

## THE UBIQUITOUS POISON

*The Inaugural Address of the 160th Session of the  
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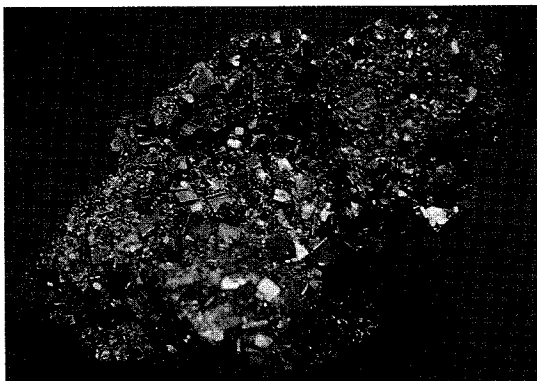
By: The President — Dr Susan Evans

Mr Past-President, Past-Presidents, distinguished guests, Members, ladies and gentlemen, family and friends:

It was in 1944 that Dr Richard Stopford-Taylor delivered his presidential address to this Institution on the subject of 'The History of Dermatology'. He was a dermatologist as was his father, and both practised in Liverpool.

The first hospital for skin diseases was established at 17 Islington in 1862 as a skin and cancer hospital. It was transferred, however, to the former Radium Institute in Myrtle Street. A second small skin hospital known as St George's Hospital for Skin Diseases was opened in Grenville Street South, off Great George's Street, in 1863 and was amalgamated with the Royal Southern Hospital in 1928.

The Royal Southern Hospital opened a clinic with Frank Barendt in charge in 1900, and it was he who became involved in treating patients affected in the great British beer poisoning epidemic of 1900. This occurred among beer drinkers of the Manchester, Salford, Stafford and Liverpool districts of England when 6,000 people became ill and of these 70 died. The source of the poisoning was arsenic, which was traced to a particular firm, Bostock & Co, who had supplied the glucose used in the brewing process. Sulphuric acid is used in the manufacture of brewing sugars and is produced from iron pyrite, often contaminated with arsenic (Figure 1). This particular pyrite was from a copper mine in Spain which contained an unusually high quantity of arsenic. The firm responsible was Nicholson & Son of Leeds who up to 1900 had supplied Bostock's with dearsenicated sulphuric acid. At the time of the poisoning, Bostock's was sending glucose to 200 breweries in the North of England and the Midlands.



**Figure 1: Iron pyrite (fool's gold)**

As long ago as 1878, Clouet reported that commercial glucose usually contained arsenic and in 1896 Blyth predicted that arsenical poisoning of beer would result from this source.

In November 1900 Dr Septimus Reynolds, assistant physician to the Manchester Royal Infirmary and visiting physician to Manchester Workhouse Infirmary, Crumpsall, published in the *British Medical Journal* his observations of an epidemic of peripheral neuritis amongst beer drinkers in Manchester and district.

From August 1900 increasing numbers of patients were presenting with peripheral neuritis. These were admitted to the Manchester Royal Infirmary, Crumpsall, Ancoats and the Manchester Skin Hospital. They complained of pins and needles, numbness and burning sensations in the hands and feet and tender muscles. It was initially thought that there was an epidemic of alcoholic peripheral neuritis but many also had odd skin rashes and increased pigmentation of the skin with running of the nose and eyes. Women were more severely affected than men even though they were, in the main, light drinkers. Dr Reynolds thought that the only three causes of peripheral neuritis of this type were beriberi, alcohol and arsenic. The obvious cause was arsenic mainly because of the increased pigmentation of the skin.

Professor Dixon Mann of Manchester University found large quantities of arsenic in samples of the beer and later this was found in the urine, skin, hair and nails of the patients.

Many sufferers were admitted to the Liverpool hospitals, especially Mill Road Infirmary, under the care of the medical superintendent, Dr Nathan Raw, who worked with Dr Stopford-Taylor Snr, and he had at this time at least 88 of these patients under his care.

