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Taylor, Alfred Swaine, 1806-1880.
Royal College of Physicians of London

Publication/Creation

London : Publisher not identified, 1864.

Persistent URL

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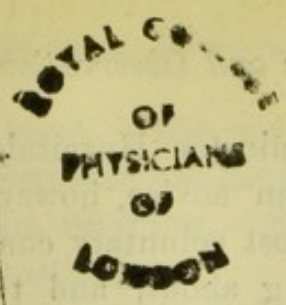
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CASES AND OBSERVATIONS IN MEDICAL JURISPRUDENCE.

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

1. *Chronic Poisoning by Mercury through the Skin and Lungs. Death after four years.*

THE notes of the following singular case of chronic poisoning by mercury were taken by Mr. Herbert Spurgin, clinical clerk.

Richard B—, æt. 32, a furrier, living in Loman Street, Southwark, was admitted December 10th, 1863, under the care of Dr. Rees. He is a well-made man, not at all emaciated, married, with two children; was formerly footman to a gentleman living at Clapham, and always enjoyed excellent health. Four years ago he first began his present occupation, which is to pack up the skins of animals (rats, neuters, &c.) that have been washed with an acid solution of mercury and afterwards dried, a process which is supposed to soften the skins and thereby render them more suitable to be afterwards made up into wide-awake hats. (He has only been employed in *packing* the skins, not being occupied in that part of the process which consists in drying the skins, and thus evolving fumes of mercury.) For the first three years, he did not suffer much inconvenience from his occupation beyond feeling some general weakness. About twelve months ago he found he could not hold his hand steady enough to shave himself, and he soon after lost complete control over his limbs, and his friends told him he was nervous. He went as an

out-patient to the Westminster Hospital, and was advised to give up his occupation, an advice, however, which he did not follow. By degrees he lost voluntary control over his muscles when standing or moving about, and three or four months back, first began to have slight twitchings when in bed. Says he was salivated for about three months soon after he began this occupation; but that his gums have not been tender, nor has he had any metallic taste about his mouth. He gave up work a month ago, finding that he was getting worse, and attended at Guy's Hospital as out-patient for a fortnight, and afterwards was admitted as an in-patient. On admission he could manage to walk tolerably well with a little assistance; but when standing could not control his limbs, which trembled considerably, and even when in bed they had the same constant tremulous motion. He complains of feeling very much exhausted, and has had no sleep for several nights; also complains of headache. His tongue is furred, bowels costive, skin perspires profusely. The heart-sounds cannot be distinctly heard in consequence of the continuous spasmodic movements of the muscles of his chest. Urine high coloured, sp. gr. 1025, contains no albumen or sugar. Passes about the normal quantity during the twenty-four hours. Ordered Ammon. Bicarb. gr. v ex decocto Scoparii t. d., and what diet he can take best.

11th.—Had a bad night, not being able to sleep at all. Much the same in other respects; his limbs have constant spasmodic movements, very much resembling those of chorea. The spasms increased in violence towards evening, when he was ordered Opii gr. iss.

12th.—Passed a very bad night, having had no sleep; feels sore all over his limbs where they come in contact with the bed; they look quite red and inflamed. Ordered Potassii Iodidi gr. iij, Tinct. Opii ℥x, ex mist. Camph., ter die. 9 p.m.—Very restless; gets out of bed, and seems quite delirious. Had not passed water since the morning. A catheter was introduced, and about a quart of high-coloured urine drawn off. Ordered Sp. Æther. Sulph. co. ʒj, Liq. Morphiae ʒss, ex Aquâ, statim, et rep. post horas quatuor si opus sit. Seemed rather quieter after his bladder was emptied. To take brandy ʒvj.

13th.—Took two draughts in addition to his mixture, but

only slept about an hour. The spasmodic movements continued unabated. A catheter has been passed, and his bladder has been emptied this morning. 8 p.m.—Has passed his urine in bed. Very restless.

14th.—Had no sleep last night. Continues delirious. Constantly throws his arms about. 10 p.m.—Was exceedingly restless; and the spasms continuing very violent, chloroform was administered, under the influence of which he was kept about twenty minutes, but with no further benefit. Bowels have not been relieved. Ordered MM. c. MS. ζj , 6tis horis; Opii gr. j, 6tis horis. 8 p.m.—Took one pill, but will not take his mixture. When given anything to drink, retains it in his mouth a few minutes, then spits it over any one near him. Pupils contracted.

15th.—Urine passed involuntarily. Bowels not moved. Movements of limbs continue much the same. Has had no rest. Ordered Liq. Opii Sed. ζss , ex Aquæ ζiij , pro injection. h. s.

16th.—Slept about an hour during the night; seems more exhausted this morning. Skin continues quite wet with perspiration. Not quite so restless as yesterday. Rep. inject. h. s.

17th.—Slept tolerably well last night; much quieter this morning, there being only slight spasm. Liq. Opii Sed. \mathfrak{mxx} h. s. s.

18th.—Is now quite quiet if not disturbed. Took his draught last night. Cannot protrude his tongue very well. Still passes his urine involuntarily. Ordered enema communis; rep. haust. Opii nocte.

19th.—Pulse 126. Quite still; answers when spoken to, although it takes some time to make him understand what is said to him; slept well; takes very little nourishment; bowels not relieved.

20th.—Had another enema, and his bowels have been relieved. Pulse 120. Cannot be induced to take much nourishment, and seems much weaker.

24th.—From the last date he has been getting weaker, and would take scarcely any food. Has had no return of spasm. He fell into a state of unconsciousness, and the action of the heart became more and more feeble, until death took place on the 25th, the fifteenth day after his admission.

The *post-mortem examination* showed the body to be well nourished, not at all wasted, and the muscles of a normal red colour. The brain and spinal cord were carefully examined, and appeared to be quite healthy. The lungs, heart, liver, spleen, and kidneys, presented no morbid appearance, so that, unless it had been for the history of mercurial poisoning, it would have been difficult to assign the cause of death.

Chemical analysis.—Soon after the admission of this patient his urine was submitted to a chemical examination. I found that it had the usual characters of healthy urine, excepting in the fact that the lithates were rather more abundant. Twelve ounces were evaporated, and the residue carefully tested, both by copper and by a gold and zinc pile, for the presence of mercury, but not the slightest trace of the metal could be detected. It was obvious, therefore, that if mercury was in the act of being eliminated at all by the kidneys, it could only be in infinitesimal quantity.

