

On poisoning by white precipitate / by Alfred S. Taylor.

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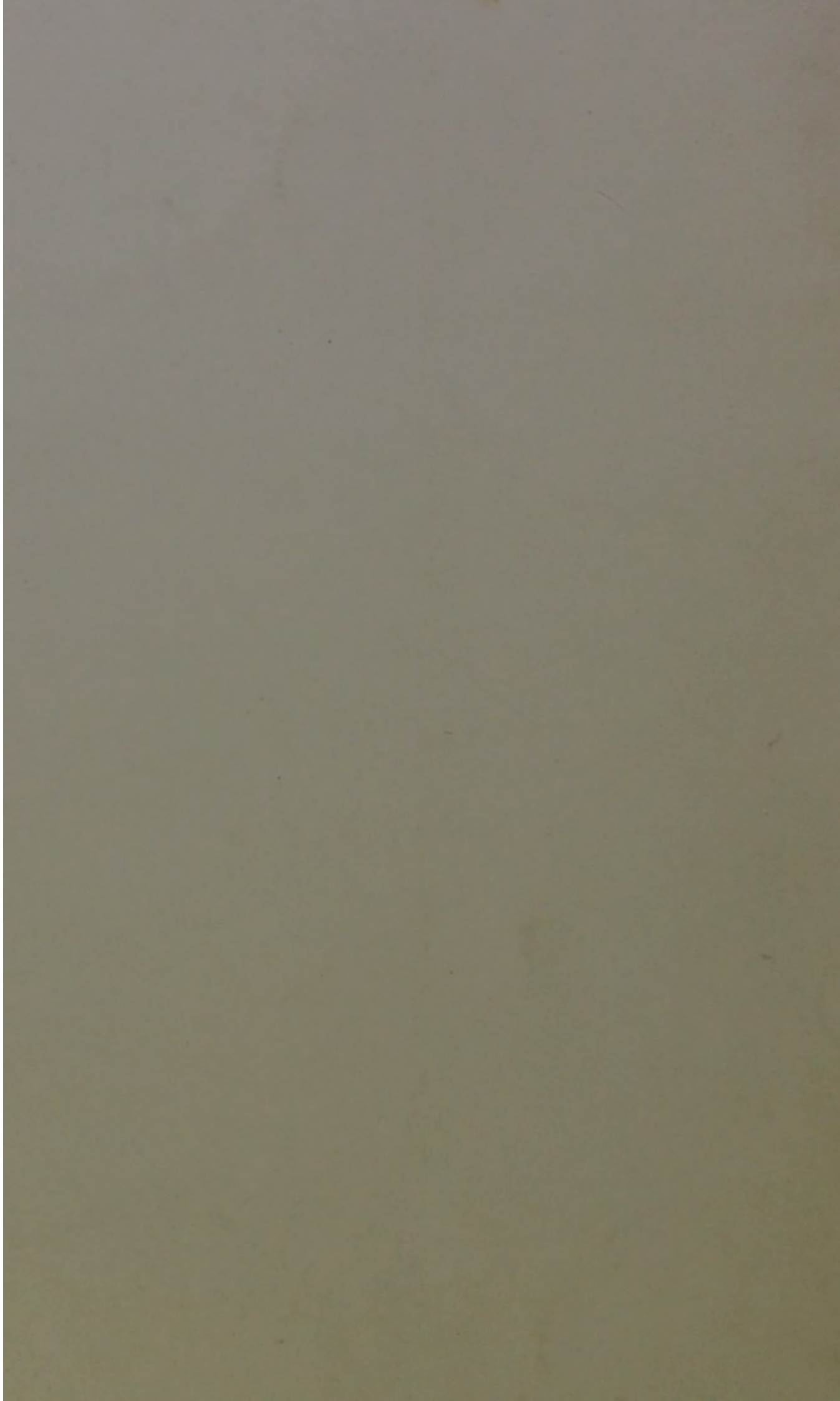
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ON
POISONING BY WHITE PRECIPITATE,
BY ALFRED S. TAYLOR;
WITH
THE PHYSIOLOGICAL EFFECTS OF THIS
SUBSTANCE ON ANIMALS,
BY F. W. PAVY.

A FEW years since, it was a contested question whether WHITE PRECIPITATE was or was not to be considered a poison. A trial took place at the Chelmsford Lent Assizes in 1850, at which a woman was indicted for administering this substance to her husband with intent to kill him. She owed her acquittal to the lenient assumption, that there was no evidence to show that white precipitate was either "a poison" or a "destructive thing." Those who have had to consider the general effects produced by mercurial compounds on the body can entertain no doubt on so plain a question as this; but, at the same time, there may be a difficulty in producing cases indicative of its poisonous operation; and, without precedents of this kind, legal minds are disposed to treat all medical opinions as untrustworthy speculations.

White precipitate is a compound containing 79 per cent. of mercury. It is not generally described as a poison by chemists and toxicologists. Orfila, Beck, and most writers on toxicology, pass it over altogether. Dr. Christison merely states that it may probably act as an irritant, but records no

instance of this action. It has been known as a medicinal preparation in the London Pharmacopœia since 1746, but has been employed only for external use in the form of ointment. Very little is known, therefore, of its effects on the human body. I have never seen a case in which it was taken internally, but in my books on Poisons and Medical Jurisprudence I have recorded several cases in which it was taken either by accident or design; and in these, vomiting, purging, as well as pain in the bowels, cramp, and paralysis, were among the symptoms. For this reason I have described it as an irritant poison, but not of a very active kind ('*Med. Jur.*,' 1844). Out of eleven cases which I have collected, in some of which from 30 to 100 grains were taken, there was only one that occurred in 1840, in which this substance is alleged to have proved fatal. It was the case of a child, aged 7, and death is stated to have taken place from salivation, but beyond this there is no account of the symptoms and appearances. In the other ten cases of adults, recovery was probably owing to early and violent vomiting.

As it is usually sold, being only intended for external use, it is often carelessly prepared, and contains corrosive sublimate—a substance from which it is manufactured. I have found as much as from $\frac{1}{2}$ to 3 per cent. of corrosive sublimate in this compound. This is a poisonous impurity, which must render the drug uncertain in its operation. It is stated by the late Dr. Pereira to be largely adulterated with the carbonates of lime and lead, as well as with sulphate of lime. These, however, are not noxious impurities. This author says of it, that "its action on the body is very imperfectly known, no recent experiments having been made with it. It is usually considered to be highly poisonous, and somewhat similar in its operation to perchloride of mercury. Palmarius and Naboth have reported fatal cases of its use."¹

The compound now known in the Pharmacopœia as white precipitate is described under the scientific name of the amido-chloride of mercury ($\text{HgAd}(\text{NH}_2), \text{HgCl}$). There are various theoretical views of its constitution, into which it is here

¹ This statement is quoted from Wibmer's work, '*Wirk. der Arzneim.*' iii, 64. On referring to Wibmer, it is pretty certain, from the description given, that the effects were produced by corrosive sublimate, contained as impurity in the white precipitate.

unnecessary to enter. Brande represents its centesimal composition to be—

Mercury	.	.	.	79.38
Nitrogen	.	.	.	5.56
Hydrogen	.	.	.	0.79
Chlorine	.	.	.	14.27
				<hr/>
				100.00

This agrees substantially with the composition of this substance as it is given by Pereira. It is procured by adding a slight excess of ammonia to a solution of corrosive sublimate, washing the precipitate with cold water, and drying it by a gentle heat. It is the variable amount of washing which the precipitate undergoes that leads to the retention of a certain quantity of corrosive sublimate in the commercial samples of this compound.¹ This noxious impurity is easily detected by digesting a known weight of the powder in cold ether, and after sufficient agitation, filtering the liquid, and leaving the ethereal solution to spontaneous evaporation. Prismatic crystals of corrosive sublimate are commonly obtained as a residue.

