SUCCESS STORY

microONE
Microplastic Particles: A Hazard for Human Health

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Module

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MICRO- AND NANOPLASTICS ARE PASSED ON TO NEWLY FORMED CELLS DURING CELL DIVISION

THE UPTAKE OF THE UBIQUITOUS MICRO- AND NANOPLASTIC PARTICLES IS HIGHLY DEPENDENT ON THEIR SIZE. HOWEVER, ONCE ACCUMULATED THESE PARTICLES ARE PASSED ON TO THE NEXT GENERATION OF CELLS UNDERLINING THE PERSISTENCE OF PLASTICS EVEN IN HUMANS.

Micro- and nanoplastic particles (MNP) are a significant concern for human health, as they are present in all our environment, including the food and water we consume, the air we breathe, and the cosmetics we use. These particles are not only found in areas with high population density, but also in remote locations such as the deep sea and hard-to-reach glaciers. Since 2022, the research partners around CBmed have been studying the effects of these particles on human health and are raising awareness about the associated risks.

The gastrointestinal tract is one of the first organs in animals and humans to be exposed to high amounts of MNP on a daily basis. However, there is still limited understanding of how persistent plastic particles remain in the human body once ingested and how cells cope with the constant exposure to plastics. The FFG-funded project ***microONE*** is focusing on these and other issues related to the effects of micro- and nanoplastics on human health.

Size matters for micro- and nanoplastic uptake

In cell experiments it was shown that the uptake of MNP is highly dependent on its size. Bigger particles with a size > 10 µm interact with the cells but are not taken up into the cell. The smaller the particles, the easier they penetrate through the cell membrane and accumulate then in small organelles, like endosomes or lysosomes, very close to the cell nucleus.

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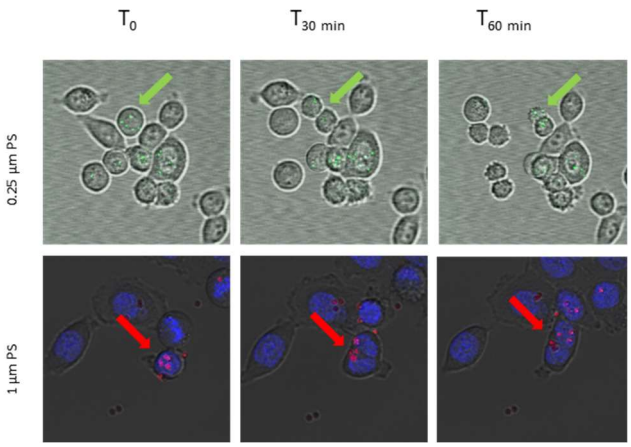
Micro- and nanoplastic is here to stay

First results out of microONE show how long-lasting micro- and nanoplastic particles are within cells once accumulated. Based on real-time live-cell imaging experiments, the team around Verena Pichler (CBmed and University of Vienna) and Lukas Kenner (CBmed and Medical University of Vienna) could show that the micro- and nanoplastic particles are passed on during cell division to the newly formed daughter cells. This implicates that even during the process of regeneration the plastic particles stay inside the cells and are not excreted. This further supports the hypothesis that plastic particles are not only persistent and hard to remove from our environment, but also from our body.



The image shows the tracking of intracellular particles during cell division was performed by applying fluorescent particles. Nanoparticles with a size of 0.25 µm are shown in green, whereas particles of a size of 1 µm are shown in red.

Figure: © Verena Pichler (CBmed)

Impact and effects

The persistency of MNP is opening up a different paradigm of cytotoxicity. Most of the compounds humans face during their lifetime are excreted or removed over time. With the knowledge, that these plastic particles are passed on from one cell to the other during regeneration, it seems unlikely that there is an efficient way to remove them once accumulated. Further research is now ongoing to investigate and understand the fate of the micro- and nanoplastic particles.

Project coordination (Story)

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- INAM Forchheim, Germany
- THP, Austria
- TissueGnostics, Austria

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