

Poison and Poisoning

A Compendium of Cases, Catastrophes and Crimes

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Chapter 2

Momentous Minerals and Deadly Dusts

Our own planet can cost us our lives. For thousands of years, we have known that there are many poisons of mineral origin, from the very earth beneath our feet. These substances cause poisoning in humans because the body absorbs them in error, mistaking them for those essential elements that the body really needs, such as minerals to incorporate into enzymes. This mix-up happens because of the similarity of the poisonous minerals' atomic size to that of the essential elements.

Some deadly natural chemicals

Antimony is a metallic element widely used in modern industry in alloys and semiconductors. Its compounds are used in flame-proofing and rubber technology, paints and dyestuffs, as well as ceramics, enamels and glass. Even in the Middle Ages it was known that pigs thrived if a little antimony was added to their feed, given as the compound antimony potassium tartrate. However, the same feed supplement, if given to humans, causes people to vomit, which explains this compound's name, tartar emetic (emetic means to cause vomiting). Medicines containing antimony have been used for centuries, but few have been used as a means of poisoning, as in the case of Charles Bravo.

* Charles Bravo was an ambitious 31-year-old barrister who was poisoned with tartar emetic in 1876. It took him three days to die. A number of suspects were involved in the case: his beautiful heiress wife, Florence, aged 29; her physician lover; and the stableman George Griffiths, who bore a grudge, having been dismissed by Mr Bravo. George also had a supply of the poison, which he kept for worming the horses.

Florence had been married before, and during her previous marriage she had taken to drinking heavily, so she had gone to Malvern to take the water cure. It was there that she began an affair with the physician James Gully, who was twice her age. Dr Gully made her pregnant and then performed an abortion, an illegal act at the time for which Florence was ostracised by her social circle. Her second marriage to Mr Bravo reinstated her position in society, but it made her lover very jealous.

Florence was very rich, and for Charles Bravo, this marriage offered the possibility of access to her fortune. He had political ambitions and hoped to enter parliament. However, the night before the poisoning, there was a furious row between husband and wife as Florence had invoked the Married Women's Property Act of 1870 to prevent Charles from getting his hands on her wealth.

In her first marriage, Florence had been abused, and she now found herself abused again by Charles Bravo. He was autocratic, and she claimed he made her perform 'un-natural acts'. She had by now suffered two miscarriages, and had come to dread his visits to her bedroom. On the night in question, Florence drank too much and retired to her bed, as did her housekeeper. Charles then retired to his room and drank a glass of water from the carafe beside his bed. This water was poisoned: it contained tartar emetic in sufficient quantity that Charles was quickly writhing in agony and vomiting severely, although it took several days for him to die.

Jane Cox, Florence's housekeeper and companion, a Jamaican woman with three sons, lied to the police and destroyed some evidence, fearing that she and her sons would be left destitute following their master's death. As a consequence, with so many suspects who all had reasons to kill Charles Bravo, it is no surprise to

discover that the Coroner's Court was unable to apportion blame to any one person. However, following the inquest, Florence was disowned by her family and died, an alcoholic, at the age of only 32. *

Arsenic and its compounds are extremely poisonous and were used in the past as weed killers, insecticides and wood preservatives. Despite its poisonous nature, arsenic is actually present in all our bodies, but only at a very low level, measured in millionths of a gram. It appears to be an essential trace element in some animals, and may also be so in humans. Experiments found that chickens that were fed on an arsenic-free diet had their growth stunted, and the same result was found when testing rats on a similar diet.

Arsenic attaches to sulphur-containing enzymes and, by blocking their action, causes the toxic effects seen in poisoning. The body can excrete arsenic quite easily, so low doses obtained in the normal diet can be readily disposed of. Shellfish can contain quite high levels, but they can store it safely by converting it to a safe form called arsenobetaine, which does not harm the shellfish and does not harm us either, when we eat shellfish, as the arsenobetaine is readily absorbed from the gut and equally readily excreted through the urine.

The symptoms of acute arsenic poisoning are vomiting and diarrhoea, progressing to numbness and tingling of the feet, followed by muscular cramps, suppression of the urine, intense thirst, prostration and collapse. Chronic, long-term, low-level arsenical poisoning is characterised by rather different symptoms: there is a tendency to oedema (swelling up), due to the accumulation of fluid in the tissues, especially of the face and eyelids, with a feeling of facial stiffness, itching, tenderness of the mouth, loss of appetite, nausea, sickness and diarrhoea.