The old White precipitate of the Pharmacopœia, called "*Calx hydrargyri alba*," is differently prepared and differently constituted. This is procured by adding (not in excess) a solution of carbonate of potash or soda to a cold aqueous solution of equal parts of corrosive sublimate and sal-ammoniac. It is not decomposed by boiling water, like the preceding compound. It contains only 65 per cent. of mercury, and a larger proportion of chlorine. It is an amido-chloride of the metal, with chloride of ammonium ($\text{HgAd}(\text{NH}_2), \text{HgCl} + \text{NH}_4\text{Cl}$). This compound, to which Pereira refers, as having been discovered by Raymond Lully in the thirteenth century, existed in our Pharmacopœia under the name of *Hydrargyrum præcipitatum album*, from 1746 until 1836, when the new method of making it was introduced, and it then took the name of *Hydrargyri Ammonio-chloridum*.

Neither of these compounds appears to have been known to

¹ If the precipitate is washed in a large quantity of cold water, it is apt to undergo a chemical change. If the washing is performed with a small quantity of water, the preparation invariably contains corrosive sublimate.

Boerhaave. In an edition of his 'Chemistry' (1727, Part ii, p. 290) he describes the mode of preparing *white precipitate*, and from this description it is obvious that he intended by it calomel, precipitated by adding a solution of common salt to a solution of nitrate of mercury. He describes the dose internally as from three grains to ten grains, "along with some proper purgative to determine its operation to the intestines; and thus it becomes an excellent cathartic in all venereal complaints, and where phlegm or worms are lodged in the body, as also in the itch or other cutaneous distempers." (Op. cit., p. 290.) In a note, he says—"This medicine is very seldom, if at all, prescribed internally by the *English* physicians, though, if cautiously used, it is safe enough, and has wonderful virtues in the lues venerea and in cutaneous diseases."¹

It is not improbable that the mediæval white precipitate, said to have been discovered by Raymond Lully, was that which is so described by Boerhaave, namely, calomel; and that the compound now in question has a comparatively modern origin.

The *properties* of the amido-chloride of mercury are pretty well known. It is a white chalky-looking solid, very heavy, without any smell. It has a peculiar metallic taste, which is only perceived after a few minutes, and is very persistent. It is insoluble in cold water, but is decomposed by long digestion in it. Boiling water rapidly produces the same change in it; it renders it yellow, and converts it into muriate of ammonia and peroxide of mercury. 1. It is entirely volatile, but when heated is converted into ammonia and calomel. 2. It is soluble in nitric or hydrochloric acid, without effervescence; it is thus distinguished from calomel, which is insoluble in those acids. 3. It is insoluble in ether and alcohol. 4. When heated in the dry state with carbonate of soda, it yields globules of metallic mercury. 5. When boiled in a solution of potash, it gives a precipitate of yellow oxide of mercury. 6. Ammonia produces no change of colour in it (calomel is blackened). 7. It is decomposed by a solution of chloride of

¹ The true amido-chloride is now only used in pharmacy in the preparation of an ointment for external use. This ointment is composed of two drachms of the ammonio-chloride to three ounces of lard; *i. e.* it forms about one thirteenth part of the weight of the ointment.

tin, a black precipitate of reduced mercury being separated. 8. Boiled with any acid, and treated with gold and zinc, it produces a deposit of mercury on the gold.

With these general remarks, I shall now detail the facts of a recent case of poisoning by this compound, which was referred to me in January 1860, by Mr. Shout, surgeon, and Mr. Blagden, the coroner for Petworth. The medical history of the case will be gathered from the subjoined deposition taken at the first inquiry.

AUGUSTUS CHARLES SHOUT, being sworn, said, I am the medical officer of the Petworth district of the Petworth Union, and attend the workhouse. About three weeks ago my attention was called to the child of Harriet Moore, by Miss Hobbs, the matron. The mother then complained that the child was troubled with wind. The child seemed griped as if from the effects of wind. I prescribed for the child—inquired of the mother as to its diet. I ordered arrow-root to be substituted for bread, and recommended sugar and a little ginger to be added. I also ordered a powder to be given that night, and castor oil to be given in the morning. I do not remember when I next saw the child. I have been at the workhouse almost daily, for some weeks past. There has been much diarrhœa amongst the inmates of the house. I have seen the child from time to time during the last three weeks. The child did not improve at first,—about two or three days after the powder and castor oil had been prescribed. I was at the house one subsequent day, when my attention was again called to the child. I saw it in its mother's arms. I was told the child had been suffering with diarrhœa. I noticed the child's face showed distress. I prescribed diarrhœa mixture for the child. I objected to the food which was given to the child, and I recommended the mother to feed it less frequently. She said she was not satisfied with the way in which the child was going on, and that she should go out and get further advice.

From that time the child improved. It went on very well up to the 20th of December. I saw the child on Monday, the 19th of December. I think it was then down-stairs. I don't recollect anything positive about the child on Monday. I did not see it on Tuesday, the 20th. On Wednesday, 21st of December, about the middle of the day I called at the workhouse. I there saw Harriet Moore and the child; it was lying on a bed. I was surprised at the appearance of the countenance, which denoted most acute pain. A nurse then present said the child kept all the women awake all night with its piercing screams. I felt the child's pulse, which indicated that it was sinking. I touched its stomach, it writhed violently. All the muscles of the face became distorted. I asked the mother what food she had given the child; she said, "I gave it the arrowroot, but it could not swallow." I asked her why; she said, "The throat seems sore." I did not examine the mouth of the child at that time. I told her to give the food in a more liquid state. I did not prescribe anything on that occasion. I noticed the child was remarkably pale, and the hands were cold. I considered the child was dying from a disordered state of its bowels. I considered the best thing to be done for the child was to give it proper food. I did not order any stimulant to

be added to the food, but merely said, they should treat the child as before, only to give the food in a more liquid form. At this time, and up to this period, I entertained no suspicion in this case. I saw nothing in this child different from other children suffering from diarrhoea, except the countenance, the peculiarity of expression, and the contortions of face when I pressed the stomach, which denoted excessive irritation of the bowels, greater than usual from the shortness of the child's last illness, which I considered a sudden attack. The previous illness of the child did not lead me to expect such symptoms. I left the workhouse early in the afternoon; I did not return there that day. The next morning, between 10 and 11 o'clock, I was told at my surgery that the child was dead. I heard nothing more of the child on Wednesday, after I left the house. I did not consider it necessary to see the child again on Wednesday. I thought it was too far gone.

