroughly in the pot, its altered appearance must have attracted attention. It was, therefore, most likely, that the insoluble matter was kept suspended pretty equally through the coffee by agitation, and would remain suspended for some little time. Still, it was probable that the portion of coffee at the bottom of the pot would contain rather more lead than that first poured off.

The fourth query admitted of no reply but this; that I knew of no chemical means by which it could be determined that the sugar of lead had been added to the vomitings after ejection from the stomach. The fact, that the quantity found in the vomitings was correspondent with, and rather less than, the proportion contained in the coffee, was favourable to the supposition that it had really been taken in this form.

I point out these details, because they afford an excellent illustration of the way in which one kind of evidence, if judged of by itself, might lead to erroneous conclusions. The correspondence between the quantity found in the vomitings, and the proportion which probably would have been swallowed in three cupfuls of coffee, such as that analysed by me, is a remarkable coincidence. Yet we know, by Millar's confession, that he did it roughly, by putting a pinch of the sugar of lead into the coffee, and then throwing the rest among the vomitings. Had the fluid ounce and half of coffee contained a few grains less, the disproportion between that and the amount found in the vomitings, would at once have convicted him of false dealing; but it accidentally hadpened that the proportions were such as to be fairly adducible in support of the truth of his statement. There can be little doubt, that had Millar's acknowledgment not been drawn from him by the acuteness of the procurator-fiscal, and had his wife been brought to trial for her imputed crime, with such an unscrupulous witness to testify against her, and his statements backed by the probabilities of the above chemical evidence, she could hardly have escaped condemnation for an offence of which she was totally innocent. But, to make the proof complete against her, it must have been necessary to bring out some additional facts, which could not have been easily substantiated. The statement made in the chemical report as to the effect of subsidence in altering the appearance of coffee containing sugar of lead, must have compelled the public prosecutor to prove that the coffee, at the time it was poured out for breakfast, must have been kept agitated in such a way, as to keep the insoluble matter formed in it, in a state of suspension. Every chemist knows that acetate of lead is the very agent employed to decompose and decolorize coffee, in preparing its characteristic constituent, caffeine. The precipitate which the lead salt forms in its infusion, if it is allowed to rest, subsides, and leaves a pale-coloured fluid, in no respect resembling that which people are accustomed to drink as coffee. To this fact the attention of crown counsel was specially

directed; and a very simple experiment showed, that if Millar took his breakfast with ordinary deliberation, the altered appearance of the coffee must have attracted his attention.

One ounce of ordinary coffee, in bulk nearly half a tea cupful, was boiled for ten minutes in the coffee-pot used by Mrs Millar, with six cupfuls of water, the total quantity prepared for breakfast by her on July 3d. It was allowed to settle for five minutes, and two fluid ounces poured off into a bottle. The decanted portion was of the ordinary appearance of unclarified coffee, dark brown, slightly turbid, and depositing some coffee grounds.

Half an ounce of sugar of lead, being the same proportion to this bulk of fluid as was found in the coffee got from Millar, was now added; the coffee was boiled again, and allowed to settle for five minutes after removal from the fire. Another similar portion, being decanted, was now found to be a clear transparent liquid, with hardly any colour, except a faint shade of green, and more resembling a weak infusion of green tea than coffee.

It was obvious, therefore, that if during the breakfast the coffee pot remained at any time at rest for five minutes, the next cupful poured off must have been so different in appearance from ordinary coffee, as at once to have attracted attention. The bottles, with the two samples of fluid prepared as above, were placed in the hands of the crown-officers, and inserted, as is required by the Scottish criminal law, in the list of productions to be used against Millar; but from the strength of the case against him in other respects, crown counsel dispensed with this evidence, which would have gone to prove, that it was, if not impossible, at least very improbable, that the acetate of lead could have been administered to him in the way alleged.