A hundred years ago, a common method of poisoning made use of arsenic-containing flypapers soaked in water, which provided a toxic solution. This solution could then be added very easily to food and drink, as it was both tasteless and odourless. Such a simple method was used by many murderers, and one instance, that of Frederick Seddon, eventually led to a change in the law.

* Florence Elizabeth Maybrick was born in Alabama, USA, and was the daughter of a titled lady, the Baroness von Roques. She married James Maybrick, a Liverpool trader, in 1881. James was 23 years older than his wife and was a hypochondriac. He regularly took small doses of arsenic, which he considered to be an aphrodisiac, as did many others in those days. The Maybricks lived in a large house in Liverpool with their two children, five servants and a nanny.

In 1887 Florence discovered that her husband kept a mistress, so she took a lover, a family friend named Alfred Brierley. In March 1889 she and her lover spent a weekend in London together, but James found out about it. The Maybricks quarrelled and James gave his wife a beating. Two weeks later, Florence bought a dozen arsenic-based flypapers from the local chemist and, at the end of April, her husband became ill. She told the doctor that her husband was taking 'a white powder'. He rallied briefly but died on 11th May.

The nanny was suspicious and handed over some compromising letters to the dead man's brother. The house and particularly Florence's room were searched, and a packet labelled 'Arsenic poison for cats' was found. Traces of arsenic were found in James Maybrick's body, and so the coroner's jury returned a verdict of murder. Florence was tried in Liverpool in July 1889. The defence proposed that this was a natural

death. Traces of strychnine, hyoscine and morphine, as well as arsenic, were found in his stomach, suggesting that James, the known hypochondriac, had poisoned himself.

However, the unfaithful wife was found guilty by the court who were prejudiced against her for her waywardness. The death sentence was passed but was later commuted to life imprisonment, of which Florence served some 15 years before being released. She died, aged 76, in Florida in 1941. *

* Frederick Seddon worked for an insurance company. In 1911 he and his wife took in a lodger, Miss Eliza Barrow, a 49-year-old spinster. She owned substantial property and had a cash box that contained hundreds of pounds in gold, which she kept under her bed because she had no faith in banks. As an officer of an insurance company, Mr Seddon persuaded her to let him handle her affairs.

And so, within a short time, Miss Eliza Barrow had signed over most of her property to Seddon in return for a small annuity and remission of her rent. It was not long afterwards that she fell violently ill, with vomiting and diarrhoea. The illness continued for several months until she eventually died. Despite there being ample money for a decent funeral, Mr Seddon gave her only a pauper's grave, and even managed to earn 12 shillings in commission from the undertaker in the process.

Miss Barrow's cousin learnt of her death from the local newspaper. After speaking to Mr Seddon and getting only evasive answers from him, he then found that all her money had apparently disappeared. At this point the cousin went to the police with his suspicions. The body was exhumed and body tissues analysed: arsenic was found in sufficient quantity to suggest murder. Mr and Mrs Seddon were both arrested and put on trial.

The evidence against them was somewhat flimsy as the only arsenic that could be found was in the flypapers that had hung above Miss Barrow's bed. According to Mr Seddon, they were used instead of carbolic, by which he meant carbolic acid, the old name for phenol. Carbolic acid was first used as an antiseptic and disinfectant by Joseph Lister in 1867 and was widely used for almost a hundred years. Frederick Seddon tried to use a lot of bluff and bluster in court, where he even used the Freemason's oath in a desperate attempt to evade justice. His manner throughout the trial led the jury to convict him, while they acquitted his wife.

It was found that Frederick Seddon obtained arsenic by extracting it from the flypapers. White arsenic, as its name suggests, is white and opaque, like flour. It has little taste and no colour and so can be mixed into food by anyone with murderous intent. In the nineteenth and early twentieth centuries, white arsenic was combined with potash or soda to make flypapers. By soaking the flypapers in water, a strong solution containing arsenic could easily be obtained, and Frederick Seddon used this simple method. He was duly hanged at Pentonville Prison in 1912. The law relating to the sale or supply of flypapers containing arsenic was amended as a consequence of this and too many other similar cases of poisoning. *

Arsenic has a prolonged action, so in many criminal cases of arsenical poisoning, where the poison was administered over a period of time, the symptoms shown may be those of acute poisoning caused by the final dose, or they may be the more chronic symptoms of long-term nerve, kidney or liver damage. The symptoms shown will vary from patient to patient, depending on the doses used and the length of time involved for the chronic poisoning. Continued use of small doses over long periods may also cause dryness, pigmentation and thickening of the skin, which may be

accompanied by peripheral neuritis and alopecia. The breath may smell of garlic. Chronic inhalation may also result in perforation of the nasal septum, an effect also seen today in cocaine addicts.

