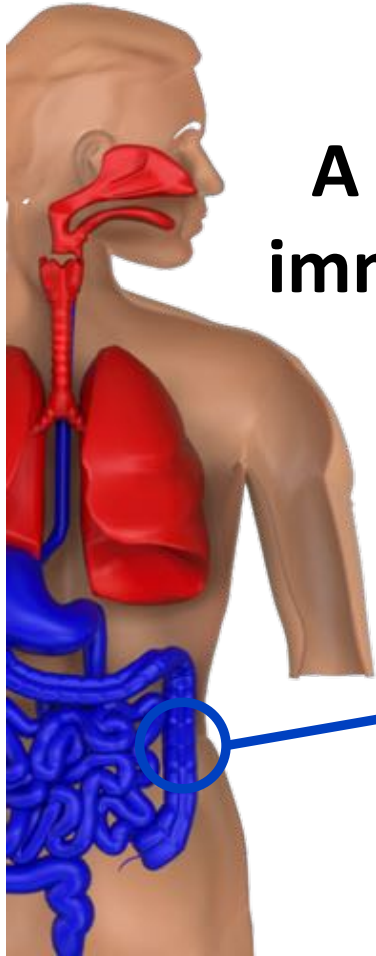




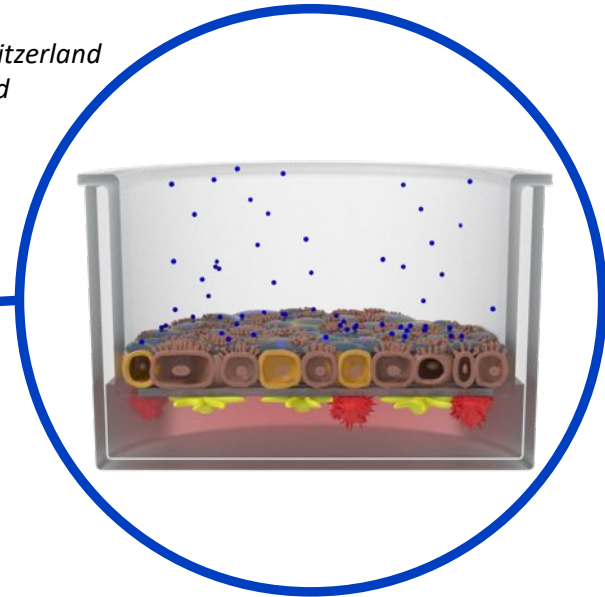
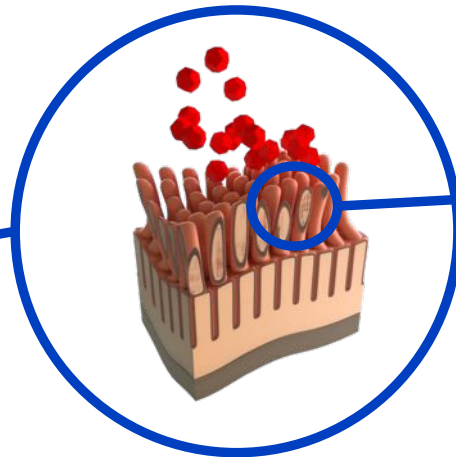
**adolphe merkle institute**  
excellence in pure and applied nanoscience



# A novel 3D intestine barrier model to study the immune response upon exposure to microplastics

Dr. Roman Lehner

*Adolphe Merkle Institute, University of Fribourg Switzerland  
Sail & Explore Association, Bern Switzerland*