I made a *post-mortem examination* of the body of the child on the 25th of December, 1859. I was assisted by Mr. Morris and Mr. Boxall. The body was well formed, and rather taller than usual for a child of that age. The body was very pale, and slightly emaciated. The countenance was anxious, and indicated great suffering of an acute nature. The eyes were sunken round the orbit. The eyes were unusually glassy in appearance. There was no external mark of violence, no ulceration of the lips. The abdomen was greatly distended; there was no decomposition. There was great redness around the anus, indicating that the excretions were of an acrid nature. The redness extended to the nates, and there were slight excoriations surrounding the outlet. There were no eruptions on the genitals or folds of the groin. We opened the abdomen. There was no increase of fluid; but the small and large intestines were greatly distended, apparently by wind, and presented externally a highly vascular and bright-vermilion-coloured appearance in places, of an arborescent form and of a dry feeling to the finger: in many parts they had lost the usual glistening, slippery character, and towards the right and anterior parts we found unusual signs of vascularity. The small intestines were much tinged with bile in many spots, and bore strong indications of being much inflamed. There was no effusion of lymph or serum discoverable between the convolutions of the intestines. The peritoneum lining the abdomen was not inflamed. The liver was of a natural size, and looked healthy. The gall-bladder was unusually full of bile. The stomach externally appeared natural, with the exception of a small, dark-coloured patch near the lesser curvature. It appeared to be full, and contained a thickish matter; it was tied at both ends and removed. The kidneys were large and apparently healthy. The bladder was quite empty, and appeared healthy externally. As to the thorax, the lungs were inflated, highly vascular, and particularly the lower part of the right lobe of the right lung, which presented a bright vermilion appearance at its inferior margin. There was no adhesion to the ribs; no effusion. The bronchi were examined, and found healthy. The thymus gland was well seen. The heart was of usual size; no fluid in the pericardium, or any sign of disease externally. I then opened the left auricle and ventricle; the auricle was healthy. The mitral valve at its base was highly inflamed, having a vascular, fringe-like border. I then opened the right side of the heart; the tricuspid valve was slightly vascular, presenting the same appearances as the left side of the heart, but not so well marked. There was no clot in the cavities. The parietes were natural. The pericardium contained no fluid. I examined the mouth; there was no ulceration

of that or the fauces. The papillæ of the tongue were much elevated, particularly at the base, but showed no sign of ulceration. I examined the œsophagus; I noticed nothing peculiar at the upper part, but about the middle, the mucous membrane was somewhat congested, and coated with a thick, mucous-looking secretion. The stomach contained about one and a half teaspoonful of a white curdy-looking substance, somewhat thick and gritty, in appearance like lumpy gruel or arrowroot not properly cooked. There was a red patch, of about the size of a three-penny piece, upon the mucous coat of the lesser curvature, about the centre of the curvature, denoting inflammation. There were likewise several other patches of the same character in different parts. The stomach and its contents were placed in a jar, which was sealed up by me; I have possession of it. The duodenum and jejunum were removed; the remainder of the small and large intestines were also removed. I then slit up part of the intestine, from the rectum for about five or six inches upwards. There were no traces of inflammation or ulceration. The part I slit up contained no fluid or fæces; it appeared quite healthy. I then opened the small end of the intestine (the duodenum); there the mucous membrane again was covered with a mucous-looking substance, and appeared slightly congested.

The appearances which presented themselves, upon my opening the body, and which I have mentioned, are most unusual, and, in my opinion, are not attributable to any natural cause. I have no doubt they were produced by some irritant given to the child, which has been absorbed into the system. The appearances I have mentioned are quite sufficient to account for the death of the child. I have not the means of analysing the contents of the stomach. I opened the head of the child; the brain was of full size, and much congested. I sliced the brain and opened the right ventricle; it contained about one drachm and a half of fluid. The left ventricle was natural, and there was about a tablespoonful of fluid at the base of the brain. The congested state of the brain would account for death. When I last saw the child alive it was not suffering from congestion of the brain. When I first prescribed for the child, which was about three weeks prior to its death, I gave it a powder, which contained, by weight, two grains of grey powder and three grains of rhubarb. After an interval of several days, I sent a second powder, precisely similar to the first. After another interval of a few days, I sent a third powder, which contained two grains of grey powder only. I believe I sent a fourth powder, which contained two grains of grey powder and three grains of rhubarb. The last powder I sent for the child, was on the Saturday before its death, December 17th. I ordered castor oil to be given after each powder. Grey powder contains mercury mixed with chalk.¹ The diarrhœa mixture was a twelve-ounce mixture, composed of aromatic confection, two drachms, the same of prepared chalk, half an ounce of gum acacia mucilage, two drachms of paregoric, and filled up with peppermint water. On the first occasion of my prescribing for the child, I touched its stomach; it then showed symptoms of pain, but not to any great extent—not more than usual with children suffering from diarrhœa. I then saw nothing alarming or unusual about the child. On a subsequent occasion, when I saw the child in its mother's arms, and was told the

¹ It appears that during the three weeks of attendance the child had four powders, each containing two grains of grey powder, making eight grains in all.

child was suffering with diarrhoea, a female pauper told me the child's motions were of all manner of colours. I asked if I could see the napkins, and was answered, that they had been washed, or could not be seen. I don't know who gave me that answer. I believe I then gave a direction that a napkin should be kept, that I might see it. Two or three days after that, I saw a napkin. There was nothing unusual in the motion which appeared on that napkin. The matter was coloured yellow and green, contained a little slime, and particles of undigested food. It appeared to me that my medicine had its proper effect. I do not remember that I ordered the child to be placed in a warm bath on the Friday or Saturday previous to its death. I saw the child on one of those days. There was no difference in the symptoms of the child, except that I thought it better at that time. I had no reason to believe the child would die. When I saw the child on Monday, the 19th of December, it was better; it was not at that time suffering from irritation of the bowels. I am positive the inflammation and signs of irritation I found in the body of the child were caused by something given to the child, subsequent to my seeing it on Monday, the 19th. I have no doubt, that if white precipitate, or any irritant of that kind, were given to the child, it would produce the inflammation and unnatural appearances which I found on the post-mortem examination.

The child was three months of age, and brought up by hand. It was admitted into the workhouse on the 17th of November, 1859, and died on Thursday, the 21st of December. It appears from the medical and general evidence, that it suffered, from about the latter end of November until its death, from disordered bowels. There was purging, with occasional pain in the abdomen; the evacuations were green and yellow, and the food was frequently passed in an undigested state. It was sick on Saturday, the 17th of December, on which day it had the last of the grey powders. On Monday and Tuesday following it appeared to have recovered. On the night of Tuesday, the 20th of December, it was much worse; there was great suffering,—had violent vomiting and purging, with difficulty of swallowing. The child from this time sank and died in about forty-three hours from the commencement of this severe attack. It seems that at the time of death there was no suspicion that it had taken place from other than natural causes; but two days after the child's death it was ascertained, that on Tuesday afternoon, shortly before the symptoms became aggravated, the mother, Harriet Moore, had caused to be purchased one pennyworth of white precipitate. She gave a false reason for the purchase: no trace of this powder could be found, and its disappearance could not be accounted for.

The parts of the deceased's body remitted to me for analysis were—1, the liver and gall-bladder with the kidneys, spleen, and the large and small intestines; 2, stomach and contents, with the tongue, fauces, and œsophagus; 3, contents of duodenum and jejunum, in a bottle, marked No. 1 draught; and 4, the heart, with a portion of lung. The result of my analysis, with the conclusions drawn therefrom, are contained in the following deposition given at the inquest.

I subsequently received for analysis two napkins, containing portions of the child's evacuations.