As little as 70mg of arsenic trioxide may be fatal as a single dose, and if adequate treatment is not given, death can occur within as little as an hour, although it more often takes 24 to 48.¹ Fortunately, arsenic and its compounds are far less common and much more strictly controlled today, detection is now easy and treatment with an antidote is readily available.

Cadmium is widely used in industry today, but many of its compounds have been found to be poisonous. This metal has similar properties to zinc, and so can be absorbed in error by the body, mistaking it for zinc. Zinc-containing enzymes perform many vital functions, as they are involved in many systems, such as regulating growth, development, longevity and fertility, as well as digestion, nucleic acid synthesis and the immune system. Interference with these key proteins can have dire consequences for the normal functioning of the body.

The presence of cadmium in the body triggers a defence mechanism in which production of a special enzyme is stimulated. This enzyme contains a lot of sulphur atoms to which the cadmium atoms can attach: seven cadmium atoms to each enzyme molecule. These conglomerates are then transported to the kidneys for excretion. Unfortunately, the cadmium atoms are so strongly bound that they tend to accumulate there, causing damage to the kidneys and, eventually, kidney failure.

The natural rate of excretion of cadmium is so slow that the harmful mineral can stay in the body for about thirty years. Consequently, even the smallest possible intake

can cause problems. The replacement of zinc by cadmium in the testes, for example, damages viable sperm production.

Chromium or its salts, when taken by mouth, may lead to serious gut and kidney problems. This results in greatly reduced urine production, with large amounts of sugar in the urine. The blood supply to the limbs is also greatly reduced. The acute symptoms are intense thirst, dizziness, abdominal pain, vomiting and diarrhoea, leading to liver and kidney damage, which may prove fatal. Less than half a gram of potassium dichromate can cause serious poisoning, and the fatal dose is less than 8g.

Skin contact with chromium salts causes a widespread dermatitis, usually on the hands and other exposed parts of the body, frequently accompanied by deep perforating ulcers known as 'chrome holes'.

Chrome dust, if inhaled, causes rhinitis – inflammation of the mucous membrane of the nasal passages – resulting in perforating ulcers of the nasal septum. Inhalation may also cause severe lung damage and bronchitis as well as gastritis and other inflammatory conditions, particularly of the eyes. There is also an increased risk of lung cancer, and there may even be central nervous system damage.²

Copper is an essential element, being part of more than ten enzymes in the body. A body deficient in copper is unlikely, as we receive all our needs from our diet and drinking water (more so in soft water areas with copper pipes). A trace of copper is essential for a number of our enzyme systems, the most important of which is the 'cytochrome c oxidase' enzyme system, which is required by all cells to produce energy. During trials with copper-plated door handles and other fittings at Birmingham Children's Hospital, it was recently

shown that the bacteria causing MRSA – Methicillin (or Multiple) Resistant Staphylococcus Aureus – infections are killed in less than a minute when in contact with copper.

Copper is part of other enzymes, including those that are involved in repairing connective tissue, those that produce hormones and the skin pigment melanin and those that remove certain harmful protein breakdown products called amines. However, poisoning can occur, as happens in the rare inherited condition Wilson's disease, in which copper accumulates because its excretion is impaired. Providing the excess copper is removed from the body by regular treatment, both the physical and mental development of sufferers may be unaffected. When it is not properly removed, that's when copper becomes a real poison.

Iodine is essential to life in animals, but not so in plants or algae, although they absorb it from soil and seawater respectively. Iodine is essential to humans for the production of the thyroid hormone, which regulates the metabolic rate of the body. Kelp is included as an ingredient in herbal slimming preparations because of its iodine content, in the hopes that extra iodine might speed up the metabolism a little and thus help with weight loss.

However, you can have too much of a good thing. Too much iodine can be toxic and may interfere with female fertility. In addition, when heated, iodine forms a vapour that irritates the eyes and lungs. In industry, there are now limits placed on iodine's concentration in the air.