After death the brain, liver, and kidney, were examined. Six ounces of each organ were dried, and one half of the dried residue was digested in one part of pure hydrochloric acid and four parts of water until the organic substance was entirely broken up, and a thin liquid was obtained in each case. This was concentrated by evaporation, and, while slightly warm, a pile formed of a slip of thin gold-foil, twisted round a slip of zinc-foil, was suspended in each of the acid mixtures properly diluted, and allowed to remain immersed for twenty-four hours. In the acid liquid from the kidney, the gold had by this time acquired a slight white tarnish, while the zinc had become dissolved. The gold-foil was washed, dried, and heated in a reduction-tube, and a well-marked sublimate of globules of mercury was obtained. These were visible by the aid of a lens, and still more perfectly under a low power of the microscope. The gold which was suspended in the acid liquids of the brain and liver received no deposits, and, on being heated, it yielded no sublimate of mercury. About a quarter of a square inch of fine copper gauze was now introduced into the acid liquids obtained from the three organs; the liquids were gently heated, and the copper allowed to remain in contact forty-eight hours. At the end of this time, the copper from the liquid of the kidney

had acquired a dark-gray tarnish; that from the liver was of a dull, grayish-white appearance, and the copper from the brain similar, but with less metallic deposit. These three portions of copper, washed, dried, and heated, yielded sublimate which were proved by a microscopic examination, to consist of globules of metallic mercury. The largest sublimate was obtained from the kidney. The average size of the globules separated from this organ was the 1-1750th of an inch, and those from the liver and brain had a diameter of about the 1-2600th of an inch. It was thus proved that mercury had been absorbed and deposited in the organs of this man; that the metal was obtainable by ordinary chemical processes from a quantity equivalent to three ounces of each organ; but that, weight for weight, the kidney yielded a larger amount than the brain and the liver. The results also showed that, in reference to the tissues, mercury was more completely separated by the chemical action of copper, than by the galvanic process with gold and zinc.

Dr. Whitley ascertained, by inquiry at the factory in which this man had worked, that it was part of the process of preparing furs, to use a solution of nitrate of mercury for brushing over the fur of the rabbit or musk-rat. For this purpose, five pounds of mercury were dissolved in twenty-five pounds of nitric acid, and the mixture was heated until all the metal was dissolved, the fumes being carefully conducted off. This strong solution was diluted with about eleven parts of water for use; the fur was impregnated with the liquid, and the skins were laid on racks to dry during the night. The object of using this liquid is to improve the fur and preserve it from the depredations of insects. In the morning the fur was evenly removed from the skin in one mass by machinery. The skins were cut up and employed in the manufacture of glue. The fur was collected by the hand and packed in paper-bags. The man whose case is above related was one of the packers, and was thus in the habit of daily handling fur on which nitrate of mercury was necessarily deposited by evaporation. Dr. Whitley handed to me a portion of the fur thus prepared. A few fibres of it were sufficient to give a rather copious deposit of metallic mercury on copper, when it was warmed with water acidulated with hydro-

chloric acid. Here, then, was a sufficient source of this metal to bring about chronic poisoning. Although the art of packing would lead to the diffusion of a fine mercurial dust, it is probable that the mercury penetrated into the system through the skin of the hands, as well as by the lining membrane of the throat, mouth, and lungs.

This case appears to indicate a remarkable idiosyncrasy to the poisonous effects of mercury, and at the same time an immunity from any serious effects for an unusually long period. It was ascertained that the deceased had been working as a packer for four years, and for three years, according to his own account, he did not suffer any injurious symptoms, if we except some salivation for the first three months, and a feeling of general weakness. It was, however, obvious that a year before his admission into the hospital, the poison had affected the motor nerves, and that he was gradually losing muscular power. Had he withdrawn from the work at this date, it is probable he would have recovered from the effects, but he declined to follow the advice which was given to him. When I saw him, shortly after his admission, he was in incessant motion, either with his head, trunk, or limbs. These movements were quite involuntary like those of chorea, and so frequent and violent as rapidly to exhaust him and prevent him from obtaining rest at night. There was no salivation, no mercurial fetor in the breath, and no blue line at the junction of the gums with the teeth. The case was unlike any known disease excepting chorea, and it was unlike any of the forms of chronic poisoning by mercury which have been hitherto described by toxicologists. Yet the nature of his occupation with the discovery of mercury in the brain, liver, and kidney, can leave no reasonable doubt that this man died from the effects of the metal, received partly by contact through the skin and partly through the lungs.

Dr. Whitley's inquiries elicited the information that others engaged in work of a similar kind had not suffered in health, and that no case of poisoning, chronic or acute, had previously occurred among the workpeople of the establishment, Admitting this statement to be perfectly correct, it is more surprising in a physiological point of view that other workmen could handle with impunity furs containing dry nitrate of

mercury for many years, than that one man should have suffered and died from the effects.

2. *Absorption and Diffusion of Mercury when taken in Medicinal Doses.*

The case above related does not show that mercury was slowly absorbed, but rather that the metal was slow in manifesting any injurious effects upon the system.

The following case, which occurred in May 1864, demonstrates that small medicinal doses of mercury, even in the comparatively insoluble form of calomel, are rapidly absorbed and diffused through the body. A child *æt.* 2½ years died after an illness of twenty-two hours. Poisoning was suspected, and at first it was supposed that the child had died from the effects of arsenic. Portions of the viscera with some of the blood, were sent to the Chemical laboratory for analysis. No arsenic was detected in any of the parts examined, but mercury was found in a green-coloured evacuation passed shortly before death. This led to a further examination of the viscera, and in four ounces of the liver, mercury was detected by the process with copper gauze described in the preceding paper. The red colour of the copper was obscured by the rapid deposit of white metal, and, on applying heat to it in a tube, a sublimate of mercury in globules was obtained. The heart was examined by a similar process, but gave no trace of the metal, nor could any be detected in the dried residue of six ounces of blood.

The history of the case was this:—The child had had no mercurial medicine until *sixteen hours* before its death. Two grains of calomel, with one of aromatic confection, were then given to it. A large proportion of this dose had been carried through the bowels with the evacuation, but a portion had evidently been absorbed and deposited in the liver. Some experts have advanced the theory that, if metallic poison is found deposited in one organ, it should be found in the blood as well as in all other organs. The actual necessity for this uniform and universal diffusion and deposition of poisons is not appa-

rent. It begins and ends with theory, for in practice we find great differences, not only in the same human body, but among different bodies. The above is one among many cases illustrative of this proposition. The cause of death gave rise to no contentions among medical witnesses. The mercury had been *bonâ fide* prescribed by a medical practitioner, and had had no share in the death of the deceased. The case shows that in sixteen hours the mercury derived from an insoluble compound like calomel may be found deposited in the liver.

