BfR2GO

ISSUE 1/2025

THE SCIENCE MAGAZINE OF THE GERMAN FEDERAL INSTITUTE FOR RISK ASSESSMENT (BFR)

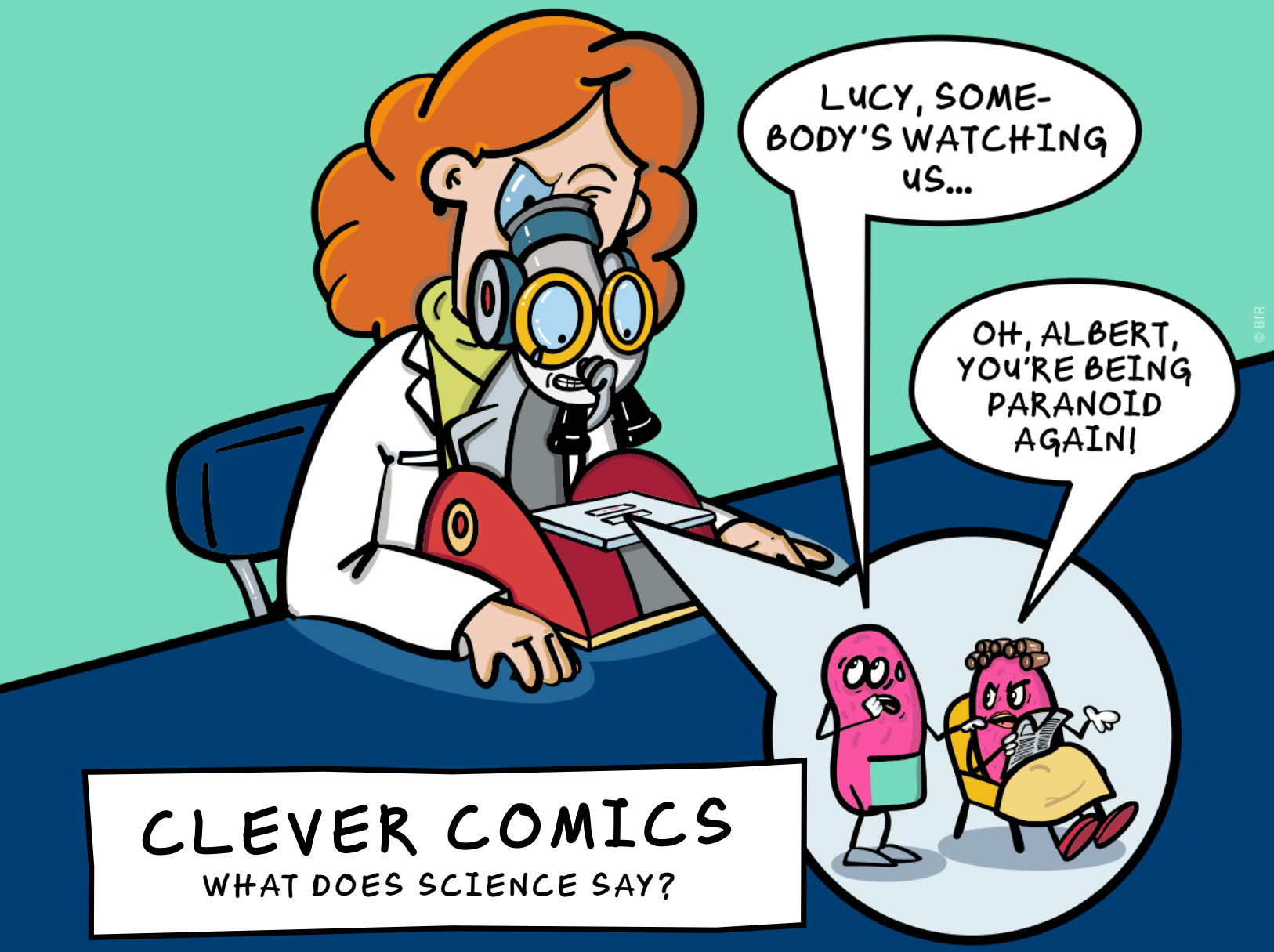
FOOD SUPPLEMENTS

Hype & Misconceptions

CHILI
SPICY RISK

E-CIGARETTES
BITTERSWEET FLAVOURING SUBSTANCES

ORGANOIDS
AN ALTERNATIVE TO ANIMAL EXPERIMENTS



CLEVER COMICS

WHAT DOES SCIENCE SAY?

Conveying science in a compact, comprehensible, and entertaining manner: this is accomplished by the BfR comic strip “What does science say?”. The characters Berta Freund, Petra Petridish, Emilia Erlenmeyer, Mikiscope and the Tuby brother triplets explain interesting facts from German science history and draw connections to the BfR’s risk assessments. Each new comic covers a topic in food, product or chemical safety. Comics about alternative protein sources, tattoo inks, raw foods, and e-cigarettes have already been published.

All comics at a glance:
bfr.bund.de/en/publications/science-comics/

One of the biggest misunderstandings: People think that food supplements are freely available medicals drugs which have been tested and declared harmless.

—

Main topic
Food supplements

Editorial

© BfR

Dear readers,

As the new Vice-President of the BfR, I am delighted to present the current issue of our BfR2GO science magazine to you. The main focus of this issue is on the topic of food supplements and the widespread misconceptions about them within the general population. One of the most common assumptions is that food supplements are freely available (and officially tested) medical drugs. This misconception is the reason that supermarket and pharmacy shelves are stocked full of pills and powders containing vitamins and minerals. However, people eating a balanced diet can typically do without these "supplements".

Of course, science is not free from misunderstandings either. "Why Most Published Research Findings Are False" – this provocatively-titled study, published by medical researcher John Ioannidis from Stanford University 20 years ago, laid bare the technical issues prevailing among scientific studies. Since then, a lot has improved, as Ioannidis says in the interview. Learning from past mistakes is a way to contribute to scientific progress. And progress is something you will find in many topics covered by the BfR, including barbecuing, spicy foods, replacing animal experiments with miniature organs, and a whole lot more in the pages of this magazine.

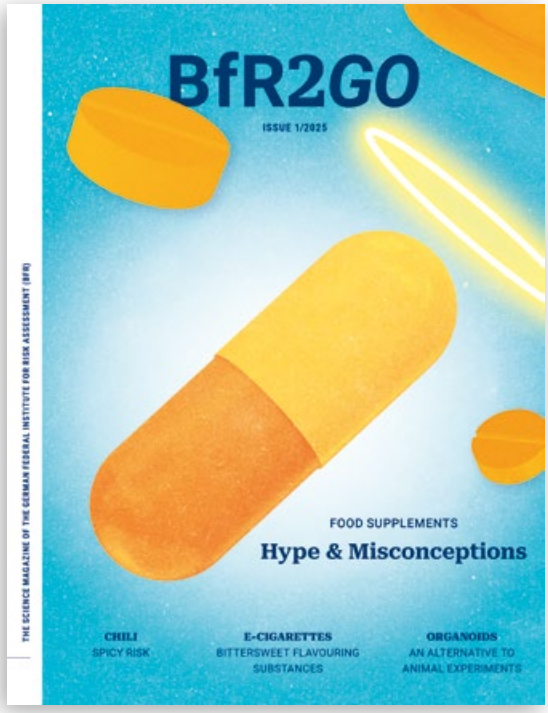
I wish you an intellectually nourishing read!

Dr Tewes Tralau
BfR Vice-President

Assessment.
Research.
Communication.

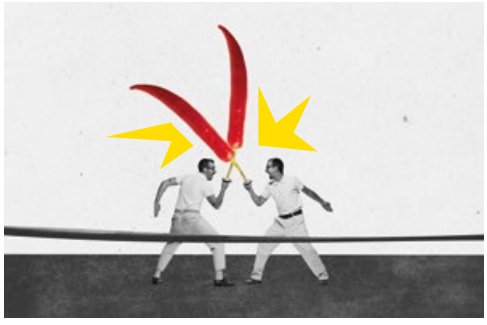
Contents

Main topic



Headings

Food

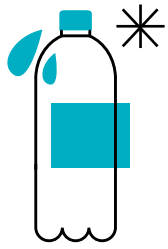


© Lustre Art Group/adobestock

INTERVIEW

Products & chemicals

© New Africa/adobestock



Protection of laboratory animals

Hotter = unhealthier

Acrylamide occurs as a by-product when baking, roasting, barbecuing, deep-frying, and frying. It was first discovered in foods in 2002 and has been the subject of intensive research ever since. The substance is formed starting at temperatures of about 120°C. From 170 to 180°C, production increases substantially. Products made from potatoes and grain often contain relevant amounts of acrylamide. In the BfR MEAL study, the highest levels were found in vegetable crisps. In animal studies, acrylamide has been found to have mutagenic and carcinogenic effects. For this reason, there is no daily intake which can be considered harmless. Tip: Cook foods gently and, if possible, not above 180°C and not longer than necessary.

More information

BfR-FAQ **"Acrylamide in food"**

Between hype and misconception

The number of people taking food supplements is high – just like the number of misunderstandings around these products. A critical look at five of them.

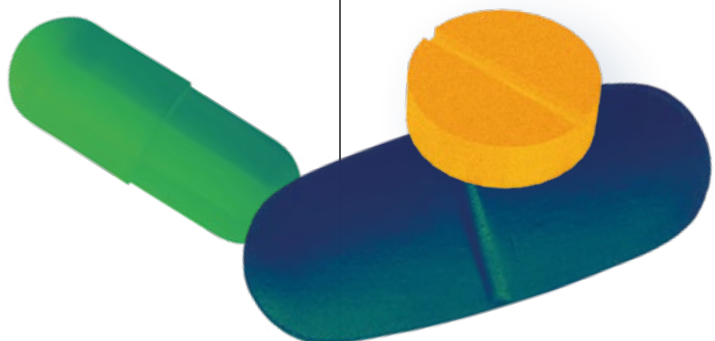
Do you take food supplements? Perhaps vitamin D during the winter? Or magnesium after working out? Maybe St John's wort to lift your mood? If so, you're part of the majority. In a recent survey conducted by the German Federal Institute for Risk Assessment (BfR), more than two thirds of respondents reported taking a food supplement within the last 12 months.

The result is not really surprising. After all, advertising, social media, and friends and acquaintances often link tempting health promises to certain products. Some of these claims are presented subtly, others less so. What is surprising, however, is how many misunderstandings there are surrounding food supplements, which also became evident in the BfR's survey.

BfR survey

1,071

people aged 16 or older participated in a representative online survey. Topics included health, nutrition, and knowledge about and intake of food supplements.



1st misunderstanding

FOOD SUPPLEMENTS ARE MEDICAL DRUGS SOLD WITHOUT RESTRICTION

According to the recent BfR study, a quarter of respondents believe this statement to be true, while another 33 percent find it probable ("somewhat agree"). However, this assumption is false. Legally, food supplements are foodstuffs. More than two thirds of the respondents think this true statement is false or somewhat false.

The EU's Directive on food supplements as well as the German Ordinance on Food Supplements (NemV) clarify what exactly is meant by the term food supplements and which vitamins and minerals may be added to them. Accordingly, only those vitamins and minerals listed in the forms provided in the Directive's annex may be used to manufacture food supplements. Food supplements also often contain what are known as "other substances with a nutritional or physiological effect." These include amino acids, fatty acids, dietary fibre, and plant-based substances such as plant extracts or secondary plant constituents (see the interview on page 14). So far, the question as to which "other substances" may be used and at which dosages has only been determined in a few individual cases. Why is it important to distinguish between food supplements and medical drugs? This question brings us to the second common misunderstanding.

2nd misunderstanding

FOOD SUPPLEMENTS ARE OFFICIALLY ASSESSED BEFORE THEY ARE PLACED ON THE MARKET

Unlike medical drugs, which must go through an official approval process, food supplements, which are classified as foodstuffs, are not subject to mandatory approval. Official bodies do not test their safety or tolerability before they are placed on the market. The food entrepreneurs (manufacturers, importers, sellers, and distributors) are solely responsible for compliance with food regulations and for the safety of their products. Entrepreneurs wishing to place a new product on the market must simply report this to the relevant authority, namely the German Federal Office of Consumer Protection and Food Safety (BVL). More specifically, they only have to fill out an online form.

The monitoring authorities of the German federal states ("Laender") are responsible for monitoring the products available on the market and assess whether they comply with the legal provisions, i.e. whether the ingredients and their dosages are harmless to health as well as if the products are properly labelled. However, monitoring is only conducted via sampling, meaning merely a fraction of the available and constantly newly released products are examined.

