



Human Health Impacts of Micro- and Nanoplastics

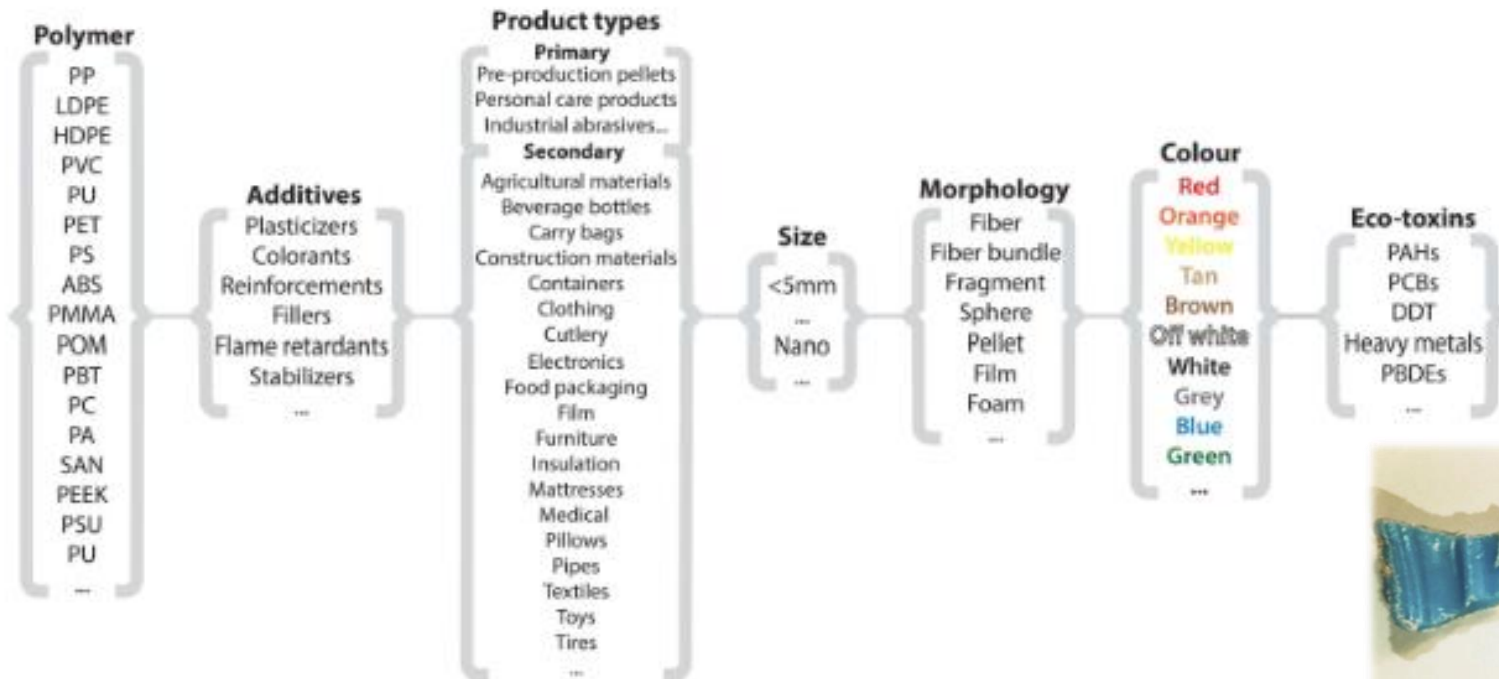
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Department of Population Health Sciences
Institute for Risk Assessment Sciences



Utrecht University

What are micro- and nanoplastics (MNP)?