3. Case of Poisoning by Turpeth Mineral. Early occurrence of intense salivation. Death in eleven days from forty grains.

The following case was communicated to me by Mr. Snoad, of Yoxall. It is a protracted case of a poisoning by turpeth mineral taken by mistake for æthiops mineral. The symptoms of the patient were accurately noted daily by Mr. Snoad :

J. W—, æt. 27, sent for me on the 8th of January, 1862, at 10 a.m. I found him sitting on the privy, suffering from violent purging and vomiting. He looked pale and anxious; pulse slow and small, skin cold and clammy; was told he had taken some yellow powder in treacle, about ten minutes before, on an empty stomach, before breakfast. I ordered him to drink freely of milk, to be brought in-doors and placed on the sofa before the fire, with warm applications to the feet, and to be wrapped in warm blankets, then to drink white of eggs beaten up. He complained of soreness in his mouth and throat, and the saliva continually ran from his mouth; continued to vomit the milk and white of eggs mixed and coloured with yellow powder; passed rice-water-looking motions, some yellow, like the vomit. 10.30 a.m.—Is warmer and inclined to sleep; is disturbed with the vomiting of mucus and blood in small quantities; gave him an ounce of a mixture containing mucilage, acacia, catechu, and chlorate of potass, which was retained ten minutes. Complains of pain in epigastrium and abdomen; gave him ℥ss Ol. Ricini. 1.30 p.m.—Vomiting and purging of mucus continues, but not so frequent; is restless. 4 p.m.—Expresses himself better, saliva flows copiously; urine scanty

and scalding, but clear. 10 p.m.—Has dozed at times, awakes frightened, vomits and strains every ten minutes; saliva flows constantly; has taken frequently milk thickened with flour and oswego. Pulse 90, tremulous; has used garg. Alum. frequently.

January 9th, 10 a.m.—Has had some sleep during the night; looks anxious; lips, gums, fauces, and tongue swollen; mercurial fetor of the breath. Pulse 95, hard; has taken milk and water thickened and castor oil this morning; vomits soon after taking anything; has had a sinapism over epigastric region; fæces more natural and bilious. 10 p.m.—Feels very low and restless. Pulse 90, tremulous; has taken three doses of effervescing mixture, and retained some, also thickened milk, eggs, and brandy. Bowels have acted four times during the day slightly; has used gallic acid gargle.

10th, 10 a.m.—Has had a restless night, with dreams and delirium. Pulse 85, regular; has taken Ol. Ricini; has passed brown loose motions; retains milk and beef tea; mercurial fetor stronger; tongue moist, swollen; gums and palate dark-bluish coloured; anus sore; passed urine in small quantity. 10 p.m.—Has taken effervescing mixture through the day, and beef tea, rice, milk thickened with flour, eggs and brandy beaten up; feels uneasy in inside. Pulse 90, softer; to take opium h. s.

11th, 10 a.m.—Has dozed at times in the night, been restless and uneasy in his inside; lips, gums, tongue, and throat, more swollen. Pulse 90; passed a loose motion, with portions of undigested rice and flour; sickness abated. 10 p.m.—Pain in the inside; has had hot applications and sinapisms externally; has retained nourishment and medicines through the day, and used the gargle frequently; looks pale and anxious.

12th, 10 a.m.—Has had a restless night; taken castor oil early; bowels have not acted; breathing is oppressed. Pulse 90; flatulence, causing pain; enema with gruel and castor oil given. 2 p.m.—Bowels have acted; breathing relieved. 10 p.m.—Appears more cheerful; has taken two doses of Chlor. Potas. mixture and used garg. Potas. Chlor. Mouth very sore; to take opium h. s.

13th, 10 a.m.—Has slept at intervals; awakes frightened. Pulse 86; tongue furred, swollen, but moist; bowels acted twice; motions brown and loose. 10 p.m.—Much the same;

bowels acted twice; tenderness on pressing the abdomen; flatus; urine clear, scanty; saliva profuse.

14th, 10 a.m.—Has had a restless night. Pulse 90; looks more anxious; lips, livid; headache; pain in abdomen; bowels have not acted; enema repeated, and turpentine fomentations on the abdomen. 6 p.m.—Feels better; bowels have acted; motions of a brown colour. Pulse 86; has taken broth and thickened milk; slept at intervals. 12 p.m.—Feels inclined to sleep; retained nourishment. Pulse 80; suppository of opium given.

15th, 10 a.m.—Has slept at intervals; rather delirious in the night; fæces brown. Pulse 84. 2 p.m.—Has taken nourishment, is sensible, and expresses himself better. 6 p.m.—Is restless, complains of pain in abdomen and stomach; headache; enema of beef tea; milk, eggs, and brandy given; unable to swallow much; refuses to take medicine. 12 p.m.—Bowels have acted. Pulse 80, soft; headache; has taken thickened milk; lips, gums, palate, and fauces, look dry and black; enema repeated.

16th, 10 a.m.—Has slept at times, dreamed and started. Pulse 84; skin dry; headache; tongue covered with dry, black fur. 2 p.m.—Death-symptoms commenced; rattling in the throat; look wild and anxious; tongue, palate, and lips dry. Pulse 90; abdominal respiration. 8 p.m.—Weaker. Pulse 96; has taken a little brandy and tea; refuses to take broths and thickened milk; has headache and pain in the right side. 12 p.m.—Has dozed at times. Pulse 100; death-rattles louder.

17th, 10 a.m.—Continues to doze. Pulse 110, weaker; is sensible; has taken a little brandy and water. 3 p.m.—Strength declining; voice weaker; breathing more oppressed. Pulse 120. 12 p.m.—Weaker. Pulse 125; swallows small quantities of brandy and water.

18th, 3 a.m.—Weaker. Pulse 130; tremulous and irregular; passes fæces and a small quantity of urine involuntarily; is sensible, and knows his friends. 8.30 a.m.—He died quietly without convulsions.

Post-mortem Appearances.

Head.—Brain was slightly congested; dura mater and pia mater adherent at the upper surface by two small fibrinous spots, the result of old inflammation. Inner surface of mouth, lips, gums, palate, and fauces covered with black sloughs on their mucous membrane. The parotid and submaxillary glands were enlarged.

Chest.—Old-standing pleuritic adhesions completely around the right lung. Left lung and the heart healthy.

Abdomen.—Mucous membrane throughout the intestinal canal softened and easily torn, with dark-coloured patches at intervals. Stomach towards the pyloric opening and lower surface congested and softened, with inflamed patches on other parts. Glands of the stomach and intestines unnaturally large. Liver in some parts congested. Kidneys much enlarged, one weighed eight ounces. Bladder full of urine, its membrane was slightly congested.

The druggist who made this serious mistake was tried for manslaughter at the Stafford Lent Assizes for 1862; but the jury considered that there had been no culpable negligence, and the prisoner was acquitted. The nature of the poison was so conclusively established that a minute chemical analysis was not considered necessary. Mr. Snoad detected mercury by Reinsch's process in a small portion of the liver.

