



# BIOLOGICAL AND PHYSICAL SCIENCES DIVISION

## Science Mission Directorate

### USING SPACE AS A RESEARCH PLATFORM

Conducting experiments in the extreme conditions of space enables researchers to study biological and physical phenomenon in ways not possible on Earth — expanding scientific knowledge for the benefit of all. This research has contributed to many advancements on Earth: from medical treatments to greener combustion engines, new technologies to consumer products — and more. And it's also led to commercial patents and spin-off companies that impact our everyday lives.

### ADVANCING U.S. SCIENCE LEADERSHIP

The mission of NASA's Biological and Physical Sciences Division (BPS) is to lead the world in fundamental space-based research, pioneer transformational discoveries, enable sustained human space exploration, and improve life on Earth and in space.

#### BPS administers NASA's:

- Space Biology Program, which uses the space environment to advance our knowledge of how gravity, radiation, and other spaceflight stressors affect the design and function of living organisms, and to understand how biological systems accommodate to them.
- Physical Sciences Program, which uses the space environment as a tool to understand how physical systems respond to spaceflight environments, particularly weightlessness and the partial gravity of planetary bodies.
- Commercially Enabled Rapid Space Science project (CERISS), which aims to develop transformative research capabilities with commercial space industry to dramatically increase the pace of research.



*Astronaut and Engineer Michael Hopkins conducts research activities inside the Microgravity Science Glovebox.*

## BPS FOCUS AREAS

BPS's research priorities are guided by Decadal Surveys issued by the National Academies of Sciences, Engineering, and Medicine. The 2023-2032 Decadal for Biological and Physical Sciences Research in Space is expected to be delivered in the summer of 2023. While BPS awaits the 2023 Decadal, the division will focus on three initiatives:

- **Quantum Science**, including using the world-class Cold Atom Laboratory (CAL) aboard the International Space Station to conduct experiments.
- **Thriving in Deep Space (TIDES)**, with an emphasis on plant biology, animal biology, and microbiology using ground- and space-based research platforms.
- **CERISS**, to accelerate research productivity using commercial capabilities.

BPS also continues to complete research recommended by the 2011 Decadal, including investigations in the areas of combustion science, biophysics, soft matter, fluid physics, and materials sciences.



*Astronaut Christina Koch unloads new hardware for the Cold Atom Lab aboard the International Space Station.*

## SCIENTIFIC ACCOMPLISHMENTS

NASA-funded research has contributed to many scientific advancements.

Here are just a few that made news in 2022-2023:

- Scientists grew plants in lunar regolith collected during the Apollo mission — a scientific first — which can inform future Moon and Mars missions, as well as contribute to agricultural advancements on Earth.
- Researchers developed a cooling technique created for use in space that also makes charging electric cars on Earth quicker and easier.
- Data from a fluid physics experiment informed improvements to software utilized by Space-X, which can help reduce the risks and costs associated with storing cryogenic propellants.
- Soft matter colloids data was fundamental to the development of new consumer products, resulting in five patents.
- CAL produced the first dual-species Bose-Einstein Condensates in space and the first dual-species atom interferometers in space, enabling precision tests of Einstein's equivalence principle.



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