Many people are unaware of the lack of official assessment, monitoring, and approval. In the BfR's survey, 47 percent of respondents were absolutely certain or at least somewhat certain that food supplements are monitored for health effects before they are placed on the German market.

The common misconception that food supplements are medical drugs sold without restriction is likely the cause of the third common misunderstanding.

3rd misunderstanding

FOOD SUPPLEMENTS CAN BE USED TO TREAT DISEASES OR SYMPTOMS

When asked about their reasons for taking food supplements, almost half of respondents said they wished to treat illness or other health conditions (16 percent "fully agree" and 30 percent "somewhat agree"). However, unlike medical drugs, food supplements are NOT meant to be used as treatment for diseases. Promoting food supplements using "disease-related" statements is not permitted, meaning it cannot be claimed that they have properties able to prevent, treat, or cure human disease. Health claims are only permitted if they have been scientifically assessed by the European Food Safety Authority (EFSA) and explicitly authorised by the European Commission. Two examples of authorised claims are: "calcium is necessary to maintain healthy bones" or "vitamin C helps alleviate tiredness and fatigue."

That vitamins and minerals serve important functions in the body, and that deficiencies can lead to physical disorders or illness, is not disputed. For this reason, it is recommended that persons following a vegan diet take vitamin B12 via food supplements, as this vitamin is exclusively found in foods of animal origin and would otherwise be lacking in the diets of vegans, even if they consume an otherwise balanced and varied diet. Another example of a sensible case of food supplement intake is folic acid for women planning to become pregnant. Following recommendations regarding consistent intake of this vitamin (400 micrograms per day) before and during the first trimester of a pregnancy can reduce the risk of severe birth defects such as spina bifida, a condition in which the spine is incompletely formed. Studies have shown that most women of child-bearing age fail to meet the concentration of folate recommended by the World Health Organisation to reduce the risk of neural tube defects.

These are examples of the handful of cases in which experts recommend targeted consumption of food supplements. Anybody who is worried they might have a micronutrient deficiency, for instance because their diet is less balanced and varied than is recommended, should first consult with a doctor instead of immediately consuming food supplements. It may be prudent to take food supplements in cases where insufficient levels of micronutrients have been determined. However, people already consuming enough of a certain nutrient do not benefit from additional nutrient intake. This leads us to misunderstanding number 4.

4th misunderstanding

HEALTHY PEOPLE WITH A BALANCED DIET ALSO BENEFIT FROM FOOD SUPPLEMENTS

There is currently no scientific evidence to support this claim. However, 37 percent of respondents still believe it to be true or somewhat true. According to experts, additional intake of vitamins and minerals beyond necessary levels is, in the best-case scenario, a waste of money. Studies show that the intake reference values for healthy people derived by the German Nutrition Society (DGE) are generally achieved through a varied diet. But erring on the side of caution by consuming food supplements is not harmful...right? This question brings us to the fifth misunderstanding.

5th misunderstanding

FOOD SUPPLEMENTS ARE HARMLESS, BECAUSE OVER-CONSUMPTION OF MICRONUTRIENTS IS NOT POSSIBLE

As foodstuffs, food supplements must be harmless to health. However, unnecessary additional intake of vitamins or minerals can lead to undesired health effects, particularly when it comes to products with high dosages. For instance, long-term self-directed consumption of high doses of vitamin D can severely increase the concentration of calcium in the blood serum. This can lead to acute symptoms such as fatigue, nausea or cardiac arrhythmia. Particularly high dosages can also damage the kidneys in the long term. In studies, it has also been observed that high doses of beta-carotene in the form of food supplements can increase the risk of lung cancer in smokers. Additional intake of biotin can falsify laboratory diagnostic studies and an extra dose of vitamin K can reduce the effectiveness of certain anti-clotting medications.

In order to prevent health impairments from food supplements with vitamins or minerals, the BfR has elaborated recommendations for maximum levels for the use of these substances in food supplements and fortified foods. Recommendations for specific labelling of certain products were also developed. These should indicate potential health risks linked to food supplements or discourage certain at-risk groups from consumption. At the moment, however, there are no legally binding maximum levels at the national or European level. Food supplements which contain “other substances” with nutrition-specific or physiological effects, such as amino acids, essential fatty acids or plant constituents, may lead to undesired effects, especially because the use of these substances is only regulated in a handful of cases. For instance, in persons with heart disease, products with omega 3 fatty acids may increase the risk of atrial fibrillation. In the past, there have been repeated cases in which substances with pharmacological effects were found in products labelled as food supplements which were advertised for weight loss or for increasing sexual potency. However, for many of the “other substances”, the data on toxicity is insufficient. Therefore, when in doubt, these products should not be consumed. —

More information

BfR knowledge portal on micronutrients and co.
microco.info

More information

BfR recommended maximum levels
“Vitamins and minerals in food supplements and fortified foods”
(pdf)

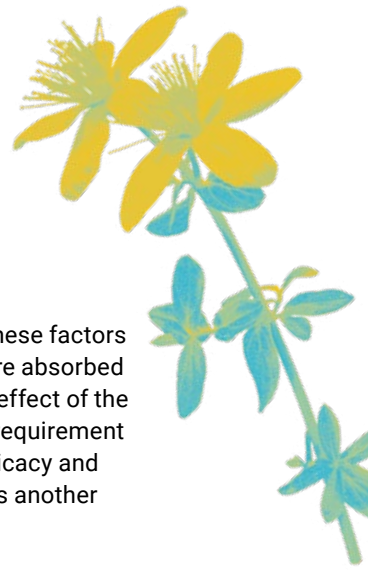
SUMMARY

- Food supplements are – legally speaking – foodstuffs, not medical drugs.
- They do not require official approval.
- They do not cure diseases.
- They are generally not necessary for people eating a healthy and varied diet.
- They can pose health risks, particularly at high doses.

Botanical *black box*

© BfR

At the German Federal Institute for Risk Assessment (BfR), Dr Nadiya Bakhiya studies botanicals, i.e. plant ingredients in food supplements. The biologist assesses health risks which may be associated with the consumption of plant-based products.



Dr Bakhiya, most people think plant-based products are "natural" and they think "natural" means "harmless". Are they right?

Unfortunately, this is often a misconception. Many plants contain substances which can be hazardous to human health. These are called poisonous plants. However, plants traditionally used as foods can also contain substances which have hazard potential when isolated and concentrated.

Can you give us an example?

The substance synephrine occurs naturally in citrus fruits. It would be very difficult to consume enough synephrine to harm one's health just by eating oranges or mandarin oranges. In food supplements, however, the doses are sometimes so high that they can impair the cardiovascular system and cause issues such as cardiac arrhythmia. The effect also depends on the form in which a substance is consumed, i.e. whether as an isolated extract or as part of a food.

Botanicals are often based on plants which are traditionally used medicinally or which are sometimes officially approved as plant-based medical drugs. Does this not provide a certain safety level?

Plant-based medical drugs are regulated differently from plant-based food supplements. This is important to understand. Strict quality standards apply when manufacturing and distributing medicine. For instance, it must be precisely stated which plant part a substance is derived from and how it was extracted and which degree of purity it has and so forth.

What about for food supplements?

There is nothing comparable. The substances contained in food supplements can stem from various parts of the plant. Sometimes isolated extract is used and sometimes dried and powdered plant parts are added. All of these factors can influence how the ingredients are absorbed and metabolised and thus what the effect of the botanical is. By the way, there is no requirement to scientifically demonstrate the efficacy and safety of these products. And there's another aspect, too.

Namely?

Medical drugs are typically taken when a health problem occurs. Food supplements, by contrast, are often taken prophylactically. Particularly when it comes to the health consequences of long-term use, there is often a lack of data. This is also the case for substances used in traditional medicine such as ayurveda which have been used for a long time and are perceived to be harmless.

What can consumers do?

Always assess advertising claims critically, especially when it comes to products sold online. For healthy people, botanicals are generally unnecessary. People who eat a balanced and varied diet consume sufficient secondary plant ingredients through fruit, vegetables, herbs, and spices, which has a proven positive impact on health. Anyone who wishes to take a botanical should purchase the product from a trustworthy source and refrain from unnecessarily prolonged use. People taking medication should be particularly careful, as interactions can occur. Doctors should be made aware of any food supplement intake. —

MORE THAN JUST A STIMULANT

Moderate amounts of caffeine stimulate the cardiovascular system and boost performance, making it popular, for example, in sports. Large amounts, however, can trigger anxiety, sweating, a racing heart, and even cardiac arrhythmia. Excessive doses, for example via an overdose of highly concentrated caffeine powder, can potentially be fatal. Food supplements of this sort are freely available for purchase. In the case of highly concentrated loose powders, it is not possible to exactly measure out the non-harmful amount of 200 mg of caffeine using conventional methods such as a measuring spoon or kitchen scales. Five to 10 grams of pure caffeine (equivalent to one to two teaspoons) can thus inadvertently cause severe or even fatal poisoning. In the BfR's view, these effects of pure caffeine powder may be underestimated.

More information

BfR communication
"Even small amounts of highly concentrated caffeine powder can cause severe poisoning"

NO LAUGHING MATTER

Misuse of laughing gas is increasing, as shown by the rising number of poisoning cases in recent years. In particular, adolescents consume it at parties, inhaling it from balloons. The colourless, sweet greenhouse gas creates brief euphoria and reduces tension or anxiety. Cartridges or cylinders containing laughing gas can be purchased online, in convenience stores ("Spätis") or from vending machines for just a few euros, under the pretense of being "for whipping cream". Thus, the availability gives the impression that it is harmless, according to the BfR. However, laughing gas poses serious health risks: Depending on the dose, it can lead to nausea, headaches, impaired consciousness and cardiovascular dysfunction, epileptic seizures and strokes, and even death by suffocation. Irreversible neurological damage has been observed after excessive use.

More information

BfR communication
"Laughing gas: a risky 'party drug'"

Cook legumes sufficiently

© Igor Dudchak/adobestock

From vegetables and grains to fruits – many plant-based foods contain lectins. Lectins can, among other functions, protect plants from pests. Most lectins are harmless in moderation. However, certain lectins found in relatively high amounts in raw legumes can cause nausea, vomiting, and diarrhoea, and in extreme cases, if consumed in excess, they can even be fatal. Lectins can be destroyed by heat. Therefore, it's important to follow the recommended preparation methods, such as cooking fresh green beans for at least 30 minutes in boiling water. Dried legumes should be soaked for at least five hours, followed by cooking in fresh water for 30 minutes. Gentle cooking methods are not suitable for most legumes.

More information

BfR opinion
"Lectins in plant-based foods"
(pdf, in German)

© ehdghk1981/adobestock

Wake up to the risks of ashwagandha

More energy, less stress, better sleep – these are just some of the effects attributed to food supplements containing ashwagandha *(Whitania somnifera)*. However, the effects of such plant-based supplements are not backed up by science and – far more importantly – possible health risks are not yet sufficiently understood. Above all, children, pregnant and breastfeeding women, as well as persons with pre-existing or a history of liver disease should not consume ashwagandha. Generally speaking, the BfR also advises other people to exercise caution. Consumption can lead to effects such as nausea, headache, and dizziness. There are also indications that ashwagandha supplements can influence the immune system and hormone system and in rare cases damage the liver.

More information

BfR communication
"Ashwagandha: food supplements with potential health risks"

© Evelien/adobestock

Hip flasks and metals:

not quite leak-proof

Sometimes in Hollywood movies the protagonists reach for a hip flask from their jacket or blazer and take a swig of some potent alcoholic drink. The flattened metallic flasks are well-suited to discretely carrying a drink on oneself. However, these flasks can also contain other potent substances. They can leak elements in the form of ions (electrically charged particles) into the liquid, including considerable amounts of lead. This has been demonstrated by a BfR study, which also detected cadmium, nickel, arsenic, and tin. In all cases, the detected amounts of elements are in the upper range or beyond the specific release limit as set by the Council of Europe.

More information

Leliwa, S. et al. 2024. **Element release from lead crystal ware and metallic hip flasks.** Food Additives & Contaminants: Part A, 41(12), 1648–1662. DOI 10.1080/19440049.2024.2406002

Better barbecuing

We're not just talking about the food: Pathogens and substances hazardous to health can spoil the joy of feasting together. What's important for a barbecue?

© Matt/adobestock

Salads and vegetable skewers, sauces and dips, meat and fish – and a sweet dessert to finish. Barbecuing and a tasty selection of dishes are key to a perfect summer's day for many people. However, there can be a few pitfalls, both when preparing food and during the cooking itself, but also when choosing the grillware. To ensure that the barbecue doesn't leave an unpleasant aftertaste, a couple of things should be considered.