On Tuesday, the 27th of December, 1859, I received from Mr. Kemmish three jars containing the viscera of a deceased child, and a small phial, marked "No. 1, Draught." On the 28th of December I received, from the same person, a brown paper parcel, containing two soiled napkins. I first proceeded to examine the contents of the jars, which were in my custody until I commenced the examination, and they continued in my custody. I found the viscera in a good state of preservation. I first examined the gullet; I found its lining membrane congested at its upper part, and it was covered with a thin mucus, mixed with food; there was no inflammation or ulceration about these parts, and the windpipe was in a healthy condition; the stomach had been opened; on re-opening it I found, at the greater end, a curdy, whitish-brown substance, of the consistency of thick paste; there was about as much as would fill a large tablespoon, and upon this there was a thin and dark coagulum of blood. I found this pasty matter closely adhering to the coats of the stomach, and mixed with much mucus. On removing it, the greater part of the lining membrane of the stomach appeared pale, except towards the intestinal opening, where there was a small red patch, arising from congestion of the vessels. The intestines were, generally speaking, empty; in some parts of the small intestines I found a small quantity of pasty-looking substance, coloured by bile; the large intestines contained no faecal matter. On laying open the intestines I found the duodenum and jejunum highly inflamed, and the vessels strongly injected with bright-red blood. The inflammation was in the mucous or lining membrane chiefly; there were some patches of inflammation in the lower part of the small intestines. The large intestines were but slightly affected. The liver, kidneys, heart, and lungs presented no appearance of disease. In one kidney I found two small calculi. There was nothing about these last-mentioned organs to account for death. I examined the different parts chemically, beginning at the upper part. I first examined the congested part of the gullet, with some of the pasty matter adhering to it: I found it to contain a small quantity of a mercurial compound, and with this was some starchy matter. I next examined the stomach: the thick pasty contents of the stomach were removed, and mixed with about two ounces of distilled water; the liquid was of a brownish-white colour, not mixed with blood or bile; it contained a number of heavy chalky-looking particles, which rapidly subsided when mixed with water; they did not dissolve in water; they had the appearance of mineral matter. I examined the

contents microscopically and chemically: I found the greater part consisted of starchy matter, like gruel, with digested food, mucus; and with these there was an *insoluble compound of mercury*, which had all the properties of white precipitate. I then examined the coats of the stomach, having scraped away all the contents, and I found a small quantity of mercury in them. I next examined the contents of a bottle I received from Kemmish; it was marked, "The contents of the duodenum and jejunum;" it contained a bilious-looking fluid, with mucus. I did not find in it any of the white particles I had seen in the stomach, and there was neither starch nor any mercurial compound in it; it was merely a mixture of mucus and bile. The coats of the upper part of the small intestines were analysed, and found to contain a small quantity of mercury. In the ileum, about three inches of the bowel were distended with a pasty-looking substance, resembling that found in the stomach. I found, on examining it, that it contained a starchy substance, mixed with a mercurial compound. I could not detect in it any of the white particles, such as I had seen in the stomach. The large intestines were empty. The coats of the colon or large intestine, were found to contain mercury.

I next examined the napkin. It was stained with faecal matter, of a green colour. I cut out a portion of the stained part of the napkin; it contained a quantity of mucus, dried upon the cloth, altered bile, which gave to it its green colour,—a quantity of starchy matter, and a comparatively large quantity of a mercurial compound, that is to say, more than I had found in the bowels. There was no blood. I examined an unstained portion of the napkin: I found in that, starch without mercury or mucus.¹ I examined one half of the heart; it contained no mercury. I examined one fifth part of the liver, and found mercury in it. I afterwards examined one of the kidneys, and separated mercury from it. The twelfth and last analysis related to a sample of white precipitate, which I had received by a registered letter through the Post Office, from Charles Whitcomb; it had all the usual chemical characters of white precipitate, with the addition of starch. It contained a small quantity of corrosive sublimate. I weighed out twenty grains of this white precipitate, and, on analysis, found it to contain one tenth of a grain of corrosive sublimate. In the powder which I received from Mr. Whitcomb there were fifteen grains of white precipitate and five grains of starch, or thereabouts. It was fully one fourth starch.²

From this examination and analysis I have drawn these conclusions:

1st, A mercurial compound, which I believe to be white precipitate, mixed with farinaceous and other matters, was found in the contents of the stomach.

2d, That a mercurial compound, mixed with starchy matter and mucus, was found in the discharges on a napkin.

¹ The second napkin was not examined until the 15th of March. The evacuation upon it contained mercury. There were many more napkins used, but only these two could be procured, and one was not distinctly traced to the prisoner.

² The white precipitate powder here referred to, was from the same stock as that supplied to the prisoner. Whitcomb sold about a drachm for one penny. It was not weighed. It was mixed with starch before delivery. The packet was distinctly labelled, in printed letters, "Poison," and it was proved that the prisoner could read. It was asked for and sold as "white cipity powder."

3d, That a mercurial compound, with starch, was found in the middle portion of the gullet and in the lower portion of the small intestines, and that mercury, without starch, was found in various parts of the small and large intestines, as well as in the liver and one of the kidneys.

4th, That the appearances presented by the viscera were—redness in the gullet, a patch of redness in the stomach, great redness (with injection) of the vessels at the upper part of the small intestines, less in the large intestines; the redness was of an inflammatory nature—what is called acute inflammation; it was seated in the mucous or lining membrane, and it was such as might have been produced either by the action of an irritant substance, or as the result of disease.

5th, The heart, liver, lungs, kidneys, and spleen presented no appearance of disease, and no appearance to account for death.

Examined.—The mercurial compound I found in the stomach could not have been grey powder, calomel, or corrosive sublimate. I found it in the stomach in an insoluble state. White precipitate is insoluble in water; it is, to some extent, soluble in the acid juices of the stomach.

If I had been told to examine a body which had been poisoned by white precipitate, I should have expected to find an inflammatory redness of the stomach and intestines. I found, as I have said, what I believe to be white precipitate. I was surprised, in this case, to find so little redness of the mucous membrane of the stomach. As far as I can judge from what I found and what I saw, the child died from inflammation of the bowels. The quantity of precipitate found in the body of the child was small. One of the effects of white precipitate would be to produce vomiting and purging. When there is a loss of power of expulsion of the matter by vomiting and purging, it might, by remaining in the body, produce inflammation. It would act as an irritant; it contains 79 per cent. of mercury. In thirty years' experience I have only been professionally consulted in one case; in that case the man recovered; he took about twenty-five grains. I delivered a portion of the contents of the jars to Dr. Miller, of King's College.

Analysis.—It will be proper to describe in this place the process of analysis pursued. 1. *Stomach and contents*—By simply washing them in successive quantities of distilled water, a number of heavy, white particles, of a slightly yellowish tint, were separated. A portion of these admitted of drying and weighing. There was much starch intermixed with them. These white particles gave no soluble compound of mercury to boiling water. They were readily soluble in acids, even in the acetic, without effervescence, and the acid liquid deposited mercury on a clean surface of copper, and on gold-foil invested with a spiral of zinc-foil. It gave the usual black precipitate indicative of mercury, when the chloride of tin was added to the solution. When some of the white particles were triturated with chloride of tin, they underwent a similar change; but when treated with ammonia, they remained white. A

portion of the food containing some of the white particles, when boiled with a solution of potash, evolved ammonia; but as there was much animal matter in the liquid, no positive conclusion could be drawn from this result. Again, a portion of the contents, acidulated with nitric acid, gave an abundant deposit of chloride of silver when nitrate of silver was added to it; but as chlorides are found in the contents of every stomach, this result also was inconclusive. From a portion of gold-foil whitened by the compound, a number of globules of mercury were obtained by sublimation in a reduction-tube. The food found in the stomach, therefore, contained an insoluble compound of mercury, having the characters of white precipitate. No grey or red compound, no chalk, and no globules of metallic mercury were contained in the washed sediment of the contents. The contents of the intestines, and the matter on the napkins, were analysed by similar processes. The evidence, however, fell short of that yielded by the contents of the stomach, inasmuch as no white particles could be obtained from these articles by washing.