# Human exposure to plastic particles

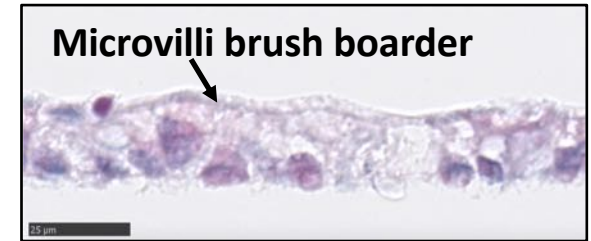
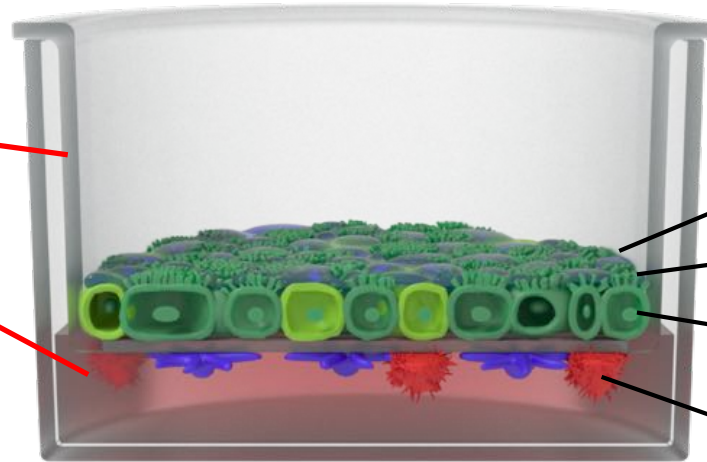
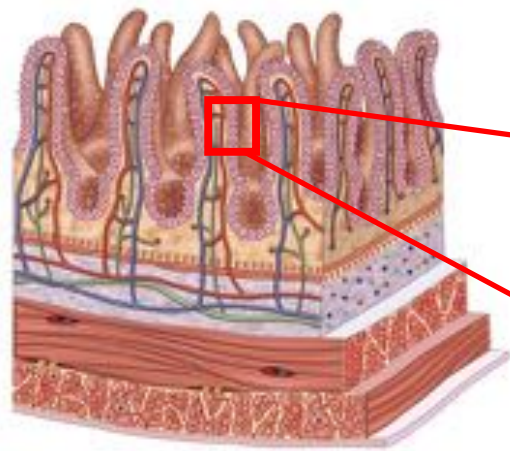
- Humans consume an estimated 39,000 – 52,000 plastic particles per year<sup>1</sup>
- With **inhalation**, estimates increase to 74,000 – 121,000 particles per year<sup>1</sup>
- First known evidence of **microplastic in human stool**<sup>2</sup>
- First evidence of **microplastics in human placenta**<sup>3</sup>

**How to investigate the possible adverse effects of microplastics on human health?**



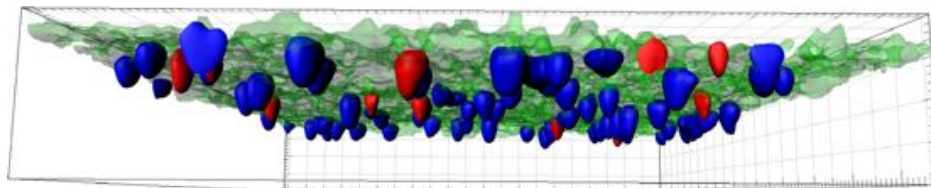
Image: Ocean Cleanup;1 Cox et al. *Environ. Sci. Technol.* 2019; 2 Schwabl et al *Annals of Internal Medicine* 2019; 3 Ragusa et al. *Environmental International* 2021

# Human 3D in vitro intestinal model

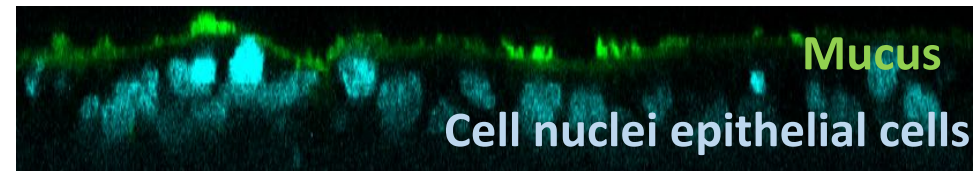


- Mucus
- Microvilli brush boarder
- Epithelial cells (Caco2/HT29-MTX)
- Immune cells (Macrophages/Dendritic cells)

