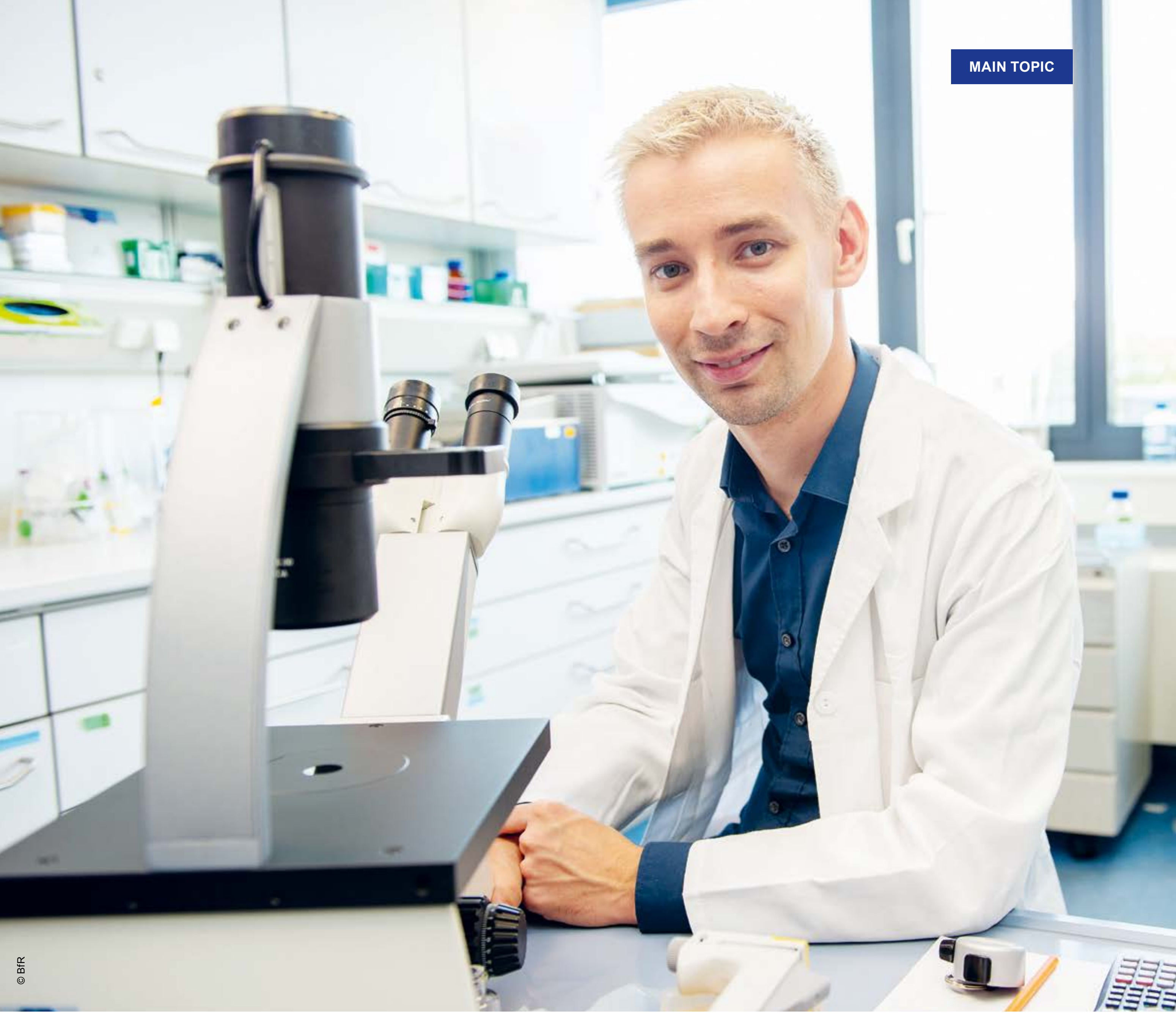
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"Nanoplastics will keep us busy for a long time"

Mr Sieg, why is it so difficult to detect microplastics in food?
Foods are very complex mixtures. Investigating the different types of microplastics and quantifying them in food is very difficult in terms of analysis. The difference in density between plastic particles and the surrounding food material is small. Standard methods, such as spectroscopic methods, are unsuitable. This is simply because the usual measuring principles do not work. The studies currently being discussed have therefore only been carried out with very simple foods, such as mineral water or table salt.

It is safe to assume that microplastics are found in many foods.
Microplastics are in the air, water and soil – all parts of the environment. The question is, how much? And: does it enter the food chain? Studies have shown that microplastics are mainly found in mussels and seafood. This might have something to do with the fact that microplastics from the environment accumulate in the sea. As long as they remain in the intestine of the fish and other sea creatures, they will not enter the food chain. Animal intestines are not usually eaten.

Which research approaches are promising to detect microplastics in food?
There is no universal method. Thermoanalytical methods are used to vaporise and analyse samples using heat. However, only the amount of plastic can be de-

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termined in this way. Spectroscopic methods can be used to characterise particles in terms of size, shape and structure.
Examples are micro Raman spectroscopy and micro-FTIR spectroscopy – both infrared methods that can also display very small particles.

Spectroscopy is based on light scattering.
When a beam of light hits a material, such as food, cell layers or even plastic particles, something happens to it: it is absorbed, bent or reflected away. The resulting scattered light can be measured and conclusions can be drawn about the properties of this material. Light waves that can be seen are referred to as optical spectroscopy. Infrared spectroscopy uses infrared light. X-ray spectroscopy also exists. Different measurements can be made using each wavelength.

Do you carry out the measurements yourself?
We work more in terms of toxicology than analysis: our junior research group is investigating the effects that plastics might cause in the body. We mainly experiment with cell-based systems, for example, simulating the human small intestine. This tells us whether plastic particles are absorbed by the cells, alter them or make their way from there into the blood – and are therefore distributed systemically.

Even smaller particles exist: nanoplastics. Are these particles more problematic than microplastics?
Nanoparticles are smaller than 100 nanometres. Very little is known about these particles. The fear is that nanoplastics might be in the position to overcome cellular barriers and spread throughout the body. But we still don't know anything about the possible effects. Nanoplastics pose a problem for research itself.

In which way?
It is hard to get results. For one thing, the particles cannot be detected with optical microscopes; they are simply too small. Furthermore, we cannot experiment with them yet. To do this, we would need standardised particles; reference particles. These are particles that are always the same size and have the same chemical properties. Nano reference particles are even more difficult to produce and process in the laboratory than microplastic particles. We are currently trying to get hold of this material. The German Federal Institute for Materials Research and Testing is able to synthesise nanoplastics.

What is this process like?
Quite futuristic: a polymer shell is synthesised around a very tiny core. A lot of chemical development work is required to achieve this. There are already core-shell particles made from a material similar to plexiglas. We want to use these to test whether our methods can be applied to nanoparticles.

What do we know about nanoparticles?
We know very little about them because they are so hard to examine. Nano-polystyrene is the most widely known substance to date. We have determined the viability of cells in cell experiments with particles of 20 and 100 nanometres in size, which is just about in the nano range. The particles have a toxic effect in overload situations in which the cells are overwhelmed and eventually collapse. These amounts are significantly higher than any expected human exposure.

So nano-polystyrene means no problem?
Little can be expected from the material itself. It is considered to be relatively unreactive. It could be more problematic that additives are released or environmental contaminants stick to the polystyrene – and then enter the body together with the particles. Projects are being planned to examine this. Many research groups have only just started investigating microplastics, and now we're talking about nanoplastics. We will be looking at this for even longer. ◘