Big ideas in small packages: The seeds and worms making their way to the ISS

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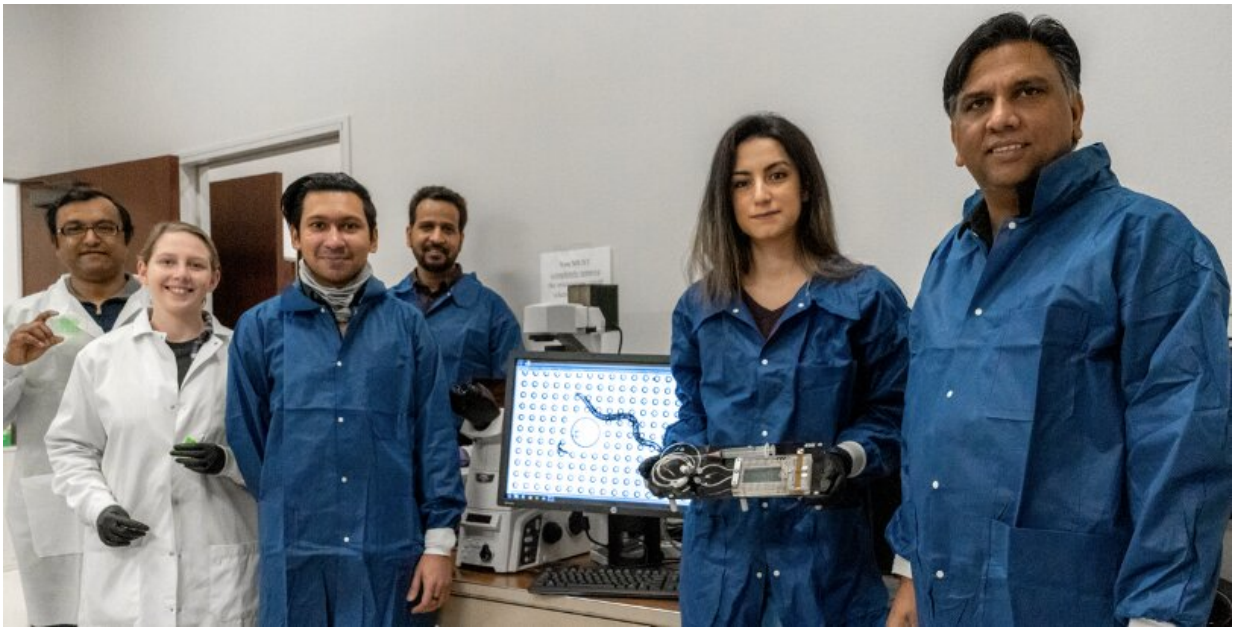


Micro-16 Science Team at Texas Tech University. Standing from left to right: Mizanur Rahman, Hunter Edwards, Taslim Anupom, Purushottam Soni, Leila Lesanpezeshki and Siva Vanapalli. Credit: Texas Tech University.

On Feb. 20, 2021, Northrop Grumman will launch its Cygnus cargo spacecraft aboard an Antares rocket to deliver several tons of cargo and supplies to the International Space Station for its 15th resupply mission (CRS-15). Included in these bulky supplies will be a handful of items that weigh no more than a few grams—a sampling of seeds, some

microscopic proteins, and a few small worms. Yet it is these tiny organisms that may yield the biggest impact to this mission, affecting the future of space travel while delivering life altering benefits to those of us still on Earth.

Three experiments, sponsored by NASA's Biological and Physical Sciences Division, focus on the diversity of space biology and physical sciences:

