



geneLAB

Expanding the Impact of NASA's Biological Research in Space

Challenge

The datasets generated from molecular biology research projects funded through NASA's Space Life Sciences, Space Biology Program, especially those that leverage the International Space Station (ISS), are providing rich information that is helping the program achieve its goal of understanding the effects of the space environment at the cellular processes/level.

Although these vast datasets hold enormous potential for other follow-up biology studies, several factors prevent their broader use. Access to the datasets is generally limited, and because the data are gathered with different instruments and are not standardized, outside researchers cannot easily compare the datasets with those from other sources.

Due to the limited number of spaceflight opportunities and the cost and complexity of these studies, NASA has a critical need to maximize the value, and return on investment, for every biological experiment in space. If standardized and made available, the datasets produced from these flight experiments can greatly increase their value and impact.

Solution

The geneLAB project is designed to leverage the value of large "omics" datasets from molecular biology projects conducted on the ISS by making these datasets available, citable, discoverable, interpretable, reusable, and reproducible. geneLAB will create a collaboration space with an integrated set of tools for depositing, accessing, analyzing, and modeling these diverse datasets from spaceflight and related terrestrial studies.

By enabling comparison of these data with genomic, transcriptomic, proteomic, and metabolomic data from other sources, this collaborative space will help scientists develop new hypotheses and design follow-up experiments aimed at a creating a predictive and comprehensive understanding of molecular responses to space conditions.

Benefits

With the goal of helping NASA overcome the challenges of sharing and integrating spaceflight research data, geneLAB seeks to create a wealth of benefits. The products of geneLAB

will support and enable NASA, as well as provide spaceflight results that can be mined and used outside NASA for Earth-based scientific and commercial benefit, making the ISS and Space Biology research much more broadly relevant to Earth applications. Major deliverables and benefits include:

- **Promote greater creativity** by allowing spaceflight biology researchers to build ideas together
- **Enable new and alternative hypotheses** by providing open access to data and tools for novel research and for testing new ideas
- **Accelerate solutions** by reinforcing open scientific inquiry and encouraging a diversity of analysis and opinion
- **Facilitate scientific breakthroughs**, as researchers apply knowledge from previous NASA missions to new studies
- **Increase return on investment** from future research, by greatly increasing the number of investigations and the development of translational applications
- **Optimize resource utilization**, by enabling scientists to better identify what data exist and what new data are needed

Approach

The geneLAB project team is developing a phased approach to conducting activities aimed at achieving four key objectives:

1. Establish an open and integrated data, modeling, and computational environment for systems biology related to spaceflight
2. Facilitate the use of omics datasets for discovering and building upon molecular networks that are influenced by space conditions
3. Share geneLAB with the broadest possible community of researchers, industry and the general public to foster innovation

4. Strengthen international partnerships to leverage existing capabilities and enhance data sharing

How to Contribute

Scientific leaders and researchers will have numerous opportunities to contribute to the geneLAB enterprise:

- Leaders in the fields of omics and systems biology will make up a Steering Committee to review the geneLAB approach and provide guidance to improve NASA's methods and results
- Experts from academia, industry and government organizations, selected through a competitive process, will be invited to participate in Science Definition Teams to define and execute geneLAB experiments
- Scientists who are generating important omics datasets from spaceflight research or relevant ground-based studies will be encouraged to collaborate with geneLAB and add those datasets to the geneLAB data system

As geneLAB studies are completed, the raw datasets and associated metadata will be verified and then expediently posted to an open-access database. Whether to study life in space for NASA purposes, or for any other Earth-based biomedical or commercial application, anyone may search the database and perform novel investigations and analyses, thereby vastly increasing the availability, of molecular biology research results from space to facilitate breakthroughs for both NASA and ground-based applications.

To learn more, please contact:

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