Tissues.—The process for the detection of mercury in the liver and kidneys was as follows: 1. The organ was sliced into small pieces. 2. The sliced portions were gently heated in a mixture consisting of two measures of hydrochloric acid and one measure of water, until the structure of the organ was entirely broken up and dissolved. (A portion of the liver was distilled with hydrochloric acid, but no arsenic or antimony was found in the acid contents of the distillate.) 3. The acid decoction was diluted with four parts of water, and a small galvanic coil of gold and zinc was plunged into it while boiling. (This coil consisted of a strip of gold-foil, one inch long by one eighth of an inch wide; it was twisted spirally *on the outside* of a piece of zinc-foil, of somewhat larger dimensions.) The gold was speedily whitened in all the experiments, while the zinc was in great part dissolved. The whitened gold was removed and well washed in water; it was dried and divided into two parts. One half, heated in a reduction-tube, gave a splendid ring of mercurial globules, having a silvery lustre by reflected light, and appearing as black, opaque spheres by transmitted light. The other half was warmed in two or three drops of strong and pure nitric acid. The white deposit was

speedily removed, and the gold reacquired its colour. The acid liquid was poured off, diluted with water; a few drops of chloride of tin were added, and the liquid was warmed. A fine, greyish-black precipitate of metallic mercury subsided. The gold and zinc, as well as the nitric and hydrochloric acids, were tested for mercury, and were found free from this metal.

Although mercury was precipitated on the gold from the *cold* acid decoction of the liver, yet it was found to take place very slowly and imperfectly; and I believe that, when the quantity of mercury is very minute, boiling is a necessary step in the process, if we wish to ensure complete precipitation.

Copper-gauze, free from mercury, was also employed. The boiling acid decoction of the liver silvered several small pieces of gauze, and from one of them, after washing in alcohol, a well-marked ring of globules of mercury was obtained by heat.

These results proved that mercury was present in some of the soft organs, probably in the metallic state, or in an organo-metallic combination.

After these experiments had been performed, I requested the authorities to allow Dr. Miller, of King's College, to make an analysis, in his own laboratory, of one half of the various solids and liquids sent to me. These were placed in his hands, without any information having been communicated to him of the results obtained by me. The questions submitted to him, were—1. Is any mercurial compound contained in the viscera or contents? 2. If so, what is its nature, and what the proportion in which it probably exists.

Dr. Miller reported that he found mercury in an insoluble form, distinctly, in the contents of the ileum, in the coats of the stomach, in the substance of the liver, and in the intestines generally. It was present in considerable quantity in the matter upon the napkin. There was no mercury present in the substance of the heart, or in the bilious contents of the duodenum and jejunum. Dr. Miller's conclusions were—1st, that a preparation containing mercury is present in the stomach and contents; 2d, that this preparation is not a soluble one; and 3d, that it is neither calomel, grey powder, nor red oxide of mercury, but that it presents all the characters of white precipitate.

These conclusion substantially confirmed those which I had previously drawn from my experiments. From a comparison of our results, and an examination of the white mineral sediment obtained by washing the contents of the stomach, we estimated that the amount of the mercurial compound present in the parts examined was from three to five grains; the greater part being contained in the evacuation on the napkin. The stomach contained more than the intestines.

The chemical results might have been disturbed by the fact, that during the three weeks' illness, the deceased child had taken, at intervals, eight grains of grey powder. As this compound contains three eighths of its weight of metal, the child had taken altogether three grains of mercury. We satisfied ourselves, both by affirmative and negative experiments, that the mercury in the stomach was not in the condition of grey powder, but of a white insoluble compound. The state of the mercury in the intestines and on the matter of the napkin could not be proved by any direct experiment; still there was a strong presumption that it was of the same nature as that found in the stomach. No calomel, or any other preparation of mercury, had been given. The mercury found in the liver and kidneys had been deposited by absorption during life, but whether this was owing to the grey powder given medicinally, or to the white precipitate assumed to have been given by the mother on Tuesday night, we could not say. Either view was reconcileable with the discovery of mercury in these organs.

Although the cause of death was, medically speaking, left somewhat doubtful by reason of the previous illness of the child, the jury, upon the evidence, returned a verdict of "Wilful murder" against Harriet Moore, the mother, and she was committed for trial at the Assizes.

As some doubt subsequently arose, whether the medical evidence clearly assigned a cause of death, and was sufficient to support a charge of murder, a series of questions was submitted to me, the nature of which will be understood from the subjoined remarks:

1. Apart from the alleged administration of white precipitate to the child, the screams heard on the night of the 20th (a few hours after the supposed administration of the poison) might be ascribed to severe pain, occasioned by inflammation

of the stomach and bowels, under which the child was then labouring, either as an effect of poison or of disease. The sinking state observed on the following day (Wednesday) might be the result of exhaustion from a severe attack of inflammation of the bowels, whether resulting from disease or poison.

2. There was nothing in the condition or appearance of the inflamed parts to show whether this inflammation depended on natural causes or on irritant poison. But for the finding of white precipitate, there would have been no reason for attributing it to the action of irritant poison.

3. The child had been more or less affected with purging, and other symptoms of disease of the bowels, up to Saturday, the 17th, *i. e.* three days before the fatal symptoms set in.

4. The child had apparently recovered, and was well on the Monday and Tuesday before the attack came on in the evening. Whether this sudden attack of inflammation was or was not likely to be a sequence of the illness under which the child had previously laboured, must mainly depend on the opinion formed by the medical gentleman in attendance. If he treated the last illness only as a relapse, and the death as not an unusual consequence (until something had been said about white precipitate), then this would go far to show that, in his view, the inflammation might have arisen from natural causes. Infants of this age are liable to sudden attacks of inflammatory diarrhœa and gastro-enteritis.

5. I am not aware that any particular condition of the brain has accompanied a fatal attack of inflammatory diarrhœa or gastro-enteritis in children. The brain of an infant is generally found more congested than that of an adult. Slight disturbing causes increase this congestion, and thus give rise to insensibility or convulsions. Hence the life of an infant under an attack of infantile diarrhœa is often cut short by disturbance of the brain and nervous system; death being preceded by convulsions and stupor.

6. Taking the fact that white precipitate, or a preparation of mercury, was found in the gullet, stomach, and bowels of the child, and in matter voided on a napkin,—with the sudden occurrence of pain, vomiting, and purging, on Tuesday evening,—the sinking state or collapse on Wednesday, and

death on the Thursday morning, with the discovery of an inflamed state of the bowels and stomach, it appears highly probable that white precipitate was the direct cause of the inflammation and death.

7. White precipitate is a mercurial poison. Its action, so far as it is known, is to produce vomiting of a violent kind, purging, and collapse. The appearances likely to be found in the body are those of inflammation and ulceration. If the poison is thrown off by vomiting, the person may recover; otherwise, death takes place. Here the poison had been in great part thrown off. The quantity remaining in the body was small, but the infant was exhausted by the effects produced.

8. A rabbit died in a few hours from a dose of five grains; another also, in an equally short period, from four grains. Rabbits do not vomit. The white precipitate used in these experiments was taken from the same sample as that which was supplied to the prisoner.

9. The medical difficulty that arises in this case, in assigning death absolutely to white precipitate, is—1. That there was no specific symptom, such as *salivation*, to point to the effect of a mercurial irritant compound. 2. That only one fatal case in a human being is recorded of death from this poison, and in that case, the child had salivation, and it apparently died from the effects. 3. That with the exception of some experiments on animals, there is no medical experience of the effects of this poison on the body. 4. That the quantity of the precipitate found in the body of the child was not what could be called a fatal dose.¹ 5. That, evidence of the presence of

¹ The quantity of poison found in a dead body forms no criterion of the quantity administered or taken. It depends on the amount of vomiting and purging, and other circumstances. The actual dose taken in this case was a matter of doubt. The druggist stated that he sold one drachm for a penny: commonly, only a scruple is sold for this sum. Allowing that there were sixty grains, and deducting the starch mixed with it, there would have been forty-three grains of white precipitate. As twenty grains of the mixed powder contained one tenth of a grain of corrosive sublimate, so the deceased, if the whole sixty grains were given, must have taken three tenths of a grain of corrosive sublimate. This, in itself, is a large dose of a powerful poison for a child. The quantity of mercury found, estimated as white precipitate, did not exceed five grains, of which the greater part was on a napkin. If forty-three grains were given, thirty-eight grains were no longer forthcoming. There is nothing surprising in this. None of

absorbed poison, deposited in the liver and other organs, utterly fails in this case, because a compound of mercury (grey powder) had been given during the treatment, and it is impossible to say whether the mercury extracted from the liver and other organs, depended on the white precipitate taken shortly before death, or on grey powder, (mercury and chalk) given some days before death. 6. That, putting aside the white precipitate found in the body, there is nothing in the appearances which I saw irreconcilable with the effects of disease.

