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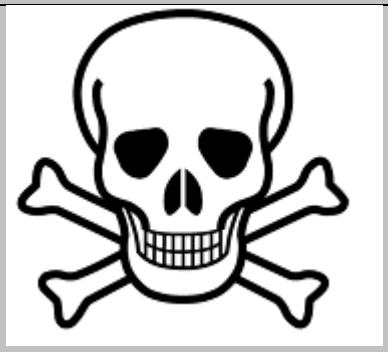
Science and dark deeds at St Helena

Nuclear processes have proved useful in setting at rest the controversies about the death of Napoleon, says S.Ananthanaryanan.

The doubt that Napoleon Bonaparte was poisoned with Arsenic while in captivity on the island of Saint Helena has never been finally settled. But scientists at the University of Pavia, Northern Italy appear to have resolved the question in part, with the help of the university's nuclear reactor.

Arsenic poisoning



This favourite of murderers and murder mystery novelists occurs as arsenic sulphide, a yello mineral and gets its name from 'arsenicon', Greek for 'yellow pigment', a word derived from Persian 'Zarnikh'. In another form, of 'white arsenic' or arsenic oxide, it is deadly poisonous, with symptoms that could be confused with those of various ailments. And then, till recently, the arsenic was difficult to detect after death. Both qualities were handy when getting rid of somebody!

It was the physicist William Thompson who first had arsenic content controlled in foodstuff – when beer was found to contain more arsenic than good for business. It was well known that small doses of arsenic were deadly over time and beer drinkers wished to be assured that their daily pint was not sending them the way of the wealthy duchess whose heirs hastened their inheritance with a pinch of the white stuff in the good lady's bedtime cocoa.

How it works

The arsenic atom has the quality of binding strongly to chemical groups that contain sulphur. A body component that often has one or more sulphur atoms are enzymes - finely sculpted proteins that are able to facilitate body processes by virtue of their very precise construction. Arsenic thus readily latches on to enzymes in the body.

Bacause enzyme action depends sensitively on its exact shape and arsenic disturbs the delicately balanced enzyme structure, the enzyme is not able to function. This leads to different kinds of diseases and ultimately death, while the bulk of the arsenic goes out through urine or sweat, without a trace!

But a little of the arsenic does remain – taken up in the keratin of the hair or fingernails before it is washed out. Since tests for arsenic were developed, locks of hair said to be Napoleon's have

been important evidence of whether it was arsenic that killed the emperor. The samples of hair do show high arsenic levels, but the proof is not conclusive and there is reason to believe that Napoleon may have died of stomach cancer.

Neutron activation

Neutrons are electrically neutral particles found inside the nuclei of atoms. When normal atoms are bathed in neutrons streaming out of a nuclear reactor, the neutral particles easily penetrate and get picked up by atomic nuclei. This raises the nuclei to an 'excited' or 'more massive' state and the nucleus can then 'de-excite' or disintegrate, emitting nuclear particles or energy in the form of 'radioactivity'. This induced radioactivity can be detected to identify the atoms that became radioactive.

The property makes for a very sensitive and accurate method to detect traces of specific atoms in small and delicate samples, without the sample itself being physically damaged. The radioactivity induced is low and lasts only a short time. The method is useful in examining artifacts, fossils or to test a sample for purity.

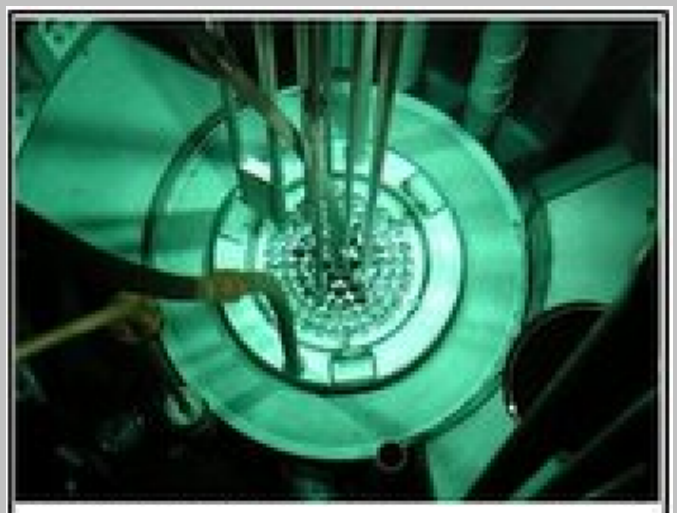
Neutrons and hair

LiveScience last week published a report of Italian scientists who tested different samples of Napoleon's hair, one when he was a boy in Corsica, another during exile in the island of Elba another on the day of his death in St Helena and then after his death. Samples of hair of Napoleon's son, over 14 years and also of Empress Josephine, when she died, were also tested. The samples were provided by museums in Parma (Italy), in Paris and in Rome.

The samples were irradiated with neutrons in the core of a small nuclear reactor in the Univ of Pavia.
The results did show traces of arsenic in all hair samples, but not in the way expected.

First, the arsenic in all the samples of hair, Napoleon's, his son's and Josephines's, was found to be about 200 times the arsenic in the hair of persons today. The arsenic in Napoleon's own hair was no different when he was grown or dead than when he was a boy!

The results seem to show that the arsenic in the environment and ingested by people in the early 19th century was at a level that we consider dangerous today. The researchers, including toxicologists who were part of the team, say Napoleon may have died because of arsenic, but this was not a case of poisoning after he arrived at St Helena.



Samples of hair were placed in capsules and inserted into the core of the experimental nuclear reactor in Pavia