Signs of acute arsenical poisoning are abdominal pain, vomiting, haemorrhage, collapse, convulsions and death. In the more chronic poisoning, inflammation of the respiratory tract leads to hoarseness, the breath smells of garlic and there is vomiting, diarrhoea, weakness and loss of appetite. The victim seems to waste away and terminally the ankles swell, eyelids become puffy, hair and nails become brittle and fall out. The skin becomes pigmented and warty. In addition a peripheral neuritis with complaints of pins and needles in the hands and feet develops, similar to that occurring in alcoholic or lead poisoning (Figure 2). A peripheral vascular disease may also occur, leading to gangrene. Long-term effects of arsenic poisoning include liver, heart and neurotoxicity, hypertension, diabetes, cataracts, cancers of the skin and internal cancers, especially of lung and bladder.



**Figure 2: Arsenical peripheral neuritis causing wrist drop**

The Royal Commission on Arsenical Poisoning, comprising six members, was appointed by command of King Edward VII on February 4 1901, headed by Lord Kelvin. The full symptomatology and presentation of arsenical poisoning was defined and methods of chemical analysis to detect arsenic were refined as a result of their report. It was further discovered that in British breweries a regular practice was to dry the barley in the fumes of arsenic-containing malting fuels. This imparted a characteristic smoky flavour to English ales, distinguishing them from the beers of Germany and Austria.

In general the source of arsenical poisoning may be suicidal, homicidal or accidental, or it may be occupational, environmental or medicinal.

Arsenic was known to the ancients, and in the fourth century BC Aristotle named the sulphide sandarach, and Theophrastus, the element arsenikon, meaning 'potent' from which the name 'arsenic' appears to owe its derivation. The Greek alchemist Olympiodorus obtained white arsenic by roasting sandarach.

Arsenic compounds are amongst the oldest known to us for their treatment properties, being used as a medicine or as a poison as long ago as 2000 BC. It was, however, in the Middle Ages that the toxic properties of arsenic compounds became fully appreciated. It was widely used as an abortifacient, and in the 15th and 16th centuries arsenic became known as the 'King of Poisons', especially through the Borgias who apparently practised mass homicide.

In the 15th century the Borgias, who were of Spanish origin, migrated to Italy and acquired notoriety as poisoners and murderers. Rodrigo Borgia became Pope Alexander VI in 1492 and it was his ambitious son Cesare to whom the worst excesses of the family were attributed (Figure 3). There is no doubt that Cesare and his wife, Vanozza, concocted a poison known as 'La Cantarella' containing arsenic as its main ingredient to be used to dispose of his enemies. He always wore a signet ring containing a hidden receptacle, which may well have been used to hold arsenic to carry out his evil designs.



**Figure 3: Cesare Borgia**

There is no evidence that the crimes attributed to Lucrezia Borgia by Victor Hugo's writing were true. On her death in Ferrara, a contemporary wrote of her as 'one who appeared to have been universally beloved, not only for the habitual piety of her life but for her unbounded charity and kindness of heart'.

The study of poisons for criminal purposes developed into a cult in Italy, and the Italian school of poisoners became known throughout Europe. Its members were ready, on receipt of certain fees, to carry out murders by poison to order.

The Venetian poisoners began their operations early in the 16th century, and a mania for poisons led the governments of the States to consider removal of emperors, princes and powerful nobles.

The Roman school of poisoners continued their activities until the early 18th century.

Arsenic was often combined with animal or vegetable poisons, and the most notorious poisoner of this time was a woman named Toffana, who is said to have been responsible for murdering over 600 people with arsenic. She began her evil career in 1650 in Palermo but moved to Naples in 1659, which became the centre of her nefarious trade. She used various names for her poison: 'Aquetta di Napoli', 'Manna of St Nicholas di Bari' or 'Aqua Toffana'. Bottles of these poisons were freely sold, especially to women, reputedly as a cosmetic to improve the complexion. The liquid was often used by young women to poison their usually older and wealthy husbands. At least two popes and other church dignitaries are said to have been victims of 'Toffana's Aqua'.

It was Renaissance Italy that the Western world had to thank for its pharmacopoeia of poisons.