AVOID CHARRING

Turn away from the grill for just a second and it's already happened: Your bratwurst and steak are a little charred. You can just scrape off the black parts, right? Ideally it should not get that far in the first place. It's not only the taste that suffers. Charring can lead to formation of harmful, carcinogenic substances, such as polycyclic aromatic hydrocarbons (PAH) or heterocyclic aromatic amines. To avoid this, the food should be barbecued from all sides slowly at low heat – not directly above the glowing coals.

IT DEPENDS ON THE TRAY

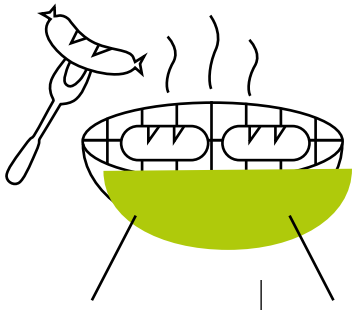
If you like marinating your barbecue foods in tasty marinades or oils, you should use a barbecue tray – preferably one made from stainless steel or ceramics. This ensures the liquids are captured and do not drip onto the hot coals or electrical grill's heating rods. This is beneficial for the taste and for your health: It reduces the occurrence of harmful substances which could otherwise transfer to the barbecue foods via the smoke. While aluminium barbecue trays are also available in shops, salt or acidic marinades can release aluminium from the tray and transfer it to the food. Through eating, aluminium ends up in the body. If aluminium is consumed in high amounts, it can damage the nervous system and also cause damage to the kidneys and bones. Therefore, if food destined for the barbecue is prepared in an aluminium barbecue tray it should only be salted and seasoned after barbecuing. Or trays made of stainless steel and ceramics should be used instead. For the same reason, the German Federal Institute for Risk Assessment (BfR) recommends not wrapping or storing acidic or salty foods such as marinated meat, cheese, or cut fruit in aluminium foil.

STOP GERMS

On warm summer days illness-causing germs such as *Salmonella* can quickly multiply due to the high temperatures. In the worst-case scenario the barbecue ends in an infection with nausea, diarrhoea or vomiting. Very young children and people with weak immune defence due to old age or pre-existing medical conditions, for example, are particularly at risk. *Salmonella* is especially found in raw or insufficiently heated meat

© Duha/adobestock

TIPS



BETTER BARBECUING

- Do not let the food char on the barbecue – better to slowly cook it on all sides at low heat.
- For marinated food, use barbecue trays made from stainless steel or ceramics.
- If you are using aluminium barbecue trays: only salt and season the food after barbecuing.
- Keep food that spoils quickly well chilled – also during transport and outside.
- Avoid germ transmission: Prepare raw animal food products and other meals separately, use separate kitchen utensils, and wash your hands after every step.

as well as in eggs or egg products. However, it can also lurk in plant-based foods, for example in cut unrefrigerated melon.

You can easily avoid an infection by following a couple of tricks. Perishable foods, such as raw animal products, salads, cut fruit, and desserts, require adequate refrigeration. This is also true during transport and outside. Deep-frozen food products for the barbecue can be best defrosted in the refrigerator. They should be stored and prepared separately so that pathogens do not transfer from the raw animal food products to other dishes. When preparing poultry, meat or fish, illness-causing germs such as *Campylobacter* can be transferred into the marinade, onto the hands, cutlery or surfaces and contaminate meals. It is therefore advisable to use different cutting boards and plates as well as separate cutlery for raw and cooked food products. Separate utensils should also be used for salads and vegetables as well as for meat and fish. Kitchen utensils that have come into contact with raw food products should be thoroughly cleaned. And don't forget your hands – wash them thoroughly with water and soap after each preparation step. Although pathogens like warmth, they die in heat. So, be sure to cook the barbecue food thoroughly.

To be on the safe side in warmer temperatures, you can avoid using raw eggs for homemade sauces such as mayonnaise or in desserts. Thankfully, tiramisu also tastes excellent without eggs. Enjoy! —

More information

BfR-FAQ
"Barbecuing"

Too much for the liver

Preparations made from certain yellow root plants (turmeric) have been used as a spice for thousands of years. One of turmeric's ingredients can, however, be problematic for health.

The dried, pulverised root rhizomes of turmeric are traditionally used as a spice for dishes in Indian and Asian cuisine. Preparations based on turmeric are a main part of curry and lend the spice mix a particular yellow colour due to the ingredient curcumin. The plant substance is also a popular colourant for margarine, pastries, ready-made meals, jams and mustard, for example. Use as a food additive (E100) is authorised for this purpose in the EU.

Therapeutic effects, such as tumour preventing properties, are sometimes attributed to turmeric preparations. To date, there is a lack of sound scientific evidence from clinical studies as to the health benefits of such products. The supposed positive effects are up against the possible negative effects on health.

A daily intake of curcumin of up to three milligrams per kilogram of body weight from all food sources is considered a total intake amount not associated with increased health risks. Curcumin is not considered harmful to health as a flavourant and colourant in food or as an additive in (processed) foodstuffs because the intake is limited. There are significantly higher curcumin amounts in certain food supplements.

INCREASED RISK

Clinical studies, in which curcumin was in part administered in high doses, have revealed undesirable effects, such as gastrointestinal issues (nausea, bloating or stomach irritation). In addition, the consumption of certain food supplements containing curcumin has been associated with several cases of acute inflammation or damage to the liver – particularly in the case of preparations with "improved bioavailability". The reason being that curcumin is not absorbed well by the organism. Substances such as piperine (from pepper) are meant to improve this. However, the use of such substances means that the negative effects, on the liver for example, might be enhanced. This is even true of smaller doses. Due to data gaps, the German Federal Institute for Risk Assessment (BfR) sees a need for more research for such products in particular and recommends pregnant women, children and sensitive people not to consume them. —

More information

BfR knowledge portal on micronutrients and co.
www.microco.info/en/vitamine-homepage.html

Burning ambition

Spicy plant substances are actually supposed to keep other organisms away. But some creatures, such as humans, expose themselves to spicy “chili” ingredients on purpose.

Hotter and hotter. Round after round. To the sound of applause. This is how chili contests are held, competitions where participants test the limits of their taste buds as well as their pain tolerance. And though, as the contest progresses, more and more people bow out, the toughest among them do their best to keep going, wheezing, sweating, and grimacing all the way. And all for the sake of breaking the next Scoville record.

In 1912, pharmacologist Wilbur L. Scoville developed the internationally renowned and frequently cited unit of pungency, which also indicates the amount of capsaicin present. This spicy substance is produced by chili plants. These capsaicinoids belong to the alkaloid group and serve as a defence mechanism against predators also in other bell pepper species.

CHALLENGE FOR THE CIRCULATORY SYSTEM

This taste challenge was also the motivation behind the "hot chip challenge". But very few were burning to see the ambulance that arrived after they ate a small tortilla chip seasoned with capsaicin and soon began feeling the physical symptoms. A while ago, this snack gained prominence among children and adolescents in many countries, particularly due to videos on social media. From a scientific perspective, when capsaicin and related substances bind to certain receptors, they cause a heat and pain sensation which is perceived as pungency. The tolerance to this oral sensation varies from person to person. Following intake, the plant ingredient can cause a burning sensation in the (upper) gastrointestinal region, acid reflux, nausea, vomiting, and pain in the abdominal and chest regions. After intake of high amounts, circulatory issues may occur: cold sweat sets in, blood pressure changes occur, people begin feeling dizzy.

BURNING BOUNDARIES

Children are particularly sensitive to hot chili products. The international scientific literature has reported severe poisoning cases and undesirable effects. Mild impairments have been reported following intake amounts of 0.5 to 1 milligram (mg) and severe impairments were seen for amounts around 170 mg. It is not possible to provide more specific information. This is particularly because the perception of "pungency" is subjective and also the type of meal influences how well an amount of capsaicin is tolerated. For instance, a meal consumed in a normal amount of time and consisting of several components is often perceived as less spicy than the same amount of capsaicin in a single small tortilla chip. There are currently no maximum legal levels for capsaicinoids in foodstuffs.

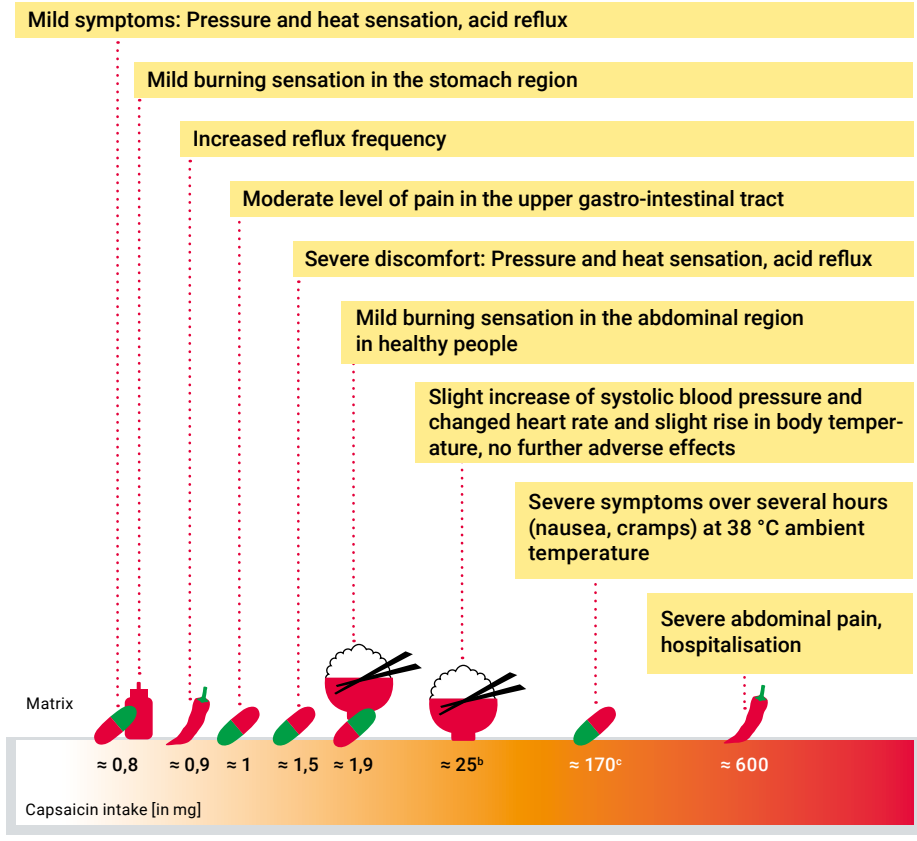
But there's one tip that always works: capsaicinoids are fat-soluble. This means that, instead of water, milk or fatty plant drinks made from soy or almonds help to "extinguish" the burn. This strategy also provides some relief to the men and women who have surrendered in the Chili contest, and they should know. —

