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Effects of Microplastics on the Environment and on Human Health

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2016: 335 million tons



2016: > 60 million tons



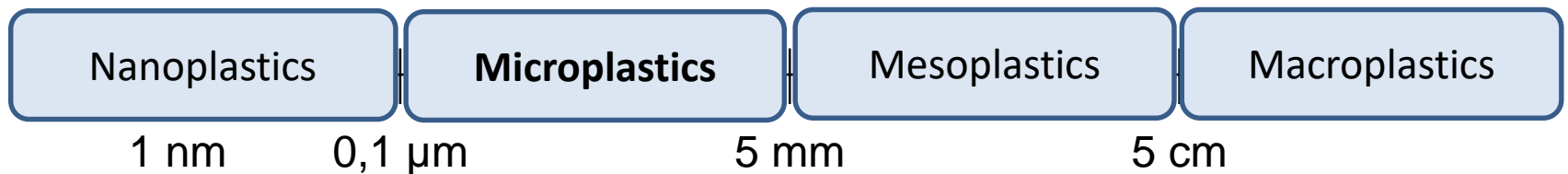
2016: 27 million tons (collected)

Non-collected waste → environmental release

Estimations 2015:

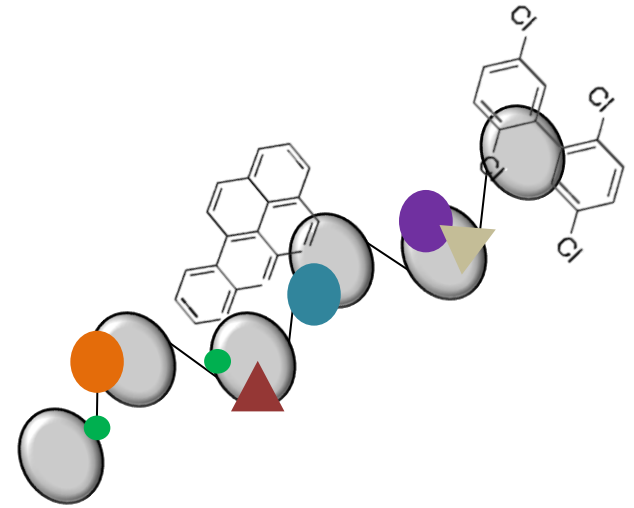
- ❖ 12.7 million tons entering the ocean
- ❖ > 5 billions of plastic items floating in the oceans

What are Microplastics?



What are Microplastics?

- Size, shape
- Polymer
- Catalysts
- Additives
- Non intentionally added substances
- (- Environmental contaminants)

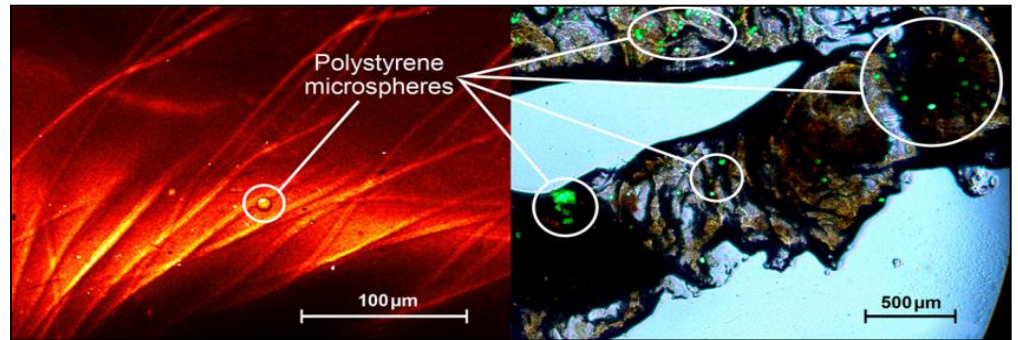
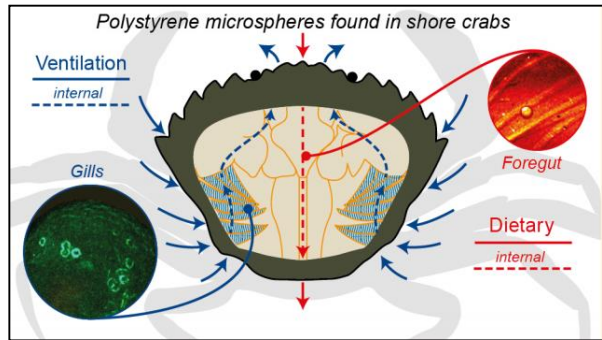


Main sources:

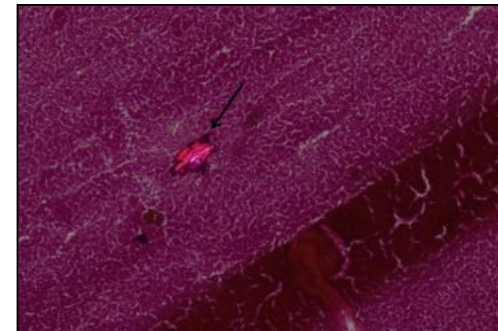
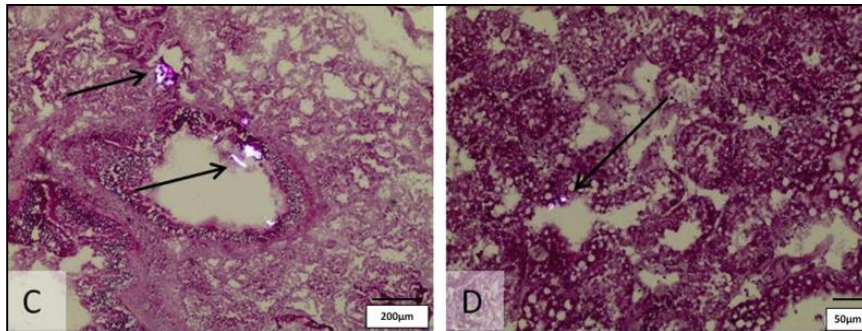
- Personal hygiene products
- Industrial scrubbers
- Textiles
- Erosion of tires
- + Secondary MPs

Effects of MPs on the environment

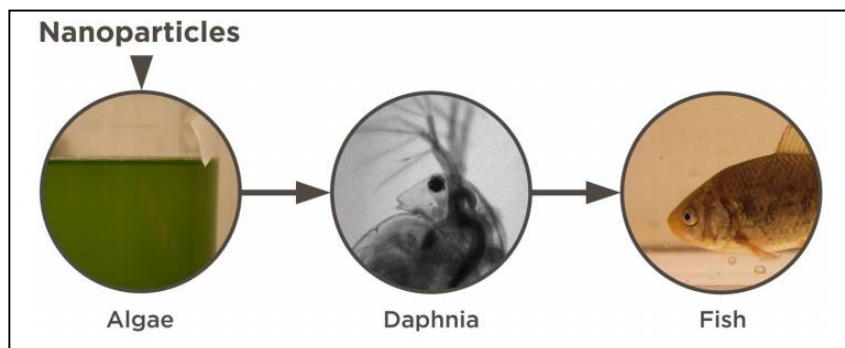
❖ Ingestion / uptake; trophic transfer



1



2,3



4

¹Watts et Al., 2014; Environ. Sci. Technol., 48, 8823– 8830; doi: 10.1021/es501090e

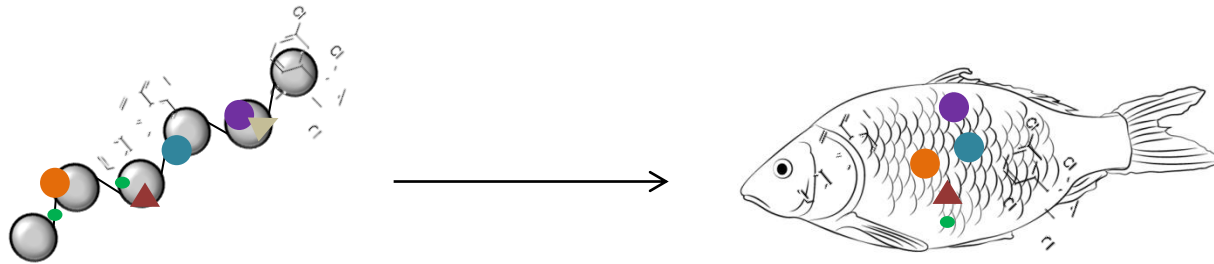
²Avio et Al., 2015; Environ. Pollut. 198 211-222; doi: 10.1016/j.envpol.2014.12.021

³Avio et Al., 2015; Mar. Environ. Res. 111, 18-26; doi: 10.1016/j.marenvres.2015.06.014

⁴Mattsson et al., 2017; Sci. Rep. 7; doi: 10.1038/s41598-017-10813-0

Effects of MPs on the environment

- ❖ Ingestion / uptake; trophic transfer
- ❖ Vector for contaminant transfer



→ MPs spiked with PCBs, PAHs, pyrene, pesticides → transfer

Effects of MPs on the environment

- ❖ Ingestion / uptake; trophic transfer
- ❖ Vector for contaminant transfer
- ❖ Main effects on aquatic species:
 - Gut damages
 - Nutrient uptake
 - Energy reserves, lipid metabolism; weight loss, general fitness
 - Growth and development
 - Reproduction
 - Immune system
 - Photosynthesis
 - Behavior