From these considerations, it is difficult to say that white precipitate, if administered on Tuesday, was the direct and only cause of the inflammation of the bowels. Had the child not been ill with disordered bowels, and other symptoms of disease, for a period of three weeks preceding death, a stronger opinion might have been expressed. As it is, the cause of death is so doubtful, that it admits of the expression of no positive opinion; and although the medical "facts are full of suspicion," there is "not absolute and complete evidence" that this infant died from the effects of white precipitate.

It may be regarded, from recent events, as hopeless to attempt to convict any one of the act of poisoning on a charge of murder, unless—1, Every step is susceptible of the clearest proof by eye-witnesses; 2, unless there is an entire absence of disease; and 3, unless there are such special characters about the symptoms and appearances in the body, that no medical doubt could for a moment exist among two or more medical men, touching the inference to be drawn. In this case, there is proof of purchase and possession of the means of death—there is said to be sufficient motive—the substance purchased is found in the dead body, and by a reasonable medical inference, it might have caused the symptoms and appearances found in the body; but against these facts we must set the previously diseased and unhealthy condition of the vomited matter was procurable, and most of the evacuations had been thrown away, as no suspicion of poisoning then existed. There was not enough remaining in the body to kill another child, yet still this child might have died from the effects. It is a remarkable fact that, with these well-known reasons for the disappearance of poison from the body, juries are so frequently directed, that a fatal dose must be found in the body, or the chemical evidence is to be regarded as incomplete.

the child, and the effect likely to be produced on an infant of three months by improper food and general neglect.

The result of this examination of the evidence was, that at the Assizes the charge of murder was abandoned, and the prisoner was indicted upon the charge of administering poison with intent to murder.

The trial took place at the Lewes Lent Assizes, 1860. Dr. Miller, Dr. Pavy, and myself attended, and gave evidence for the prosecution. The facts, as above detailed, were proved to the satisfaction of the Court, and the prisoner was convicted of the charge.

The following is a summary of our evidence at the trial :

Alfred Swaine Taylor deposed—White precipitate is an insoluble compound of mercury. It is an irritant poison. On the 27th of December I received from Kemmish some jars, and on the 28th some napkins. I examined the gullet, and found the lining membrane congested, and covered with a thin, pasty substance, mixed with mucus. There was no acute inflammation, neither was there any on the windpipe or parts connected with the throat. I scraped off a portion of the mucus and pasty matter from the gullet, and I found in it a small quantity of mercury, and the pasty matter was partly starch. It was an insoluble compound of mercury. I examined the stomach. It was distended, and on laying it open I found it contained about a teaspoonful of pap, such as is given to children. There was a small red patch on the mucous membrane. I analysed the pasty matter I found in the stomach. I found a quantity of white, chalky-looking matter. It had the property of white precipitate powder, and I have no doubt it was white precipitate, which is an insoluble compound of mercury. I proceeded to examine the intestines, which showed, in parts, acute inflammation. The small intestines were nearly empty, except at the lower part. I found in the contents of the lower bowels an insoluble mercurial compound, but cannot say it was precipitate. There are three common insoluble compounds of mercury—grey powder, calomel, and white precipitate,—the only one resembling precipitate being calomel. Grey powder would not account for what I saw and found. I found no chalk, which forms nearly two thirds of grey powder. Grey powder would not cause the inflammation. If the mercury had been administered in the form of grey powder, I should have expected to find chalk. In the large intestines I found patches of redness. There were traces of mercury in the liver. I found in one kidney traces of mercury, the result of absorption. These organs were perfectly natural. The child died from inflammation of the bowels. White precipitate would cause inflammation of the bowels. The action of it on the bowels would occasion great pain. It would also produce vomiting of the most violent kind, and purging. The vomiting would take place, if the stomach were empty, shortly after it was administered. I examined one of the napkins at the time I received it. I found, in the matter upon it, a large quantity of a mercurial compound, mixed with bile and starch. On the other napkin, which I examined recently, I

also found traces of mercury. The heart was the only organ I examined which contained no mercury. I examined the specimen of white precipitate sent in a letter by the chemist. There were 82 grains of powder, containing 28 per cent. of starch, and 72 per cent. of white precipitate. In a drachm of the powder I received there would be about 43 grains of precipitate. If the child had had the whole of the powder administered to it on Tuesday, it would account for the appearances found in the bowels. The time it survived would be affected by the strength of the child. I cannot account for the presence of white precipitate in the body, except on the assumption that the child had swallowed it.

Cross-examined—If 43 grains of the precipitate had been administered on the Tuesday night, there is nothing improbable in the child surviving until Thursday. It would become exhausted from the continual vomiting and retching. It is possible that in one act of vomiting a large proportion of the powder might have been thrown off. The stomach was the only organ in which the white precipitate was detected. If the child survived, it would only be by the powder passing off as a result of natural evacuation. The quantity of mercury in the liver was small, as absorbed poison is always found. My experiments do not enable me to say that 40 grains must have been administered. I should imagine a few grains would produce the appearances I witnessed.

Dr. William Allen Miller deposed—On Tuesday, February the 3d, I received certain parts of the body from Dr. Taylor. I was told to ascertain if there was any mercurial compound present, and if so, what was the nature of it. I found in the contents of the stomach a quantity of farinaceous food, mixed with mucus. I found white precipitate with it. I afterwards examined the stomach, and found that the coats contained mercury. I examined a bottle containing a liquid from the ileum, which contained mercury. I examined the liver, and found mercury deposited in it. I also found mercury in the matter on the napkin. In the two articles in which Dr. Taylor found no mercury I did not, but did so in all the rest.

Dr. Frederick William Pavy, of Guy's Hospital, said that the evidence given was quite consistent with the experiments he had made with white precipitate on animals. White precipitate is one of the most irritant poisons he knew of, and it acted directly on the surface with which it came in contact. Grey powder, in moderate doses, would not account for the appearances.

Cross-examined—I agree with Dr. Taylor when he says that a few grains of white precipitate would cause excessive vomiting. I should say two grains would cause vomiting and inflammation, and might produce the effects which Dr. Taylor has described. Inflammation from so small a quantity might produce death in so small a child. I think it not improbable that if the dose of white precipitate was given on Tuesday night, the child might live till Thursday at two o'clock. I administered a large dose of precipitate to a dog, and it survived four days. The dog is more closely approximated to a human being than any other animal as regards the action of poison.

Cases of Poisoning by White Precipitate in the Human Subject.