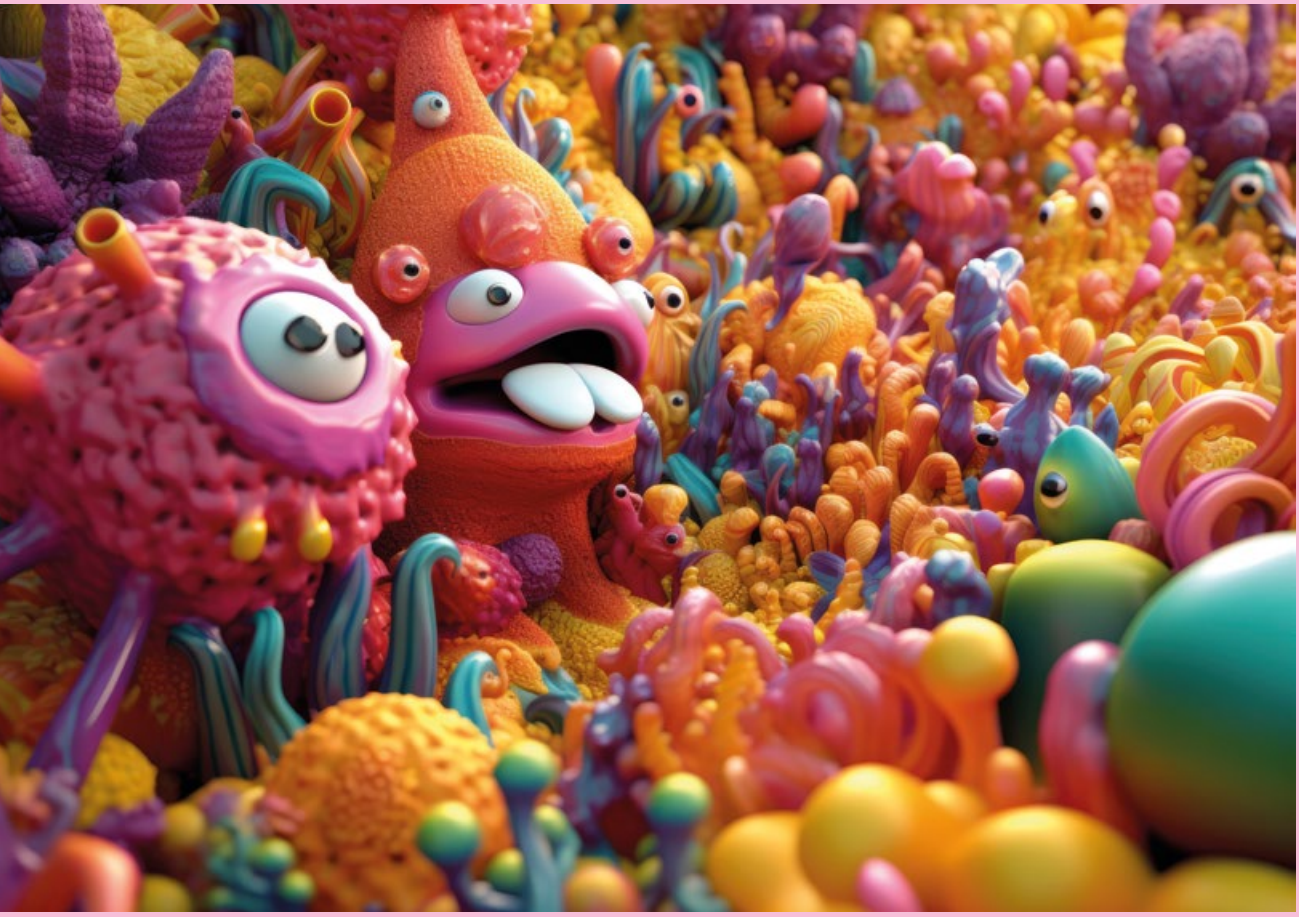
More information

BfR opinion
"High capsaicin levels can harbour health risks"

How pungency works

Acute symptoms, depending on the degree of pungency and the matrix (= composition of the consumed product); orientation values; evaluation of currently available studies





© whitehoune/adobestock

More than just a sugar high

They look like regular sweets and promise relaxation and feelings of happiness – products with psychoactive substances. But consumption doesn't always trigger positive effects.

They look like brownies, lollies, or fruit gums, but there is a major difference: these products contain psychoactive substances that have an intoxicating effect. This effect can be traced back to ingredients such as the cannabinoid HHC (hexahydrocannabinol) from the hemp plant, or the fly agaric toxin muscimol. They are sold in online shops, vending machines, and kiosks.

DANGEROUS RISK OF CONFUSION

In addition to deliberate consumption, there is also the risk that the products may be confused with regular sweets. "Especially for particularly sensitive groups such as children, this confusion can have serious health consequences," says Dr Nina Glaser, who is involved in establishing the national poisoning registry at the German Federal Institute for Risk Assessment (BfR). "Under certain circumstances they may

consume larger quantities than adults, who consume a specific dose for intoxication purposes." They then run the risk of serious poisoning.

EUROPE-WIDE TREND

In recent years, products with psychoactive substances from the hemp plant, above all HHC, have attracted particular attention. Products with HHC were first observed on the European market in 2022 and were marketed primarily as a "legal substitute" for cannabis or THC (tetrahydrocannabinol). From that point on, supply increased rapidly. By the end of that year, such products were already available in the majority of EU countries.

However, poisoning cases illustrated that the promised feelings of happiness were not the only possible effects of consumption. In the Czech Republic several children ended up in hospital after consuming sweet-like products containing HHC. Germany and France also recorded cases involving light to severe symptoms following consumption of products containing HHC.

"Since June 2024, HHC has been subject to Germany's New Psychoactive Substances Act (NpSG). This means that a new psychoactive substance may not be manufactured or placed on the market," says Professor Dr Bernd Schäfer, whose work at the BfR includes examining the health risks of plant substances. Other EU countries, including Denmark, Finland, France, Greece, Austria, Sweden, and the Czech Republic have now also regulated HHC products.

BENEFITS RATHER THAN RISK?

HHC, THC – wasn't there something else? CBD (short for cannabidiol) is also a cannabinoid from the hemp plant, however, it is not psychoactive.

CONSUMPTION CAN LEAD TO SEVERE POISONING – ESPECIALLY IN CHILDREN

© Irina/adobestock

CBD products are primarily sold as "food supplements." The manufacturers promise numerous effects that promote health, most of which are not scientifically proven. In the EU, however, such products are not considered marketable, as they are classified as novel foods that require authorisation from the European Commission before they can be marketed.

The number of products available that contain hemp seeds has also increased in recent years. They are used for edible oils and added to muesli bars, pasta, or protein powder. "The seeds contain important nutrients such as essential amino acids and fatty acids, but naturally no THC. During harvesting and processing, however, they can be contaminated through contact with parts of the hemp plant that contain THC," Schäfer says. As long as appropriate measures are taken, the THC concentration can be kept low. Most hemp seed oils contain such low concentrations of THC that no health impairments are to be expected.

FLY AGARIC TOXIN IN "WINE GUMS"

In addition to the psychoactive cannabinoids in the hemp plant, there are also other natural substances with an intoxicating effect. "These include muscimol, found in the fly agaric mushroom," says Glaser. Various food-like products with muscimol are available in shops. "Consuming these products can lead not only to intoxication, but also to considerable health impairments." This claim is backed up by a case from the German Federal State Hessen, where a man had to be brought to hospital after consuming "wine gums" containing muscimol. In response to enquiries from the BfR, the German poison information centres reported several cases in which muscimol consumption resulted in symptoms ranging from confusion and disorientation to coma.

In order to obtain an overview of such poisoning cases throughout Germany, the BfR will launch the German national registry of poisonings in 2026. This registry will collect reports of poisoning from the poison centres of the German federal states ("Laender"), as well as from hospitals, doctors' practices, and statutory accident insurance bodies, and make them available for evaluation. —

More information

BfR opinion
"Psychoactive effects to be expected following consumption of products containing hexahydrocannabinol (HHC)"

FOOD SAFETY IN TIMES OF (CLIMATE) CHANGE

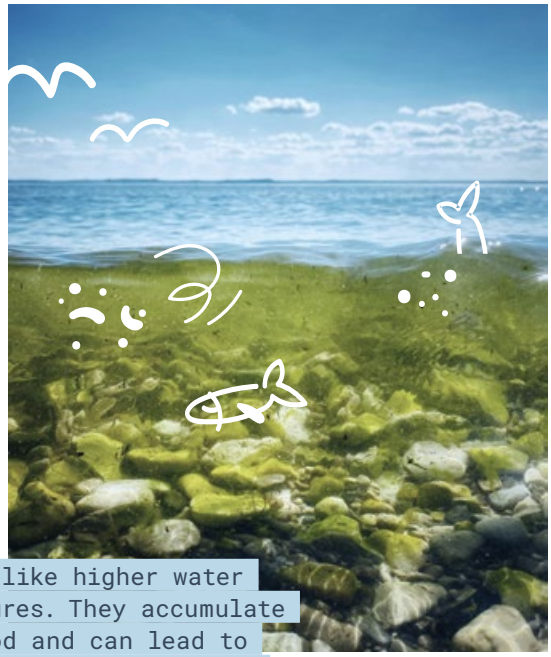
© Scott Webb/unsplash

Global warming with all its effects poses a threat to the environment, animals, plants – and to human health, by increasing the risk of foodborne diseases. An overview.

Heatwaves, fires, heavy rains, floods, rising sea levels – climate change is impacting nature and society in ways that are impossible to ignore. However, it also has effects on a smaller scale. Microorganisms such as bacteria and parasites and toxins (poisonous substances) along with their prevalence in food are influenced by temperature, rainfall, and humidity. These can seriously harm human health.

FAVOURABLE WARMTH FOR PATHOGENS

Higher external temperatures increase the likelihood of livestock carrying certain zoonotic pathogens, which are pathogenic microorganisms that can be transmitted between animals and humans. The reason is that the microorganisms have better survival conditions in the environment and insects and rodents transmit them more easily. Furthermore, pathogens may reproduce faster in perishable foods, especially in case of improper storage outdoors, for example during barbecues or picnics, or in warm kitchens (due to higher temperatures) without refrigeration. In Germany, most foodborne infections with



© Saketh/unsplash

Vibrions like higher water temperatures. They accumulate in seafood and can lead to gastrointestinal infections.

Salmonella or *Campylobacter* are reported in the summer months. They are often accompanied by diarrhoea and abdominal pain.

With respect to parasites, climate change may particularly favour infections with single-cell parasites, known as protozoa, which are already very stable in the environment. Protozoa include *Cryptosporidium* and *Giardia*. Infections are usually asymptomatic or are accompanied by gastrointestinal symptoms.

For people with impaired or not fully developed immune systems, however, these diseases can be more severe and in individual cases may even be life-threatening. Hygienic handling of food during transport, storage, and preparation in the kitchen can usually prevent infections (see More information).

The German Federal Institute for Risk Assessment (BfR) also studies how pathogens adapt to changing climatic conditions. For instance, a long-term project is examining the prevalence of various pathogens in relation to geographical location and their related environmental factors such as temperature and humidity.

THEY DON'T JUST SPOIL APPETITE: VIBRIO

Higher water temperatures also favour the growth of certain pathogens, such as *Vibrio* spp. The bacteria accumulate in seafood such as mussels and shrimps and reproduce particularly well in warm water (>18 °C). If food containing *Vibrio* is eaten raw or insufficiently heated, mild to severe gastrointestinal infections may result. For immunocompromised people, direct contact with water, for example when swimming, can also pose a risk – namely, when they become infected with the bacteria through small, unnoticed wounds. Blood poisoning with fatal consequences is possible.

TOXIC IN WATER AND ON LAND

Climate change also influences the occurrence and geographic distribution of toxins. This includes marine biotoxins – toxic substances produced by some algal species. These toxins can accumulate in the tissue of mussels and fish that feed on such algae, and in turn can cause various illnesses in humans after consumption. Symptoms can vary and range from diarrhoea, nausea, vomiting, and headache to amnesia and neurological disorders or even paralysis which can be fatal in rare cases. Due to an increase in water temperatures, toxin-producing warm-water algae can, e.g., spread towards the poles and occur in new areas where they were not previously reported.

Another example are moulds and the toxins they produce, which are known as mycotoxins. Climate change can affect the occurrence of moulds and thus the geographic distribution and prevalence of mycotoxins. They can be found in plant-based foods such as oil-rich seeds, nuts, grains, fruits, and vegetables, but also in animal food products such as dairy products. Even small amounts of mycotoxins can be harmful to health. The effect depends on the specific toxin, the duration of exposure (acute or chronic), the amount of intake, and the health condition of the individual consumer.

The European Commission has set limits for marine biotoxins as well as maximum levels for certain mycotoxins in various foods. —

More information

BfR communication
"Climate change and foodborne diseases"

More information

Poster
"ABCs of kitchen hygiene"

“We have to accept uncertainty”

What is good science? This question greatly concerns John Ioannidis. He is a professor at Stanford University and one of the most cited medical researchers. The physician and epidemiologist examines the quality of scientific studies, known as meta-research.

Mr Ioannidis, you once wrote: “Doing research is like swimming in the ocean at night.” What exactly do you mean by that?

Swimming in the ocean at night can be enjoyable, mysterious, or dangerous. The same applies to science. It’s fun and exciting to be surrounded by so many unknown elements, so many unanswered questions and mysteries. At the same time, it can be a dangerous environment, full of potential for mistakes, conflict, and bias – you might easily drown or be devoured by “sharks”. Science is no simple matter. You’re constantly aware of just how little you know. But the process of discovering (and hopefully reducing) our lack of knowledge should be fun.

20 years ago, your provocative essay “Why Most Published Research Findings Are False” triggered a global debate about quality issues in research. One of your main points of criticism was the lack of statistics in studies. How have things developed since then?

I think that by now the vast majority of scientists have been sensitised to some degree to this problem. Many are actively working on finding solutions.A stable, large community of scientists has developed, which conducts research on research, known as meta-research or meta-science. We have improved methods, research practices, and the use of tools. That makes scientific research more transparent, reproducible, and hopefully even useful – when it comes to applied research. This does not mean that we have solved all problems.

What needs to be done to put science on the “right path”?