Effects of MPs on the environment

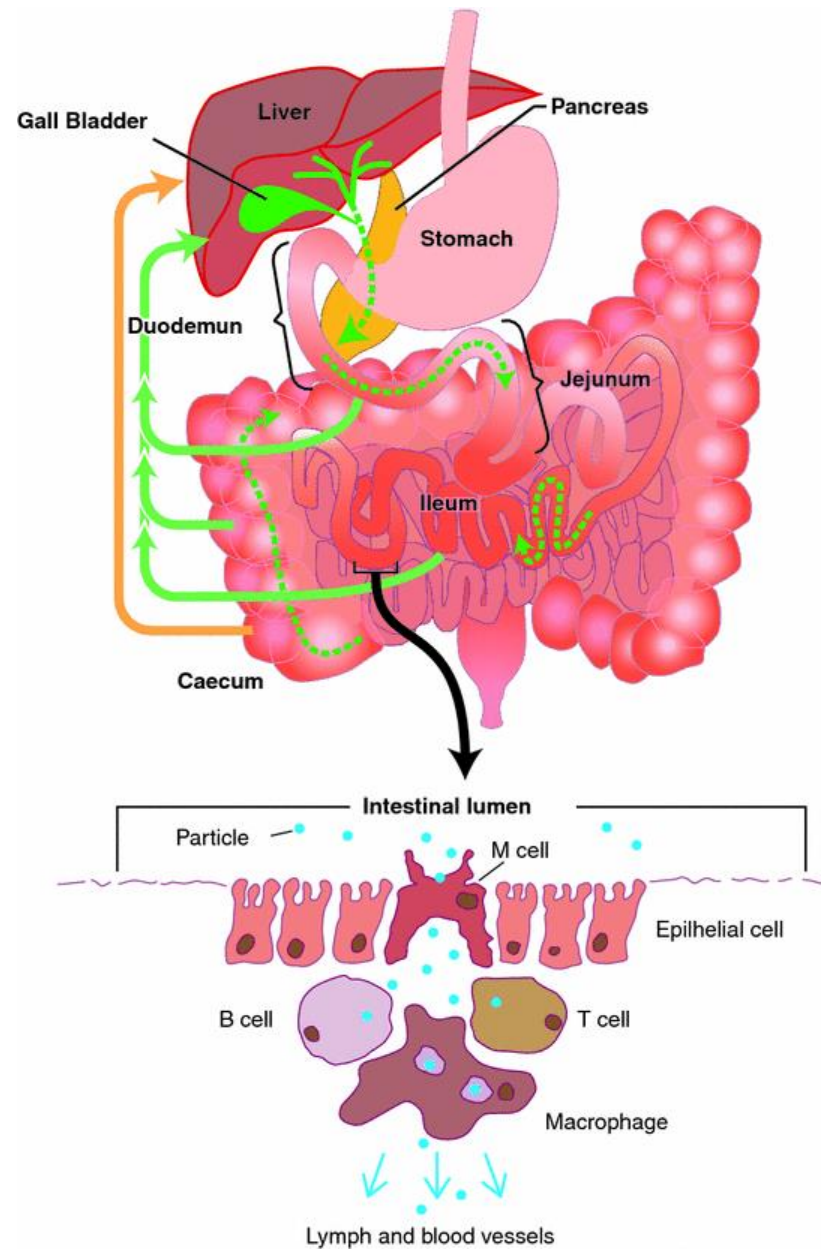
- ❖ Ingestion / uptake; trophic transfer
- ❖ Vector for contaminant transfer
- ❖ Main effects on aquatic species



- Publications showing no effect
- Lab conditions
- Data do not necessarily support work hypotheses

Microplastics – are we at risk?

- No MP quantification in human
- *In vitro* studies (nanoplastics):
 - Inflammatory responses



Microplastics – are we at risk?

- No MP quantification in human
- *In vitro* studies (nanoplastics)
- Measurement of chemical concentrations in body fluids
 - **NOT** specific to MPs
 - Detects contact with plastics

Phthalates

BPA

Brominated flame retardants

Triclosan

Bisphenone

Organotins



Adverse effects of plastic-associated chemicals:

- Cardiovascular diseases
- Reproduction and development outcomes
- Breast and prostate cancers
- Diabetes, obesity
- ...