The taste of the sugar of lead, must also have attracted the notice, of any person who got such coffee, as that analysed by me. It is true, that, in reply to the druggist's direct question, Millar stated that he had felt a sweet taste. But coffee so impregnated with sugar of lead, has such a marked sweet astringency, that no one could have swallowed a spoonful of it, much less three cupfuls, without being stopped in so disagreeable a process of deglutition. Still less is it likely, that this would have passed unobserved, by a person who averred, that the very party now suspected, had tried on a former occasion to destroy him, with the very poison now alleged.

This case does not afford otherwise much subject for remark, but it seems worthy of being recorded, as a most atrocious and deliberate attempt to impute crime to an innocent party, deservedly punished.

In addition to the general, moral, and confessional evidence, by which Millar's fraud was brought home to him, I would specially indicate as worthy of attention, one feature in the case which appears to be of some importance, as characterising an individual

falsely alleging himself to have been poisoned. I allude to his indifference and want of anxiety as to procuring medical aid for his own relief. In the case of Leith, who pretended to have got arsenic from his wife, [page 6,] it was observed, that instead of being anxious for medical aid, he seemed indifferent to it, and was not so alarmed as his visitor who found him sick in his shop. The same indifference characterised Elliot Millar. He went to his brother, and told him he believed he had got the poison, but he never seemed to think of getting any medical advice, till his relative suggested to him to go to the druggist's and get a vomit. That much he certainly did, but it is more than doubtful if he swallowed the dose. He ostentatiously mixed it in his wife's presence, but without any assignable reason, he carried it into another room, where he said he swallowed it, but it did not produce even the least nausea. It must be allowed, that it is possible that a scruple of ipecacuan, and a grain and half of tartar emetic, may have been really swallowed, and have produced no effect; but it is at least a suspicious circumstance, that when the dose was repeated about two hours afterwards, and undoubtedly swallowed, it not only produced full vomiting, but caused so much nausea as to make him lie down in bed. To this it may be replied, that this is no more than is often observed with fractional doses of tartar emetic repeated at two hourly intervals, where nausea and vomiting frequently follow a second or third dose, where the first has produced no such effect. Admitting, however, that he did swallow the first emetic, the very failure in the means to get rid of his poison, especially as he now declared to his father and brother that he felt much worse, ought to have increased his alarm. But nothing of the kind was remarked. He had been desired to go back to the druggist's in half an hour if his first emetic failed, but, instead of this, he allowed nearly an hour and a half more to elapse, and he did not go back at all, till his friends urged him to do so. Such præternatural coolness contrasts strongly with the flurry and solicitude about medical aid, generally manifested by persons, who believe themselves to have swallowed any thing deleterious.

If we believe Mrs Millar's account of her own conduct, we have another, added to many recorded instances, of the comparative inactivity of acetate of lead as a poison. Half an ounce was the quantity she got, and she affirmed on oath that she swallowed the whole of it. It is true that no one saw her swallow it, nor did any one witness any serious symptoms produced by it; for she states that she took it at night, in a room where she slept in a bed by herself, and its effects had almost entirely gone off by next morning. Nevertheless, she was seen by her son to vomit in the morning before breakfast, without any other obvious cause; and, although she might have a motive for pretending to her husband to have attempted suicide, her established truthfulness in every other particular, entitles her to be believed in making this confession also.

Symptoms of Irritant Poisoning; Death; Failure of Chemical Analysis to detect Poison.

A TRADESMAN and his wife came to reside in a Scottish manufacturing town, where the husband possessed some property. They had with them their only child, a daughter of twenty years of age. The father was a confirmed sot, and drank himself to death. The mother was a drunken, violent-tempered woman. The mother having left her husband and daughter in Scotland, went to a distant part of the kingdom, from which she suddenly returned on Christmas day, on hearing that her husband had made a will, in which he had bequeathed all his property to his daughter. She was drunk when she arrived, and was hardly within the house when she began to discharge upon her husband and daughter a torrent of the foulest abuse, and subsequently had recourse to blows. Her violence on this and other occasions was such, that her daughter threatened to "swear the peace" against her; and her husband, in a confidential conversation with his man of business, stated his belief, that the ill-will of the mother towards the daughter was such, that he did not consider the girl's life to be safe. Among other expressions regarding her daughter, she threatened to one witness to "swinge" her; and in presence of another she said to her daughter, that her father, who was in very bad health, would to all appearance be dead before to-morrow, and "she wished she saw her stretched alongside of him." The mother had been drinking a little, but was not intoxicated when she said this. The parties continued to drink and quarrel as before; and on new-year's day the father and mother removed to a fresh lodging, the daughter continuing to live in another house, where she had resided from Christmas day. She went, however to her parents' lodging, and took all her meals with them.