To 17th century France, poison was the Italian crime just as sodomy was the Italian vice and venereal disease the Italian malady.

Poison was considered the importation of the two Medici queens of France. One of them, Catherine de Medici, bride to the Valois King Henri II, arrived with a sinister suite of poisoners and necromancers. Throughout her reign she encouraged practitioners of the occult sciences and the black arts. The baffling poet-oracle Nostradamus was one to enjoy her patronage. 'Rat killer', white arsenic, was the chief poison used, and being odourless and tasteless it defied detection. It became a woman's weapon and to be 'Italianated' was the term used for poisoning in France at that time.

In the 17th century occurred the infamous case of the Marquise de Brinvilliers, who became interested in the study of poisons. She and her lover, known as Sante-Croix, assisted by an apothecary named Glaser, concocted various poisons, some of which contained arsenic and toads' venom.

She experimented on patients in hospital under the cover of sympathetic visits and then proceeded to murder her husband, father and two brothers to obtain money and their possessions. She was tortured and executed. The more popular method of executing poisoners at that time was by drawing and quartering.

Over the years, arsenic has acquired in the public mind notoriety as a poison, unequalled by any other substance.

During the first half of the 19th century, arsenical poisoning was still common in England and France. However, by 1870 there had been a fall in this incidence especially in France, where only two cases in each of 1870 and 1871 were reported. This reduction can be attributed to the legislative measures restricting its sale as well as to public awareness that arsenic can be readily detected in tissues long after death.

The trial in 1889 of Mrs Maybrick here in Liverpool at St George's Hall for the murder of her husband by poison played a major part in influencing changes in English criminal law. The defendant at that time was not allowed to give evidence and there was no Court of Appeal to which the verdict could be referred on any ground whatsoever. It was largely as a result of this case that the Criminal Appeal Bill of 1907 was passed.

The American Florence Chandler (Figure 4), aged 18, met James Maybrick, a Liverpool cotton broker, aged 42, aboard a transatlantic liner en route to Liverpool in 1881. They became engaged on board, married in London and settled in Liverpool, renting a house in Aigburth, Battlecrease House, 6 Riversdale Road, where Professor Norman Jeffcoate, one of our former Presidents, used to live.



**Figure 4: Florence Maybrick**

She bore him two children but discovering that he had five children from a mistress, the last two after their marriage, her ardour cooled and she acquired a lover.

In 1889 James Maybrick became ill and was attended to by Dr William Carter, physician to the Royal Southern Hospital and President to the Liverpool Medical Institution at the time.

Although before his death James and Florence were reconciled, she was accused of murdering him despite his death being certified as due to gastroenteritis, as arsenic had been found in his organs.

Florence had purchased arsenic-impregnated flypaper not long before to use as a cosmetic, but no-one believed her at her trial. They had been found soaking in water in the house during his illness.

She was convicted but her sentence was reprieved to penal servitude and she was finally released in 1904, spending her last days in America.

There is no doubt that James Maybrick was, however, an arsenic eater consuming large amounts of up to one-third of a grain per day of arsenic by prescription and arsenic powders which he kept in the house. This was attested to by friends, acquaintances, his doctor and various chemists.

If in fact the prescription for the arsenic-containing solution for topical cosmetic use had been produced at Florence's trial, this would have cast doubt on the prosecutor's case. This was found by her mother inside Florence's Bible several years later.

I do not think that Florence was guilty of her husband's death and the grandson of her defence counsel, Sir Charles Russell, certainly does not.

In the early 19th century it was realised that peasants in Styria, a province in Austria, and nearby Hungary were in the habit of taking arsenic of up to 10 grains a day until they had become almost immune to it. They became known as the 'arsenic eaters of Styria' and the habit was called 'arsenophagy'. In fact, the regular consumption was known in the 16th and 17th centuries but kept secret and referred to as 'the elixir of the devil'. They used yellow arsenic powder and Styrians obtained it from the Dalmatian coastal belt of Croatia. One theory is that the habit was introduced by gypsies from Hungary travelling to Austria with horses which they regularly fed with arsenic, and that the peasant population began to take it also. The gypsies gave it to their horses to increase their muscle bulk and work capability, their wellbeing and the appearance of their coats. Menfolk took it to keep themselves healthy, increase their physical strength and sexual prowess. The women took it to improve their complexions and give themselves a plump figure.

