

# Toxicogenetics

## Genotoxicity testing

There is a group of specialised tests to check the *genotoxic* (mutagenic) effects of various external factors. Both the mutagenic potential of the substances (e.g. chemicals) themselves - *in vitro* - and the current state of the individual after exposure to mutagens - *in vivo* - are tested.

### Ames test

The **Ames test** is the classic test for determining the **mutagenic potential** of various chemicals. The original version of this test involves a special strain of bacterium **Salmonella typhimurium** that has a mutated gene that prevents the bacterium from synthesizing the amino acid **histidine**. Since the bacterium grows on a medium that does not contain this amino acid, the bacterium cannot access this amino acid and does not survive. The test is conducted by exposing this strain of bacteria to the test substance. The growth of these colonies is then monitored on the same medium without histidine. The percentage of surviving colonies indicates the mutagenic potential of the test substance - this is because a 'mutation of a mutation' occurs - a reverse mutation, where the originally defective gene is actually repaired, giving the bacterium the ability to synthesise histidine again (and survive).

### ACA

 For more information see *Acquired Chromosomal Aberrations*.

The **ACA** test, or Acquired Chromosomal Aberration, allows us to assess the effect of mutagens on structures *in vivo*. The test is very simple to perform. After collecting peripheral blood and culturing acquired lymphocytes, we assess the percentage of aberrant cells, i.e. cells with chromosomal aberrations. This method informs about the exposure of the individual under investigation to mutagens during the last few months. Values up to about 3% are normal, between 3% and 5% are borderline and above 5% are high. This test can also be performed, for example, as part of preventive examinations of employees working in environments with a higher risk of genotoxicity.

## Other methods in genotoxicology

### Comet assay

Subscribe to DeepL Pro to edit this document. Visit [www.DeepL.com/pro](http://www.DeepL.com/pro) for more information. **Comet assay** - consists of electrophoresis of whole cells, with small fragments of nucleolar DNA (produced by mutagenic factors) tend to travel out of the nuclei, giving the result of a comet image when visualized.

### Sister chromatid exchange

**Sister chromatid exchange** - consists in observing the exchange of genetic material between sister (identical) chromatids (made possible by different staining), which is proportional to the exposure to a genotoxic substance.

### Micronucleus test

**Micronucleus test** - consists in observing fragmented nuclear material, so-called micronuclei, which have been formed by the action of genotoxic factors.

## Links

### Related articles

- Mutation
- Acquired chromosomal aberrations
- Chromosomal abnormalities

### Source

ŠÍPEK, Antonín. *Genetika [online]* [online]. [cit. 2009]. <<http://www.genetika-biologie.cz/mutageny>>.