On the morning of the 4th of January, the girl as usual went to breakfast with her parents. She herself prepared, in a frying-pan, some finnon haddocks for the breakfast, which, besides these, consisted of tea and bread and butter, and was taken about nine A.M. By the concurrent testimony of several witnesses, she was that morning in excellent health and spirits, and shortly after breakfast she went to a distant part of the town to get some vegetables for dinner. When, however, she was in the house where she got the vegetables, at eleven A.M., she complained of a burning pain in the stomach, and looked pale; but as she frequently had a pale aspect, the person to whom she made this complaint thought nothing of it. This, however, seems to have been the beginning of the fatal illness. She came home with the vegetables and cleaned them; but when she had finished doing so, she came into the room where her parents were, and complained of severe bellyach. The chief witnesses of her illness were her mother, who was the party accused of poisoning her,

and her besotted and enfeebled father, neither of whom could thus furnish trustworthy evidence. The following notes, made at the time of the investigation of the case, and drawn up by the Sheriff-substitute of the district, give the most correct account that can be obtained of the symptoms:—

The girl was seen in robust health and high spirits at nine o'clock on Tuesday morning, 4th January. After that breakfast was prepared, and she is *supposed* to have breakfasted upon tea, bread, and butter, and the whole of a small finnon haddock.

She was seen again at or before eleven o'clock still in excellent spirits, but complaining of a pain in her stomach. Shortly after this she was seized with retching, and became so ill as to go to bed. She complained of a burning pain about her heart or stomach. This pain was increased by pressure.

She seems to have had some purging during the forenoon. A witness, who saw one stool, describes it as resembling what might be produced by a person chewing grass and spitting the juice of it out, being greenish liquid, and with foam on the top of it.

She was seen by a medical attendant going to stool about three o'clock, when the result was, half a tea-spoonful of mucus, tinged of a brick-dust colour, he thought by blood. She was then affected by tenesmus, and there is no proof of any diarrhœa after that time.

During her whole illness she was affected with intense thirst, and constantly drinking, principally water, but also immense quantities of ginger beer: she had also some whisky, whisky toddy, hot ale with pepper in it, brandy and rum made into toddy.

Every thing she swallowed was immediately discharged, and the medical man who attended her, saw her also vomit repeatedly a greenish or yellowish bilious fluid.

She died between eight and nine o'clock on the morning of Wednesday the 5th, and the vomiting continued down to the time of her death. The woman who attended her says, that her vomitings continued getting greener and greener to the last.

She once or twice, on the evening of Tuesday, showed decided symptoms of delirium, but these seem to have continued only for a very short time. From ten o'clock P.M., on Tuesday, she suffered from cold, and had to be lifted up to the fire to be warmed, having then lost the power of her limbs.

She complained that her heart was smothering—that it was "dipping"—by which she perhaps meant throbbing; but her general complaint during her whole illness was, that her heart was burning, and an incessant demand for liquids of any kind. She is described as having drank a "stoupful" of water during the night, and vomited the whole of it.

She was not seen by a medical man except on Tuesday, at three o'clock P.M., and then the expression of her countenance was rather anxious.

He prescribed a turpentine cloth for her belly, a calomel powder with opium in it, and also senna, but probably they would be immediately vomited.

The only other circumstance connected with her illness which requires notice is the fact, that about six o'clock at night, *i. e.* about seven hours from the beginning of her illness, the girl left the lodging of her parents, where she had been taken ill, walked across unassisted, though with great feebleness, to her own lodging, and then her illness went on to its fatal termination. Why her mother should not have accompanied her when she saw her so seriously ill, and why she should not have gone to see her daugher for more than two hours

thereafter, was not accounted for by her. The father was so feeble as to require assistance himself, rather than to afford it to another.