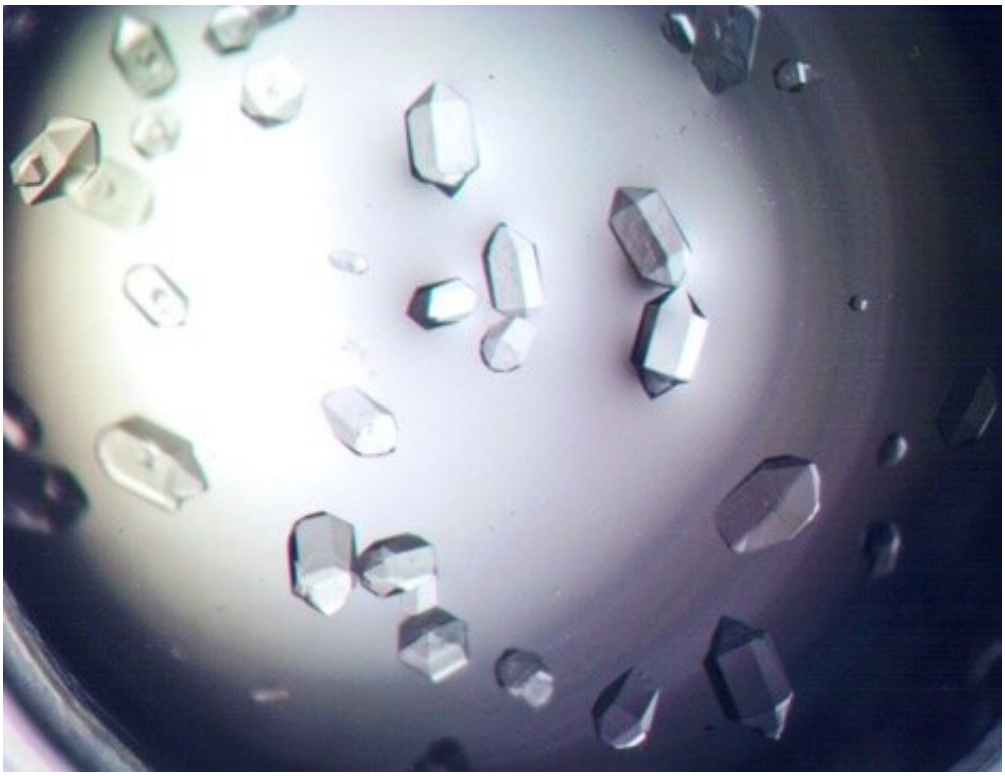
Micro-16

Meet Caenorhabditis elegans, a 1-mm roundworm that shares a common trait with humans: muscle. Long space voyages present a unique challenge to astronauts: loss of muscle mass and strength. Can this tiny worm provide clues regarding how to mitigate this risk? The Micro-16 project will use this roundworm to see whether decreased expression of muscle protein is associated with decreased strength. The research team developed a new device that will measure muscle strength over multiple generations of worms that will be born and raised on the space station.

Phase II Real-time Protein Crystal Growth Investigation

One of the ways scientists develop new drugs to fight disease is to use a process called protein crystallization which takes place when individual protein molecules are stabilized by crystal contacts. These crystals can grow differently in microgravity conditions than they do on Earth, producing a higher quality crystal. Real-time Protein Crystal Growth-2 on the space station is designed to demonstrate new methods for producing these high-quality protein crystals. Eight different proteins will be incubated on special growth plates inside the BioServe Space Automated Bioproduct Lab at precisely controlled set temperatures. At different times during incubation, the plates are removed and placed on the BioServe's TS-100 microscope to locate and image any crystals that

form. These images will then be used by the experiment's principal investigators to design the next iteration of protein growth conditions.



Aeropyrum pernix Flap Endonuclease-1 (FEN-1) protein crystals are shown grown under Earth gravity conditions. FEN-1 serves as the experimental protein for the Phase II Real-time Protein Crystal Growth on Board the International Space Station (Real-Time Protein Crystal Growth-2) investigation. Credit: University of Toledo.

The MISSE-Seed Experiment

Think about what you might include in your next salad: some lettuce, Pac Choi, radishes, tomatoes, cauliflower, and a few peppers. A nutritious dish for you or any astronaut. But can these veggies grow and thrive in an extraterrestrial greenhouse if they're exposed to too much

radiation? That's the driving question to the MISSE-Seed Experiment: to study the effects of long duration space exposure on crop seeds. For six months, eleven seed varieties will be exposed to the space environment outside the space station at the Materials International Space Station Experiment (MISSE) sample carrier's Zenith position. The project will also examine a number of passive sample containment vessels to ascertain what type of storage units are optimal to preserve seeds or other biological samples during exposure to the space environment.

As Craig Kundrot, the division director of the Biological and Physical Sciences Division noted: "After the Cygnus spacecraft delivers its cargo, the big ideas that will emanate from these experiments will help give us the knowledge we'll need to inhabit the Moon, Mars and beyond. At the same time, they'll change what we know about biology and physical science on Earth, helping us find new ways to feed and improve the health of the world's growing population."

More information: For more information, see www.nasa.gov/mission_pages/sta … 5-science-highlights

Provided by NASA

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