

Assessing the health risks of microplastic exposures during pregnancy and early life



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Plastic pollution problem

Plastic production and waste have increased exponentially since the 1950s. Plastic degrades into small plastic particles and fibers: microplastics (<5mm) and nanoplastics (<1 µm). This pollution is not readily reversible and is a threat to planetary systems. The scale of human exposure and the potential risks to health are largely unknown.

The EU-funded AURORA project (2021-2026) is

1. Developing methods to measure MNPs in human tissues;
2. Assessing the impact of MNPs on placental function and child development in toxicological and epidemiological studies; and
3. Generating knowledge and methodological approaches to inform health risk assessment of MNPs, focusing on reproductive and developmental toxicity.

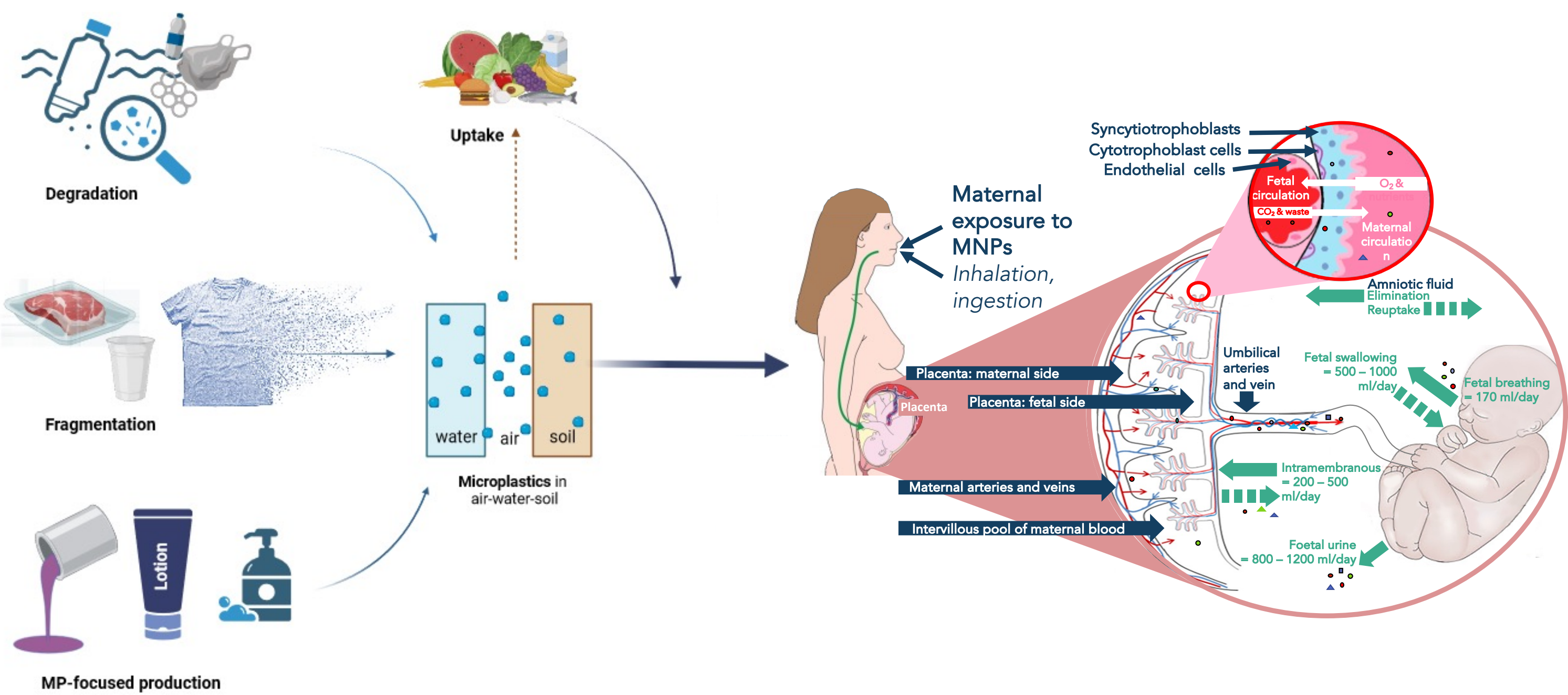


Fig. 1. Sources and routes of exposure to micro/nanoplastics.