The girl's previous health appears to have been generally good. She had shown some slight hysterical symptoms some months previously, and about a fortnight before her death had slight sore throat; but she never had any abdominal symptoms, or other manifestation of disease which could be at all connected with the fatal attack.

The body was examined by two medical men, under the injunctions of the authorities, and the following is the report of the autopsy :—

6th January 1848.

We, the undersigned, certify that we have this day examined the body of —— —— (*post-mortem*), and that the following appearances were observed :—

Externally, the body presented a plump healthy appearance, and on the depending portions extensive sugillations were observed. On opening the thorax the lungs were found healthy, except that they were considerably congested, and of a darker red colour than natural; the heart and pericardium were quite healthy and natural in appearance, as were also found the auricles and ventricles, on being opened. On opening the abdominal cavity, the intestines were observed moderately distended, and externally of a healthy aspect; eight ounces of a reddish-brown turbid fluid was found effused in the abdominal cavity. The œsophagus being tied, the whole contents of the abdominal cavity were then removed, and the alimentary canal slit open throughout its length. The stomach presented a reddish tinge, more or less deep, over the whole of its mucous membrane, and at the large curvature where this tint was deepest, several patches of a bright red colour, apparently from blood effused under the mucous membrane, were observed. The stomach contained several ounces of a brownish-green fluid.

The mucous membrane of the duodenum, throughout its entire length and over its whole surface, was found covered with patches partly of a reddish colour, and varying from that to a brown and almost to a black colour, the prominent rugæ, in particular, presented these appearances; the duodenum was filled with a dark-brown fluid. The jejunum, for four inches, presented a vascular appearance, the blood-vessels being congested and arborescent, the rest of it was apparently natural, as was the ileon, except for four or five inches where it joins the colon, where it presented the same arborescent appearance of the blood-vessels as was observed at the commencement of the jejunum. The arch of the colon presented very great vascularity, the vessels having a strikingly arborescent appearance. The rectum was healthy. The jejunum and ileon contained yellowish feculent matter; the large intestines were nearly empty, containing only a little mucus. Two lumbrici were found in the small intestines.

The bladder was empty, and healthy in appearance, as were the uterus and appendages; the kidneys, liver, spleen, and pancreas were also quite healthy.

The tongue with the œsophagus and trachea were now removed, the lining membrane of the œsophagus presented only some slight reddish streaks, but the mucous membrane of the fauces, that covering the epiglottis, and that lining the trachea, were found highly congested, and of a very deep red colour.

On opening the head, the brain and its membranes were found quite healthy.

From the above appearances, we are of opinion that in this case death was caused by the action of some irritant poison.

To this it is proper to add, that although no allusion is made to it in this report, the inspecting medical men made very special

search for perforation of the stomach or intestines, as was stated by them in precognition; and when the viscera were subsequently sent to Dr Anderson and myself for analysis, we carefully inspected every part of the alimentary canal, and could find no appearance of any perforation.

Moreover, the fluid found in the peritoneal cavity was stated by the medical men to be quite distinct in appearance from the contents of the stomach and bowels. I had, however, no opportunity of judging of this fact for myself; for unfortunately, at the *post-mortem* examination, in putting the contents of the stomach into a bottle, a small proportion of this had been accidentally poured into the vessel which at the moment contained the fluid from the peritoneal cavity.

The various articles contained in the following enumeration, were sent to me for analysis; and my colleague, Dr Thomas Anderson, was associated with me in the investigation.

1. Bottle containing the effused fluid from peritoneal cavity, mingled with part of contents of stomach. 2. Bottle with remainder of contents of stomach, and contents of duodenum. 3. Contents of intestines. 4. Bladder containing tongue, œsophagus, trachea, stomach, and duodenum. 5. Remainder of intestinal canal. 6. A piece of cloth on which the girl had vomited, but which had subsequently been washed. 7. A shift partly wetted by vomitings. 8. A bottle of tea stated to have been made for the girl by her mother, and given to her.