Iron, although poisonous, is essential to human life. People with a reduced iron level in their blood (a medical condition called anaemia) feel tired, because a lack of haemoglobin (haem is an iron-containing compound) means there is insufficient oxygen being

carried around the body. Haem is responsible for both the red colour of blood and its oxygen-carrying capacity.

Not all blood is red though. While our red blood contains iron as part of the haemoglobin molecule, some animals like octopuses, oysters, snails and spiders have blue blood, because they have copper instead of iron contained at the centre of their oxygen-carrying molecule, haemocyanin.

Iron is also a part of various enzyme systems, including those involved in the synthesis of DNA. The brain needs iron to function properly. Excess iron is stored in the liver, where it is held as the iron storage proteins ferritin and haemosiderin. The bone marrow, where red blood cells are made, is another part of the body that is naturally rich in iron.

Although rare, some people are allergic to iron. In the 1970s, a 66-year-old toolmaker suffered from an allergic contact dermatitis due to exposure to iron.³

Oral doses of iron, such as ferrous sulphate tablets, are best absorbed on an empty stomach, but they are usually taken after food as they can be an irritant to the stomach of some patients. In overdose they can be corrosive to the gastro-intestinal tract, where necrosis and perforation may occur. The symptoms may be delayed for some hours and can include epigastric pain, diarrhoea and vomiting blood. If the diarrhoea and bleeding are very severe, circulatory failure can result, leading to death.

Poisoning from swallowing iron tablets can be particularly dangerous to small children, as it can result in a severe electrolyte imbalance that develops soon after the tablets have been absorbed. So speed is essential in treating such children, as a dose of as little as five ferrous sulphate tablets can be considered toxic

in small children.⁴ This topic will be discussed in more detail in a later chapter about paediatric poisoning.

Lead, used by humans for thousands of years, is easily extracted from the sulphide ore galena simply by heating. Lead is a very useful metal; because it is so soft, it can easily be worked, bent and shaped even at room temperature. It has been used for pipe work since Roman times, despite its poisonous properties, which were known even then. As a heavy metal, lead is also widely used in industry, paints, batteries and as tetraethyl lead, an antiknock agent which used to be added to petrol.

Lead's poisonous qualities have been known since ancient times. Lead poisoning, or plumbism, may be acute or chronic and can be caused by either organic or inorganic lead. Lead poisoning causes gastro-intestinal and cardiovascular effects, as well as liver and kidney damage, but it does the most damage to the central nervous system, causing mental disturbances and even convulsions.

Symptoms of acute lead poisoning include intense thirst, a metallic taste in the mouth, a burning abdominal pain called lead colic, vomiting and diarrhoea. Longer exposure leads to anorexia, anaemia, peripheral nerve damage and brain damage, together with convulsions and coma. There can be permanent kidney damage and impairment of mental function.

Chronic poisoning is due to the accumulation of small quantities over a prolonged period of time following inhalation, ingestion or absorption through the skin, leading to the development of a characteristic black or blue lead line on the gums. The fatal dose is estimated to be 500mg.⁵

This infamous poisonous metal – lead and its

compounds – will be discussed in many chapters of this book.

Lithium's mode of action is not yet fully known. However, it is confirmed that it competes with sodium at various sites in the body and acts on the brain, where it was found that those suffering from bipolar disorder, formerly called manic depression, have an excess production of a chemical messenger. Lithium appears to interfere with the production of this messenger, reducing it to normal levels, and so making life more bearable for those suffering from bipolar disorder.

The therapeutic dose of lithium is not much less than the toxic level, so patients must have regular blood tests to check for toxicity. Symptoms of toxicity are tremor, weakness, nausea, thirst and excessive urination. Lithium interferes with thyroid function and long-term use can cause kidney function changes; too high a dose of lithium can ultimately lead to renal (kidney) failure. An overdose can be fatal.

Manganese is yet another essential element, but we need only a very small quantity for a number of important enzymes, such as those involved in glucose metabolism, and for the functioning of thiamine (vitamin B1). Most manganese is found in our bones, but it also concentrates in the pituitary and mammary glands, the liver and the pancreas. Inhalation by miners in under-ventilated mines causes brain damage and symptoms similar to Parkinsonism.

Mercury is a heavy metal that we acquire from our food, although our bodies have no use for it at all. Mercury can be absorbed through the lungs, the skin and the digestive tract. Most mercury in the body is found stored in the kidneys, liver, spleen and brain. It is the only metal that is liquid at room temperature, which explains why, in the past, it was called quicksilver.