Epithelial cell layer



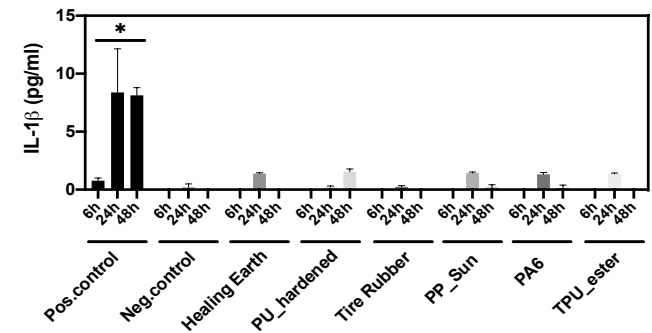
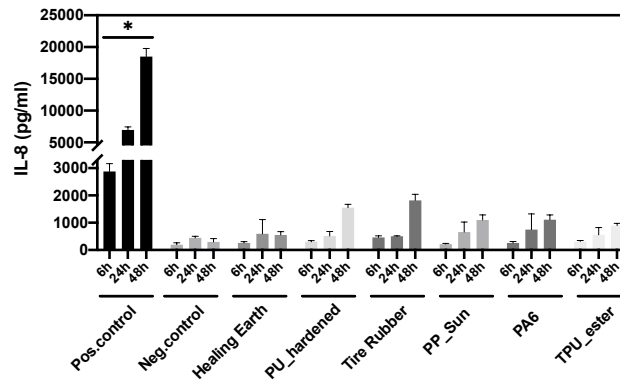
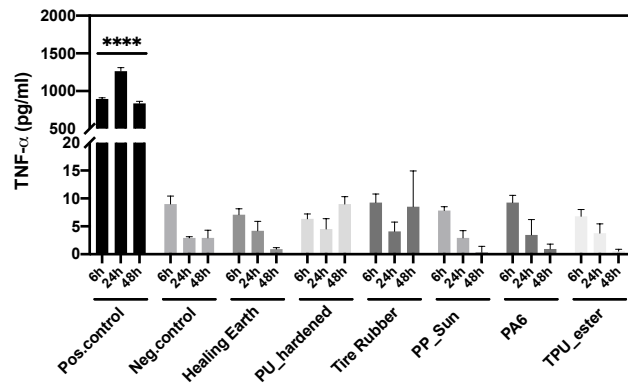
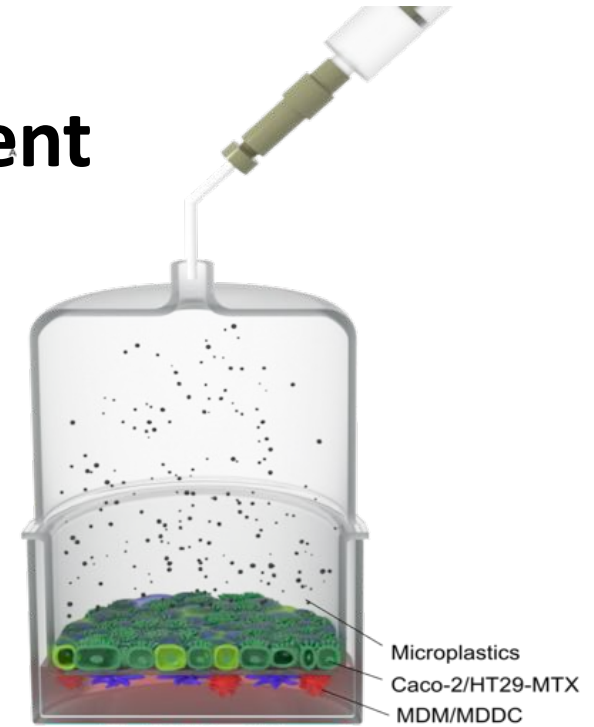
Macrophages      Dendritic cells



Mucus  
Cell nuclei epithelial cells

# Pro-inflammatory cytokine measurement

- Material tested: polyurethanes, tire rubber, polypropylene, polyamide
- Average particle size 41  $\mu\text{m}$  - 282  $\mu\text{m}$
- Average delivered dose 0.8 - 1.3 mg/cm<sup>2</sup>



# Conclusion

- **Establishment of a suitable 3D intestinal model for the testing of microplastics**
- **no induction of cytotoxicity nor (pro-)inflammatory response found**
- **size of the microparticles studied (on the order of 50–500  $\mu\text{m}$ ) may contribute to the absence of a biological response**

**Further research will include:**

- **smaller plastic fragments ( $< 50\mu\text{m}$ )**
- **chronic exposure of the particles to the intestine barrier**