The result of our chemical examination is contained in the following report by Dr Anderson and myself:—

3, Surgeon's Square, Edinburgh.
22*d January* 1848.

We have examined the articles sent to us for analysis in the case of —— ——, and have to report thereon:—

The bladders, Nos. 4 and 5 of inventory (which with the other articles were all duly sealed, the seals unbroken), were found to contain the stomach, intestines, and other organs, as specified on the labels. The appearances presented by them corresponded with the description given in the report of the *post-mortem* examination by Drs —— and ——, with this exception, that the dark coloration of the duodenum mentioned by them had disappeared. The appearance of the stomach was such as, in our opinion, to warrant the conclusion that the deceased had taken irritant poison. In our chemical researches we confined our investigations to poisons of this class.

We have to state, that in none of the articles sent to us, have we been able to detect any poison which could account for the morbid appearances observed by us, or the symptoms, so far as we have been informed concerning them.

We do not think it necessary to detail all the steps of the chemical processes by which we have arrived at this negative result; but we have to state, that we have applied in vain, both to the contents of the bottles and to the tissues of the stomach itself, all the most approved and delicate tests for oxalic acid, arsenic, corrosive sublimate, copper, lead, zinc, and the corrosive mineral acids. The latter, however, were excluded from such a case by the morbid appearances, and the impossibility of their being administered as poison to an adult.

We have to state, that in our search for corrosive sublimate, on testing for the second time a portion of No. 2, "Remainder of the contents of the stomach, and contents of the duodenum," we separated from it a small portion of mercury. This at first led to the supposition that corrosive sublimate was present. But seeing that, on repeating our experiments several times with the same, and subsequently with more delicate tests, we could find no more mercury, we came to the conclusion that what we had found was probably derived from calomel, which, being perfectly insoluble, might have happened to be attached to some of the solid particles, and therefore not found in the rest of the fluid. This opinion has been confirmed by our finding no traces of mercury in the tissues of the stomach itself, and by the fact subsequently communicated to us, that calomel had been administered to the deceased. It is proper, however, to add, that there are no chemical means of positively distinguishing calomel from corrosive sublimate, when the latter has been long in contact with animal matters.

We also found some globules of oil floating on the contents of bottles Nos. 1 and 2. The only substance of this nature which might have caused irritant poisoning is croton oil; but what we examined, being completely soluble in its own volume of cold alcohol, was not croton oil, but seemed to us to be castor oil.

Our experiments having thus failed to afford any evidence of mineral poison, and retaining our belief, as deduced from symptoms and *post-mortem* appearances, that this was a case of irritant poisoning, we are of opinion—either that if mineral poison was administered, it has been rejected by vomiting in an early stage of the case, and so lost; or that the poison may have been a vegetable or animal acrid substance. We know of no tests which could be depended on to detect, much less to identify such matters, and therefore have not specially searched for them. Moreover, as they are generally substances possessed of strong acrid or bitter taste, they are not easily swallowed unconsciously.

We have also examined some tea sent to us subsequently, likewise a piece of rag, and a shift belonging to the deceased, but have been unable to extract any poisonous substance from them.

We have not used the whole of the articles in our experiments, and the remainders of them have been sealed up and preserved by us, that crown counsel may, if they wish it, have them further examined by us or by any other analyst.

ANDREW DOUGLAS MACLAGAN, M.D.
THOMAS ANDERSON, M.D.

It is unnecessary to enter into any details as to the processes which were followed by Dr Anderson and myself in our chemical investigation. We followed all the most approved and delicate methods of analysis known to us, and most of our experiments were performed twice. Dr Christison, who was subsequently consulted on the case, could suggest no other methods of investigation than those which we had followed; but, on his recommendation, the liver and kidneys were subsequently procured, and examined by us for arsenic, mercury, and copper; but neither of these, nor of any other metallic poison, could a trace be detected.

In this case we were deprived of one important subject of research, from which, in all probability, some more certain evidence might have been obtained. The vomitings were all thrown away. No attempt seems to have been made to preserve them; but it does not appear that any particular care was taken by the mother or by any

other party, to get them out of the way. At all events, that was certainly not done in defiance of any instructions from the medical man who saw the girl during her illness. He does not, in fact, seem to have entertained any suspicion of poisoning at the time of his visit.