Risk of transgenerational effects

Microplastics – sources of exposure



1.7 fibers



4 fibers



15 fibers

→ Atmospheric fallout: up to 335 fibers/m²/day (urban area)

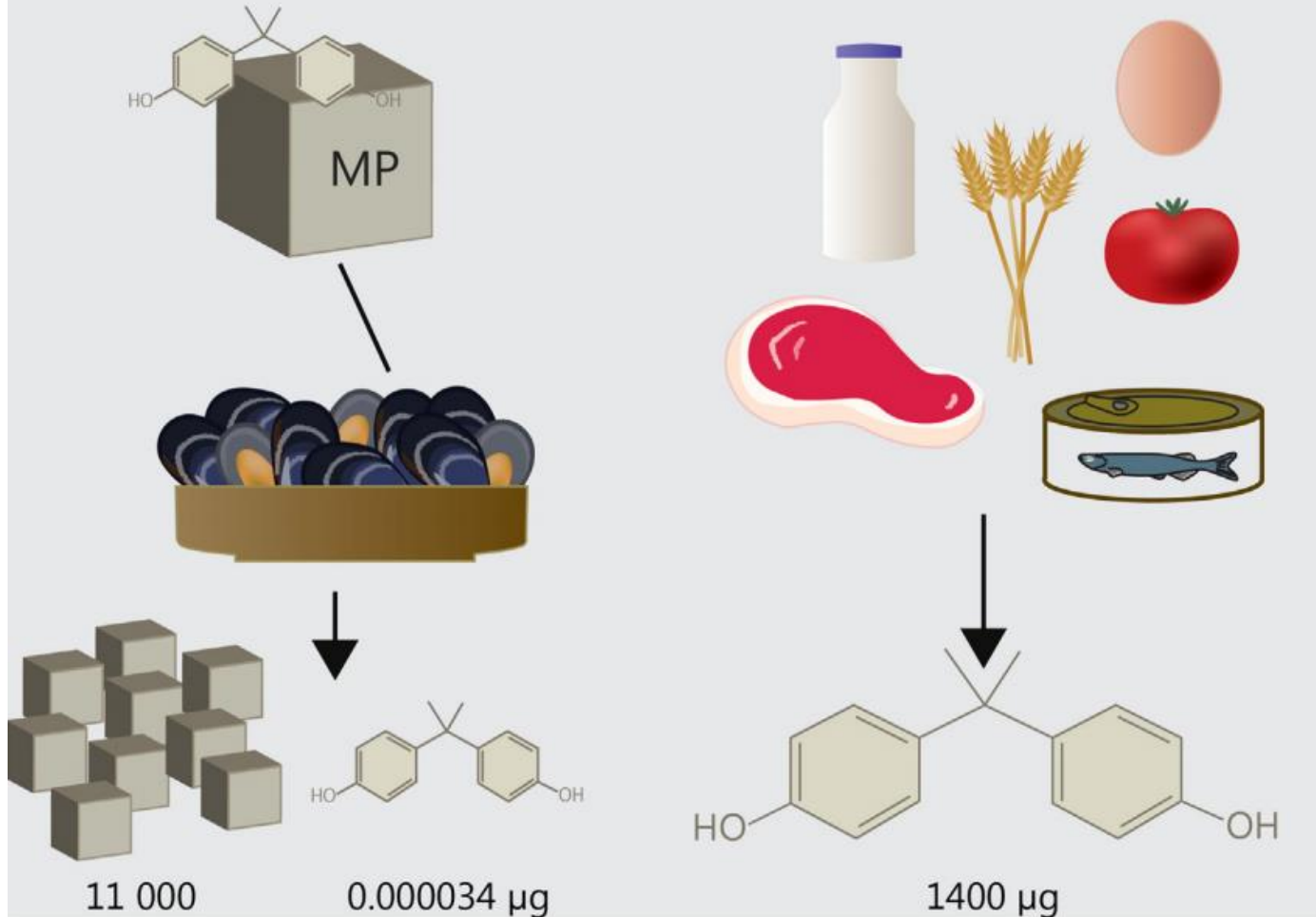
→ Textile factory: 500 000 – 800 000 fibers/m³

MPs as vector for contaminant transfer



BPA from MPs in seafood

BPA from general food consumption



~ x 40 millions

Rist et al., 2018; Sci. Total Environ.
626, 720–726.
<https://doi.org/10.1016/j.scitotenv.2018.01.092>

To wrap it up:

- ❖ MPs = complex contaminant
- ❖ MPs are found everywhere
- ❖ Data supporting harmful effects on various species...
- ❖ ... but not only!
- ❖ Various sources of exposure for humans
- ❖ For the moment, no data supporting strong toxicity
- ❖ **Need to see the overall picture related to plastic consumption and use !**