There is no magic formula. Those who provide funding, universities, institutions, organisations, supervisory authorities and other organisations that regulate

science must design their reward and incentive structures in order to obtain reliable, trustworthy research results. Scientists themselves may be the most influential players in shaping more rigorous research practices. Grassroots movements to improve precision and reproducibility may have the best chances of success compared to top-down approaches. Doing research in accordance with the best standards and methods and with a minimum of bias should not be seen as a burden or as bureaucracy. On the contrary, it is integral to good science. At the same time, we need evidence about all the proposed and promoted interventions that try to change research practices. Many proposed interventions may seem reasonable, but they may not work when tested rigorously.

During the pandemic, you criticised measures such as school closures and faced a lot of opposition.

I believed that, based on the knowledge available back then, school closures and other aggressive attempts to isolate the virus would likely bring no additional benefit compared to more targeted and moderate measures, and might even cause major harms. Based on what we know now, these aggressive measures did not save any lives, but may even have indirectly cost human lives and negatively affected school education, mental well-being, health systems, the economy, and society at large. At the time I believed that masks and vaccinations would be efficient. I was presumably right with respect to vaccinations, but probably I was wrong about masks, since the best current studies suggest they had no great effect.

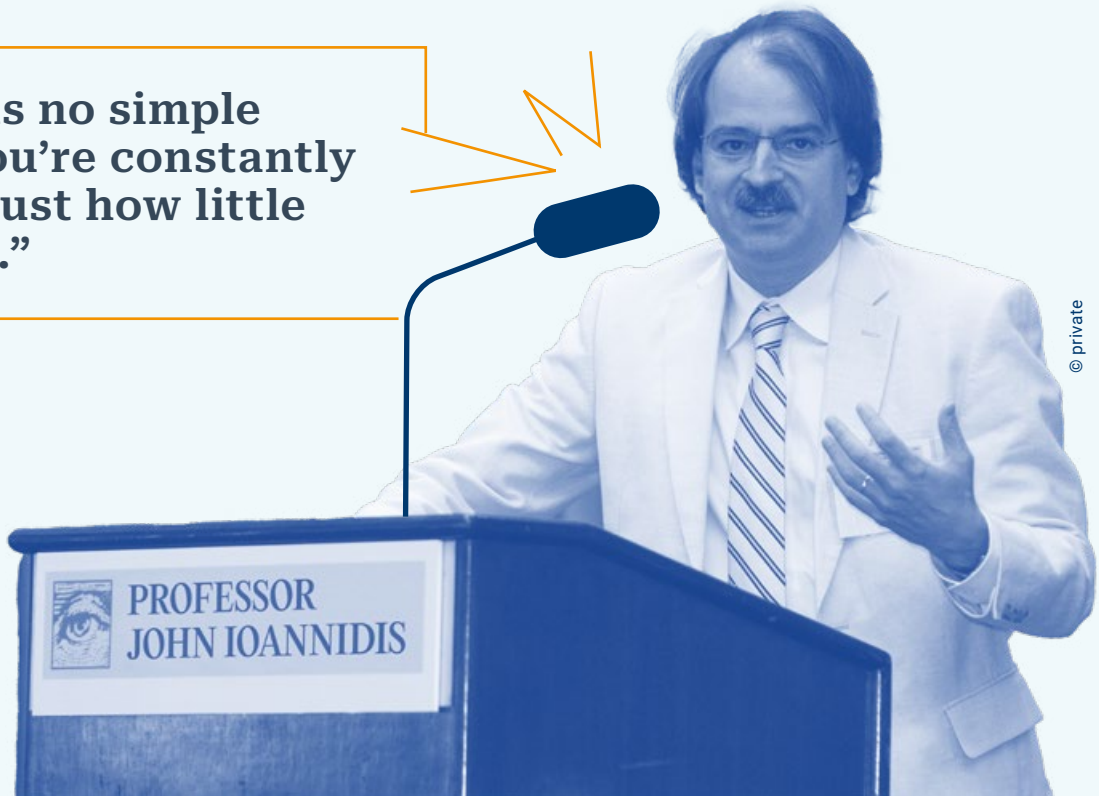
What lessons should science learn from the pandemic?

Rules are often not the best path forward. In the long term they can cause more problems than the potential moderate use of one's own strategies. I am afraid that the loss of trust in science and public health has been fed by irrational rules and regulations. We should all learn from our mistakes and commit to using rigorous scientific methods, avoid merging politics with research or mistaking influencers for scientific evidence. We have to accept uncertainty and be willing to revise our views when better evidence emerges. —

More information

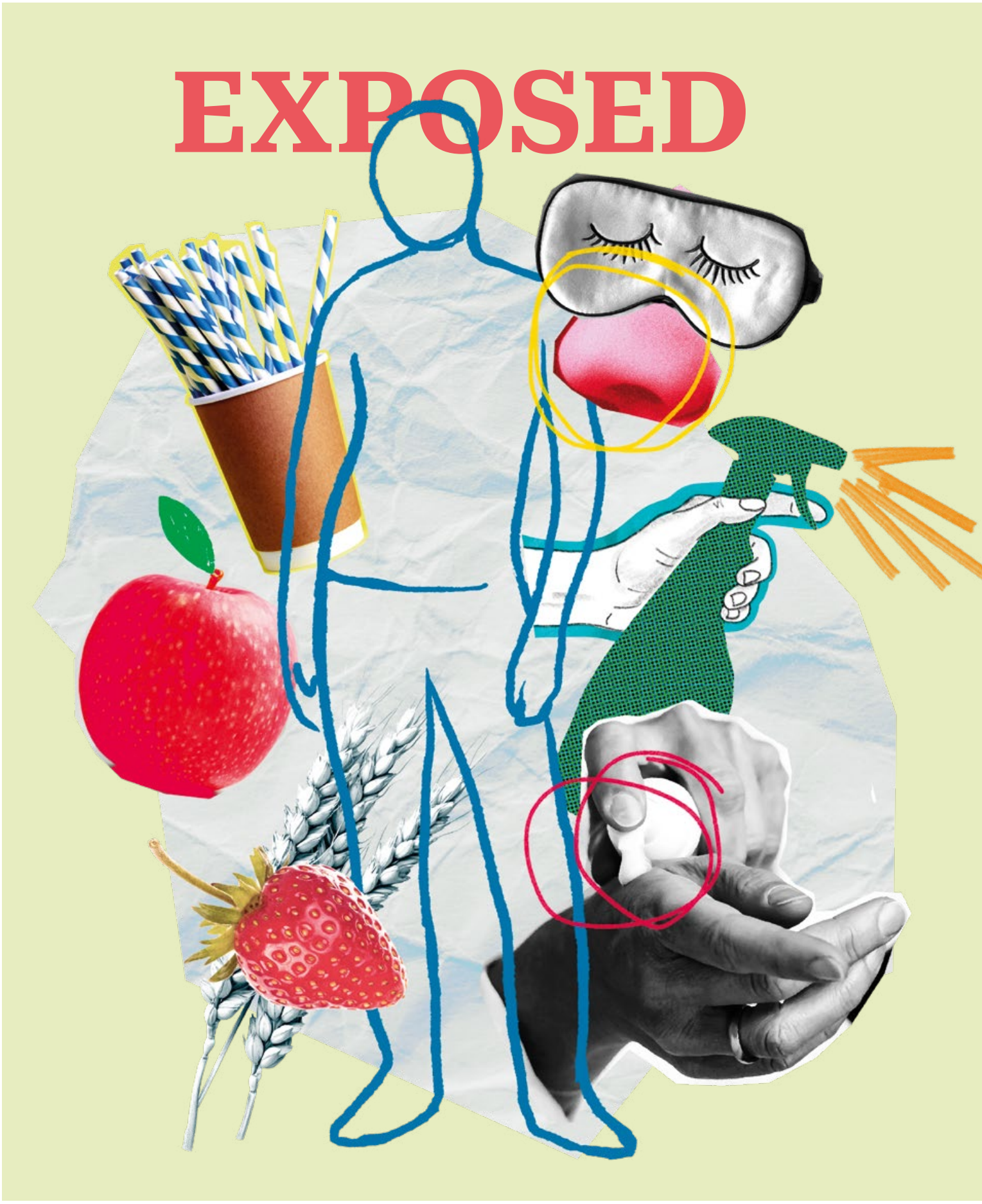
Ioannidis J. P. A.2005. **Why most published research findings are false.** PLoS Med 2(8): e124

"Science is no simple matter. You're constantly aware of just how little you know."



© private

EXPOSED



Exposure is a basic concept in risk assessments. The extent to which an organism is exposed to a potentially harmful substance is a key factor in determining the health risk.

What does poison have to do with classical music? Surprisingly more than one might assume at first. One important element of classical music is exposition: the musical theme is introduced at the beginning of a composition. This exposition has much in common with the exposure which is so central to toxicology, the science of poisons. But in toxicology, it is not a melody that is being presented. Rather, it is a potentially dangerous substance, such as a toxin (poison) or a chemical, to which a person is exposed. There is no poison without exposure. Furthermore, the larger the amount (dose) of the toxin, the greater the exposure and thus the health risk. And this is where the analogy to the beautiful sounds of classical music ends.

Whether or not a substance can cause harm to a person is not just down to the substance. It also depends on the duration and the intensity of the exposure. As such, determining exposure is central in human health risk assessments. This plays a role in, for example, the assessment of chemicals, impurities (contaminations), and residues in foodstuffs or when it comes to the use of plant protection products. For the German Federal Institute for Risk Assessment (BfR), which focuses strongly on these topics, comprehensive and precise understanding of the exposure to a substance is of central importance.

INHALED, INGESTED, ABSORBED VIA THE SKIN

There are three main pathways through which a substance can enter the human body. It can be breathed in (inhaled) or ingested (oral intake) or absorbed by the body through the skin (dermal intake). It is not just the dose that determines the activity; the route of exposure is central, too. A chemical which is ingested is transported via the intestine to the “detoxification centre” that is the liver, where it may in some cases already be “diffused”. By contrast, if a substance is inhaled, it enters directly and often very quickly into the bloodstream. Intake through the skin is yet another case. “The skin is an underestimated organ when it comes to forming a barrier against toxins,” says pesticide expert and BfR Vice-President Dr Tewes Tralau. “It has an incredible and unique ‘detoxing’ talent.”

So, it is not only a question of the dosage of a substance, but also of the route of entry into the body and the extent to which the substance is absorbed. Whether exposure is sudden (acute) or constant (chronic) must also be considered. 50 milligrams of strychnine, a poison formed by plants, can be life-threatening if taken all at once. However, if strychnine is taken over 20 days in daily amounts of 2.5 milligrams, the effect is not deadly, despite the total dose being the same.