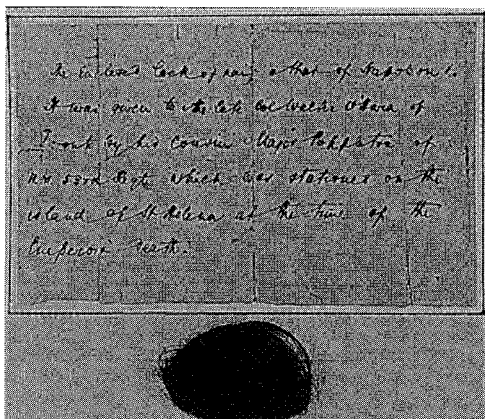
Another theory is that tribes from Illyria, the Adriatic coastal region west of the Balkans, moved to Macedonia, Albania and the mountainous regions of western Austria, Styria, introducing the habit. Peasants in this area continued eating arsenic until after the First World War. The younger generation stopped because of loss of horses in the conflict and the habit died out.

In 1994 *The Times* announced that the American FBI were to subject hairs of Napoleon Bonaparte (Figure 5) to atomic absorption (neutron activation analysis) to decide if he had died of arsenical poisoning. Some hairs were found to have high amounts of arsenic in them whereas others did not.



**Figure 5:**  
**Napoleon Bonaparte**

This lock of hair (Figure 6) had been obtained from Major Poppleton, one of the staff officers on St Helena. He had given it to his uncle, whose relatives kept it until the First World War. It is now owned by Mr Albert William Plenty of Toronto.

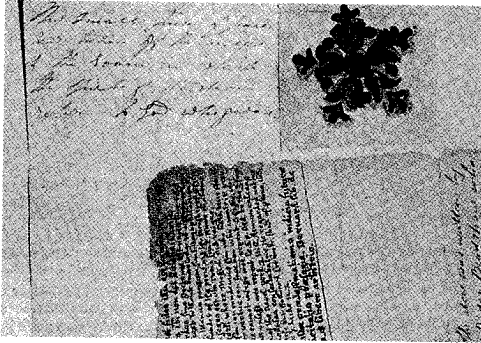


**Figure 6: Lock of Napoleon's hair**

Neutron activation analysis showed normal levels of arsenic. However, the debate has continued to the present day, the French accusing the British doctors of poisoning him. It is known, however, that Napoleon hated doctors and only saw a few during his exile on St Helena.

The Comte of Montholon is reported to have confessed to poisoning Napoleon when he was a member of his household on St Helena, claiming he had added arsenic to his wine from 1817 to 1821. Frank McLinn in his recent biography of Napoleon is absolutely convinced he was the culprit, being bribed by the Bourbons to kill him. He was thought to be an unscrupulous adventurer trained in the black arts of poisoning, which were a special feature of that era.

Another explanation for the presence of arsenic in the hair is the possible release of arsenic gas from wallpaper in Longwood House where Napoleon was incarcerated. On damp wallpaper moulds can metabolise arsenic into the volatile poisonous arsenic methyl which is then released into the atmosphere. In 1982 wallpaper from his room in Longwood House preserved in a scrapbook was analysed and the green area was found to contain arsenic. This black and white picture shows a flock-demarkated rosette on a beige background with bright green areas (Figure 7). The green copper arsenite pigments Scheele's green and Paris or emerald green were introduced in 1780 and widely used in paints and wallpapers. By 1815 these pigments were known to be poisonous and it was thought that in the 19th century many people were made ill and some killed by arsenic from their wallpaper.



