Space Station worms' research potential is anything but flat

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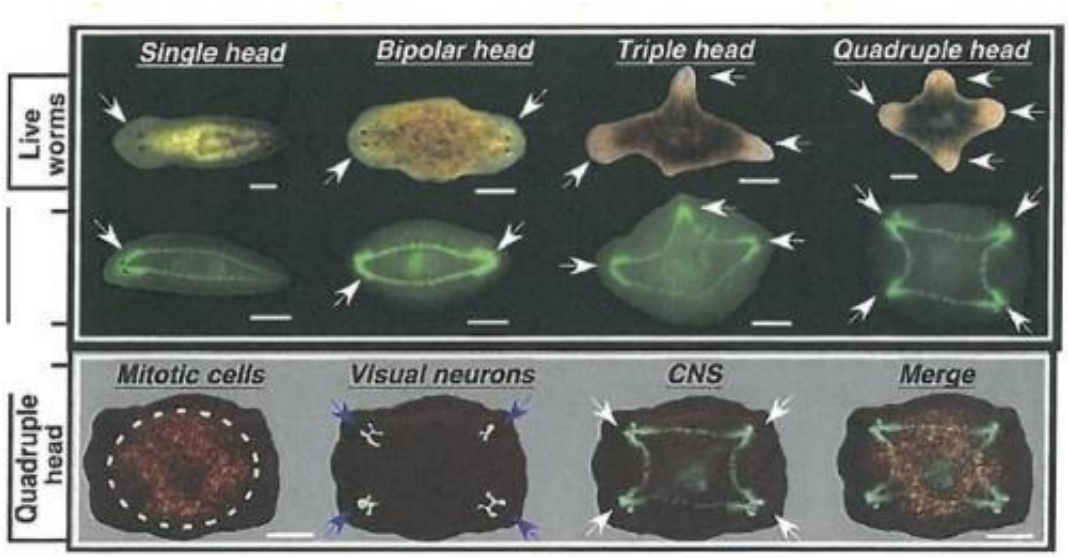

Image representations of live worms with single, bipolar, triple and quadruple heads for the Flatworm Regeneration investigation aboard the International Space Station. Credit: Dr. Michael Levin, Tufts University

For years, it was assumed the world was flat. Now, we have a laboratory that orbits our big, blue marble. So, it's funny to think of returning to flatness aboard the International Space Station, but this outpost currently houses flatworms for research. The study of these creatures has the potential to be rather robust in implications for regenerative medicine, an area of treatment for repairing or replacing human cells, tissues or organs on Earth to restore normal function. A new study launched

aboard SpaceX's fifth commercial resupply services (CRS) mission to the space station examines the reparative processes of flatworms in microgravity.

As flatworms age, or should they encounter cellular damage, they have the ability to renew their cells. For example, if they lose their tail, they can regrow it. A team of researchers from Kentucky Space LLC and the Center for Regenerative and Developmental Biology at Tufts University in Medford, Massachusetts, will use the worms to observe repair processes and wound-healing done by cells in space during the Flatworm Regeneration investigation. This insight could influence the development of medicine on Earth with new methods for repairing damaged tissue from injury or physical impairment.

"We are specifically looking at regenerative processes and applications that could be potentially valuable for use on Earth," said Kris Kimel, president and founder of Kentucky Space. "Much of what has been done in the past has been focused on astronaut health, and you can learn a lot from that, but we're focused primarily on the cellular and molecular level processes that could impact regenerative processes on Earth."

This investigation is a first step toward understanding how gravity affects an organism's mechanisms for repair and renewal. Researchers hope to map the cell signaling processes that help the worms' bodies locate cellular damage and instruct an area or appendage to regrow. They are observing the worms in space to find out how these processes may be disrupted by the lack of gravity.

Sample test tubes used to contain flatworms during the Flatworm Regeneration investigation aboard the International Space Station. Credit: Kentucky Space

The research implications not only apply to regenerative medicine, but also to technology development. Engineers may be able to create new algorithms - a set of steps used in mathematics or to design computer processes - based on the knowledge gained from flatworm study in orbit. This could lead to technology that employs these algorithms to reconfigure their own components and energy use in deep space.

Flatworms with amputated heads or tails are contained inside sealed test tubes for this study. The tubes were placed in Biological Research in Canisters (BRIC) hardware and loaded on the SpaceX Dragon spacecraft for delivery to the station. This flatworm investigation does not require power or interaction from the station crew.

"It's a potentially valuable experiment in terms of the results, but in this first iteration, we're making it as self-sustaining as we can," said Kimel.

The research plan stipulates that the flatworms return alive upon landing.

They are currently scheduled to return aboard Dragon at the conclusion of SpaceX CRS-5. The research team will analyze regeneration patterns of the space-flown worms and compare them with control worms living in similar conditions on Earth during the study time period.

Kimel describes the study as a critical step in specific regenerative medicine research and commercial pathways to space. His research team wishes to focus on projects with specific pathways they are trying to understand. The results obtained in this first flatworm study between Kentucky Space and Tufts University will become the basis for their next phase of research in regenerative medicine.

"When we do something, we look at why we're doing it, where it fits in that pathway and whatever the result, it's going to lead us to another experiment," said Kimel. "Whether the first experiment takes us to step two or it doesn't look like it's going to go anywhere, we're not just doing one-off research studies. We plan to keep trying and move toward more high value outcomes."

Given the potential reparative impacts for patients suffering from injury or physical impairment on Earth, this microgravity study of worms does not fall flat.

Provided by NASA