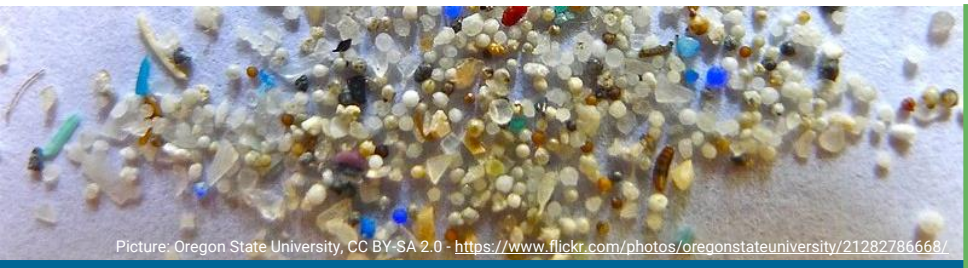


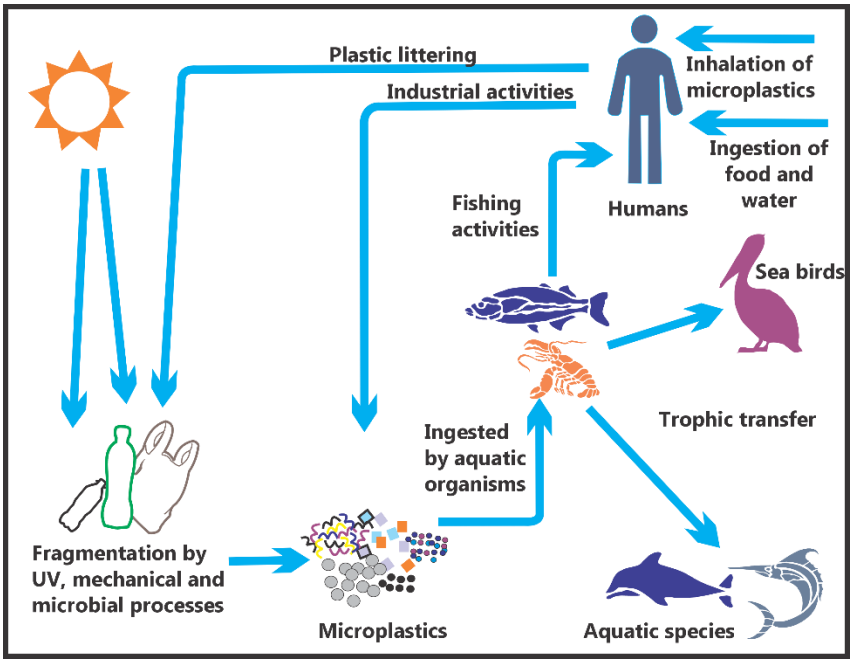
Picture: Oregon State University, CC BY-SA 2.0 - https://www.flickr.com/photos/oregonstateuniversity/21282786668/

Exposure to Microplastics and Associated Effects

MP-1-16 07/2024

Microplastics – What Are They and Why Do We Care?

ITRC defines microplastics as solid polymeric materials to which chemical additives or other substances may have been added. Their size ranges between 1 nanometer (nm) and 5 millimeters at the longest dimension. This definition includes nanoplastics, which range from 1 nm to 1,000 nm. Every habitat and organism is exposed to microplastics. The diagram here generalizes some exposure pathways for how animals and humans may be exposed to microplastics in the environment.



Exposure Pathways

Potential exposure pathways include inhalation, ingestion, and dermal contact:

- Inhalation - Humans can be exposed to microplastics through inhalation of indoor and outdoor dust, as well as airborne microplastics from various sources, including but not limited to tire wear particles and burning of trash containing plastic materials. Occupational exposures (e.g., 3-D printing and textile industry) are also well-documented.
- Ingestion - Ingestion of contaminated food and water and other liquids is an important route for exposure to microplastics. Some organisms feed on microplastics, mistaking them for food. Other organisms are exposed through trophic transfer, as shown in the diagram.
- Dermal contact – Although dermal contact is the least significant pathway, humans are exposed through contact with impacted water or by use of personal care products that contain microplastics. Dermal exposure is also a key route of exposure for aquatic and terrestrial organisms.