**Figure 7: Wallpaper in Longwood House**

We know for sure that Napoleon died of cancer of the stomach as did his father and sister and possibly also his grandfather, one brother and two other sisters. At post-mortem, as well as stomach cancer his body was found to be feminised with the suggestion of testicular atrophy. Napoleon was probably of low potency and sub-fertile. It is likely that his sexual inadequacy nearly led Bonaparte to conquer the world, compensating for these deficiencies by his aggression.

Napoleon was very anxious for a male heir, leading him to divorce Josephine who was by then unable to conceive having been promiscuous and acquired gonorrhoea. He married Marie-Louise of Austria who bore him a son, the 'King of Rome'. He did have at least three illegitimate children as seen here (Figure 8).



**Figure 8: Napoleon with his three children**



I suggest that he took, as was the custom of his day, *Liquor Arsenicalis* to improve his potency. It was also being prescribed at that time for dermatitis and epilepsy, both conditions from which Napoleon suffered. This would explain the presence of arsenic in his hair and also the definitive cause of death, that is cancer of the stomach. Arsenic is carcinogenic so I suspect that he did die of arsenical poisoning, chronic and self-administered and not criminal or accidental.

In 1840 Napoleon's body was transferred from St Helena to Les Invalides and on opening the coffin the body was found to be perfectly preserved. The bodies of other historical figures thought to have been poisoned by arsenic have been similarly well preserved. Arsenic was in fact used as an embalming agent because of these preservative properties.

In the United States the widespread use of arsenic in embalming fluids began in the Civil War, 1861-65, and battlefield embalming stations were set up to enable the bodies of the Union dead to be returned home. From 1856-73 six patents were issued for fluids which contained arsenic, from as little as 4 ounces to as much as 12 pounds per body. After the Civil War the embalmers took their craft home with them and the practice was spread through the whole country and continued until about 1910.

Arsenic, being toxic and persistent, has left a legacy which can potentially harm the health of archaeologists and cemetery workers and impact on the environment. Wooden and metal caskets eventually degrade so arsenic is dissolved by rainwater and spreads to soil or ground water. Sampling from old hand pumps has been conducted in Iowa and also in New York providing evidence of considerable ground water contamination by arsenic. The cemetery workers and archaeologists are now subject to strict health and safety guidelines, wearing protective clothing and respirators to avoid arsenic poisoning ingested via skin contact and inhalation.

The famous disease of Reichenstein was due to arsenic being present in the drinking water. Reichenstein is a small town in Silesia, now Poland, where gold was produced from gold-containing arsenical ores. During smelting, large quantities of arsenical fumes escaped, were precipitated by rain and reached underground streams. The resultant drinking water contained 12.2 ppm of arsenic. For centuries the high incidence of serious disease was known in the area but not until the late 19th century was it recognised by Geyer to be chronic arsenical poisoning. Most of the population had mouth ulcers, gastrointestinal troubles, melanosis, keratotic warts on fingers and cancers. One doctor mentioned that half of his patients had died of cancer. Once recognised the smelting methods changed as did the water supply and the disease disappeared.

One of the most serious occurrences of occupational arsenical poisoning was in Moselle vintners who, like their counterparts in the Beaujolais district, sprayed their crops extensively with arsenic-containing insecticides up to halfway through the Second World War (Figure 9). These people ingested arsenic of up to 30 mg per day by inhalation and skin absorption as well as consuming large quantities of 'house-drink wine', a perk of the job. Many died of arsenical poisoning. It is recorded that 27 of them examined at autopsy had severe chronic arsenicism, 13 suffered from cirrhosis of the liver, and 16 had 28 malignancies between them of which 12 were in the bronchial tree. Other organs affected were the biliary tract, skin and oesophagus.



**Figure 9: Moselle vinyard — Bernkastel**

Tobacco smoke had a high arsenical content due to the practice of the Virginians spraying their tobacco plants with arsenical insecticides. This level has dropped as the practice was stopped in 1955.