4. *Case of Poisoning by Corrosive Sublimate. Death in seven days. No Salivation. Suppression of urine.*

The Notes to this Case were taken by Mr. PYE SMITH.

W. P—, æt. 26, a brass-polisher, living in Rotherhithe, having been for some time in a depressed state of mind and twice attempted suicide, swallowed, at six o'clock on the morning of the 16th of October, 1861, a solution of corrosive sublimate in vinegar. It appears that his mother had bought three-pennyworth of the salt in powder, "about half a thimbleful," and had dissolved this in a wineglassful of vinegar for

use in their work. Of this the man drank half, so that the amount of poison taken was probably from five to ten grains.

16th.—Immediately after swallowing the liquid, he felt a burning sensation in the throat, and vomited freely. Assistance was procured, and he was taken to the hospital at 7 a.m., and admitted at once into Accident Ward, under Mr. Birkett's care. He was then anxious and depressed, and suffered from nausea and shivering. Ordered *Zinci Sulph. ℞j ad vomitum*. 8 a.m.—Two hours after taking the poison, he was found suffering great pain, referred to the pit of the stomach, and also from tenesmus. He has passed bloody stools, with abundance of mucus since admission, but no urine. The stomach-pump was now used with effect, and milk and eggs ordered every three hours. During the day the patient brought up a thick, yellow, frothy matter, tinged with blood, in small quantity. He passed little but blood and mucus per anum. 12 p.m.—Restless, but does not complain of pain. No water has been passed since admission.

17th, 10 a.m.—Has not slept during the night more than five minutes at a time. Face pale and anxious. Upper lip swollen. Mucous membrane of the tongue white. There is no salivation, but he complains of soreness of the mouth, and cannot open it wide. There is also tenderness on pressure at the epigastrium. Pulse 70. Respiration normal. Back and feet cold. At 9 a.m. he passed a copious stool, and another shortly afterwards, both without blood. Vomited once. 12 p.m.—There has been nothing but bloody mucus passed per anum. Vomiting of a slate-coloured semifluid substance. No urine has been passed.

18th.—Has had a bad night, and is now cold and depressed. The urine was drawn off this morning by a catheter. During the day the patient passed frequent stools, consisting chiefly of mucus and coagula. The soreness of the mouth he complained of, is now gone. There was no mercurial fetor. Pulse 72, feeble. Ordered *Tr. Opii ℞ xxx statim sum*.

19th.—Slept much better than before, for three or four hours together, in which time he passed some urine naturally for the first time since taking the poison. He vomited once some greenish biliary liquid, with flakes of white of egg.

There is now no tenderness of the abdomen. Pulse and tongue good.

20th.—Slept but little; three or four motions, which were more natural; complains of soreness of the throat and inability to swallow; tenderness in the umbilical region on pressure; face somewhat swollen.

21st, 10 a.m.—The patient is much worse to-day. Blanched, and greatly depressed. Tongue and fauces sore, and the lips swollen and encrusted with a dry secretion. He was delirious during the night. He now complains of burning thirst, and spits up thick pellets of mucus mixed with blood. Ordered Tr. Opii \mathfrak{m} xxx statim sum.

In the afternoon he could scarcely open his mouth to answer questions when roused from the half-stupor in which he lay. Face blanched, drawn, and singularly fixed in expression. Pointed to his mouth, which was evidently very sore. Breathing laboured. Pulse 90.

22nd.—The patient lay during the night in this unconscious condition, the motions passing involuntarily. They were tolerably healthy, though loose, containing little blood. The suppression of urine continued. At six o'clock on the morning of the 22nd he called out loudly, and suddenly died without any convulsion.

Inspection, eight and a half hours after death.—The face presented the fixed expression it had had for the last two days. The rigor mortis was remarkably strong.

The lungs were extensively affected with lobular pneumonia. The œsophagus was marked by injected longitudinal streaks, and contained shreds of organized lymph. The mucous membrane of the stomach was throughout minutely injected of a bright rose colour. It was much reddened, but not corroded or destroyed. The duodenum, jejunum, and most of the ileum, were not affected, but at a sudden bend of the latter part of the intestine there was a space where the mucous membrane was deeply injected. The cæcum appeared to have suffered but to a slight extent, the increased vascularity of the mucous membrane being continued directly from the ileum to the ascending colon. In this last part of the bowel, there was very deep injection of the mucous membrane throughout its whole cir-

cumfereuce with small depressed ulcers scattered here and there. The coats of the rectum were throughout stained of a deep-red colour, from extravasated blood, and this appearance was most marked in the "longitudinal folds" of the mucous membrane. In the dilatation close to the anus there were three large oblong patches of effused lymph. The kidneys were large and coarse in texture, but otherwise normal. The mucous membrane of the bladder was marked throughout by ecchymosis. The spleen was very small, but healthy. The heart, brain, and other viscera, were perfectly healthy.

Chemical analysis.—The mucous membrane of the stomach presented an appearance more resembling that of arsenic than the effects of corrosive sublimate. There was, however, no arsenic present. One half of the stomach, with the adhering mucus, treated with hydrochloric acid and water, and tested by copper-gauze, as described in a preceding case, yielded a deposit which was proved, by the sublimate obtained, to consist entirely of metallic mercury. A portion of the liver, amounting to seven ounces, was dried, and distilled with four ounces of strong hydrochloric acid. The object of this proceeding was to determine whether there was any absorbed arsenic. The acid distillate was tested with pure zinc, and the hydrogen obtained from it was found to be entirely free from arsenic. The residue left in the retort was diluted, gently heated, and then tested with a pile of gold and zinc-foil. In twenty-four hours there was a deposit on the gold, from which globules of mercury were obtained by sublimation, but in small quantity. It may be remarked that no mercury was present in the acid distillate. The quantity of mercury obtained from the liver was very small.

The residue of the poisonous mixture which the deceased swallowed contained corrosive sublimate in solution. The matters which he had vomited in the early stage of poisoning had been thrown away, so that no examination of them could be made.

The case is worthy of notice on one or two points. There was soreness of the mouth from the local action of the poison, but no salivation. There was absence of mercurial fetor, and suppression of urine. The irritant and not the corrosive action

of the poison was manifested on the alimentary canal. The mucous membrane, from the stomach to the rectum, presented, more or less, marks of irritation and inflammation. The man complained during life of pain in the region of the cæcum and ascending colon; but the cæcum did not present that degree of inflammation which has been found in other cases of poisoning by this substance.

The chemical analysis showed that the poison, whether free or absorbed, had been nearly eliminated or discharged from the body. The deceased had lived seven days, and had been actively treated; hence one half of the stomach gave only traces of mercury, probably derived from the coats. As to the absorbed poison, seven ounces of the liver gave mere traces, showing that the metal was rapidly leaving the system. Had the man lived another week, probably none would have been found.