Environmental Toxicology and Chemistry—Volume 38, Number 4—pp. 703–7

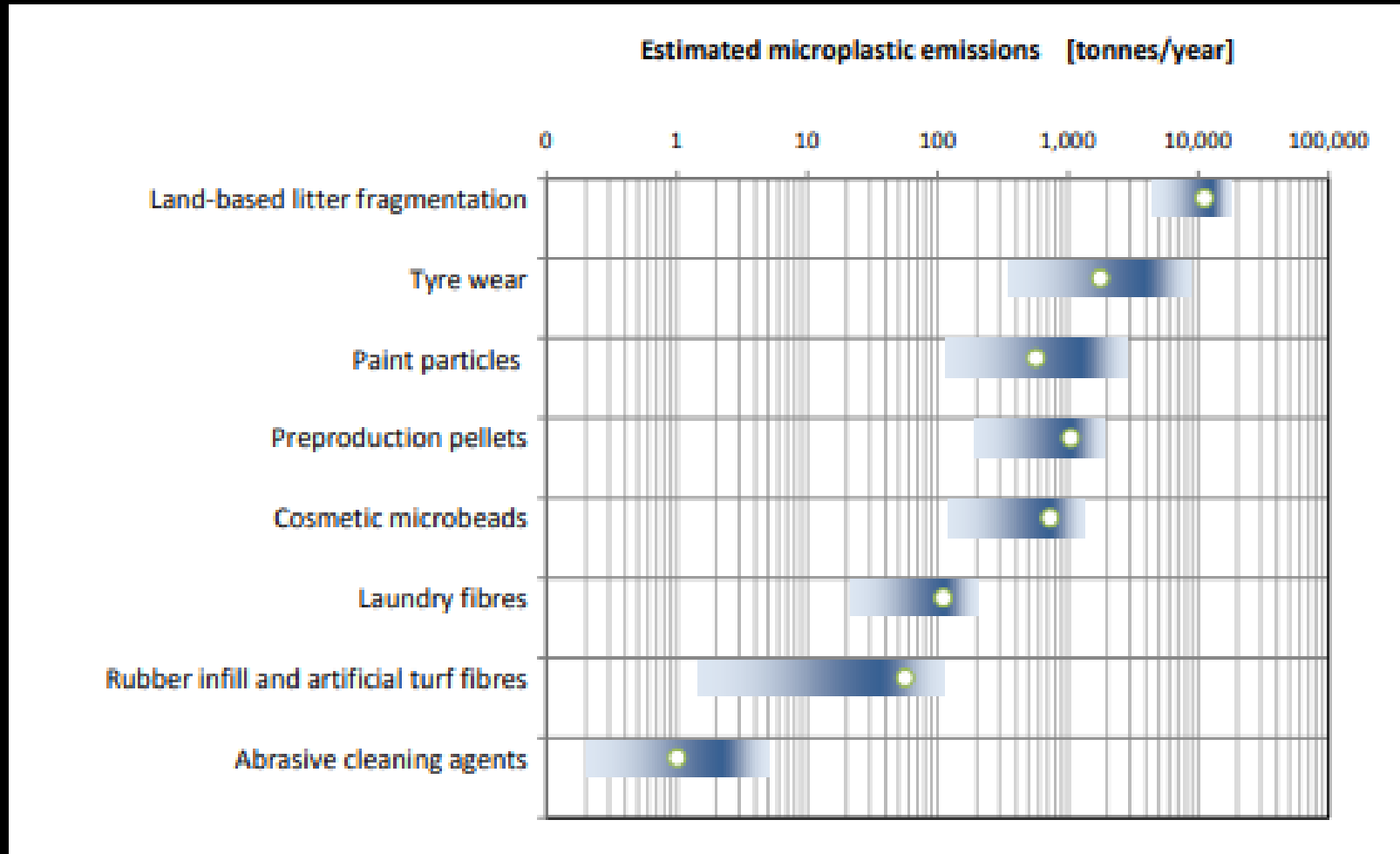


microplastics (MP <5 mm)

nanoplastics (NP < 100 nm)



Microplastics emissions in the Netherlands



Food contact plastics as source of micro- and nanoplastics: recent studies

Water Research 166 (2019) 115082

Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres

Does mechanical stress cause microplastic release from plastic water bottles?

Anna Winkler^a, Nadia Santo^b, Marco Aldo Ortenzi^c, Elisa Bolzoni^a, Renato Bacchetta^{a,*}, Paolo Tremolada^a

Check for updates

Plastic Teabags Release Billions of Microparticles and Nanoparticles into Tea

Laura M. Hernandez, Elvis Genbo Xu, Hans C. E. Larsson, Rui Tahara, Vimal B. Maisuria, and Nathalie Tufenkji*

Cite this: *Environ. Sci. Technol.* 2019, 53, 21, 12300–12310
Publication Date: September 25, 2019
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ARTICLES

<https://doi.org/10.1038/s43016-020-00171-y>

Microplastic release from the degradation of polypropylene feeding bottles during infant formula preparation

Dunzhu Li^{1,2,6}, Yunhong Shi^{2,6}, Luming Yang^{1,2}, Liwen Xiao^{2,3,4}, Daniel K. Kehoe¹, Yurii K. Gun'ko^{4,5}, John J. Boland^{1,4} and Jing Jing Wang¹

Journal of Hazardous Materials

Volume 417, 5 September 2021, 126074

Research Paper

Migration of (non-) intentionally added substances and microplastics from microwavable plastic food containers

Ying-Jie He^{a,1,2}, Yan-Qin^{a,1}, Tie-Li Zhang^a, Yan-Yan Zhu^a, Zhao-Jie Wang^a, Zhong-Shun Zhou^a, Tian-Zhen Xie^a, Xiao-Dong Luo^{a,1,3,4,1}

SCIENTIFIC REPORTS

nature research

Microplastics generated when opening plastic packaging

Zahra Sobhani¹, Yongjia Lei^{1,2}, Youhong Tang³, Liwei Wu^{3,4}, Xian Zhang⁵, Ravi Naidu^{1,6}, Mallavarapu Megharaj^{1,6} & Cheng Fang^{1,6*}

Food Packaging and Shelf Life 24 (2020) 100489

Contents lists available at ScienceDirect

Food Packaging and Shelf Life

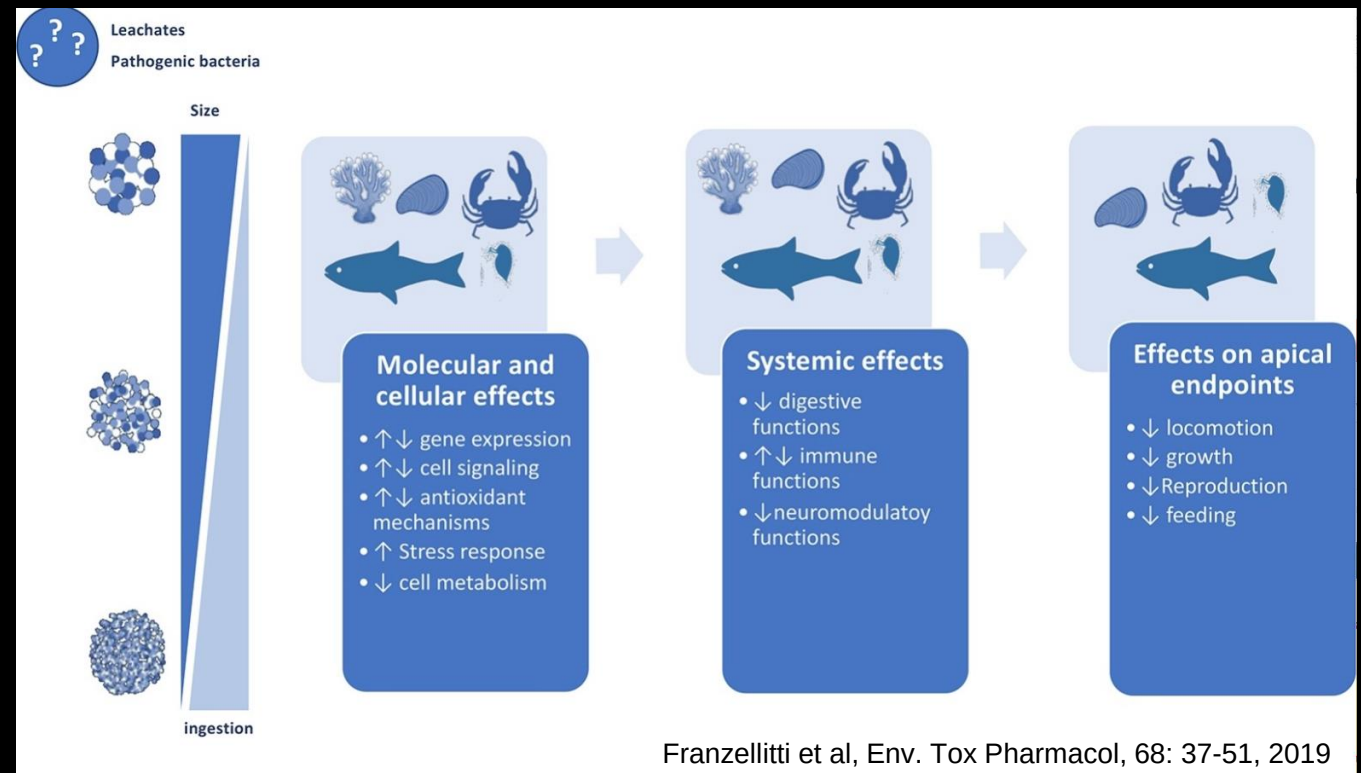
journal homepage: www.elsevier.com/locate/fpsl