CHEMICALS, CHEMICALS EVERYWHERE

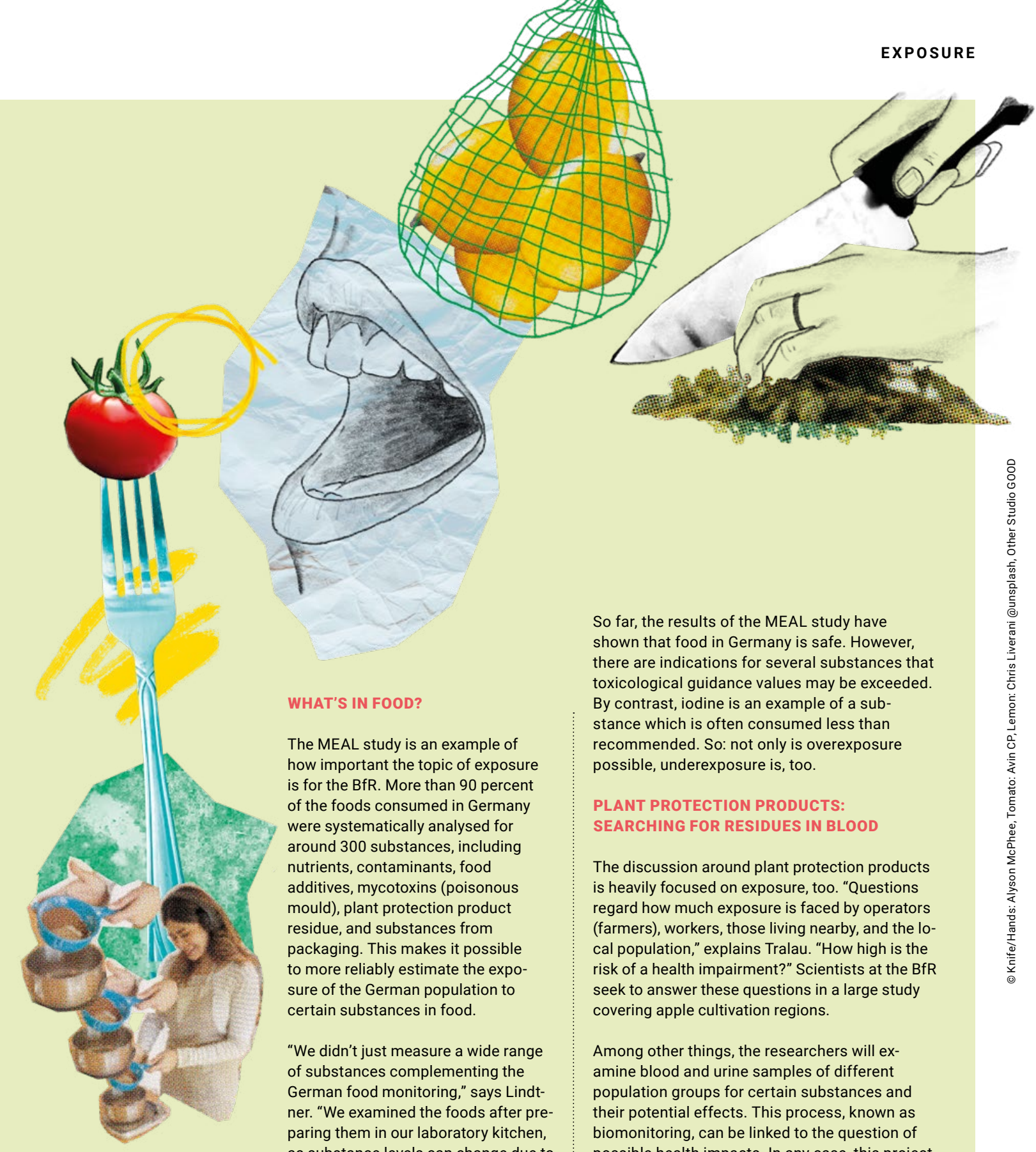
Food and drink, furniture, clothing, cosmetics, work and leisure: we encounter countless substances and articles every day which contain tens of thousands of chemical compounds. It is the central task of the BfR to determine if consumers are exposed to a health risk through consumer goods. This is why exposure is a crucial topic for the institute. First, a reliable classification of the "world of things" is in order. That starts with splitting those things up into the categories of products (such as cosmetics, cleaning products, dyes...) as well as articles (like furniture, toys, and clothing) before these categories are branched off further.

First, a reliable classification of the "world of things" is in order.

In 2017, the Organisation for Economic Co-operation and Development (OECD) evaluated existing classifications for chemical substances and ended up with a total of 107 functional groups, meaning chemicals with the same purpose (i.e. gluing or cleaning). Factors which cause particular attention to be paid to potential intake of these substances, e.g. in the body include close skin contact, products for children or contact with foodstuffs.

Exposure to chemical substances is the subject of various legal regulations in the European Union (EU) in order to manage potential risks. One important legal framework is the REACH Regulation. Accordingly, in order to register a chemical, manufacturers or importers must declare data on toxicity (poisonousness) of the substance and determine the extent to which humans might be exposed to it. This type of exposure assessment is meant to contribute to the use of a given substance in a manner that is not harmful to health across as broad a variety of products as possible, and must therefore be set up to be an accordingly broad assessment.

The BfR, too, conducts exposure assessments for selected substances in accordance with the REACH Regulation. For instance, the institute becomes involved when suspicion arises whether a certain product might pose a health risk. "Sound data are a fundamental basis for realistic assessments," says Dr Oliver Lindtner, exposure expert at the BfR. What is the source of a substance? How and in what amounts does this substance reach humans? Which people are exposed to it? The data is entered into formulas for estimating exposure.



© Knife/Hands: Alyson McPhee, Tomato: Avin CP, Lemon: Chris Liverani @unsplash, Other Studio GOOD

WHAT'S IN FOOD?

The MEAL study is an example of how important the topic of exposure is for the BfR. More than 90 percent of the foods consumed in Germany were systematically analysed for around 300 substances, including nutrients, contaminants, food additives, mycotoxins (poisonous mould), plant protection product residue, and substances from packaging. This makes it possible to more reliably estimate the exposure of the German population to certain substances in food.

"We didn't just measure a wide range of substances complementing the German food monitoring," says Lindtner. "We examined the foods after preparing them in our laboratory kitchen, as substance levels can change due to the effects of heat." After all, deep-frozen chips are not the only foods for which concentrations of chemicals change during preparation.

So far, the results of the MEAL study have shown that food in Germany is safe. However, there are indications for several substances that toxicological guidance values may be exceeded. By contrast, iodine is an example of a substance which is often consumed less than recommended. So: not only is overexposure possible, underexposure is, too.

PLANT PROTECTION PRODUCTS: SEARCHING FOR RESIDUES IN BLOOD

The discussion around plant protection products is heavily focused on exposure, too. "Questions regard how much exposure is faced by operators (farmers), workers, those living nearby, and the local population," explains Tralau. "How high is the risk of a health impairment?" Scientists at the BfR seek to answer these questions in a large study covering apple cultivation regions.

Among other things, the researchers will examine blood and urine samples of different population groups for certain substances and their potential effects. This process, known as biomonitoring, can be linked to the question of possible health impacts. In any case, this project is of about the same scope and size as the MEAL study, which has by now almost concluded. One thing is clear: the BfR will continue to set the tone on exposure. —

(No) reason to see red

Metals, pesticides, biocides: news proclaiming the discovery of hazardous substances in period products make the rounds every so often. What risks might tampons and other period products pose?

They are available in different forms and materials – the kinds of period products on offer are enormously diverse. But what about the detection of undesirable substances? What materials and substances are being discussed? While some alarming headlines can be judged based on scientific evidence, other claims reveal areas which require more research.

HEAVY METALS AND PESTICIDES IN TAMPONS

In 2024, American researchers detected traces of 16 metals – including heavy metals such as arsenic, lead, and cadmium – in tampons from various manufacturers, including those from the EU. Furthermore, in 2015 and 2016, small amounts of pesticide residues were detected in different hygiene products made of cotton. "Because tampons consist primarily of cotton, this possibility cannot be entirely excluded," explains Suna Nicolai, whose work at the German Federal Institute for Risk Assessment (BfR) concerns the safety of consumer products. The rayon staple and cotton used in tampons should comply with the purity requirements of the European Pharmacopoeia for non-sterile sanitary cotton made from cotton and viscose. These requirements mandate that pesticide residues should be limited to a technically unavoidable minimum level. "In the view of the BfR, health impairments from pesticide residues and heavy metals in tampons are not to be expected, even in case of complete uptake via the mucous membranes," Nicolai says in conclusion.

ALTERNATIVES – LIMITED DATA

Today, reusable alternatives are commonly used among the available period products. These alternatives

include menstrual cups which are typically made of medical grade silicone. Thermoplastic elastomers (rubber-like plastics) or natural rubber are also used. Depending on the material, different residues may be present in the menstrual cups. The available data on potential health risks is limited. However, initial data gathered by consumer protection authorities do not suggest that health impairments are to be expected.

Menstrual sponges, including those made from sea sponges, are considered another sustainable alternative. The BfR has not yet conducted a health risk assessment for menstrual sponges. However, there are concerns regarding exposure to bacteria, mould, and residues for example from clams.

HYGIENE MATTERS

Hygiene should be particularly prioritised in relation to period products which are inserted into the body (tampons, menstrual cups, and menstrual sponges). Measures include thorough hand washing, cleaning of reusable products, and regular changing of inserted products. This reduces the risk of toxic shock syndrome (TSS). TSS is a rare, sudden-onset illness caused by bacteria. It can result in fever, headache or rash. Severe cases can lead to life-threatening conditions such as multiple organ or heart failure.

For many women, period underwear is a welcome alternative. Blood is absorbed by a multi-layer insert integrated into the underwear. In order to combat bacterial growth and unpleasant odours, some manufacturers include biocides such as silver chloride in these products.

BIOCIDES – MISSING APPROVAL

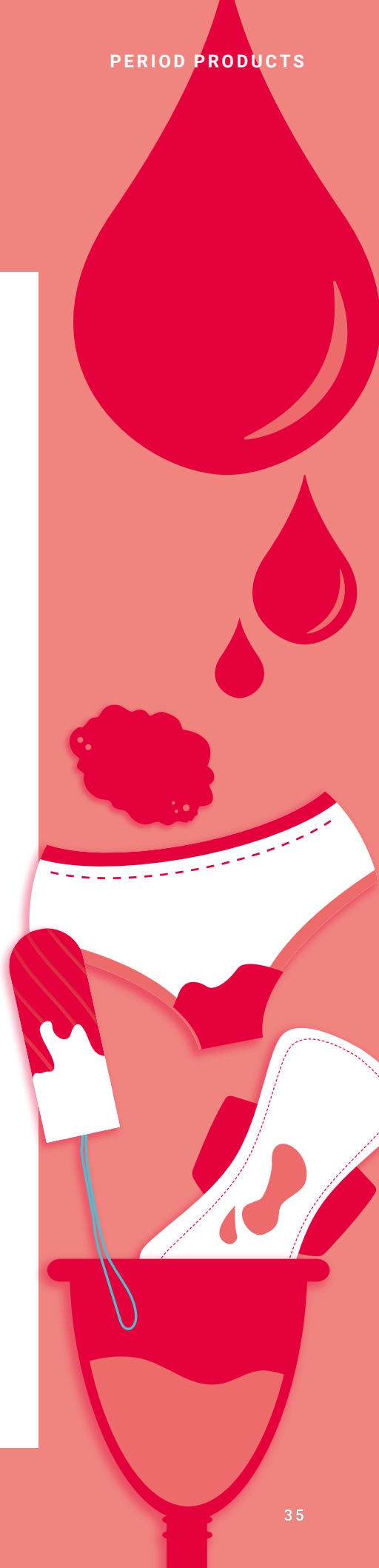
"Biocides must be approved before use. For many so-called old active substances which were already in use prior to May 2000, European approval processes are still ongoing. These substances can be used in period underwear until the processes have concluded," explains Dr Vera Ritz, who oversees the health assessment of biocides at the BfR. Until then, however, the manufacturers are required to provide a safe and effective product and fulfil their labelling and information obligations.

"Depending on the substance characteristics and on the concentration, biocides may have health effects, including allergic reactions or disturbances of the skin's bacterial flora," says Ritz. When in doubt, the BfR recommends using other products until the approval process has concluded.

As a rule, the following is true for period products: The manufacturer or distributor is responsible for compliance with legal regulations. Monitoring based on samples, which is coordinated by the German Federal Office of Consumer Protection and Food Safety (BVL), is carried out by the market monitoring authorities of the German federal states. —

More information

BfR-FAQ
"Usually harmless: potential risks of period products"



Message in a bottle

Enough to spoil your appetite: reports about microplastics, plasticisers etc. in drinks from PET bottles. What are the health risks of this plastic?

© Ekaterina Demidova/gettyimages

PET, recognisable by the three-pointed arrow symbol with the number 1 and short for polyethylene terephthalate, is mainly used for beverage bottles but also for other food packaging. Whether there is actually more than the desired drink lurking in the bottle – i.e. substances harmful to health that can transfer from the material into the drink – is a repeated topic of public debate.

LIQUID HORMONES

At first glance, the suspicion that PET bottles could transfer hormone-like substances into the drinks appears to be not unfounded. Some studies showed a low oestrogen activity in mineral waters from PET bottles. However, the activity was approximately 10,000 times lower than the natural hormone-like effect of beverages such as milk, beer or red wine. Interesting: "A comparison of mineral waters from PET and glass bottles showed no difference in the measured oestrogenic activity. Therefore, there is no reason to assume that this activity is caused by the PET bottles," says

Dr Thomas Tietz, who deals with the safety of food contact material at the German Federal Institute for Risk Assessment (BfR).

PLASTICISERS OR BPA IN PET?

Phthalates and other plasticisers come to mind when plastics are discussed. Some of them also have hormone-like effects, but they are not used in the manufacture of PET bottles. Small traces of these substances could certainly be introduced, for example, as impurities during recycling or via the lid seals. However, in the investigated mineral waters, they were only, if at all, detected in concentrations far too low to explain the measured oestrogenic activities.

Does the presence of PET mean BPA isn't far? Drinking cups, plastic tableware, or the inner coating of food cans may contain the substance bisphenol A (BPA for short). It is often associated with various adverse health effects. BPA is also not used for the production of PET, but it has been detected in some recycled PET bottles. "The amounts were, however, far below the legally defined limit values and thus, according to current knowledge, do not pose a health risk," says Tietz.