5. Poisoning by Aconite.

Mr. Puckle consulted me in November, 1863, in reference to the case of William Hunt, who destroyed himself by swallowing a quantity of the tincture of aconite. He brought the stomach to the Chemical laboratory, and it was there examined as to post-mortem appearances, and for the detection of the poison. Mr. Puckle has furnished me with the following notes of the case:

On the 9th November, 1863, at a few minutes past 11 p.m., I was sent for to the Camberwell Police Station to see Samuel William Hunt, æt. 42. I went directly, taking with me Æij of sulphate of zinc, and was with him in less than five minutes. I learnt that he must have taken poison about ten minutes or a quarter after 10 p.m., when the police knocked at his door. I afterwards ascertained that, after knocking several times, the police were admitted by Hunt; they went up together into the bedroom, when Hunt sat down and retched immediately, vomiting into the chamber-utensil and on the floor. He then dressed himself, and accompanied the police to the station (conversing freely), a distance of about

250 yards. On his arrival I was immediately sent for; I found him sitting in a chair, retching violently in a spasmodic manner; he at once recognized me, remarking that I had attended his wife in her confinement. His countenance was pallid, skin cold and clammy, pulse small and hardly perceptible, and the action of the heart exceedingly feeble. The eyes presented a remarkable appearance, the pupils being very much dilated.

The breathing was quiet and regular between the fits of retching, which were violent. On questioning him as to what he had taken, he would not at that time admit that he had had anything but gin. I immediately administered ℥j of sulphate of zinc in warm water; he refused to take it, but on making him open his mouth he filled it, but spat it out, jerking the rest on the floor. I gave him another ℥j, taking care to make him swallow it; he appeared to vomit the whole almost immediately. He then exclaimed, "Oh my heart!" saying he had heart-disease. I then had him raised up, to see if he could stand or walk; he staggered across the room, nearly falling against the wall, apparently without the power of raising his arms. He was then again placed in a chair, remaining perfectly conscious; he shortly afterwards said, "I lost my eyesight just now, but now I can see quite plainly." He became sleepy, and seemed to doze for a few seconds, but roused up almost directly, saying he had had such delightful dreams. At this time his eyes were fixed, and presented a most brilliant sparkling appearance; the pupils were extremely dilated. He asked for writing materials, and wrote a few lines, but was unable to finish. He became suddenly worse a quarter of an hour before his death, losing all power and sensation in his limbs, the sharpest pinches producing no impression, although cold water dashed on his face caused a sharp shriek; the pulse was imperceptible; there were no convulsions, but complete relaxation of the limbs at death, which appeared to arise from syncope, at five minutes before twelve o'clock, an hour and three quarters after taking the poison.

On going to Hunt's house I found in the bedroom a recently emptied tumbler, which had evidently contained tincture of aconite and water. I also found an ounce bottle, uncorked, lying just inside a cupboard by his bedside, and a

saturated cork fitting the bottle lying in the room ; there were two drops left in the bottle of a sherry-coloured liquid ; both the bottle and the cork showed the presence of aconite,—when applied to the tongue, they produced numbness and tingling lasting for two hours. On comparison with the pharmacopœal tincture, that taken by Hunt was evidently much the strongest.

Post-mortem Examination, forty-two hours after death.

External appearances.—Extreme rigidity of the muscles ; erection of the penis and escape of seminal fluid ; there was a hydrocele of the right testicle.

Internal examination.—The vessels on the surface of the brain were turgid ; the substance of the brain was firm and healthy ; the ventricles contained but little fluid ; there was no effusion at the base of the brain.

Chest.—Heart perfectly healthy, right side greatly distended with dark fluid blood, left side contracted and quite empty. Lungs healthy, but congested posteriorly from gravitation.

Abdomen.—All the organs quite healthy, except the stomach and duodenum, the internal surface of the latter having a reddish appearance, and being minutely injected. On opening the stomach it presented the following appearances :—great capillary congestion at the larger end, that portion being of a bright-red colour ; strong marks of irritation, with softening and separation of part of the mucous lining ; the whole of the membrane in a highly corrugated condition.

Remarks.—Ammonia and four ounces of brandy were administered by means of the stomach-pump shortly before death. Contents of the stomach about seven ounces, containing blood and mucus.

[The appearance of the mucous membrane of the stomach was so remarkable, and so much resembled the effects of an irritant poison, that I caused a drawing of it to be made by Mr. Hurst. This is now in the Museum collection.

In reference to the analysis, it may be observed that the contents of the stomach were simply exhausted by alcohol, and the extract thus obtained produced the peculiar numbing sen-

sation of the lip which is characteristic of this poison. Circumstances did not permit of the performance of any experiments on animals. The cause of death was obvious from the liquid which remained in the bottle found in the house.—A. S. T.]

6. *Poisoning by Ammonia in Compound Camphor Liniment.*

Compound Camphor liniment consists of one fourth of strong solution of ammonia with three fourths of rectified spirit, the mixture holding dissolved a certain proportion of camphor. Its poisonous properties are those of an irritant; they are due to the ammonia. In November, 1858, a lunatic swallowed two fluid ounces of this liquid, and recovered in four days. For the particulars of the following fatal case I am indebted to Mr. Gill, now a pupil at Guy's Hospital.

This was the case of an infant only four and a half days old. It occurred in September, 1863. Mr. Gill saw the infant about half an hour after the liquid had been taken; it was then screaming in a suppressed manner, as if the act increased the pain; the hands were tightly clenched; the skin was pale and covered with a cold perspiration. The mucous membrane of the lips was blistered, and that of the mouth and tongue was white. A yellowish froth escaped from the mouth and nostrils; breathing was painful, and the pulse imperceptible. In about two hours the infant appeared better; but at intervals it suddenly started and screamed, as if from sudden pain. In six hours it continued much in the same state, and swallowing was painful. In seventeen hours the skin was moist and cool; it had had a natural motion, and had been in a drowsy state during the night. After twenty-four hours the infant was much weaker; the limbs were cold, and the breathing was feebly performed. It became drowsy, and died thirty-two hours after taking the poison. There was an inquest, but no inspection. A question of importance arose in reference to this case. Either the mother or a child two years of age must have given the poison to deceased. The mother stated that this child was playing with the bottle of embrocation on the bed on which her infant was lying. She left the room for a

short time, and on her return she gave the infant a teaspoonful of food which she had previously prepared for it. She was sure the infant swallowed part of this food; but as soon as the food was taken it screamed violently and struggled for its breath, and then she perceived the food to smell strongly of the embrocation. As, from the nature of this irritant compound, the symptoms could not be suspended, it is clear that the mother, either consciously or unconsciously, gave the poison to her infant. On the latter supposition it must have been placed in the food, which was on a chair near to the bed, by the child of two years, during her absence; but in this case it is remarkable that she did not perceive the odour until after she had poured the liquid into the mouth of the infant. The quantity swallowed was unknown.