Microplastic contamination of packaged meat: Occurrence and associated risks

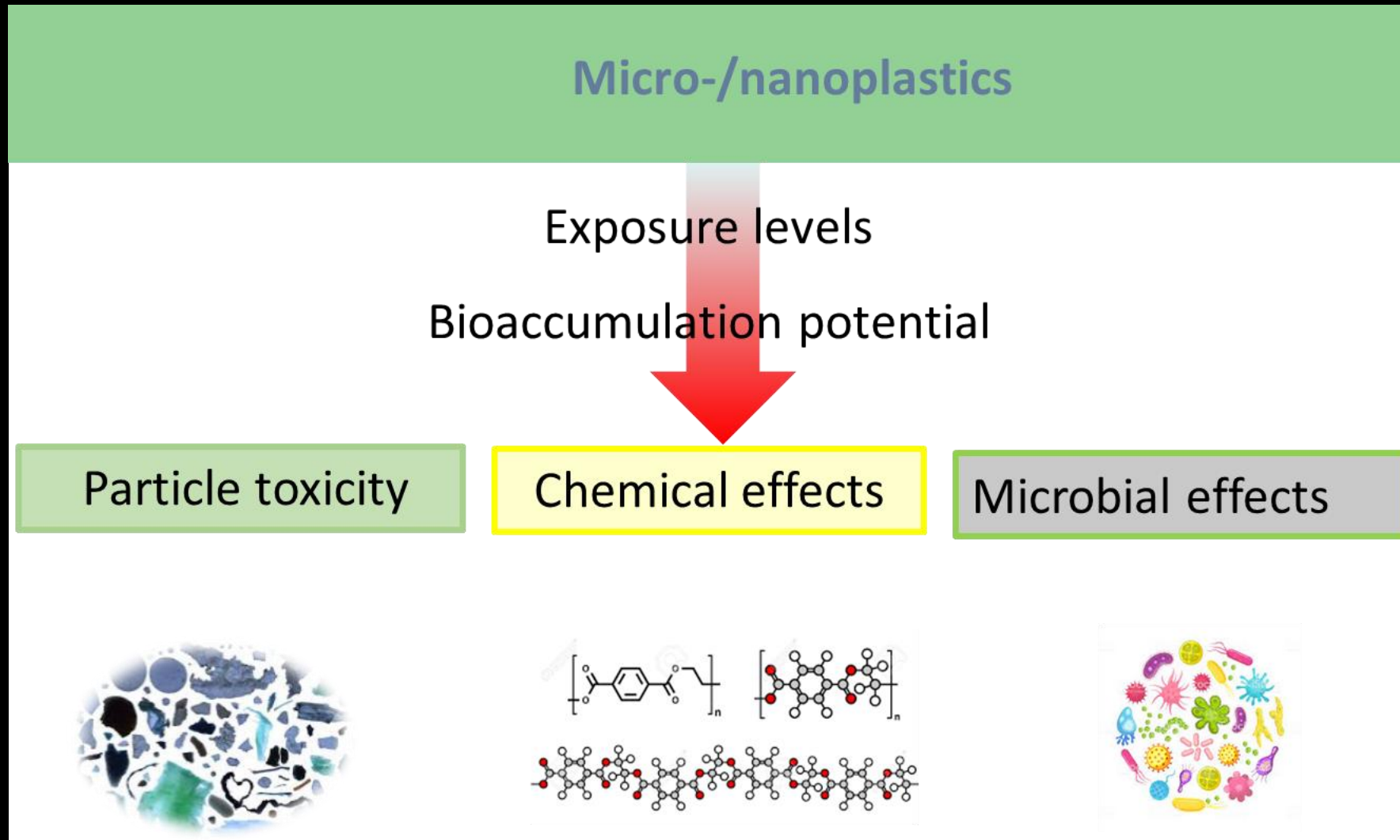
Mikaël Kedzierski^{a,*}, Benjamin Lechat^a, Olivier Sire^b, Gwénaél Le Maguer^c, Véronique Le Tilly^b, Stéphane Bruzard^a

Observed effects of micro- and nanoplastics

- Adverse effects in > 100 species in laboratory experiments
- Using high exposure concentrations
- Using mostly particles of a different size or plastic type than those reported from the field
- Limited field evidence
- No human epidemiological studies



Potential effects of micro- and nanoplastics





Humans are exposed to different types of fibers and particles, including microplastics; the potential health effects of microplastics are largely unknown.

