

# The risk of (almost) every- thing

The BfR is working on a concept to estimate and assess the exposure to chemical mixtures in advance.



In the course of his or her life, every human being comes into contact with countless chemical compounds, microorganisms, radiation and other environmental influences. This confrontation is part of our existence, but it is also the origin of diseases. In 2005, the scientist and cancer researcher Christopher Wild coined the term “exposome” which he defined as the totality of all environmental factors and influences to which we are exposed.

It is no coincidence that the exposome is reminiscent of the genome, the totality of the genetic make-up of an organism. In the context of Wild’s definition the genetic causes of disease are hidden within the genome, the non-genetic causes in the exposome. A group of scientists at the Federal Institute for Risk Assessment (BfR) has now for the first time presented a concept on how to use this approach for the identification and assessment of health risks from exposure to predictable and unpredictable mixtures of chemicals as well as food.

More than 350,000 chemical compounds or mixtures are produced worldwide. One way or another they can find their way into the food chain and hence form a sizeable part of the exposome. Correspondingly, assessing the resulting health risks is of high priority for consumer health protection.

### Providing knowledge in advance

“In a perfect world you could record all the chemicals a person comes into contact with and do so from the time of conception,” says Dr Tewes Tralau, an expert on plant protection products at BfR. “Of course this is practically not feasible. Still, with regard to the exposome, one can and should try to make use of whatever actually is possible.” The decisive factor of the new approach is that it is designed to identify health risks prospectively. This is in contrast to the current practice of retrospective analyses which are predominantly based on measurements in blood and tissue.

The concept, which was presented by the BfR team in the scientific journal “Nature Food”, is based on several steps. First, all available information on significant chemical substances is collected. Data collected originate, for example, from dossiers within the framework of the EU chemicals regulation REACH or from the registrations of plant protection products.

### Identification of possible interactions

Following data collection and compilation it will be necessary to determine which substances are likely to be taken up together, for example in the form of mixtures – and to what extent people are realistically exposed. In order to do so it is helpful to consult, amongst others, data from monitoring programmes, scientific studies on the intake of chemical substances, surveys on consumer behaviour as well as sales information.

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“We want to know what chemicals are being circulated and which populations are affected,” Tralau explains. “For example, it would be useful to know who buys which cleaning products and chemicals in the supermarket – such anonymised data would be a good starting point for estimating the exposure of normal households. It would also help to identify which substances are most likely to be used in parallel.”

### Like thousands of mosaic pieces

From the data, an overall picture of a small exposome can be compiled, similar to putting together thousands of mosaic pieces. The respective information would provide clues about important possible mixtures or jointly used chemical compounds and help to generate consumption profiles. Depending on the data, this can be done for specific consumer or occupational groups but also for sensitive individuals such as pregnant women or children. In a next step, mixtures identified as potentially relevant can then be compared with existing toxicological data or be examined further in the laboratory. Novel methods enable precise tests on cells, for example. Also, it can be determined whether the individual substances increase each other’s effect.

In Tralau’s view, the concept not only has the advantage of identifying risks in advance but it also makes it easier to identify major hazards and lays a scientific foundation for risk assessment as a precondition for targeted action. “Decisions based on this approach are based on solid data, not conjecture,” says Tralau. Now it’s a just a matter of putting the idea into action. ■

#### More information:

Tralau, T. et al. 2021. A prospective whole-mixture approach to assess risk of the food and chemical exposome. *Nature Food* 2, 463-468. DOI: 10.1038/s43016-021-00316-7