SMALL PARTICLES, SMALL EFFECTS?

84% of consumers worry about microplastics in foods. This is demonstrated by a representative survey of the BfR from 2024. Several studies were able to detect plastic particles when investigating mineral waters, particularly in reusable bottles. Water from reusable glass bottles, however, showed similar levels to water from reusable PET bottles, which points to a contamination during the cleaning or refilling processes – for example when removing labels. The abrasion of the lids or ageing of the materials of reusable bottles could also be a source. According to the current knowledge, it is unlikely that microplastic particles in food pose any health risks.

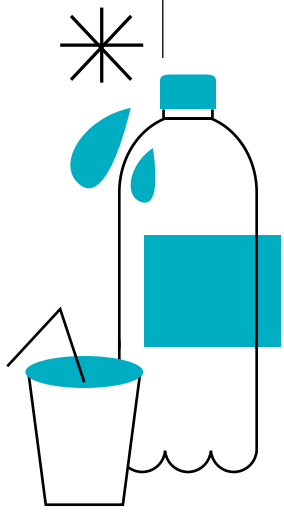
SWEET AFTERTASTE

What if the water tastes strange? Anyone who drinks mineral water out of PET bottles might have noticed a sweet and fruity taste – caused by acetaldehyde. Even very small amounts of it can be tasted or smelt. "The substance is created during the manufacture of PET and can transfer into the water due to technical defects. With small amounts, however, no health risk is to be expected," explains Tietz. PET bottles only release very small amounts of acetaldehyde since a taste impairment of the water is legally not permissible.

In summary: PET bottles do not contain hormone-like substances or plasticisers, BPA or microplastics in such quantities that could have a negative impact on health. This is also true of the occasional sweet and fruity taste of mineral water from PET bottles which is caused by acetaldehyde. Consumers can feel confident grabbing a bottle. —

More information

BfR-FAQ
"PET bottles: no indication of health risk"



HYGENIC HANDLING OF BOTTLED DRINKS

— Store already opened bottles closed and chilled.

— Avoid drinking directly from the bottle or sharing with others.

— If possible, drink immediately after opening the bottle – especially if you are drinking straight from the bottle.

— Freshness tip: Pay attention to the "best before" date for waters in PET bottles (carbon dioxide can more easily escape PET bottles than glass bottles).

“Sunscreen is not top priority”

UV rays can cause skin cancer. Dr Inge Paulini, President of the German Federal Office for Radiation Protection (BfS), explains that while sunscreen offers protection, other measures are more important.

Dr Paulini, the number of new cases of skin cancer caused by UV radiation has increased dramatically over the past 30 years. In 2023, about 4,500 people in Germany died of skin cancer. But we have always had sun and UV rays: What has changed?

The climate. We know that this changes things including the cloud cover. The result is an increase in the number of hours of sunshine per year, the number of years with a lot of sun, and therefore UV radiation.

How are these events connected to each other?

Clouds partially block or disperse UV rays. On an overcast day, very little radiation reaches us. But due to climate change, we are seeing an increase in days with a lot of sunshine and few clouds. Our behaviour has changed, too. On a sunny day people tend to spend more time outdoors and are thus more exposed to UV radiation. This increases the risk of skin cancer.

What time of the year should I start focussing more on sun protection?

This is not necessarily only a question of the season. It is better to look at the UV index, which is stated in many weather apps and is a globally standardised scale indicating UV strength. It starts at 1 and there is no upper limit. We should start protecting our skin and eyes at level 3. Level 3 corresponds to a nice day in spring with a little sun. That is already sufficient to damage the skin. In January, too, for instance when skiing at higher elevation, one should think about appropriate UV protection.

How can I best protect my skin? Should I use a lot of sunscreen, if possible with SPF 50?

Sunscreen application is the last step. The most important thing is to avoid being exposed to direct sunlight if possible. The more intense the sun, the more it should be avoided. If there is shade, people should seek it. The second step is to cover your skin: long sleeves, long trousers, a hat, sunglasses. Sunscreen is the third step.

What should I keep in mind when there's intense sun and I want to go out and use sunscreen?

For sun protection products, the higher the sun protection factor (SPF), the better the protection. It is important to apply enough sunscreen and to reapply it regularly. Otherwise, the UV protection does not fully work. Sunscreen should be immediately reapplied after going into water. I would say it is advisable to apply it more frequently and use more of it than too little.

It sounds like we should avoid sunbathing entirely.

If people wish to sunbathe, then only in very small doses and not during the intense midday sunshine. People often spend time in the sun in order to get a tan. However, one should know that a tan is a protective mechanism of the skin cells to keep the UV radiation from doing even more damage. With that being said, a tan is actually already indicative of damage, it is a defence reaction by the skin. A tan is not a sign of health.

Does it make sense to use a tanning bed before a vacation in order to acclimatise your skin?

No, all that it does is increase your risk of skin cancer. The UV radiation in tanning beds is typically as strong as the sun at the equator – during midday when the sun is at its highest point. It doesn't get much more intense than that. —

Plasticisers in sunscreen

In early 2024, studies found traces of the plasticiser DnHexP in a subset of sun screen products. The substance is prohibited to be used in cosmetic products, but it may be detected in a specific UV-filter as a contaminant due to the manufacturing process. According to the BfR, the amounts of DnHexP detected in the individual sun screen products were very low, meaning that adverse problems are very unlikely.

BfR survey
UV filters in sun protection products

81%
of respondents have heard of UV filters in sun protection products as a health topic.

54%
do not feel well-informed about this topic.

18%
are (very) concerned.

42% are not (at all) concerned.

More information

BfR Consumer Monitor 08/2024

BfR online survey of 1,001 people in Germany from 5-14 August 2024.

Bittersweet aftertaste

From cola or menthol to strawberry-kiwi: e-cigarette aromas appeal to young people in particular. However, the substances pose health risks.

In contrast to "classic" cigarettes, no tobacco is burned in e-cigarettes. Instead, a liquid is heated and vaporised in the devices. The main ingredient of this liquid is usually propylene glycol, which is also used in fog machines. Together with glycerine, it functions as a nebulising agent and is responsible for the dense vapour from e-cigarettes. The liquids also usually contain nicotine and numerous aromatic substances and fragrances. They give e-cigarettes a fruity, fresh, or sweet taste.

Studies indicate that heating the nebulising agents propylene glycol and glycerine can lead to the formation of carcinogenic substances known as aldehydes. It is well established that, on the one hand, nicotine is highly addictive, and on the other hand can disrupt brain development. This is demonstrated, for example, by reduced learning ability and increased anxiety.

UNKNOWN EFFECTS OF MANY INGREDIENTS

"It is still unclear what effects many ingredients have on the body after inhalation," says chemist Dr Elke Pieper, who examines the safety level of tobacco products and e-cigarettes at the German Federal Institute for Risk Assessment (BfR). This particularly applies to the aromatic substances and fragrances in e-cigarettes. "Individual liquids often contain a mixture of dozens of different aromatic substances and fragrances."

Many of these substances have been tested and approved for use in foodstuffs and cosmetics. "Negative health effects are not to be expected in these cases. However, it's another story altogether when a substance is heated and inhaled," Pieper says.

SWEETENER BREAKS DOWN WHEN HEATED

Heat and contact with other ingredients can cause substances to change, and new, possibly harmful compounds may occur. One such example is the sweetener sucralose, which is permitted in the EU as a food additive. It does not pose a health risk when used in sugar-free lemonades, spreads, or jams. However, when sucralose is heated to 120 °C – as happens with e-cigarette liquids – chloropropanols arise, which can harm health.

MENTHOL REDUCES URGE TO COUGH

Another problematic aromatic substance is menthol, which is found not only in e-cigarettes with an explicit "menthol taste", but also in lower doses in many other liquids to round off the taste. A side effect which should not be underestimated is that menthol reduces the natural urge to cough, which is actually an important defence mechanism of the body. "If the urge to cough is weakened by menthol, then substances from e-cigarettes that are harmful to health can be more easily and deeply inhaled," Pieper says. "We assume that, even at lower dosages, menthol and similar aromatic substances in the liquids make it easier to start using e-cigarettes and make them more appealing to adolescents and young adults." This is one reason why menthol in tobacco cigarettes has been banned in the EU since 2020.

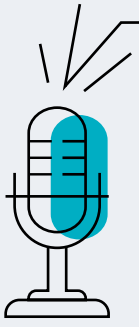
UNKNOWN LONG-TERM EFFECTS

Many questions about the health risks posed by e-cigarettes remain unanswered, particularly with respect to long-term effects. That is another reason why the BfR will continue to examine the issue. "However, based on initial population group studies, particularly from the USA, we already know that the number of cardiovascular diseases among e-cigarette users has risen," Pieper says. "In Germany, too, there have been repeated cases of severe pneumonia. No matter how tempting the vapour may smell, users are inhaling a chemical mixture containing many substances hazardous to health." —

More information

BfR communication
"Flavouring substances in e-cigarettes: updated assessment of safrole, sucralose and menthol"

Risiko – the BfR podcast



More information on the health risks posed by e-cigarettes is available from the BfR science podcast "Risiko". There, the expert Dr Elke Pieper explains everything important about the structure, ingredients, and effects of this product (in German).

A ball of tissue

Biochemist Dr Julian Heuberger cultivates intestinal organoids, miniature replicas of organs. In this way he simulates the digestive system and wants to replace animal experiments.

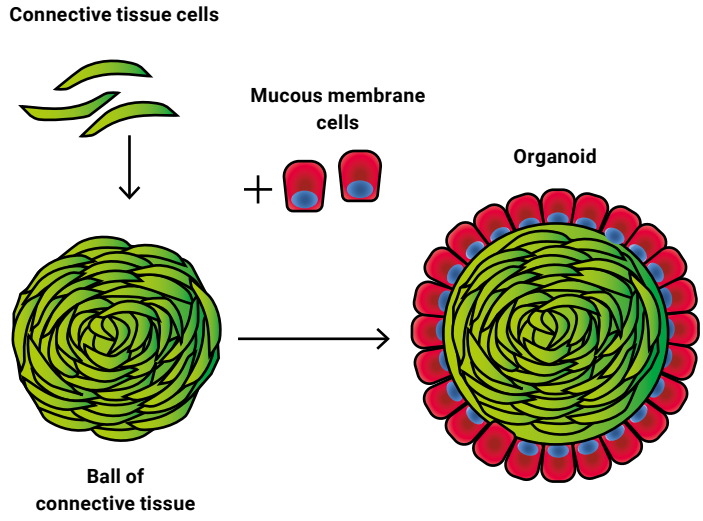
At first glance, the object examined under the microscope gives the impression of being a small, glinting ball. Magnification reveals a layer of tightly packed rows of long cylindrical cells on the ball's surface. Beneath these surface cells, the other cells appear fibrous and randomly arranged. All cells organised in this ball-like structure originate from the intestine. Its scientific term is "organoid." It is a tiny, very similar version of a "real" organ. Organoids are the subject of intensive research and development because they pave the way for new scientific advances, including the use of organoids to help replace animal experiments.

The man behind the ball-shaped organoids is Dr Julian Heuberger from the German Centre for the Protection of Laboratory Animals (Bf3R) at the German Federal Institute for Risk Assessment (BfR). Heuberger cultivates intestinal organoids from animal and human cells. The human intestinal organ consists of several layers. The single-layered epithelium as the "lining" towards the inside. It forms the intestine's mucous membrane which absorbs nutrients from the bolus. Underneath the epithelium is the connective tissue (stroma) interlaced with blood vessels, followed by an outer muscle layer.

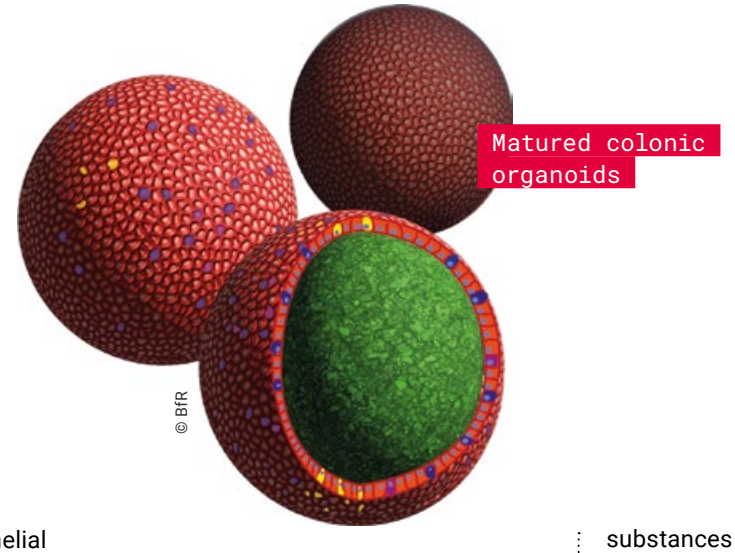
SELF-ORGANISING ORGANOIDS

How can this be recreated in the laboratory? Heuberger has found an elegant solution. He combines stroma cells from the intes-

How colonic organoids are created



The mucous membrane cells (epithelium) huddle up to the balls of connective tissue (stroma), fuse with them and continue to mature. The organoid organises itself and, within a few days, the core of stroma cells is completely covered by epithelium.



tine and the corresponding epithelial cells in a bioreactor – a special vessel for cultivating cells. Then what scientists call "self-organisation" occurs. The epithelial cells huddle up to the stroma cells, fuse with them and continue to mature. The organoid-ball organises itself. "After a few days the core of the connective tissue is completely covered with epithelium," says Heuberger.