Exposure to Microplastics and Associated Effects

Challenges in Toxicity Assessment

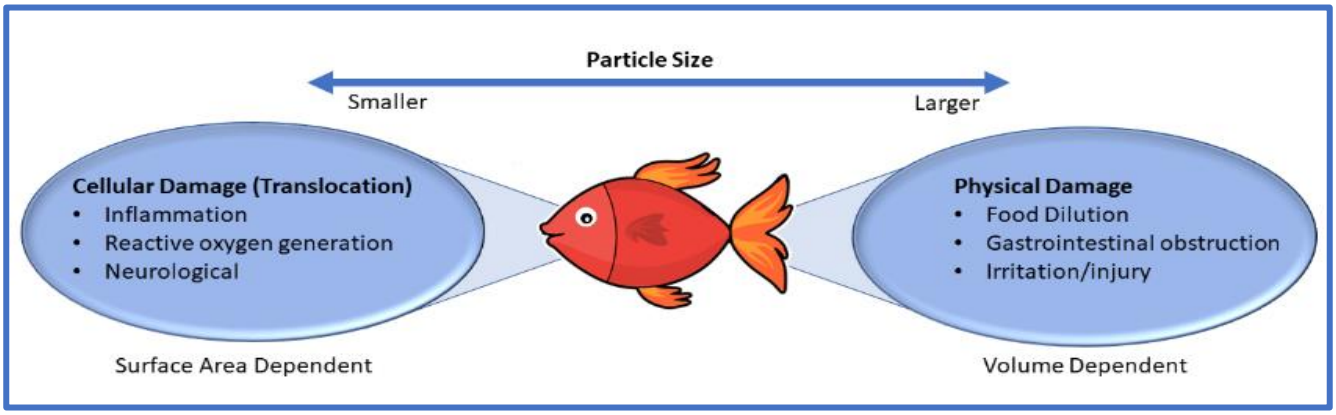
There is a lot of variation in quality and usability of available information on health impacts related to microplastics exposure. Microplastics toxicity can be caused by both physical and chemical properties and the pathogens that may adhere to them. Exposure does not necessarily equal adverse effects.

There has been an exponential growth in recent years of nonhuman mammalian studies, but variations in study design, exposure concentration, data quality, and data reporting have led to significant data gaps. Currently, there is not enough information to establish toxicity criteria to use in environmental or human health risk assessments.

Human Health Effects

Although the associated risks of exposure remain uncertain, microplastics have been detected in several human tissues, including lungs, placenta, and blood. Microplastics have also been detected in human breast milk and meconium of newborn babies. Currently, there is not sufficient weight of evidence to definitively state what the health effects are for humans exposed to microplastics. Additional information regarding potential human health effects can be found in the ITRC Microplastics Technical Guidance Document - https://mp-1.itrcweb.org/human-health-and-ecological-effects/#4_5.

Ecological Effects



The figure above is a conceptual diagram of aquatic organisms exposed to microplastics. These concepts are expected to be similar for terrestrial organisms. There are two kinds of health effects associated with microplastics, both of which are related to their particle size. The first is that, when the particle size is very small, as shown on the left side of the continuum, it is more capable of causing molecular- and cellular-level damage, such as inflammation and oxidative stress reactions.

The second is that, when the particles are larger, as shown on the right side, the effects are more physical damage, often related to the ingestion route. If microplastics are accidentally or intentionally consumed with food, this can lead to food dilution, or blocking certain portions of the gastrointestinal tract or other types of injury. Even the particle surface (rough or smooth) can make a difference when it comes to causing irritation.