7. *Poisoning by Alcohol. Fatal effects of Brandy on a Child.*

Of all the liquids operating as narcotics or affecting the brain, this has the most powerful local action on the stomach. A case of alcoholic poisoning of a child *æt.* 7, referred to me by Mr. Jackaman, Coroner for Ipswich, in July, 1863, will serve to show the correctness of this remark. The girl was found at four o'clock in the morning, lying perfectly insensible on the floor. She had had access to some brandy, which she had swallowed from a quartern measure found near her, quite empty. She had spoken to her mother only ten minutes before, so that the symptoms must have come on very rapidly. She was seen by Mr. Adams four hours afterwards. She was then quite insensible, in a state of profound coma, the skin cold and covered with a clammy perspiration. There had been slight vomiting. The child died in twelve hours, without recovering consciousness from the time at which she was first found. On *inspection* there was congestion of the brain and its membranes; the heart and lungs were quite healthy. The mucous membrane of the stomach presented patches of intense redness, and in some places it was thickened and softened; portions of it were detached and hanging loosely in the stomach, and there were patches of black extravasation about it, evidently from altered blood. It contained a greenish-

coloured liquid, but there was no smell of brandy in it, neither was this perceptible in the breath of the child four hours after the alcoholic liquid had been taken. At first it was suspected that arsenic had been administered; but the symptoms were not those of arsenical poisoning, and neither arsenic nor any other metallic irritant was present in the contents of the stomach;—but slight traces of the vapour of alcohol were detected by distillation. The vapour readily reduced chromic acid to green oxide of chromium.*

8. *Poisoning by Nitrobenzole.*

This liquid, which is largely employed as a substitute for the essential oil of bitter almonds in perfumery and confectionery, has now taken its place among narcotic poisons. In the second edition of my work on Poisons (1859) some experiments were quoted from the 'Lancet' (Jan. 10, 1857, p. 46), showing that one drachm of nitrobenzole killed a rabbit almost instantaneously, and half a drachm mixed with two drachms of water rendered a cat insensible for several minutes, a slimy mucus flowing from its mouth for several hours afterwards. The animal refused all food, and died in twenty-four hours. ('On Poisons,' 1859, p. 701.) In 1859 the late Professor Casper, of Berlin, published an account of this liquid under the name of "A New Poison"—"Ein neues Gift," ('Vierteljahrschrift,' B. xvi, p. 1). Its effects on a rabbit and a dog are here described. Two drachms of it were given to a rabbit without any symptoms being produced; two drachms were then given to the animal at intervals of ten minutes or a quarter of an hour, until the rabbit had taken one ounce. In a minute and a half after the last dose, the animal fell suddenly on its left side. The pupils were dilated, while the limbs and tail were strongly convulsed. The animal died in a minute. The dose was probably unnecessarily large, but the result shows that nitrobenzole in a large dose destroys life rapidly. On opening the body the powerful odour of the liquid was everywhere perceptible, even in the blood. This odour remained strongly in the body when it was again examined, *fourteen days* after

* Compare a case by Dr. Wilks, 'Guy's Hospital Reports,' 1859, p. 131.

death. Twenty cubic centimeters (about five drachms) given to a middle-sized dog produced no remarkable symptoms. After some hours the animal was observed to be dull and languid; in twelve hours there was profound coma, with slow respiration, and coldness of the skin, but there were no convulsions. The animal was then killed. All the solids and liquids of the body, including the blood, had a strong odour of the poison, and some drops of the oily liquid were separated from the contents of the stomach. The fluid on which it floated had a strong alkaline reaction. The blood retained the odour for several days.

Passing from experiments on animals to the effects produced on man, the following cases are of interest; they tend to show that, as in the action of chloroform and fusel-oil, the vapour is much more potent than the liquid.

Mr. Nicholson ('Lancet,' Feb. 1, 1862, p. 135), in referring to one fatal case of poisoning by the liquid, states that he has known several instances in which the *vapour*, as it is evolved from almond-glycerine soap, has seriously affected females. A friend of his, who used a cake of this soap in taking a warm bath, fainted from the effects of the vapour of nitrobenzole set free, and was ill for some time afterwards. In July, 1863, Mr. Fotherby communicated to me a case of poisoning by this compound, in which the symptoms so closely resembled those of the essential oil of bitter almonds, that it was at first supposed this oil had been taken. A woman aged thirty tasted a liquid which had been used for flavouring pastry, and, perceiving that it was very acrid on her tongue and lips, spat it out immediately and washed her mouth with water. She thought she could not have swallowed more than a drop, but in replacing the bottle she spilled about a table-spoonful on the table, and did not immediately wipe it up. The vapour strongly impregnated the air of the small room in which she was, and produced a feeling of sickness in another servant. The burning taste in the mouth was immediately followed by a sensation of numbness and tingling in the tongue and lips, and a strange feeling for the next hour. As the woman became worse, Mr. Fotherby was called in, and saw her in an hour and three quarters after the occurrence. Her aspect was then quite typical of prussic-acid poisoning; the eyes were bright and glassy; the features pale

and ghastly; the lips and nails purple, as if stained by blackberries; the skin was clammy, and the pulse feeble. Her mind was then clear, and she described how the accident had occurred and what her sensations were. She was able to swallow a mustard emetic, after which she became rapidly worse; lost her consciousness; the teeth became set, the hands clenched and blue, the muscles rigid and convulsed. She vomited freely a pale fluid matter, which had the peculiar odour of nitrobenzole. The stomach-pump was used, but the fluid washed out of the organ had hardly any odour, owing, probably, to the small quantity actually swallowed, and its removal by absorption. The breathing became much reduced, and the pulse could scarcely be felt. In about eleven hours there was reaction, consciousness returned, and she was able to swallow. At the end of seventeen hours she was much better; but she then complained of distorted vision with flashes of light and strange colours before her eyes. For some weeks she continued weak. It was at first supposed the woman had swallowed a larger quantity of the liquid than she had imagined; but it is obvious, from the entire absence of the odour in the fluid drawn off by the stomach-pump within about two hours, that but little could have passed into the stomach. There is no doubt, from what has been observed in other cases, that these severe symptoms were chiefly due to the breathing of the vapour in a concentrated form. A fellow-servant who was in the room at the time the nitrobenzole was spilled also suffered from the inhalation of the vapour. Mr. Fotherby sent to me a portion of the liquid, and I found it to be pure nitrobenzole, unmixed with any essential oil of almonds.

