Does mercury damage genes?

Mercury has many uses but its toxic properties are a health concern. A recent analysis explored the effects of mercury exposure on human genes. They identify four possible processes that could lead to genetic damage and suggest that international safety limits may need reviewing.

Mercury is versatile and this means it is used in areas ranging from industry to dentistry and from pharmacology to mining. However, the consequences of mercury intoxication are not fully understood.

Some mercury compounds cause developmental defects in embryos. For example, methylmercury is directly transferred to the foetus through the placenta and affects the central nervous system. The most well-known exposure to methylmercury is through the consumption of fish. Exposure to other mercury containing compounds through diet and occupation is thought to cause tumours. However, the carcinogenic effects of mercury are controversial since there are mixed results on its toxicity to genes (or ‘genotoxicity’).

As part of the review, indicators of DNA damage used in research were evaluated. This suggests that chromosome abnormality is the best indicator because it is sensitive to low concentrations of mercury. From the research four mechanisms of mercury genotoxicity were identified:

- DNA damage by free radicals generated by mercury, such as hydrogen peroxide and nitric oxide.
- Changes to the microtubules (tiny fibres involved with cell division)
- Effects on DNA’s ability to repair itself
- Direct interaction with DNA

Among the mercury compounds studied, methylmercury is the most genotoxic. The lowest concentration of methylmercury needed to cause significant damage to DNA is below the safety limit set by the WHO for mercury exposure, which suggests that tolerance levels need to be reviewed.

If the relationship between genotoxic mechanisms and exposure to mercury is understood more accurately, strategies can be developed to prevent and avoid toxic consequences. The EU’s ban on mercury exports from 2011 and its restrictions on mercury use will reduce exposure1. However, guidance on methylmercury through diet is not as simple since recent research has demonstrated that the nutritional benefits of fish consumption must also be considered.


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