Historic application 1 - Did mercury-poisoning cause the death of Tycho Brahe?

The famous Danish astronomer Tycho Brahe (1546-1601), active on the island Hven between Denmark and Sweden made fundamental contributions to science through his astronomic observations. This gave him international reputation and he was also strongly favoured by the Danish king, Fredrik II. Tycho Brahe was not popular everywhere, and after the death of the king Fredrik II, he left Hven and spent the last years of his life he in Prague under protection of the emperor Rudolf. During a banquet he got acute problems from his prostate, but did not leave "until too late". He got sick, suffering from fever and attacks of giddiness for many days. He got worse and finally died on the 24:th of October, as it was said, due to urinary poisoning.

New scientific facts however question the historically believed explanations on his death. Strains from his beard, which had been stored in Prague, were analysed (using atomic absorption analysis) for Pb, Hg and As by the Laboratory of Forensic Chemistry in Copenhagen. Increased levels of Hg (and Pb) were found. By courtesy of the Landskrona Arts Museum, Sweden, having an exhibition about Tycho Brahe, it was possible to obtain some hair strands to make an investigation using another technique. The strands were transferred to the Lund Nuclear Microprobe facility at the Lund University and analysed by PIXE. The advantage of using a Nuclear Microprobe is that it has a multielemental capability and also a high spatial resolution. This means, that it is not only possible to tell which elements that are present in a sample, but also where. Several hair strands were thus investigated searching for Pb and Hg.

One of the hair strands, which also contained the hair root, exhibited very high local concentration of mercury (Hg). The location of mercury was close to the hair root. Careful investigations of the Hg-distribution across the hair strand also shows that Hg is situated inside the hair. The origin of the Hg must thus be the blood, from which it was rapidly built into the growing hair. Studying the Hg-concentration along the hair from root towards the tip is then actually a study in time; as the hair grows with constant speed the distance from the root can be converted to time.
It can also be seen that the raise in concentration of Hg was very quick, maybe 5 - 10 minutes. The same is true for the fall-off, which is in accordance with the known high metabolism of the hair roots. (This has been verified in experiments where radioactive tracers were distributed to mice, 5-15 seconds later the radioactivity could be seen in the hair of the mice.) Assuming that the hair was growing up to the point of death, the Hg must have been given to Tycho Brahe only one day before he died. The Hg-exposure had a duration of less than one hour.

One can of course not from this type of data explain how or for what reason Hg occurred in the blood of Tycho Brahe. We know that Tycho Brahe was working with elements like Hg and As trying to make gold. It is then likely that it was present in his laboratory in various forms, so he could have used it himself as a drug in order to cure him from his pains, he might have done it by mistake, or somebody else might have poisoned him.
Historic application 2 - What happened to Andrée during his polar expedition?

The famous expedition led by Andrée failed to reach the North Pole using a balloon at the end of the last century. Among the remains from the expedition found on "Vitön" in 1930 was a glove, in which three nails were discovered during conservation procedures during 1979. The idea was brought up that lead poisoning, because of their canned food, could have influenced the members of the expedition. In 1997 one of the nails was analysed using XRF by a commercial lab, and the results showed unexpectedly high levels of lead and copper. To make a more detailed analysis, one nail was analysed at the Lund nuclear microprobe in 1998, where 12 spots from the root to the tip of the nail were selected and irradiated. Elevated levels of both copper and lead were confirmed, with the highest levels close to the tip of the nail. At the moment it is not clear if the source of this is internal (poisoning) or external (i.e. contamination from ammunition), however further investigations are in progress aiming to analyse cross sections of the nail to decide if the levels are higher inside of the nail or on its surface.