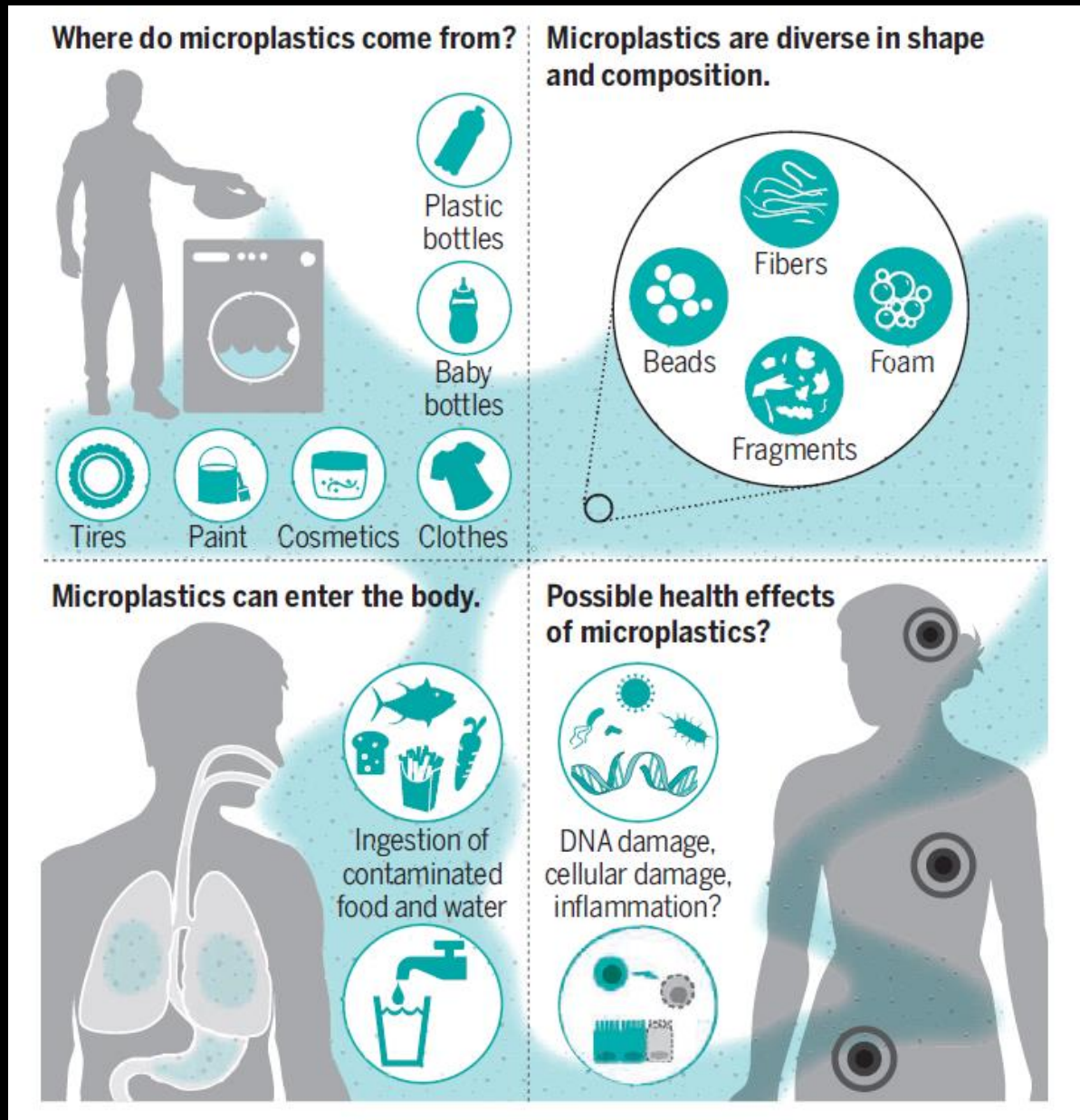
PERSPECTIVES

TOXICOLOGY

Microplastics and human health

Knowledge gaps should be addressed to ascertain the health risks of microplastics

10^4 particles/liter, with generally greater particle counts for small-sized microplastics (8). The first atmospheric measurements of larger-sized, predominantly fibrous microplastics indicate that plastic particles are a relevant component of fine dust, with, for example, deposition rates in central London



Knowledge gaps:

Human exposure

- analysis methods
- internal exposure
- exposure to smaller MNPs

Uptake

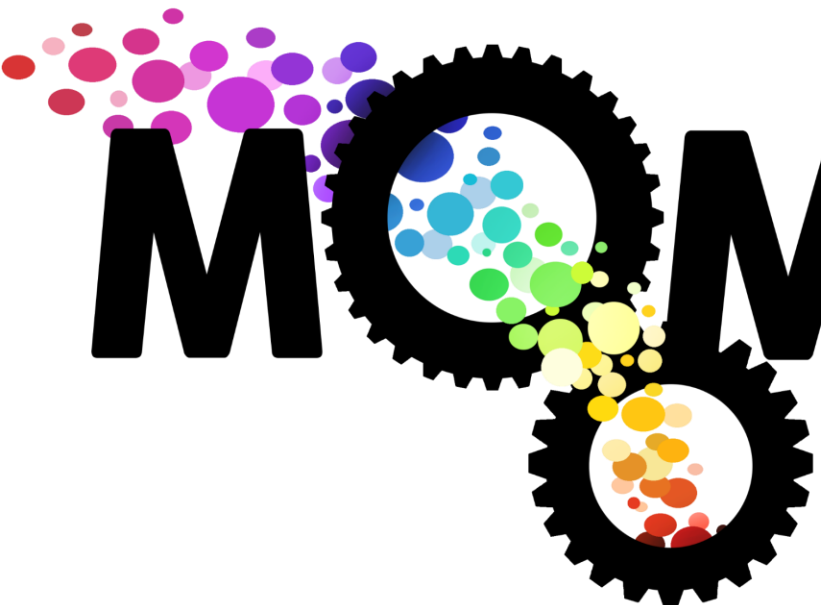
- size, source, shape
- (bio-)corona
- ADME

Toxicity

- particle
- chemical
- microbial

Risk assessment?

- Parallels with air pollution?
- Nanotechnology?