The above case was never brought to trial. The want of chemical proof; the uncertainty of evidence from symptoms and *post-mortem* appearances alone; and the absence of any known facts, which could bring home to the party accused, the possession of poison, rendered it hopeless to look for a conviction.

In the absence of positive proof, what explanation are we to give of the above case? Was it a case of death from natural disease simulating poisoning, or was it really a case of poisoning where chemistry failed to detect the cause of the symptoms? That the latter is the true interpretation I have no doubt. There was the general evidence of poisoning, both moral and medical. That part of the former, which directed suspicion to the particular party accused, does not concern our present purpose. It is enough for us to bear in mind, that there was a party present who bore an ill-will to the deceased, had motives for wishing her dead, and had expressed a wish to that effect, and which party was of depraved habits and violent temper. The proof of administration is certainly defective. It could only be at the breakfast that the poison could have been given, and the daughter, mother, and father took this meal at the same table, and at the same time. It is true, that the father stated that the mother poured out the tea, and that she gave an entire finnon haddock to her daughter, of which the latter alone partook; but the enfeebled state of the father's mind and memory, at the time his deposition was taken from him on his deathbed, renders his evidence not trustworthy. It is moreover not easy to see how a fish, cooked by the girl herself, could be made the vehicle for poisoning at the table, without something suspicious on the part of the accused being observed. The tea, which the accused poured out, seems the more likely article in which poison may have been given. The tea, in which Dr Anderson and I failed to find poison, was not a portion of that which had been used at the breakfast on 4th January, but the remains of some which had been given to the deceased during her illness on the morning of her death.

If from the moral, we turn to the medical view of the case, we have the general evidence of poisoning very decidedly before us. The deceased is in previous good health and spirits; no evidence of disease, no inducement to suicide. The symptoms commence not long after a meal; they are those which characterise the action of irritant poisons; they commence without rigors or other symptoms premonitory of acute disease; they rapidly acquire a great intensity; and they go on progressively and continuously to a fatal termination in twenty-four hours. The *post-mortem* appearances are consistent with the supposition of irritant poisoning; in some respects are cha-

racteristic of it; and they at all events do not enable us to account for death by natural causes.

If this was not a case of poisoning, of what disease did this girl die? Perforation of the stomach or intestines was looked for, but not seen, and the peritoneum did not contain matters effused from any part of the alimentary canal; nor, indeed, were the symptoms such as are usually observed in cases of this disease. Peritonitis might be supposed to be indicated by the effusion of reddish-brown turbid fluid in the peritoneal cavity; but this, though not common, does appear sometimes to occur in irritant poisoning, and the peritoneum itself presented no other morbid appearance which could warrant the idea; moreover, constant vomiting is not a common symptom, and diarrhœa not only is not usual, but is generally absent in peritoneal inflammation.

The presence of two lumbrici in the bowels will not account for the symptoms, or fatal termination. In all the cases simulating poisoning, which have been supposed to be connected with worms, these parasites have been present in unusually great numbers.

Are we to regard this as an example of acute spontaneous gastritis, of which so much has been written, but so little seen? To use the words of Dr Christison, "the possibility of the occurrence of a case of the kind from natural causes, must be granted;" and in the more recent work of Taylor, three cases are actually quoted which seem to countenance this belief; but it is to be observed, that in these instances diarrhœa was absent, whilst in the present case, besides some powerful source of irritation of the stomach, there was some agent at work operating on the bowels, so as to cause not only bilious alvine discharges, but tenesmus and bloody slimy stools.

It appears to me, then, that the legitimate conclusion in this case is, that the girl died from the effects of an irritant poison; but that this had, which is by no means a common occurrence, been entirely got rid of by vomiting. I have not presumed to form any opinion as to what the individual poison may have been.

66, Frederick Street, Edinburgh,
February 1849.

MURRAY AND GIBB, PRINTERS, EDINBURGH.