

GeneLab : The NASA Systems Biology Platform for Space Omics Repository, Analysis and Visualization

The NASA GeneLab project capitalizes on multi-omic technologies to maximize the return on spaceflight experiments. To do this, GeneLab maintains a publicly accessible database (GLDS) that houses spaceflight and spaceflight relevant multi-omics data and collaborates with NASA principal investigators and projects to generate additional omics data. GeneLab houses more than 220 transcriptomic, proteomic, metabolomic and epigenomic datasets from plant, animal and microbial experiments, with a growing number of these having been produced by the GeneLab sample processing lab. The GLDS contains rich metadata about each experiment and has recently integrated radiation dosimetry data from experiments flown on the Space Shuttle. GeneLab has also recently implemented an effort to present processed data in the GLDS in addition to the raw omics data. The processed data will enable interpretation of the data by a larger group of students, scientists and the general public. Standard pipelines for the transformation of raw data into visualizations were developed by four GeneLab Analysis Working Groups (animals, plants, microbes, multi-omics) comprised of over 120 scientists from NASA, industry, and academia. To explore the data, the GLDS provides users various tools for data analysis, collaborative workspace for file storage and sharing, and a visualization portal. The analysis platform built using the Galaxy toolshed provides access to a broad variety of users including those with limited bioinformatics experience and students to learn how to analyze spaceflight omics data. The visualization portal takes GeneLab one step closer to data democratization by removing all bioinformatics requisites to interpret transcriptomics data hosted in the repository. Discoveries made using GeneLab have begun and will continue to deepen our understanding of biology, advance the field of genomics, and help to discover cures for diseases, create better diagnostic tools, and ultimately allow astronauts to better withstand the rigors of long-duration spaceflight.