MOMENTUM

Microplastics and Human
Health Consortium

Duration: 2021-2024

Budget: 5.4 M EUR

Coordination: Legler UU/Vethaak Deltares

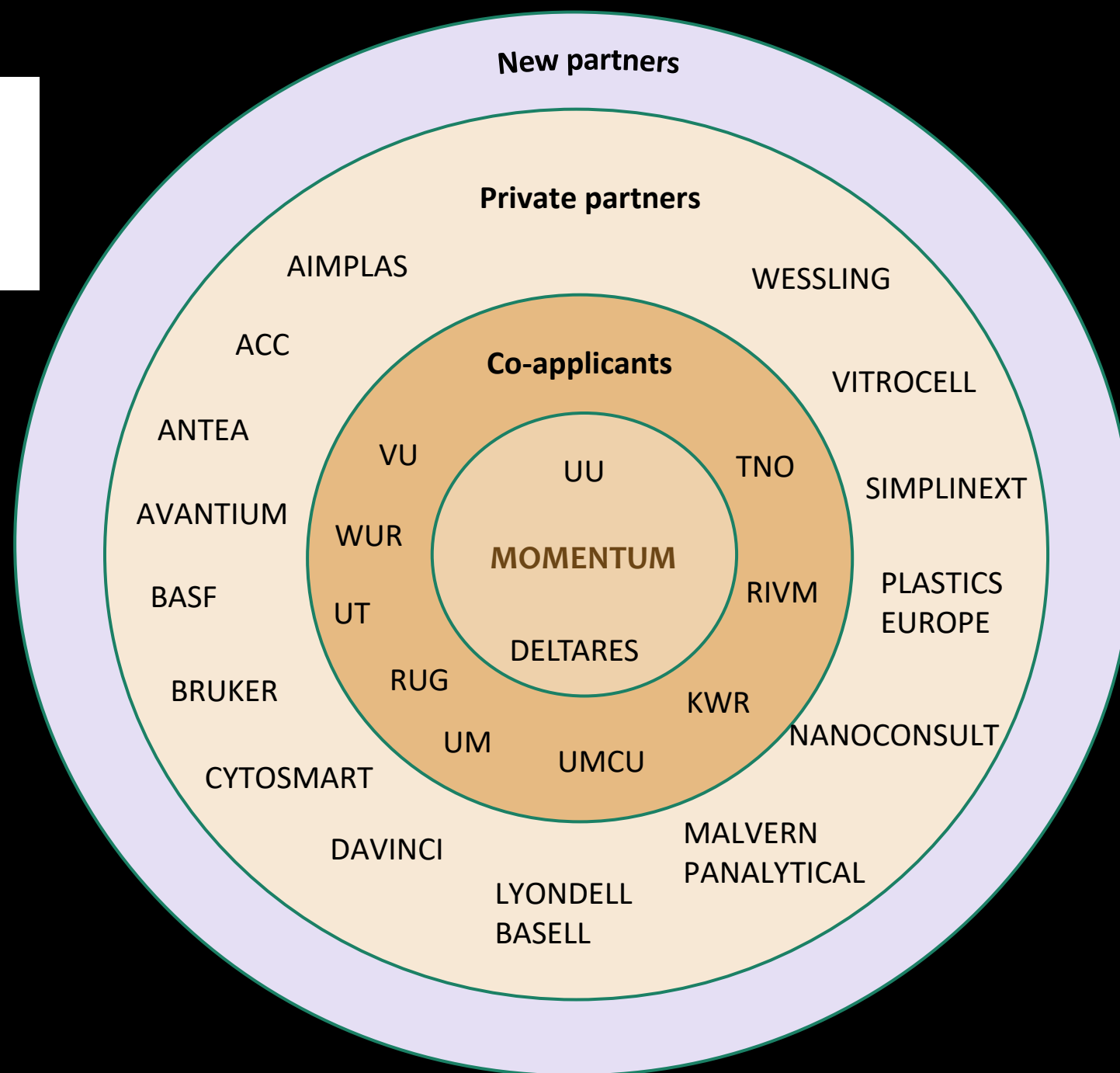
www.momentummicroplastics.nl





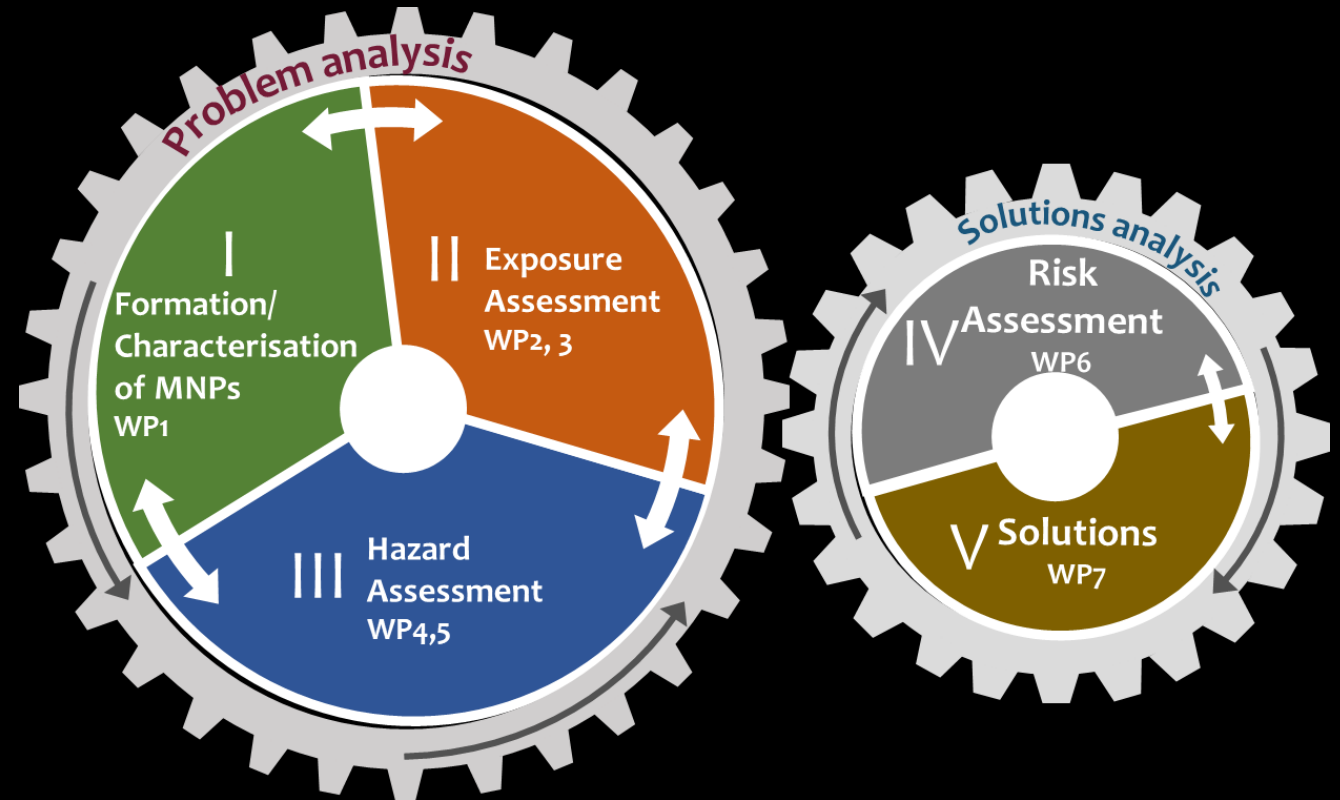
26 PARTNERS, 5.4 M Euros

- 6 universities
- 4 research organisations
- 1 medical centre
- 6 SMEs
- 2 trade organisations
- 7 large enterprises