In 1994 when our son went to teach in Marseille for a year, being an admirer of Cézanne, we wished to capture this view of Marseille from L'Estaque (Figure 10). One of his schools was nearby, since blown up by one of his recalcitrant pupils, and the whole area much changed since the early 1900s. Driving up an old disused road to get this view, through a prohibited area, we came across this sign. The factory making arsenic was clearly in disrepair, green fluid dripping down the old walls into the Bay of Marseille. Those of you wishing to sample the local delicacy bouillabaisse should be aware of the capacity of shellfish to concentrate arsenic to horrific levels!



**Figure 10: Cézanne's L'Estaque**

The arsenic calamity in West Bengal and Bangladesh is a modern-day instance of environmental pollution on a grand scale. Due to over 50% of all illness and death in young children being caused by germs in food and water, the use of surface water has been largely discontinued in the last 20 years. The World Bank, Unicef and other organisations initiated a programme of sinking over a million tube wells in villages to provide ground water to the Bangladeshi population of 77 million and to over 30 million people in West Bengal.

Supply of drinking water had been one of the few success stories in the public health arena, helping to reduce water-borne diseases such as cholera and typhoid. However, arsenical contamination of this water has become the new headache for the nation.

In 1982 a dermatologist working near Calcutta came across a case of arsenical poisoning with typical skin lesions. Since then he and his colleagues have found many thousands of people in West Bengal suffering from cancers and gangrene and undergoing early death (Figure 11). The first Bangladeshi victims were found in 1985 and since that time the disaster has unfolded, Bangladesh being much more severely affected than India. It is estimated that over 50 million of the Bangladeshi population are either already suffering or at risk. This has led to the people believing this disaster to be witchcraft, and the villagers in remote areas still believe it to be the curse of the devil. Victims are ostracised by villagers who believe that the disease's cancerous sores and rotting limbs are signs of leprosy (Figure 12). Women are unmarriageable, children excluded from school, wives are driven from the family, and men lose their jobs and become outcasts. West Bengal and Bangladesh's 'green revolution' has become a poisoned chalice.



Figure 11: Bangladesh sufferer with loss of fingers from gangrene



Figure 12: Arsenical keratoses

These regions are lying on fine alluvial sediment of a younger deltaic deposition 50-60 million years old. The whole of the Ganges delta basin is affected. The ground water is being drawn from pyrite-rich sedimentary aquifers, and over-pumping has led to the rock drying out. The insoluble inorganic arsenic in the pyrite therefore oxidises, goes into solution and poisons the water.

As well as the water being extracted for drinking, thousands of gallons are used for irrigating the crops so that nowadays Bangladesh is very fertile, producing three crops of rice yearly and becoming a net exporter as well as growing and supplying plenty of fresh vegetables. Bangladesh's resources of sweet water, like rivers, wetlands, flooded river basins and oxbow lakes, are amongst the highest in the world. Moreover the annual rainfall is more than 2000 mm for nine months of the year.

The arsenic calamity of Bangladesh can be brought under control if withdrawal of ground water is restricted, surface water properly utilised and rainwater harvested. Bangladesh requires proper watershed management. In the short term, water from tube wells needs to be tested and if found to contain arsenic, capping can be done. Treatment of arsenicated water can be achieved but it will be costly. The World Bank, Unicef and WHO have now been motivated to instigate and carry out this work.

There is little to be done for those already affected, especially the children. Improving nutrition, especially by increasing protein intake and administering Vitamins A, C and E, will help but many are destined to die young.

Before I finish, I would like to draw your attention to some links in this talk. They begin with arsenic poisoning affecting Liverpudlians in 1900, the source being pyrites, going on to the Maybrick murder case in Liverpool, to the pyrites again causing poisoning in the modern tragedy unfolding in Bangladesh. Next, the convenor of the International Conference on Arsenic Pollution in Bangladesh, in which I took part earlier this year, was Dr Quazi Quamruzzaman from the Dhaka Community Hospital. He had worked in Ormskirk at the Brandreth Hospital at a

time when I was collecting data and studying patients who had been given medicinal arsenic in the Southport and Ormskirk areas of Merseyside up to the 1960s. This work formed the basis for my MD over 20 years ago, and arsenic has remained both a research interest professionally and a topic of historical and literary interest to this day.

Thank you for your attention.