A case of poisoning by this liquid, which was the subject of an inquest at Ramsey, in the Isle of Man, is reported in the 'Pharmaceutical Journal' for December, 1862, p. 283. A clerk in some Chemical works took, on the 6th of November, a few drops (supposed to have been fifteen) of nitrobenzole. Immediately afterwards he felt unwell, and became insensible. Stimulants restored consciousness, but there was a relapse, and he died the next day. The following case occurred at the London Hospital:—A boy *æt.* 17, while drawing off some nitrobenzole by a siphon, swallowed a portion of the liquid. There were no immediate symptoms, but he soon felt sleepy,

and when at dinner ate but little, and said he felt as if he was drunk. This was between two and three hours after he had swallowed the liquid. He fell into a stupor, which became deeper and deeper, until death took place, without vomiting or convulsions, twelve hours after the ingestion of the poison. (Dr. Mackenzie, in 'Med. Times and Gaz.,' 1862, vol. i, p. 239.)

In a paper communicated to the Royal Society in 1863 Dr. Letheby describes this and another case which fell under his observation—that of a man *æt.* 43, who spilled a quantity of nitrobenzole over his clothes, and went about several hours breathing an atmosphere saturated with the vapour. The effects were nearly the same in both cases; although in one the poison was inhaled in vapour, and in the other it was swallowed as a liquid. For some time there was no feeling of drowsiness in this man; gradually, however, his face became flushed, his expression stupid, and his gait unsteady; he had the appearance of a person who had been drinking. The stupor gradually increased, until it passed into profound coma, and in this state he died. The progress of each of the fatal cases was much the same as that of slow intoxication, excepting that the mind was perfectly clear until the coming on of the fatal coma. This was sudden, like a fit of apoplexy, and from that moment there was no return of consciousness or bodily power; the sufferer lay as if in a deep sleep, and died without a struggle. The duration of each case was nearly the same. About four hours elapsed from the time of taking or inhaling the poison to the setting-in of the coma, and the coma lasted five hours. The *appearances* after death were—flushed face, livid lips; the superficial vessels of the body, especially about the throat and arms, were gorged with blood, which was everywhere black and fluid. The dependent parts were turgid, the lungs somewhat congested; the cavities of the heart were full of blood; the liver was of a purple colour, and the gall-bladder distended with bile; the brain and its membranes were congested, and in the case of the man there was much bloody serosity in the ventricles. Nitrobenzole, as well as aniline, into which it appears to be partially converted in the body, was detected in the brain and stomach. ('Proc. Royal Soc.,' 1863, No. 56, p. 550.) It is not stated what the result of the analysis, if any, was in reference to the case of death from the

vapour in which the poison was absorbed through the lungs. In performing some experiments on animals Dr. Letheby found that the local action on the stomach was slight; there was rarely any vomiting, and there was either rapid coma or a slow setting-in of paralysis and coma, after a long period of inaction. There was a complete loss of voluntary power, a spasmodic fixing of the muscles of the back, with violent struggles, a look of distress, and occasionally a kind of epileptic fit. The pupils were widely dilated, the action of the heart was irregular, and the breathing difficult. The time of death, in the more rapid cases, varied from twenty-five minutes to twelve hours after the administration of the poison. In other experiments, in which smaller doses were given, the time that elapsed between the administration of the poison and the coming-on of the first symptoms (an epileptic fit) varied from nineteen to seventy-two hours; in most cases it was about two days, and the time of death was from four to nine days. The appearances were similar to those already described. When death had taken place within twenty-four hours the odour of the nitrobenzole was clearly perceptible in the stomach, brain, and lungs; and aniline (from the chemical conversion of nitrobenzole) was found in the organs. In the slower fatal cases, the odour had often entirely disappeared, but traces of aniline could be detected in the brain and urine, and sometimes in the stomach and liver. Occasionally no aniline was found, although death had taken place from the poison!

This narcotic compound differs from the ordinary narcotics in its powerful and persistent odour, which would render it difficult for a person to administer it, either in liquid or vapour, unknowingly to another; in the production of profound coma at an uncertain interval after the stupor; and in the rapidly fatal effects when coma has followed. It operates powerfully as a poison in vapour as well as in a liquid state; but, so far as cases have yet been observed in the human subject, the symptoms resembling those of the first stage of narcotic poisoning have very soon appeared. The rapidly fatal cases only would be likely to be mistaken for apoplexy, but in these the poison would be detected by its odour.

Analysis.—Nitrobenzole, or essence of Mirbane, is a pale

lemon-coloured oily liquid, of a strong odour, resembling that of bitter almonds. It has a pungent, hot, disagreeable taste. It gives to confectionery the smell but not the pleasant taste of oil of bitter almonds. It destroys the colour of litmus, and gives a greasy stain to paper, leaving a yellow mark when the stain disappears. It sinks in water, and is partly dissolved, giving to it a yellowish colour. It is soluble in alcohol, ether, and chloroform, but when agitated with water it is in great part separated from its ethereal and chloroformic solutions. It has no basic qualities; its aqueous solution is not precipitated either by tannic acid or the chloriodide of mercury and potassium. It is highly combustible, burning with a yellow, smoky flame. It yields no Prussian blue when mixed with sulphate of iron, alcohol, and potash, and its vapour produces no cyanide of silver in a solution of the nitrate. It is distinguished from all other liquids, excepting the essential oil of almonds, by its odour, and from this oil by the following test:— Pour a few drops of each liquid on a plate, and add a drop of strong sulphuric acid. The oil of almonds acquires a rich crimson colour with a yellow border, the nitrobenzole produces no colour. In order to separate it from organic liquids, they may be acidulated with sulphuric acid, and submitted to distillation. If any of it exists in a free state, its odour will be sufficient for detecting its presence. If converted into aniline, another process will be required. There is no probability that this liquid will be successfully employed for the purposes of murder without the certainty of detection.

9. *Poisoning by Aniline.*

This is a narcotic poison in liquid or vapour resembling nitrobenzole in its toxicological effects. Schuchardt found that a small rabbit was killed by sixty drops in six and a quarter hours, and a large rabbit by one hundred drops in four hours. There was loss of sensibility, with loss of heat; and violent clonic and tonic convulsions ensued, which continued until death. From experiments hitherto performed, it does not appear to be an active poison as a liquid, and it seems to affect the spinal marrow more than the brain. It has also a local

irritant action. Dr. Turnbull gave half a drachm of the sulphate to a dog. In two and a half hours, the animal vomited, and an hour later it was purged. It became dull, weak, and tremulous; the pulse was rapid, and the breathing laboured. The feet were cold, the hind legs paralyzed, and the tongue was of a blue colour. In five hours the symptoms abated, and the next day the animal had recovered. ('Lancet,' Nov. 16, 1861.)