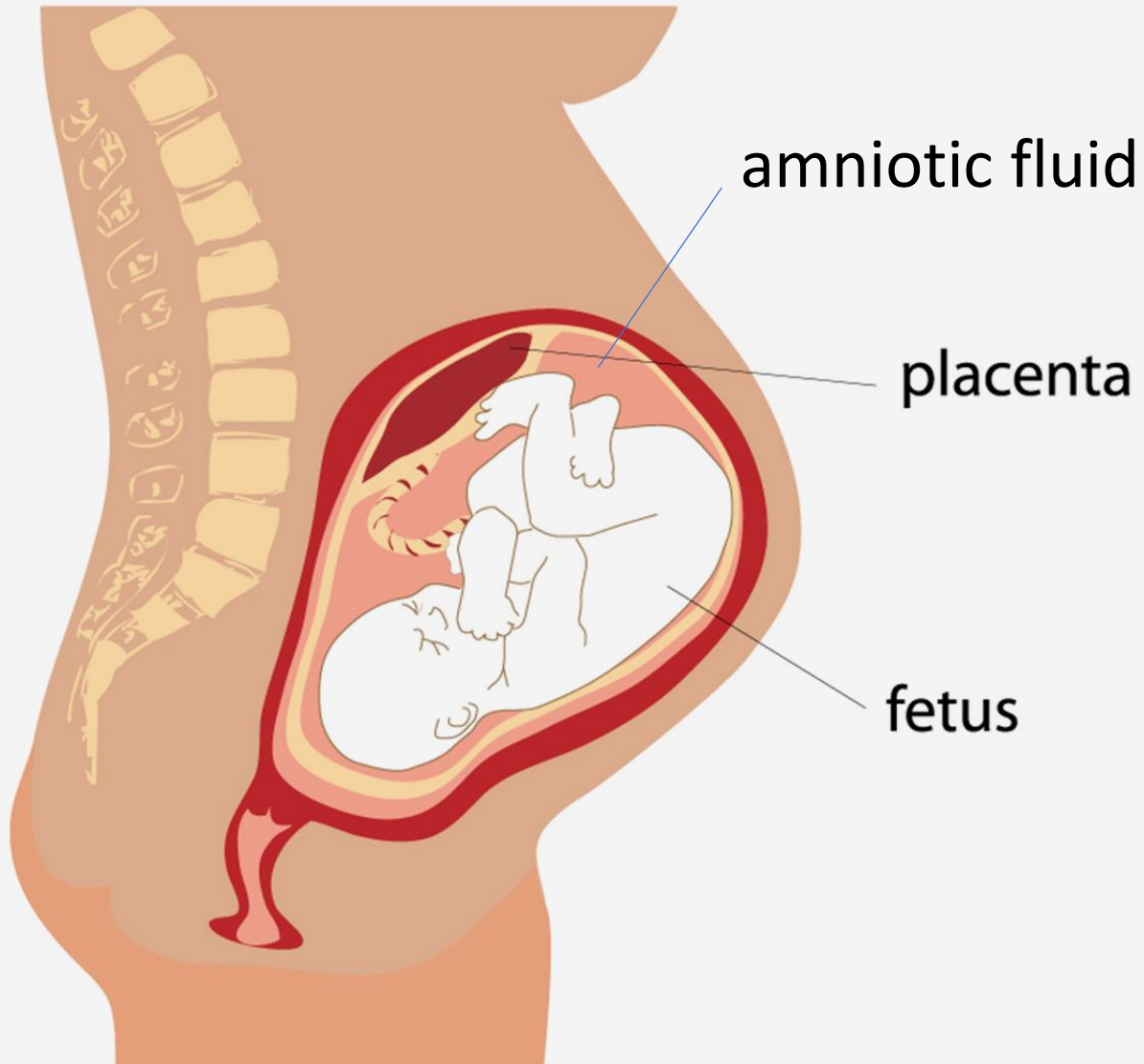


Objectives:

1. To understand **how MNPs are formed**
2. To characterise the **internal human exposure** to MNPs
3. To characterise the **immunological hazards** of MNP exposure
4. To develop a **risk assessment roadmap** for MNPs
5. To develop the **solutions-oriented, future research agenda** for the Dutch PPP on MNPs and Health



The human fetal environment



Do microplastics reach the human fetal environment?

Can they cause harm to the placenta?

Can the chemicals associated with microplastics cause harm?

'Team Science'