The colonic organoids produced in this way have significant advantages compared to earlier organoid models. The addition of growth-promotion factors is only required to a very limited extent since the stroma itself produces growth factors. In addition, these organoids can be composed with numerous macrophages (phagocytes that belong to the immune system).

The organoids thus have another essential element of the "real" intestine, as this is rich in cells for immune defence. This method of culturing organoids enables them to survive for weeks and be produced at a precisely defined, standard size. This significantly increases the range of applications for test systems.

INSIDE OUT

The greatest advantage of this culture technique, however, is the easily accessible epithelial surface of the organoid. The epithelial cells cover the stroma core like a thick lawn. This greatly facilitates the scientific study of the intestinal barrier, in order to, for example, better understand infections, metabolism and the influence of medications or chemicals on the organism. "We have turned the intestine inside out," explains Heuberger. "In a sense, the epithelium is "bathing" in the test liquid, whereas in classic organoid cultures, the epithelial surface could only be reached with difficulty."

A LONG ROAD

Even though the idea of artificial miniature organs is impressive and currently all the rage in the scientific community, the road to them being used as replacement for legally required animal experiments is still a long one. The intestine is just one part of the body, albeit an important one. Thus, intestinal organoids offer advantages such as the ability to test substances and make preselection before an animal experiment is necessary. Cooperation with other laboratories is also important to the scientists as to date almost everyone has their own "recipe". "This might be sufficient for academic questions," says the researcher. "But it makes standardisation difficult, which is essential for the use of alternative methods to animal experiments." To find joint solutions Heuberger cooperates with institutes such as the Berlin University Clinic Charité, the TU Berlin and the Max Delbrück Center for Molecular Medicine in Berlin-Buch.

After multiple scientific stops, Julian Heuberger has now found the ideal place at Bf3R to put his ideas into action. Both the scientific environment of the Bf3R and its proximity to the Berlin biomedical research institutes contribute to this. Heuberger has been at the Bf3R since 2023 – and it already appears to be a very organic relationship. —

Animal experiments? SMAFIRA searches for alternatives

The EU requires the possibility of animal-free alternatives to be examined before animal experiments can be carried out. The computer scientist Mariana Lara Neves has developed an online tool to make the corresponding research easier.

Ms Neves, you have developed the online tool SMAFIRA. Who are the intended users?

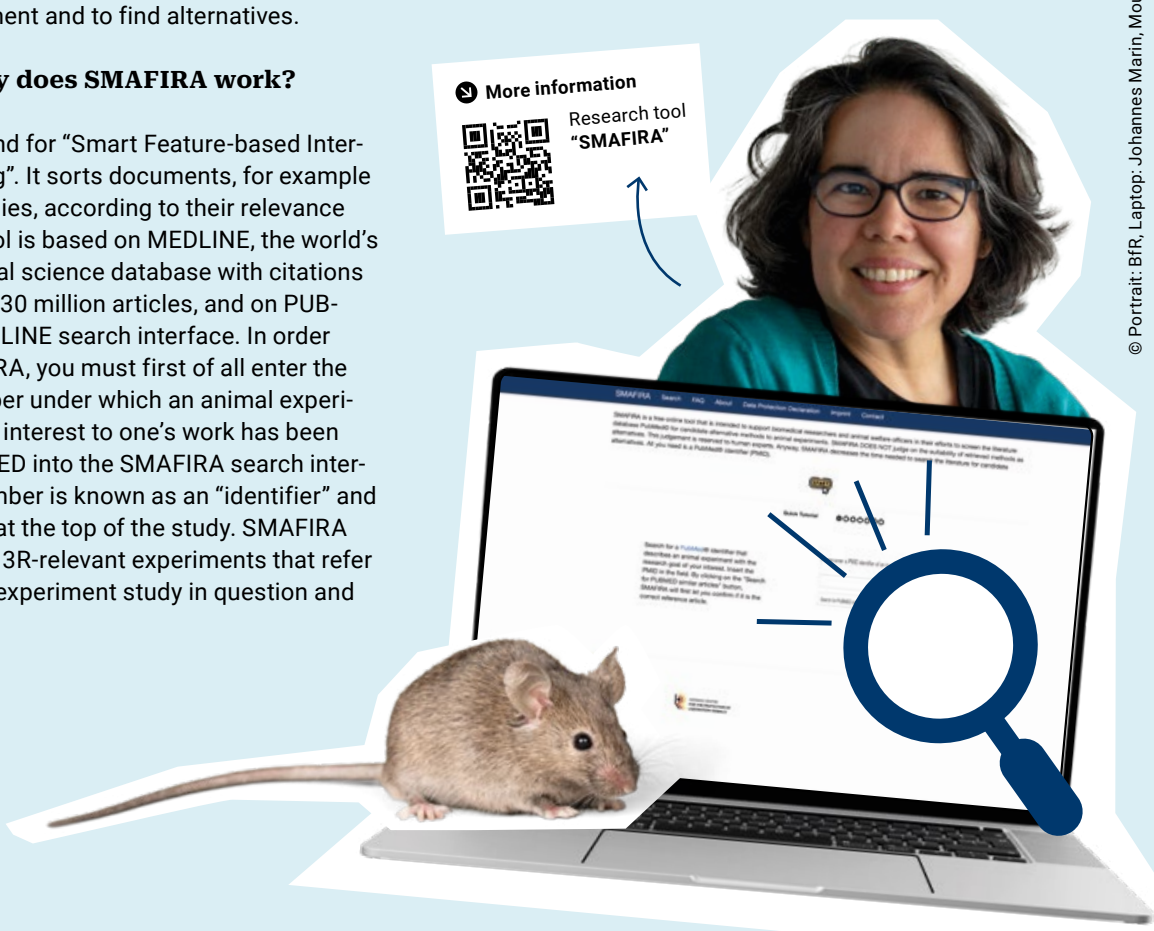
SMAFIRA is aimed at scientists who experiment with or without laboratory animals and are interested in the 3R principles. 3R seeks to reduce and replace animal experiments or to refine the conditions for laboratory animals. Our online tool makes it easier to locate 3R-relevant information for an experiment and to find alternatives.

How exactly does SMAFIRA work?

SMAFIRA stand for “Smart Feature-based Interactive Ranking”. It sorts documents, for example scientific studies, according to their relevance for 3R. Our tool is based on MEDLINE, the world’s largest medical science database with citations for more than 30 million articles, and on PUBMED, the MEDLINE search interface. In order to use SMAFIRA, you must first of all enter the relevant number under which an animal experiment study of interest to one’s work has been filed at PUBMED into the SMAFIRA search interface. This number is known as an “identifier” and can be found at the top of the study. SMAFIRA then looks for 3R-relevant experiments that refer to the animal experiment study in question and ranks them.

What benefits does SMAFIRA offer?

Just like PUBMED, SMAFIRA is free of charge and freely accessible. Because the tool uses artificial intelligence, it continues to develop. It allows you to search in a targeted manner for specific criteria, for example experiments using human or animal cells or tissues tests. We want to stress that we are improving SMAFIRA continuously. So it’s worth sticking with it. —



INTERNATIONAL NEWS

Connected beyond borders
Supporting the development of new methods for the risk assessment of chemicals in food – this is the mission of ILMERAC, an international network of more than 25 organisations from the area of food and feed safety. From 2024 to 2026, the BfR will fill the role of ILMERAC chair, support the Scientific Secretariat, and organise, among other things, meetings and strategy discussions. In the past, ILMERAC has worked on various challenges in risk assessment, for example relating to mixtures and the transferability of data from animal experiments to humans.

EFSA Public Consultations
Did you know? The European Food Safety Authority (ESFA) regularly consults public opinion around the world with respect to risk assessment and scientific publications. EU law requires these consultations in the name of greater transparency and to obtain the broadest possible range of perspectives and scientific findings. The BfR also contributes its expertise to the consultations.

More information

Current public EFSA consultations

INTERNA

BfR with a fresh look
We've revamped our appearance! Since May of this year, the BfR has a new online look: In a clearer and more modern way than before, ***www.bfr.bund.de/en/*** and the associated microsites present issues concerning consumer health protection. The new, accessible website was specially developed for mobile use, meaning that more than 1,000 pages and 10,000 German- and English-language publications such as opinions, brochures, and videos on issues concerning food, product, and chemicals safety are also available while you are on the move. From easily comprehensible information for the public to specific, specialist knowledge for experts, the platform offers all target groups various entry points to the full spectrum of BfR topics.


© BfR

Coronavirus exhibition on tour
The exhibition "#Krisenalltag – Kommunikation in der Pandemie" (#everydaycrisis – communication during the pandemic) can still be seen at the Landesmuseum Dithmarschen until 5 October 2025. The exhibition allows visitors to reflect on public communication during the pandemic. The interactive concept was developed as part of the BMBF-funded project "Optimising risk and crisis communication for governments, agencies, and public health organisations (MIRKKOMM)". The exhibition was launched at the Museum of Communication Berlin in 2023 and is now on tour. The BfR coordinates the project, and in a sub-project is researching conflicts of knowledge and values in times of crisis.

More information

Project website **mirkkomm.de** *(in German)*

INTERNAL AFFAIRS

New BfR Vice-President
Since 1 March 2025, Dr Tewes Tralau has been the new Vice-President of the BfR. He succeeds professor Dr Tanja Schwerdtle, who switched to a new role as President of the Max Rubner Institute in autumn 2024. The biologist Tralau has worked at the BfR since 2010 and specialises in the topics of secondary metabolism, biochemistry, and regulatory toxicology.

© BfR

SURVEY

Your opinion on BfR2GO
Last autumn, we asked you, our readers: How do you like our magazine? Your feedback showed that BfR2GO keeps you well informed about everyday health risks and the research behind them without causing anxiety. BfR2GO is perceived as trustworthy, comprehensible, and interesting, as well as scientifically accurate. The magazine is seen to have a clear format, to be engaging, varied and pleasant to read, the colours and text lengths are deemed suitable, the topics up-to-date and relevant, and the layout modern yet professional. Some respondents felt that BfR2GO could work on less complex but more in-depth articles involving consumer protection trends.

Thank you to everyone that participated in the survey. We'll stick with it – and with you, whose opinions we greatly value: publikationen@bfr.bund.de

Legal notice

BfR2GO – Issue 1/2025

Publisher:
German Federal Institute for Risk Assessment (BfR), Institution under public law

Represented by the President,
Professor Dr Dr Dr h. c. Andreas Hensel
Responsible according to the German Press Law: Dr Suzan Fiack

Editorial department address:
German Federal Institute for Risk Assessment (BfR)
Max-Dohrn-Strasse 8–10
10589 Berlin, GERMANY
www.bfr.bund.de/en
publikationen@bfr.bund.de

Edited by:
BfR Press and Public Relations Unit

Design, graphics & image editing:
Studio GOOD, Berlin

Translation:
GlobalSprachTeam Sassenberg e. K., Berlin

Print-ISSN 2567-3858
Online-ISSN 2567-3866
DOI 10.17590/20250709-155638-0

The articles are translations of the original German texts which are the only legally binding versions.
The opinions of external interviewees expressed in the BfR2GO interviews reflect their own views.

The BfR science magazine BfR2GO is published twice a year. Free subscription at:
www.bfr.bund.de/en/publications/bfr2go/

BfR
German Federal Institute for Risk Assessment

Follow us:

Consumer health protection to go

Twice a year, the compact and knowledge-packed BfR2GO Science Magazine provides up-to-date and well-founded information about research and the assessment of this research in consumer health protection and for the protection of laboratory animals.

Order, subscribe or download the magazine free of charge:
bfr.bund.de/en/publications/bfr2go/

BfR2GO