It is unnecessary to give the details of these cases with the exception of two of the most recent, for a report of which I am indebted to Mr. Boxall. Taking them chronologically—

No. 1. 1840.—The case of a female, admitted into St. Thomas's Hospital; dose taken unknown. *Recovery.*

No. 2. 1840.—The case of a child, æt. 7 years, recorded in the 'Returns of the Registrar-General' for that year. The child died from profuse salivation. *Death.*

No. 3. 1849.—The case of a female adult; she suffered from violent sickness and paralysis of the limbs. This case gave rise to a trial at the Exeter Lent Assizes ('Regina v. Evans'). An acquittal took place for want of sufficient evidence. *Recovery.*

No. 4. 1850.—In this case a woman administered to her husband white precipitate, on meat. About 25 grains were taken. It led to violent vomiting, which lasted two hours, during which the poison appears to have been expelled. The woman was tried for the administration of poison, at the Chelmsford Assizes, but acquitted, as it was considered that white precipitate was no more poisonous than blue pill or grey powder. *Recovery.*

No. 5. 1850.—A case which occurred to Dr. Bence Jones, in St. George's Hospital, and is reported by him. A girl, æt. 18, took 40 grains of white precipitate. She said that it tasted like chalk. In half an hour she had severe pain in the stomach, followed by retching and violent vomiting. She remained two days under treatment. *Recovery.*

No. 6. 1855.—This case, that of an adult man, who suffered from violent vomiting, was the subject of a trial for administering poison, at the Bristol Assizes. The prisoner was convicted. *Recovery.*

No. 7. 1857.—A case which occurred to Mr. Scott, of Stafford. No particulars. *Recovery.*

No. 8. 1857.—A case which occurred to Mr. Walker. A child, æt. 2 years, took 40 grains. On the following day *recovery.*

No. 9. 1857.—A case communicated to me by Mr. Procter, of York. A dose of 40 grains was taken by a woman. In half an hour she complained of pain in the gullet, extending to the stomach, and her mouth was dry and clammy. It is remarkable that there was neither vomiting nor purging until a dose of tartar emetic and castor oil had been given. In three days *recovery*.

No. 10. 1857.—A case which occurred to Mr. Michael, of Swansea. A woman, *æt.* 37, took 100 grains. She suffered from pain in the stomach, with cramps. There was violent vomiting, for two hours, of a thick, white mucus, which deposited a white sediment. There was also purging. There was great prostration, and the pain in the stomach did not subside for several days. *Recovery*.

No. 11. 1857.—A case which occurred to Mr. Giles. A girl took 30 grains; she suffered from much pain in the stomach, and there was frequent purging. On the following day there was swelling of the face and gums, with salivation, which lasted several days. *Recovery*.

I subjoin the two recent cases communicated to me by Mr. Boxall :

No. 12. 1858.—A woman, *æt.* 23, four or five months pregnant, was admitted into the Great Northern Hospital, under the care of Dr. Coote, on January 30th, 1858. She had swallowed a halfpennyworth (from 15 to 20 grains) of white precipitate, in powder, at 6 p.m. The first symptom which she observed was, as she described it, a horrible taste. It occurred immediately, and was followed by a burning pain in the throat and stomach. She was, however, able to walk for a quarter of an hour, without attracting attention. She then sucked an orange, and this was followed by vomiting. About half an hour, therefore, had elapsed without any urgent symptom presenting itself. As she was passing the hospital she complained of dimness of sight, and she nearly fell down; this induced her to apply for aid. Faintness, and not pain, was the chief symptom at this time. The stomach-pump was applied, and oil was injected. Castor oil was also given to her. January 31st.—There was much pain in the throat and stomach, with difficulty of swallowing; the tongue felt swollen. There was pain in the gums of the lower jaw. February 1st.—She

was slightly salivated, and the tongue was covered with a thin, white fur. February 2d.—The gums were rather swollen and spongy. There was a *blue line* around the edges of the gums. The bowels were not open, and there had been no purging. There was less pain in the throat and stomach, and the act of swallowing was less painful. There was great tenderness over the region of the stomach. She gradually improved until the 6th, when she had recovered from the effects of the poison. Abortion did not follow.

No. 13. 1860.—A. S—, a girl, æt. 18, was admitted by Mr. Clapton into St. Thomas's Hospital on February 5th, 1860. She had taken one pennyworth (30 grains) of white precipitate thirteen hours before admission. This had caused vomiting. She now complained of pain in the throat, extending to the stomach. Castor oil and eggs were prescribed, with barley-water. This girl recovered in a few days. The account she gave to Mr. Boxall was, that she swallowed the poison in a cup of cold water, at 11 o'clock a.m., on Sunday, February 5th. She rinsed the vessel out with some more cold water. She had the intention to destroy herself. In a quarter of an hour after taking the poison she felt giddiness. She lay down and lost herself completely. Some salt in water was given to her, and this made her very sick in five minutes. She suffered from severe pain in the stomach, was purged all day, and was taken to the hospital at 12 o'clock at night. The pain in the stomach and purging continued during the four days she remained in the hospital. There was great thirst, but no difficulty in swallowing. There was no soreness of the gums, nor salivation, in this case. The quantity of white precipitate taken was 30 grains. A sample of this precipitate was brought to me by Mr. Boxall. It contained no starch, nor any impurity, excepting corrosive sublimate, of which it contained about 1 per cent.

Effects of White Precipitate on Animals.

To aid this inquiry, and to supply that post-mortem and chemical evidence which, from the paucity of fatal cases among human beings, appeared to be absolutely necessary, I called in the aid of Dr. Pavy. Experiments were performed by him

with some of the white precipitate procured from the druggist's stock at Petworth (being the same as that supplied to the prisoner), and also with other specimens procured from respectable druggists. As a general rule, the white precipitate before use was deprived of any corrosive sublimate by digesting it in ether. I may here remark of four samples submitted to examination, that corrosive sublimate was contained in all.

The subjoined remarks on the effects of this substance are by Dr. Pavy.

Physiological action of White Precipitate.

The action of white precipitate on animals is that of a powerfully and purely irritant poison. It has proved fatal to the dog, rabbit, and mouse, on which animals its effects have been tried. The symptoms widely differ in the dog and rabbit, on account of the one being an animal that is most susceptible of vomiting, the other an animal that never vomits.

EXPERIMENT 1.—In the case of the dog, *twenty grains* of white precipitate mixed with the food were devoured without the slightest reluctance on the part of the animal, there being no sign of discovery of the presence of the poison. In a quarter of an hour, violent vomiting was produced, and in two hours the whole of its food with the white precipitate, had been rejected, and the animal seemed to have recovered. It drank water, but refused to touch food again. A few hours later, *twenty grains* more of white precipitate were mixed with some mucilage and injected through a gum-elastic tube into the stomach. Within five minutes most violent vomiting was induced, which lasted about two hours, when the animal appeared to have ejected the poison, and to have recovered. At first a white mucus was brought up, but afterwards mucus streaked with blood. On the following day *ten grains* were administered in two portions, at an interval of three hours. Upon each occasion the same violent vomiting was almost instantly induced, and the mucus that was ejected was streaked with blood. Although no more white precipitate was given, yet the animal refused to eat, grew gradually more feeble, and died five days after the commencement of the observation.

On making a post-mortem examination, the stomach was found to contain a small quantity of a dark-green, viscid fluid, apparently a mixture of bile and blood. The inner surface of the stomach was strewed over with small patches of ulceration. The small intestine was injected a little at its two extremities, but appeared otherwise natural. The cæcum and large intestine also were unnaturally injected, and the glands were prominent and dark-coloured, but there was no sign of ulceration.

It is thus evident that white precipitate acts as a violently acrid poison when introduced into the stomach. Its effects here were directly and only, to any significant extent, on the stomach; and, probably, this was the only organ upon which the poison could act, vomiting occurring after each administration, until apparently the whole of it was rejected. The vomiting was of an exceedingly violent character, showing how strongly the surface of the stomach must have been affected. By the repeated administrations that were resorted to, fatal gastritis was induced.