Chemists

*VU: Marja Lamoree, Heather Leslie
MSSM U.S.A.: Douglas Walker*



Pediatrician

Gavin ten Tusscher, Dijklander Ziekenhuis



Toxicologists

Hanna Dusza, Juliette Legler, UU



Environmental Scientist

Dick Vethaak, Deltares



Environmental Epidemiologist

Roel Vermeulen, UU



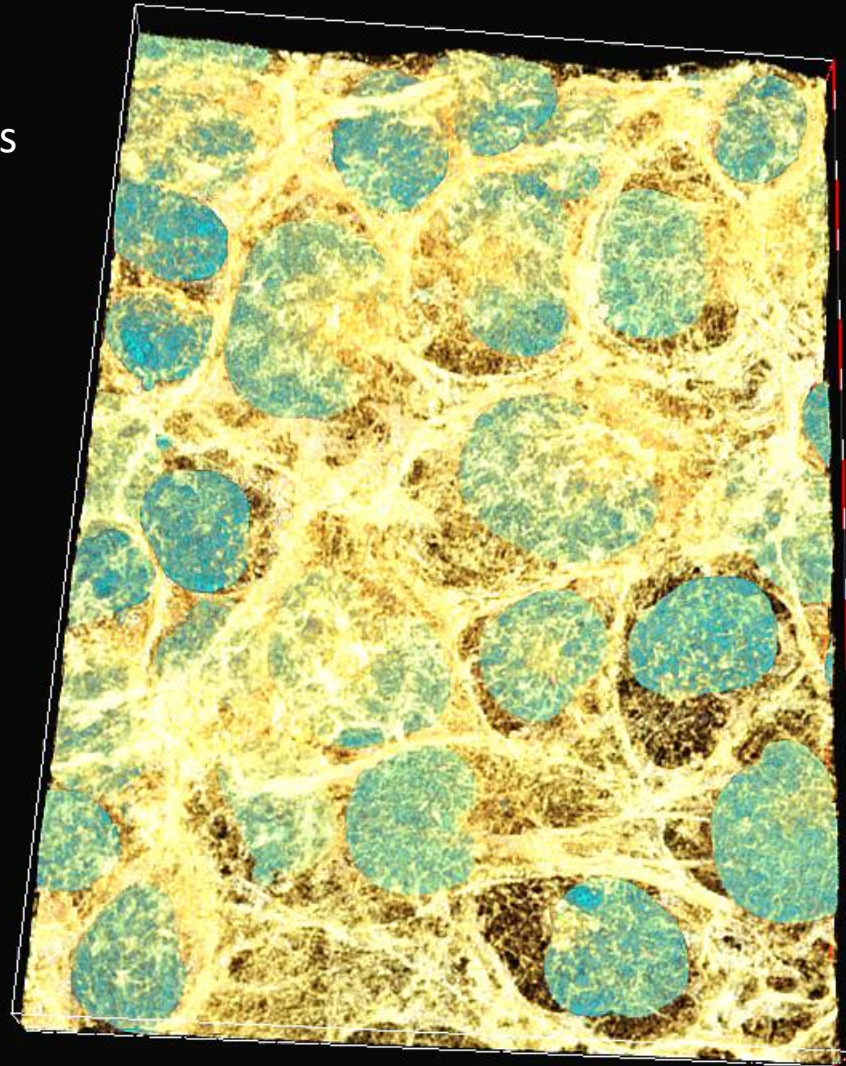
Cell Biologist

Anna Akhmanova, UU

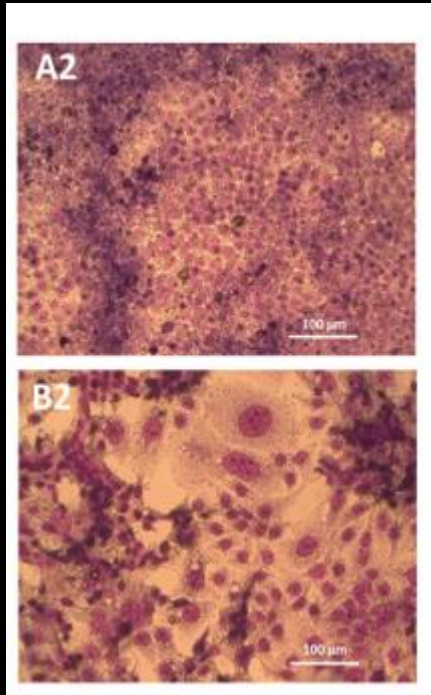
JEG-3 placenta cells

200 nm polystyrene nanoplastics

20 μm



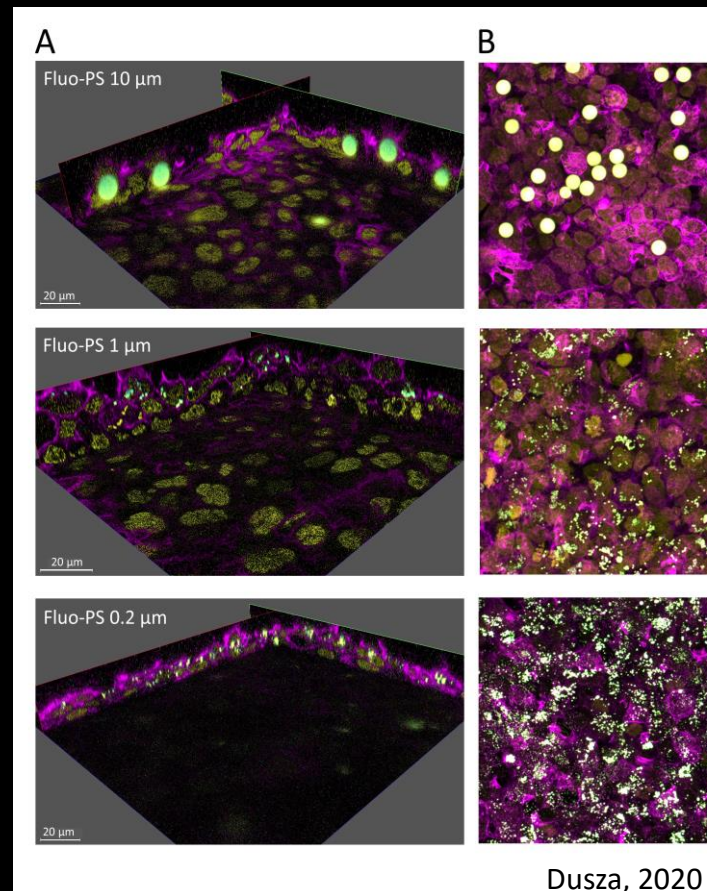
Uptake and effects of MNPs in placental cells



