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Microplastics Everywhere

The tiny particles are even in our bodies. What might this mean for our health?

Nature, Nurture

 by Stephanie Dutchen —  4 minute read

—  Climate in the Clinic



Fibers, flakes, spheres, foams: every day we eat, drink, and inhale tiny bits of plastic. What happens once they enter our bodies is a question that worries a growing number of scientists and clinicians.

The study of whether and how microplastics – particles smaller than 5 millimeters that slough off plastic as it degrades – pose threats to human health is still in its infancy. As the World Health Organization underscored in a 2022 report, current technologies don't yet enable researchers to quantify population-level microplastics exposures or gauge what proportion of those particles stay in our bodies. However, microplastics' ubiquity in the environment, combined with preliminary findings

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from human cell and animal studies over the past decade, have led to urgent calls for more research and regulation.

“There are so many unknowns,” says Bernardo Lemos, an adjunct professor of environmental epigenetics at the Harvard T.H. Chan School of Public Health, “but we are seeing more data that suggest microplastics affect human biology.”

Understanding what these particles might do to our genes, cells, and organs is of increasing importance as changing weather patterns sweep microplastics into more of Earth’s lands, waters, and air.

Fortunately, according to Eşref Demir, an HMS visiting professor of dermatology at Massachusetts General Hospital, and Fatma Turna Demir, an HMS research fellow in neurosurgery at Mass General, the medical community is becoming more knowledgeable about plastic particle pollution and the diseases and syndromes that may be linked to it.

Where they are

We encounter microplastics everywhere: from trash, dust, fabrics, cosmetics, cleaning products, rain, seafood, produce, table salt, and more.

Little wonder that microplastics have been detected throughout the human body, including in the blood, saliva, liver, kidneys, and placenta. Investigators are probing how they get into other organs and tissues from the lungs and gastrointestinal tract. Microplastics

smaller than 1 micrometer, known as nanoplastics, worry researchers the most because they can infiltrate cells.

Using a model of human intestinal lining, a team led by Philip Demokritou, director of the Environmental Health Nanoscience Laboratory at the Harvard Chan School, found that nanoplastics can enter cells in two different ways and even get into cell nuclei.

Lessons from the field of environmental toxicology raise flags about cancer and reproductive issues. Studies in cell cultures, marine wildlife, and animal models indicate that microplastics can cause oxidative damage, DNA damage, and changes in gene activity, known risks for cancer development. Microplastics have been found in human breast milk and meconium, an infant's first stool. A few studies in mice have found reproductive effects such as reduced sperm count and quality, ovarian scarring, and metabolic disorders in offspring.

Microplastics' physical properties are one source of potential hazards. Some marine organisms seem to be eating more microplastics and fewer nutrients, which can reverberate up the food chain. In humans, researchers point to illnesses caused by particulate air pollution, which contains microplastics, and by workplace exposure to plastic dust.

Other threats arise from chemicals in and on microplastic particles, including plastic components — such as BPA, phthalates, and heavy metals — that are known or suspected to cause disruption to nervous, reproductive, and other systems.

Although the variety of microplastics and the difficulty of estimating accumulation in human tissues make it challenging to pin down risks, findings in models show inflammation, cell death, lung and liver effects, changes in the gut microbiome, and altered lipid and hormone metabolism.

Mounting evidence suggests that microplastics magnify the potency of other toxicant exposures, such as cadmium, as Demir and Turna Demir have confirmed in fruit flies and Lemos has confirmed in mice and fruit flies. Others are chasing down hints that microplastics can carry antibiotic-resistant bacteria and other pathogens on their surfaces and into our bodies.

What to do?

While research develops, solutions beckon. Scientists are exploring plastic-eating microorganisms and plastic alternatives. Individuals can advocate for reduced plastic manufacturing and more recycling, and physicians can push for greater sustainability in hospitals and clinics.

“We want to get rid of terrible plastics in our transdisciplinary projects, our hospitals, and our patients’ lives,” wrote Demir and Turna Demir in a joint email. “Find strategies to segregate and recycle plastic medical waste. Review the use of plastic, especially single-use plastics, and synthetic textile products.”

As plastic waste skyrockets, threats to human health may escalate, according to a May 2021 *Nature* news article. The production and destruction of plastics produces particles and gases that contribute to climate

change, and plastic left to break down in the environment releases greenhouse gases. Studies suggest that microplastics disrupt marine microorganisms' globally crucial roles of sequestering carbon dioxide and producing oxygen. These deficits further jeopardize our health and that of our planet.

Stephanie Dutchen is the manager of feature content and multimedia in the Office of Communications and External Relations at HMS.

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