Translocating Nanoplastics in Zebrafish

GA, UNITED STATES, December 13, 2025 /EINPresswire.com/ -- Scientists from the City University of Hong Kong have found that nanoplastics can enter zebrafish via two pathways: waterborne exposure and dietary exposure. These tiny particles can cross biological barriers to enter the circulatory system, and then translocate to and accumulate in various organs, including the blood, brain, gills, liver, intestines, gonads, and muscles. The gills and intestines are the most important absorption organs, while the intestines serve as the primary excretion organ.

Nanoplastics accumulate in various organs of zebrafish after ingestion.

Plastic waste breaks down into smaller fragments in the environment, with those measuring less than 1 micrometer are defined as nanoplastics. Aquatic animals such as fish will inadvertently ingest nanoplastics suspended in water or consume food contaminated with these tiny plastic particles. However, because of their ultra-small size, nanoplastics can also cross biological barriers. Hence, after being ingested, they can transfer to different organs. This build-up of nanoplastics in organs can have harmful effects on the organism, with the most severe cases potentially stunting the fish's growth and reproduction.

Previous field studies have found plastic fragments inside fish, mostly within the digestive system. There is also evidence of plastics entering the circulatory system, such as fragments found in the heart. This has intrigued scientists: how do these particles enter the bloodstream, and how do they travel through the body?

Zebrafish are commonly used in toxicology research and share many physiological and genetic similarities with humans. In a new study published in Environmental Chemistry and Ecotoxicology, a duo of researchers from City University of Hong Kong exposed zebrafish to nanoplastics — They found that within 24 hours of ingestion, nanoplastics entered the bloodstream and spread throughout the body, quickly accumulating in organs and reaching a stable level within days. The particles, ingested via the water or through food, were found in

critical tissues, including the brain, gills, liver, intestine, gonads (reproductive organs), and muscle. This widespread accumulation could potentially lead to disorders in systems like the nervous and reproductive systems.

The researchers also discovered that most nanoplastics entered through the gills and intestine, and were primarily expelled through the intestine. However, a portion remained trapped within the body for a long time.

Based on these experimental results, the duo developed a computer model that simulates the nanoplastics in fish's body. This model successfully predicted how nanoplastics accumulate, travel, and are cleared from different organs, whether ingested from water or food. This model also provides a valuable reference for predicting how nanoplastics might behave in mammals.

“Our study demonstrates that nanoplastics can cross biological barriers, enter the circulatory system of fish, and spread throughout their bodies,” says corresponding author Wen-Xiong Wang.

“This alarming journey may also occur in other animals, and even in humans.”

DOI
10.1016/j.enceco.2025.10.002

Original Source URL
https://doi.org/10.1016/j.enceco.2025.10.002

Funding information
This study was supported by the National Science Foundation of China (42430709, 22276157) and the General Research Fund of Hong Kong Research Grants Council (11104225). W.-X. Wang was supported by a 5-year Senior Research Fellowship from the Hong Kong Research Grants Council (SRFS2425-1S06).

Lucy Wang
BioDesign Research
email us here