Placenta models

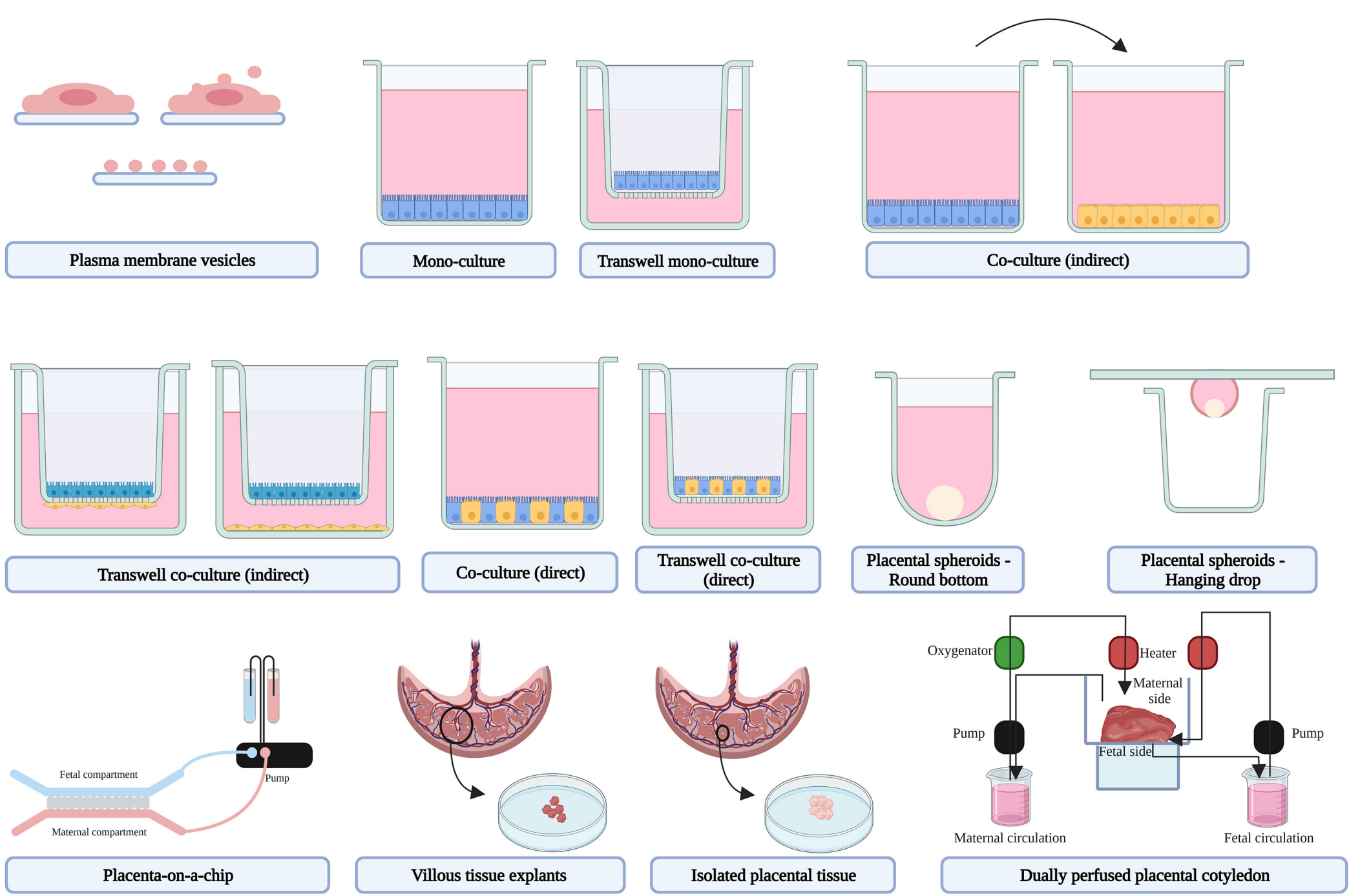


Fig. 2. Experimental *in vitro* and *ex vivo* human placental models with increasing order of complexity (from a molecule, cell, tissue to organ) used to study placental development and functions, including the uptake, transplacental transport, and toxicity of MNPs.

