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Scientists race to understand the health risks of microplastics

From city air to drinking water, microplastics are becoming impossible to avoid. EU-funded researchers are now exploring how these tiny particles interact with our bodies and assessing their long-term health impact.

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Visitors to Utrecht's Wilhelmina Park in the summer of 2023 may have come across an unusual sight: volunteers on stationary exercise bikes, cycling for science.

The bikes were set up in different parts of the park – in its centre, beside a busy road and at a traffic junction where cars constantly stopped and started. The aim was to observe how the body reacts to pollution.

After the ride, researchers analysed the cyclists' blood, looking for changes in white blood cells linked to exposure to tiny plastic particles in the air.

These particles, known as microplastics, are now found almost everywhere. Tyres shed them as vehicles move, synthetic materials break down over time, and plastics persist in the environment long after they are discarded.

The Dutch study found that breathing polluted air containing these particles could temporarily affect the immune system. As the volunteers were all healthy they recovered quickly, but the findings raise a bigger question: what happens after years of repeated exposure?

"We know people are constantly exposed," said Dr Raymond Pieters, an immunotoxicologist at Utrecht University. "What we don't yet know is what that means in the long term."

Understanding health impacts

Pieters led a four-year EU-funded research initiative called POLYRISK that concluded in September 2025. Working with a network of European laboratories, his team set out to better understand how micro- and

nanoplastics (MNPs) enter the body, to what level we are exposed to them, and whether and how they affect the immune system over time.

The scale of the issue is sobering. Each year, an estimated 200 to 600 Olympic-sized swimming pools' worth of microplastics is released into the environment. They have been detected in oceans, drinking water, and even the air we breathe.

In response, European policymakers are stepping up efforts to tackle the problem at its source, targeting both intentionally added microplastics and those created as plastics break down. The aim is to cut pollution by 30 % by 2030 as part of a broader push to protect health and the environment.

Chronic exposure

While we do not yet fully understand to what extent MNPs can cause health issues, we do know that we are constantly exposed to them.

"We are exposed through the food we eat, the water we drink and the air we breathe," said Alba Hernández, a toxicology researcher at the Autonomous University of Barcelona, Spain. "But it's still unclear which route is most important, or most harmful."

Hernández led a parallel European research effort called PLASTICHEAL that examined the impact of plastics in the body on human health.

By exposing cells to MNPs and developing new ways to detect them in human samples, her team found early signs of inflammation, DNA damage and other forms of cellular stress. These are not diseases in themselves, but warning signs.

One theory is that repeated exposure could trigger low-level inflammation in the body – small "fires" that build over time and might contribute to chronic illness or develop into a disease such as cancer.

At the same time, detecting the smallest particles remains a major challenge. Some are hundreds of times thinner than a human hair and cannot be seen with standard microscopes, making them difficult to track in both the environment and the body.

Trojan horse effect

Microplastics may also pose a more indirect risk. As they age, their surfaces become rougher and more likely to pick up environmental toxins such as traffic-related pollutants, heavy metals, or even bacteria and viruses.

"They are good at attracting substances from their environment," said Hernandez. "Then, when you inhale or ingest these particles, you take in all these other substances, too."

Scientists refer to this as the "Trojan horse" effect. In this case the plastic particle acts as the vehicle, carrying potentially harmful substances into the body.

Exactly how significant this effect is remains unclear. Researchers still do not know how much plastic people typically absorb, which types are most harmful, or how different contaminants interact once inside the body.

The researchers also found that once inside the body, the smallest particles can be taken up by immune cells known as macrophages – literally "big eaters". These cells normally engulf and break down harmful substances, but plastics are not easily digested.

“Macrophages can take them up, but they can’t break them down,” said Pieters. “Particles can also be absorbed and moved around the body and we don’t know what the impact is.” Some studies suggest they may accumulate in tissues such as the liver, kidneys or fat.

Concerted effort

To tackle these questions, the EU has funded five distinct research initiatives working in parallel and collaborating within the framework of the European Research Cluster to Understand the Health Impacts of Micro- and Nanoplastics (CUSP).

Each initiative under CUSP focuses on a different stage of the journey. Taken together, they offer a fuller picture – from exposure to impact – of how these invisible particles might affect human health over time.

While Hernández’s work focused on detecting plastics in the body and assessing their effects on health, other teams are focusing on more specific health questions. One is investigating whether microplastics could play a role in allergic diseases, while another is looking at how exposure during pregnancy and childhood might affect development.

Coordinated by the UK-based research consultancy Optimat, the PlasticsFatE research team brought together 28 partners across 11 European countries to investigate how plastic particles behave inside the body, tracking how they move through organs, what they carry with them, and how they might build up over time.

The PlasticsFatE researchers developed laboratory models that mimic human organs such as the lungs and gut, allowing them to study how particles behave without experimenting on people.

“We built tissue cultures to mimic what would happen in the real world,” said Mark Morrison, who coordinated the investigation.

Their findings suggest that some plastic particles can cross the gut barrier and enter the bloodstream, potentially travelling to other organs.

For most healthy adults, current evidence suggests that low-level exposure is unlikely to cause immediate harm. But scientists remain concerned about long-term effects, especially for more vulnerable groups.

People with conditions such as inflammatory bowel disease, for example, may be more susceptible. In these individuals, the gut barrier is less effective and may allow particles to pass more easily into the bloodstream.

A measurement problem

One of the biggest challenges is simply understanding how much plastic we are exposed to.

“We still don’t have reliable tools to measure what is in the environment, in our food or in our bodies,” Hernández said. “That makes it very difficult to assess risk.”

The problem is complicated by the wide variety of plastics. Different types, such as polyethylene, polypropylene and polystyrene, behave differently, and the additives used to colour or strengthen plastics may have health effects of their own.

Some researchers believe the plastic particles may be less harmful than the substances they carry.

“It’s not just the particles themselves,” said Morrison. “It’s what they transport. They can act like a conveyor belt for other chemicals.”

Acting amid uncertainty

Interest in these findings is growing, including within the industry, as companies anticipate future regulation. At the same time, international efforts to tackle plastic pollution continue.

Negotiations on a global plastics treaty stalled in 2025, even as organisations such as the UN Environment Programme and the Lancet Commission on Plastics and Health warned that plastic pollution is becoming a growing health concern.

To bring these strands together, the CUSP researchers have drawn up a roadmap for the next phase. Published in 2025, it highlights the biggest knowledge gaps, from how much plastic we are exposed to, to how the smallest particles behave inside the body, and sets out priorities for future research.

One message stands out: uncertainty should not be a reason to delay action.

Even without complete answers, the CUSP scientists argue that reducing our exposure to microplastics now could help limit potential risks later.

“We already have enough information to be concerned,” Hernández said. “We shouldn’t wait until we have all the answers. We should act now.”

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* To learn more about the other two CUSP initiatives (AURORA and IMPTOX) and how the cluster got started, please revisit our 2022 article ‘We eat and inhale thousands of bits of plastic every year. Now what?’.

More info

- POLYRISK (CORDIS)
- POLYRISK project website
- PlasticsFatE (CORDIS)
- PlasticsFatE project website
- PLASTICHEAL (CORDIS)
- PLASTICHEAL project website
- AURORA (CORDIS)
- AURORA project website
- IMPTOX (CORDIS)
- IMPTOX project website
- CUSP - the European research cluster to understand the health impacts of micro- and nanoplastics (MNPs)
- EU - CUSP cluster
- EU action on microplastics
- EU plastics strategy