



Open Science for Life in Space: Data Sharing and Tools for Knowledge Discovery



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Overview

Molecular-omics, physiological-phenotypic-behavioral, and environmental-radiation telemetry data from spaceflight biological and health studies are increasingly being made findable, accessible, interoperable, and reusable for the scientific public. These data, as well as space science-relevant biospecimens, are available through NASA's Open Science Data Repository (OSDR), which is the new umbrella grouping of NASA GeneLab, the Ames Life Sciences Data Archive (ALSDA), and the NASA Biological Institutional Scientific Collection (NBISC). The quality of data is underpinned by datasets having rich metadata (determined through Analysis Working Group members), processing pipelines to enable data reuse standards, and ontologies specifying terminology semantics (e.g., the Radiation Biology Ontology).

Data Repository: Data Mining

Integrate and analyze data across hazards (microgravity, radiation, isolation, etc.), missions/experiments (ISS, Space Shuttle, NSRL), species (human, rodent, microbe, plant/crops), assays (omics, phenotypic-physiological, telemetry), and formats (tabular, images, video).

859
Experiments

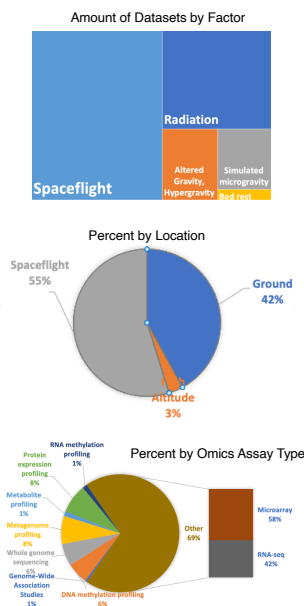
400
Studies

780
Datasets

45
Species

>20
Assays

>150TB
Data



Radiation, Data, and Specimens

Radiation Dosimetry

- From Space Shuttle, Bion-M1, Foton-M4, ISS
- Exposure types, particle charges, energies, absorbed radiation doses, exposure durations, HZE, other standardized radiation metadata

Assays

Molecular-omics

- Transcriptomics, proteomics, metabolomics, epigenomics, metagenomics, +all other omics

Physiological-phenotypic-behavioral

- Tabular, bioimaging, video
- Behavioral (e.g., open field, elevated plus maze, novel object recognition, etc.), micro-computed tomography, microscopy, histology, IHC, peripheral quantitative computed tomography, ultrasonography, DXA, flow cytometry, ELISA, mechanical testing, gait, tonometry, spectrofluorometry, magnetic resonance imaging, etc.

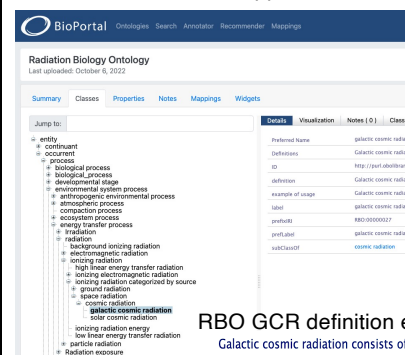
Biospecimens

From ISS, Space Shuttle, NSRL studies

- Rat & mouse; ~90,000 specimens
- Heart, kidney, ovaries, brain, muscle, etc.
- Microgravity; ground analogs; radiation exposures (carbon, titanium, silicon, iron, proton, gamma, combinations, etc.)

Radiation Biology Ontology

RBO is an ontology for the effects of radiation on biota in terrestrial and space environments. Aids in rich metadata, formal semantics, and support of data linkages for mining.



RBO on
Bioportal



RBO'
GitHub
Consortium



RBO GCR definition example

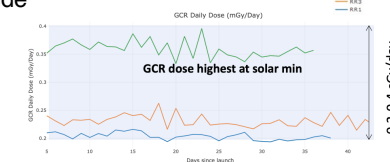
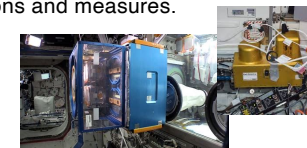
Galactic cosmic radiation consists of high-energy charged particles originating from outside the solar system

Environmental Data

OSDR recently implemented a 'Mission Telemetry' pipeline collecting and standardizing data from ISS Rodent experiments. Coming soon, a public application will enable users to access and compare these environmental data among differing missions and measures.

Parameters

- Relative Humidity
- Temperature
- Carbon dioxide
- Acceleration
- Oxygen
- Radiation
- Acoustics



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