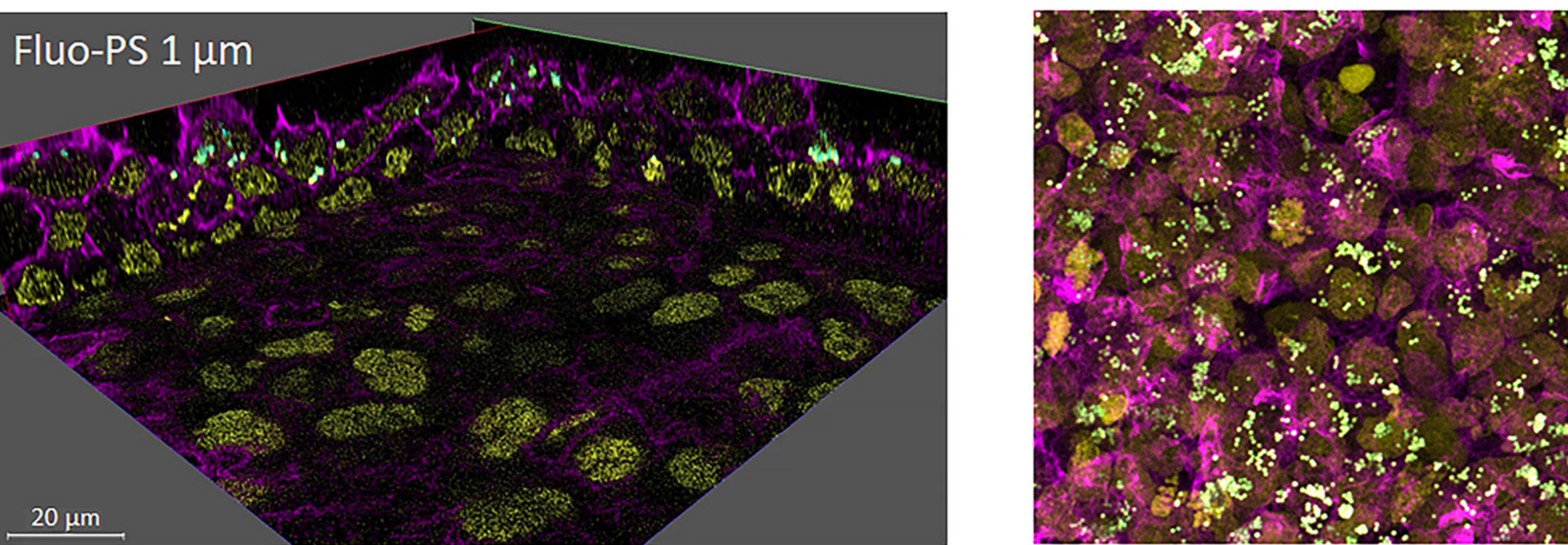
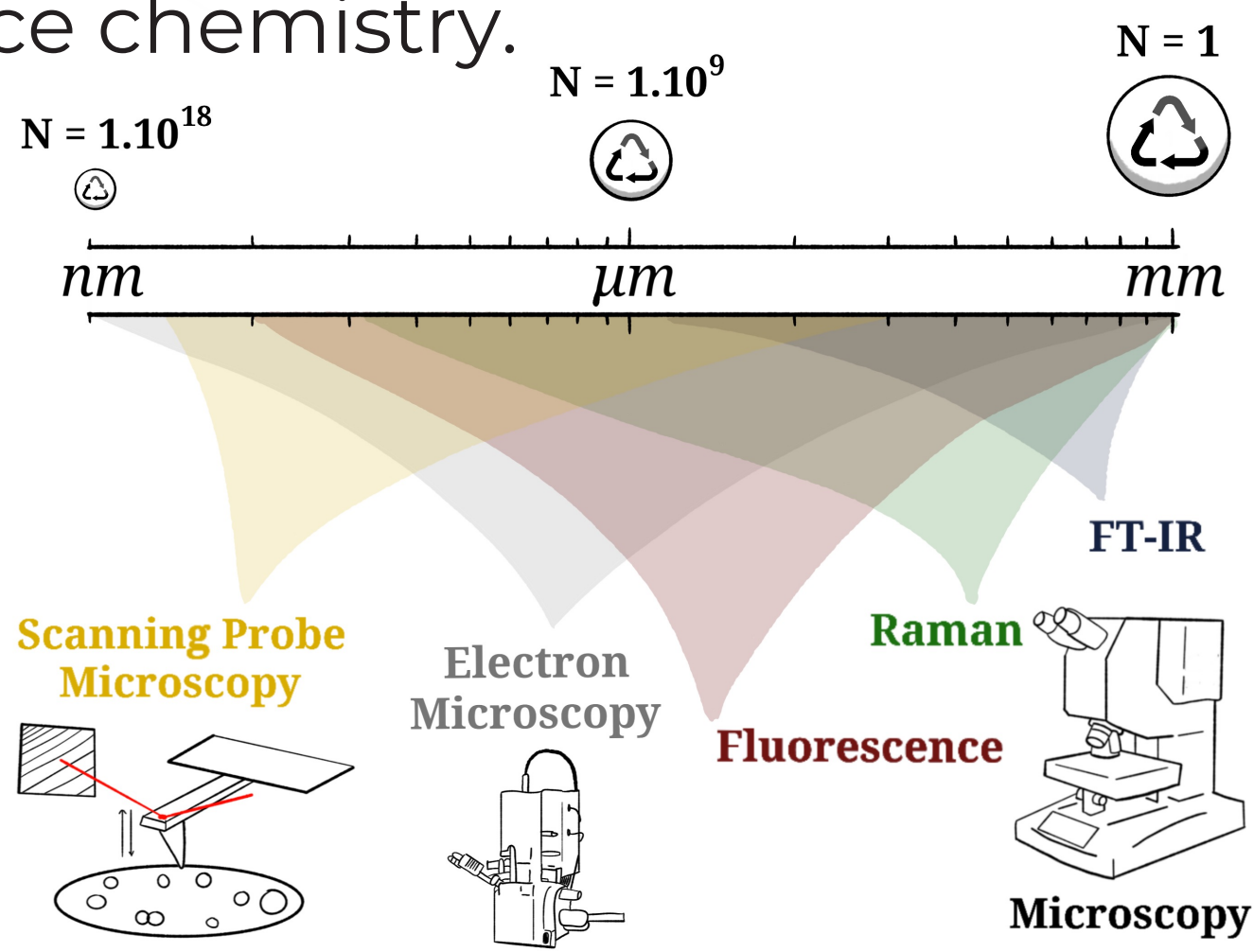


Fig. 3. Size-dependent uptake and transport of MNPs observed in placental cell models. Internalization of fluorescent polystyrene particles in nonsyncytialized BeWo b30 cells. (Dusza et al. 2022)

Measuring micro/nanoplastics

MNP concentrations (mass-based) in placenta and cord blood samples are assessed with high-resolution mass spectrometry coupled with pyrolysis (py-GC/MS). Low-throughput spectro-microscopic analysis is used to characterize MNP properties, including size, shape, polymer/chemical composition, and surface chemistry.

Fig. 4. MNP analysis is challenging due to their small size, high particle-to-mass ratio, and elemental composition similar to elements in human biological samples. Micro(spectro)scopy methods with their detection limits. N = number of particles that make up the same volume assuming constant density.



Risk assessment