On the rabbit the effect of a dose of four and five grains is to kill in the course of a few hours. In one instance *five*, and in another *four*, grains were administered to a full-sized rabbit at half-past five in the evening, by means of injection into the stomach, mixed with a little water, through a gum-elastic catheter passed down the œsophagus. In each case the rabbit was found dead, cold, and rigid, on the following morning. On examination, the lungs and pleura were found natural. The heart was gorged with dark-coloured blood on both sides. The interior of the stomach presented intense redness in patches, and a few dark-coloured spots, looking as if blood had been extravasated on the surface. Attached to a large portion of its extent was a white, false-membrane-like layer, which was so firmly adherent that it resisted the action of water in removing it, but could be peeled off in strips with the knife. In this false-membrane-like layer a few opaquely white particles were discoverable, which bore the aspect of white precipitate. Towards the pyloric end of the stomach there was a clear, gelatinous material separating the viscus from the food. The intestinal canal, except at its upper part, looking here and there a little preternaturally vascular, presented an ordinary appearance throughout.

In smaller doses the administration of white precipitate may be persisted in for several days, but it ultimately kills from the effects of inflammation of the alimentary tract, and there is at the same time a most peculiar condition of the kidney produced. Even in two-grain doses *per diem*, at first the rabbit manifests no symptoms of disturbance, eating its food and appearing lively; but afterwards diarrhœa sets in, the animal refuses to eat, and looks dull and pinched-up. In one case *two grains* a day were given for seven days without producing any perceptible effect. *Two grains* twice a day were then given, which the animal supported for three days. On the following day the rabbit had died before any injection was practised. The day after the quantity was increased, the animal showed signs of disturbance, and then grew rapidly worse. It took *twenty-six grains* in all before death was produced. In another instance one grain was administered the first day, two grains the second, and two grains the third day, when diarrhœa was produced, and on the following day the animal was found dead. In a third case one grain a day, for four consecutive days, was given, then two grains and two grains again on the succeeding days. Diarrhœa was now observable, and the administration was stopped, but the rabbit died within forty-eight hours. Lastly, in another case, the quantity taken was one grain a day for three days, and then two grains a day for a similar period, when death was occasioned.

From the post-mortem appearances presented by these rabbits, it appears that the poison, in repeated doses, produces inflammation of the alimentary tract, not throughout, however, but only of certain parts of it, and the cæcum more than any other. The following is a *résumé* of the appearances observed:

Lungs congested and solidified in places.

Heart, both sides full of dark, coagulated blood.

Stomach, spots of ulceration in two cases, no decided ulceration in the other two. Patches of preternatural vascularity, and a false-membrane-like layer adherent to portions of the surface. In one case blood had evidently exuded from an ulcerated spot.

Small intestine natural throughout, with the exception of a little undue injection here and there.

Cæcum strewed with patches of ulceration; surface rough and granular, as if from the exudation of inflammatory material. In one of the rabbits the contents were plum-coloured, from the escape of blood. Signs of inflammation were also observable in the peritoneal aspect, shreds of easily detached lymph being seen.

Large intestine ulcerated, and unnaturally injected at its commencement, but natural in appearance elsewhere.

Kidneys, in each case, more or less affected in the following manner — They appeared of very large size. In one the two kidneys weighed 349 grains, and in another 326 grains. (The weight of the two kidneys of a similar sized healthy rabbit was taken for comparison, and found to be 180 grains.) The surface was highly speckled, as represented in fig. 2 of the accompanying plate. The capsule easily peeled off, leaving a hard, rough surface underneath in the more advanced specimens. In section the appearance is given at fig. 1. The medullary part presented nothing unusual in character, but the cortical part was highly striated, consisting, when examined closely, of a number of white columns imbedded in the fleshy texture of the organ, and running from the medullary part towards the surface. These white columns, reaching the surface, occasioned the speckled aspect that has been referred to. In the specimen from which the drawing has been taken, the altered structure felt quite gritty on cutting and manipulating with it. Examined microscopically, the uriniferous tubules were displayed, filled with a dark, granular matter. At fig. 3 is the appearance with an inch object-glass. As thin a section as possible was made, and the white columns are shown to consist of plugged-up tubules. The direction of the tubules in these columns is also shown. Figs. 4 and 5 give the appearance of isolated tubules under the quarter-inch power, in different stages of implication. At fig. 4 there is a natural tubule by the side of another in which the deposit has taken place in somewhat rounded masses. At fig. 5 the natural tubule is seen continuous with a portion where the deposit has occurred. In one of the two tubules the deposition is in a much greater state of advance than in the other.

The first idea that occurred on seeing the microscopic appearance was, that the deposit in the tubules consisted of an albuminous material; but in the specimen from which the plate was taken, this was proved not to be the case. The deposit is of an earthy character, and composed principally of the phosphate of lime. The Malpighian bodies seemed entirely to have escaped implication. Each one seen was perfectly free from any dark accumulation.

The urine of three of the rabbits was examined a short time before death took place. There was no albumen to be discovered in either specimen.

In addition to the experiments on the dog and the rabbit, the effects of white precipitate have been tried on the mouse. A small quantity of the poison was mixed with lard, and placed in a cage where two mice were confined. They were both found dead on the following morning.

Chemical analysis.—The following were the results of an analysis in some of these experiments:

EXPERIMENT 1.—The contents of the stomach, amounting to about 2 drachms of a brownish-coloured liquid, gave no evidence of mercury. The coats of the stomach yielded a mere trace. The contents of the small and large intestines gave no mercury, while the coats of both yielded a trace. Mercury was found in the liver and kidney, but there was none in the heart. The whole quantity separated was calculated not to exceed one eighth part of a grain. Although the quantity administered was very large (50 grains), the greater part had obviously been expelled from the body.

EXPERIMENT 2.—A rabbit was killed, in a few hours, by 5 grains. The liver and one kidney were examined. A well-marked sublimate of metallic mercury was obtained from the kidney, but none was found in the liver.

EXPERIMENT 3.—Twenty grains of white precipitate (well washed with ether) were given to a rabbit. The animal was last seen alive about seven or eight hours after it had taken the poison. No analysis was made of the contents of the stomach, but the two kidneys were found to contain a well-marked quantity of mercury.

EXPERIMENT 4.—Two grains of white precipitate were given daily to a rabbit for four days, making 8 grains altogether.

The animal was found dead. In this case mercury was found in the kidney, a mere trace was detected in the liver, and about the same quantity in the whole of the intestines and their contents. These results prove—

1st. That white precipitate, like other insoluble mineral poisons is absorbed, and its mercury is deposited in the organs. It is probably rendered soluble by the acid secretions of the stomach.

2d. That the kidneys are the chief receptacle of the poison, the liver containing a trace, and the heart none. The intestines appear to retain the poison only in small quantity.

3d. That whether the quantity administered be large or small, and whether given in one or several doses, the quantity found in the body of the animal was, in each case, very small.

Description of Plate, showing the effect of the administration of White Precipitate, in repeated doses, on the kidney of the rabbit.

Fig. 1. Section of the kidney, natural size. The highly striated appearance of the cortical part is displayed.

Fig. 2. Appearance of the surface of the kidney, showing its highly speckled character. The drawing is somewhat magnified.

Fig. 3. Microscopic appearance of a thin section of the cortical part, examined by the inch object-glass. The uriniferous tubules are seen plugged up with an earthy deposit. A collection of them into a bundle forms one of the white columns to which the striated character at fig. 1 is due.

Fig. 4. A normal tubule by the side of one in which a deposit has occurred in the form of roundish masses. These are seen by the quarter-inch glass.

Fig. 5. Likewise viewed with the quarter-inch power. Two tubules are shown with a deposit in them, to a varying degree of extent. The natural tubule is seen continuous, with a portion where the deposit has occurred.

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