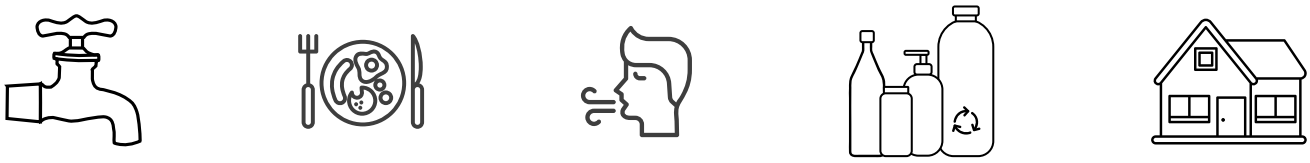
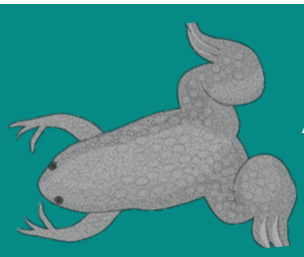
What can frogs can teach us about human health?

Over our lifetimes, humans are exposed to many different things in our environment that can affect our health. These exposures happen through the water we drink, food we eat, air we breathe, products we use, and places we spend time.



This makes it challenging to directly study the effects of a particular environmental exposure on humans, so scientists have to find other models.

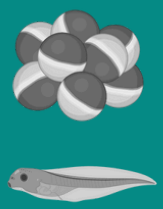
Scientists are studying a frog called *Xenopus laevis* ("zen-o-pus lay-e-vus") to learn about cell biology, development, infectious and autoimmune diseases, and cancer.



African clawed frog, *Xenopus laevis*

Xenopus are easy for scientists to study.

- They lay many eggs at a time.
- Tadpoles develop very quickly, from a single cell to a tadpole in 36 hours.



- Scientists can study multiple life stages (cells, tadpoles, or adult frogs).
- Tadpoles are very sensitive to environmental contaminants because they develop outside of the mother's body, in water.

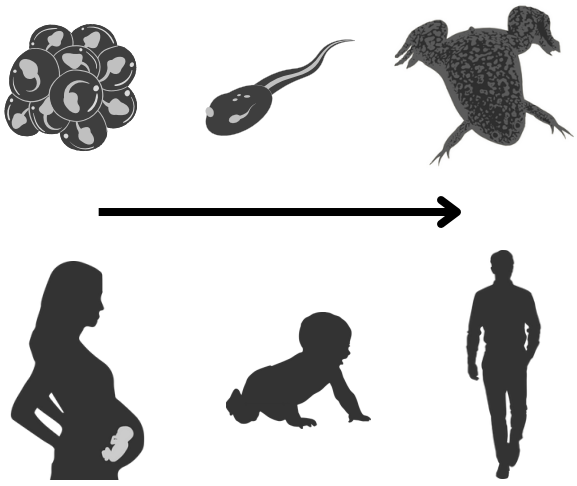
Studying immune development in frogs can help us learn about both frog and human health.

Before birth and during early life, the immune system is learning how to do its job. **Exposure to even small amounts of pollution or hazardous chemicals at this stage can damage the immune system for life.**

Immune system damage may...

- decrease the body's ability to fight infections from viruses and other microbes
- increase the likelihood of developing autoimmune diseases and cancer

...even as an adult.

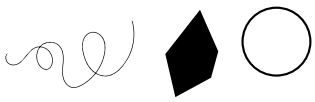


Environmental exposures early in life can affect health as an adult.

Xenopus frog and human immune systems have many similar features. Learning about frog development can teach us about human development too.

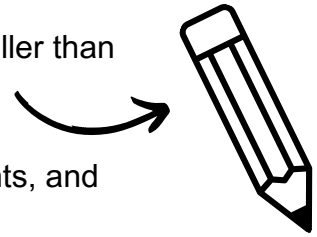
Frogs, microplastics, and the immune system

Microplastics are found everywhere in the environment. Animals and people eat, breathe, and drink microplastics without knowing it, and these small particles can get into our bodies.

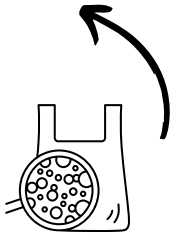


What are microplastics?

- Less than 5 mm in size (smaller than a pencil eraser)
- Found in water, air, soil, plants, and animal and human bodies



- Fibers, fragments, films, beads, and other shapes
- Any plastic item can break down into microplastics over time



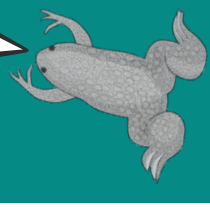
Microplastics may reduce the body's ability to fight off viral infections.

Research at the University of Rochester showed that exposure to PET microplastics interfered with immune cells in tadpoles. This made the frogs more vulnerable to viral infections.

Because the immune systems of *Xenopus* tadpoles and humans are similar, this research suggests that exposure to microplastics may also affect humans' ability to fight off infectious disease.

Polyethylene terephthalate (**PET**), used in packaging and bottles, is a common kind of plastic pollution.

Learn more about the research:



Studying microplastic pollution and immune system development can help us protect both humans and frogs.

More than 40% of amphibian species worldwide are vulnerable, endangered, or extinct. Habitat loss, pollution, climate change, and the emergence of new diseases threaten amphibian populations.

Plastic waste can enter the frogs' environment and break down into microplastics that may harm their health.

In 2020, over 136 billion lbs of plastic waste was not properly disposed of or recycled globally. Plastic production continues to increase, which could lead to even more plastic pollution in the future.

Learning about the impact of microplastic pollution on immune system development may also help us understand new threats to frog populations.

This work is supported in part by the Lake Ontario Microplastics Center (LOMP), which is jointly hosted by the University of Rochester and the Rochester Institute of Technology with funding from NIEHS (P01 ES035526) and NSF (OCE-2418255). LOMP is a hub for research and community engagement around microplastics in the Great Lakes. Last updated 2/24/25. **Learn more at LOMP.urmc.edu**

LOMP

Lake Ontario MicroPlastics Center