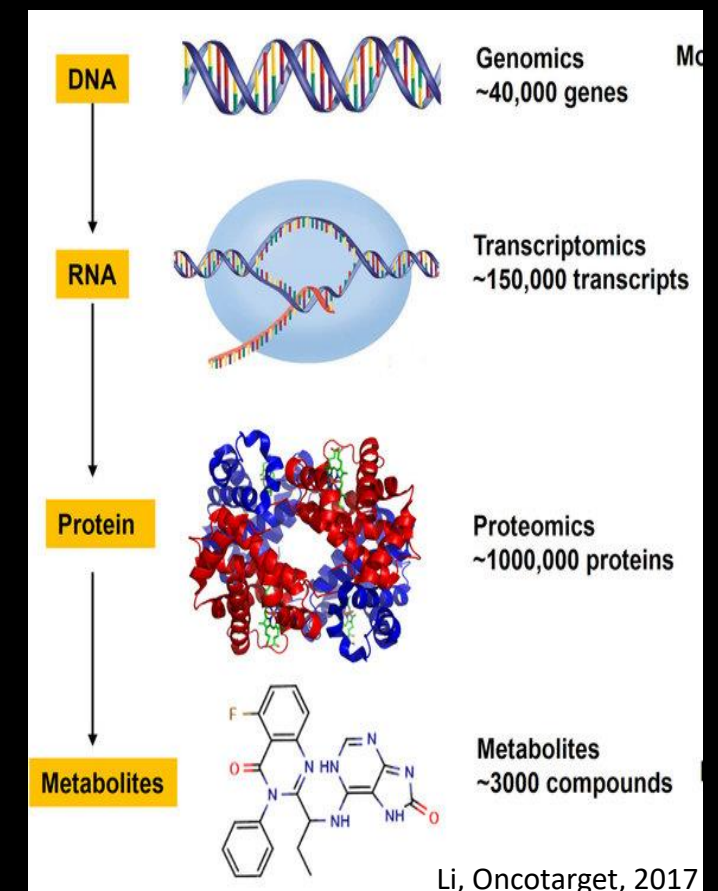
cytotrophoblasts

syncytiotrophoblasts

BeWo b30 human placenta cells



Dusza, 2020

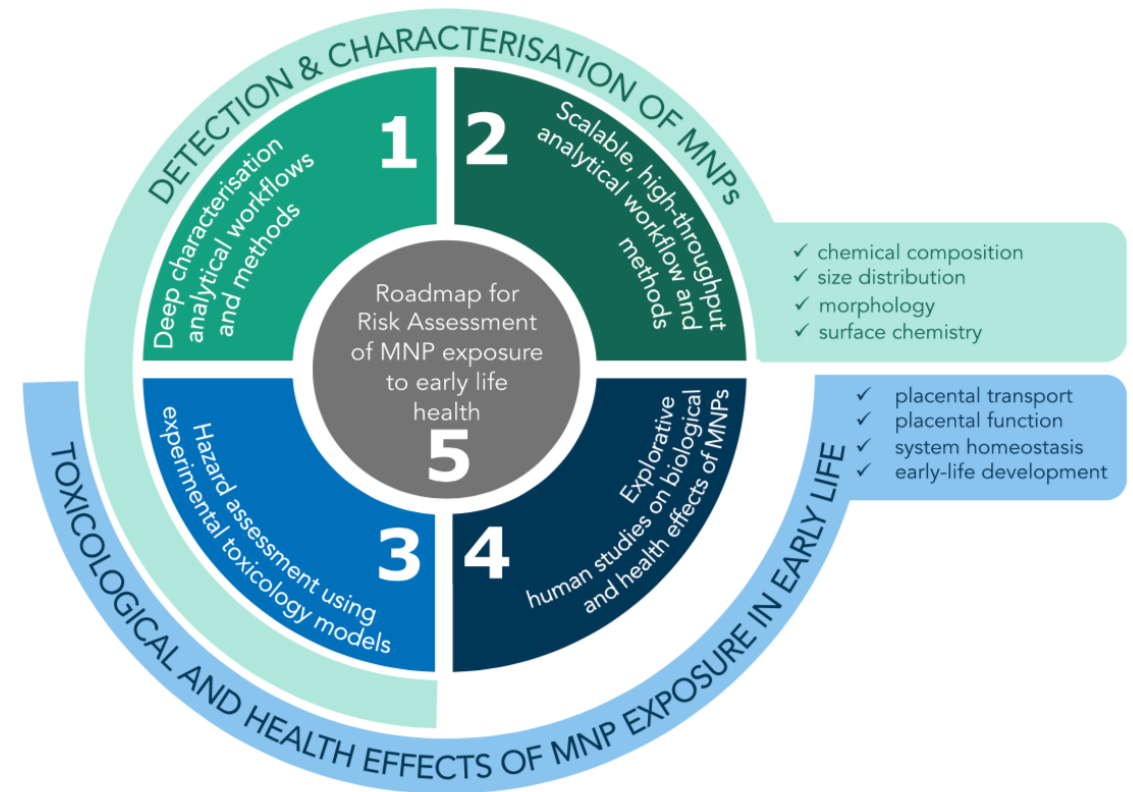


Actionable eUropean ROadmap for early-life health Risk Assessment of micro- and nanoplastics

Our goal is to develop a roadmap for assessing the health risks of micro- and nanoplastics for **early-life health**.

We will address roadblocks in MNP exposure assessment by **advancing analytical methods for measuring MNPs** in human tissues.

We will focus on **MNP exposure and toxicological and health effects during pregnancy, in utero, and in early life**.



Duration: 2021-2026

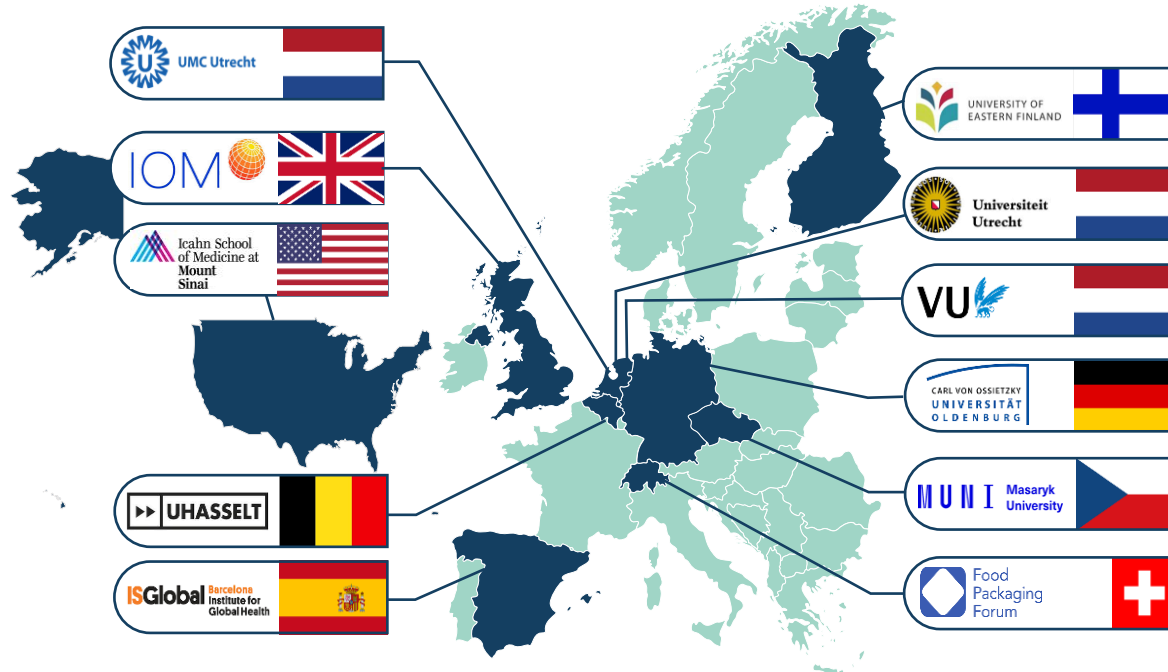
Budget: >5 M EUR

Coordination: Vermeulen/UMC

[www://auroraresearch.eu/](http://auroraresearch.eu/)



Acknowledgements



Hanna Dusza, Utrecht University