Dr. Letheby found that aniline given to dogs and cats in doses of from twenty to sixty drops caused a rapid loss of voluntary power. The animal staggered and fell upon its side powerless, the head was drawn back, the pupils were dilated, the breathing was difficult, and the action of the heart tumultuous; there were slight twitchings or spasms of the muscles, and the animal quickly passed into a state of coma, from which it did not recover, death taking place in from half an hour to thirty-two hours. On inspection the brain and its membranes were congested, the cavities of the heart were nearly full of blood, and the lungs slightly congested. The blood all over the body was black and coagulated. The poison was easily discovered in the brain, the stomach, and the liver, although it was found that, as nitrobenzole is changed into aniline, so in some cases aniline and its salts are converted into mauve or magenta. This arises from the oxidation of the salts, and it has been especially observed on the surface of the body. ('Proc. Royal Society,' No. 56, 1863, p. 556.) There is no instance recorded of the effects of aniline as a poison on the human body. It is a liquid of nauseous odour and taste, and could hardly be taken or administered without the consciousness of the person taking it. The salts appear to have very little action. They have been used medicinally in large doses without producing any unusual effects. In one case 406 grains of the sulphate of aniline were given to a patient in the London Hospital, in the course of a few days, without any symptoms of poisoning. (Dr. Letheby, *loc. cit.* See also cases by Dr. Fraser, 'Med. Times and Gazette,' March 8, 1862, p. 239.) It is difficult to suppose that combination with an acid to form a perfectly soluble salt can render aniline inert, as this would be contrary to experience in reference to other bases, *e. g.* nicotina and conia; at the same time, if we except

the action of the vapour, no case has occurred which will enable us to solve the question.

There are facts which show that the *vapour* of aniline, even when much diluted, exerts a poisonous effect on man. Mr. Knaggs met with a case in which a workman accidentally broke a carboy containing a large quantity of this liquid; the aniline fell over him, but none entered his mouth. In his anxiety to wipe up the aniline he respired the vapour for some time, felt giddy, and complained of his head and chest. When seen some hours after the accident his face and body were of a livid leaden hue, the lips, gums, tongue, and eyes, of a corpse-like bluish pallor; he was breathing by gasping, and appeared at the point of death. There was no convulsion; he was sensible, and able to give a correct account of his feelings. His pulse was small and irregular. Under active treatment he recovered. ('Pharm. Journ.,' July, 1862, p. 42.)

Dr. Letheby relates the following case:—In July, 1861, a boy *æt.* 16 was brought into the London Hospital, in a semi-comatose condition. In scrubbing out an aniline vat he had breathed the vapour; and, although he did not suffer pain or discomfort at the time, he was suddenly seized with giddiness and insensibility. When brought to the hospital he looked like a person in the last stage of intoxication; the face and surface of the body were cold, and the pulse was slow and almost imperceptible; the action of the heart was feeble, and the breathing heavy and laborious. After rallying a little, he complained of pain in his head and giddiness. His face had a purple hue, and his lips, the lining membrane of his mouth, as well as his nails, had a similar purple tint. On the next day the narcotic symptoms had passed away, but he was remarkably blue, and looked like a patient in the last stage of cholera. These cases appear to show that aniline vapour is less poisonous than that of nitrobenzole, and that the symptoms follow more rapidly on the inhalation of the vapour. For a full account of the effects of aniline on animals, I must refer the reader to a pamphlet by Dr. Sonnenkalb, of Leipsic—'Anilin und Anilinfarben in toxikologischer und medicinalpolizeilicher Beziehung,' Leipzig, 1864, p. 20. The injurious effects to public health likely to arise from the employment of aniline

colours in confectionery and cosmetics are also fully described in this essay.

Analysis.—Commercial aniline is an oily liquid, of a reddish-brown colour, with a peculiar tarry odour. It produces a volatile greasy stain on paper. It is volatile and combustible, burning with a thick smoky flame. It falls to the bottom of water, and does not readily dissolve in it. It is quite soluble in alcohol and ether, but not in chloroform; in the latter property it differs from nitrobenzole. Diluted sulphuric acid combines with it to produce a white compound, which is soluble in water. A solution of chloride of lime added to the acid watery liquid produces a splendid colour of various shades of purple and red.

The solution of sulphate of aniline is not precipitated either by tannic acid or chloriodide of mercury and potassium; but aniline itself, in the small quantity in which it is dissolved by water, yields, like the alkalies, a yellow precipitate with arsenio-nitrate of silver. It also reduces completely a solution of chloride of gold—precipitating metallic gold. A minute quantity of aniline may thus be detected. When pure aniline is heated with powdered corrosive sublimate, it produces a rich crimson dye. When present in organic liquids, aniline may be separated by digesting the concentrated liquid in alcohol, mixed with a little diluted sulphuric acid. The alcoholic extract, distilled at a high temperature with a solution of potash, yields aniline in the receiver. This may be tested by the methods above described.

10. *The Process for Detecting Chloroform in the Blood.*

The process usually adopted consists in placing the liquid supposed to contain chloroform in a Florence flask, the neck of which is fitted with a cork, perforated to admit a hard glass tube, bent at right angles, and having a length of from twelve to fifteen inches. The flask is gradually plunged into water at about 160° , and at the same time the middle portion of the tube is heated to full redness by an air-gas jet. At a red heat chloroform vapour is decomposed, and chlorine and

hydrochloric acid are products of its decomposition. Litmus paper applied to the mouth of the tube is reddened; starch paper wetted with iodide of potassium is rendered blue, and nitrate of silver is precipitated white.

Two drops of pure chloroform were thus readily detected, and so persistent was the vapour in the flask that it was detected after one, two, and even three weeks, although nothing could be seen in the flask. Two drops added to a quantity of putrefied blood were detected by a similar process after a fortnight, the flask being closed, but the mouth of the tube remaining exposed to the air. This method of detecting chloroform by its products in experiments thus conducted appears to be perfectly satisfactory. In practice, however, it will be found a very difficult matter to detect it, even where we know that it has been administered. Some years since, in conjunction with the late Dr. Snow, I examined by this process the blood of a boy who had died in Guy's Hospital from the effects of chloroform vapour, but without detecting any trace of it. There was no odour in the blood, and the result was negative. In 1863 I examined on three occasions blood taken from patients while they were under the full operation of chloroform. It was brought from the operating-table of Guy's Hospital, where it had been collected in closely stopped glass bottles. One of the samples, examined within half an hour after removal from the living body, had no odour of chloroform, and gave not the slightest chemical indication of its presence. The two other samples kept in close bottles until tested forty-eight hours after removal, did not contain a trace of chloroform vapour. Either the quantity in a few ounces of blood is too small for detection, or it is rapidly lost by its volatility, or it is converted in the blood into formic acid or some other product, and is thus withdrawn from this method of analysis.

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