SUCCESS STORY

microONE
Microplastic Particles: A Hazard for Human Health?

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INFLUENCE OF MICROPLASTIC PARTICLES ON THE HUMAN GUT MICROBIOME PROVEN

USING BIOREACTOR EXPERIMENTS, WE SHOWED THAT A WIDE VARIETY OF MICROPLASTIC PARTICLES CAN HAVE DIFFERENT INFLUENCES ON THE COMPOSITION AND FUNCTION OF OUR GUT MICROBIOME.

Micro- and nanoplastic particles enter the human body via the food chain. The particles are distributed in all parts of our organism and have already been detected in faeces, for example. What effect the particles have on the human gut is still largely unexplored.

The human gut harbours a large number of bacteria - our gut microbiome - which could potentially be affected by plastic particles. Previous research on fish and mice already indicates this, but such results are often difficult to transfer to humans. Another disadvantage of many experiments carried out to date is that tests are often carried out with plastic particles produced in the laboratory. Due to their uniform shape, standardised size and precisely defined material, it is often possible to draw very specific conclusions, but the comparison with particles actually encountered in the environment is not possible.

Our aim was to depict environmental conditions more realistically and to demonstrate the direct influence on bacteria. In order to actually understand the influence on bacteria, it is necessary to remove them from their natural habitat and decouple them from influences such as protective mucus or immune cells. Our chosen approach for this was so-called bioreactors.

A bioreactor allows bacteria to be grown in an artificial habitat, in this case a glass vessel, which is

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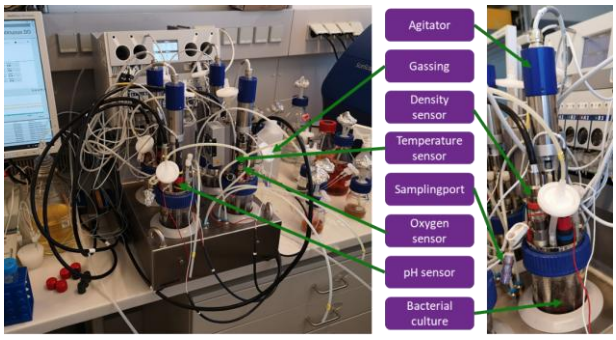
measured and monitored around the clock to create optimal conditions that are similar to those in the gut and allow bacterial growth.

Our bioreactor model (MyBioScope) has been inoculated with human faecal samples, which has the advantage that experiments can be carried out directly on the human microbiome without potentially harming people or conducting lengthy trials.

Not all plastics are the same

In the environment, microplastic particles are mainly produced by abrasion and crushing of larger particles. They differ in their properties due to the type of plastic used, the size, additives added, various impurities and also bacterial contamination. In order to paint as diverse a picture as possible, we used a wide variety of particles in our experiments, produced from ground coffee cups, sold as adhesive powder or produced as an additive for cosmetics.



The illustration shows the structure of the MyBioScope model with labelling of the various components.
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Influence on bacteria

Daily exposure of the microbiome of healthy test subjects to various types of plastic in the bioreactor quickly revealed that plastic exerts a strong influence on individual bacterial groups. The influence is not uniform or in a specific direction, but differs from one tested particle type to the next. This once again emphasises the complexity of this topic and highlights significant knowledge gaps.

One thing that all the plastic particles tested however, had in common, was a strong influence on the pH. The addition of plastic led to an acidification of the bacterial environment in all the experiments carried out.

In order to find out what led to a change in the pH value, the products produced or metabolised by the bacteria – our metabolome - were also investigated in our experiments.

Some of these metabolites showed clear correlations with the pH changes and also with the increase or decrease of certain bacterial groups, suggesting that the bacteria either act differently when plastic is present or are partially inhibited or promoted in their growth by the particles.

Connection with diseases

It is known from the literature that some of the changes caused by the plastic reflect similar changes in certain diseases, such as diabetes or obesity. In the next steps, our aim will be to compare our results with such literature, which could reveal a possible link between microplastic particles and the development of such diseases.

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FFG Forschung wirkt.

Project coordination (Story)

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