



**Open Science Data Repository**

The NASA Open Science Data Repository (OSDR) enables access to space-related data from experiments and missions that investigate biological and health responses of terrestrial life to spaceflight. The goal of OSDR is to enable multi-modal and multi-hierarchical fundamental space life science data be reused toward basic science, applied science, and operational outcomes for space exploration and knowledge discovery. These data include 'omics, phenotypic, physiological, behavioral, hardware, environmental telemetry; raw, processed; tabular, text, code, bioimaging, and video.

[Learn More About OSDR](#)

## AGU: The Future of Biological Data: How Data Standards Unlock Research Opportunities

12/9/2024

Amanda Saravia-Butler, Ph.D.  
NASA GeneLab Science Lead  
Contractor: Amentum

**Support:** NASA SMD, BPS, SB, HRP

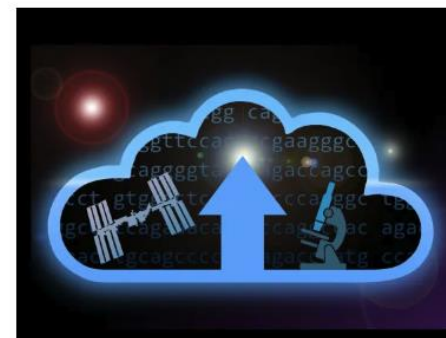
### Explore and Contribute



#### Open Science Data Repository

Search and upload spaceflight datasets

[Explore the Data Repository](#)



#### Submit Data to OSDR

Have space-relevant data to submit?

[Contribute via the Submission Portal](#)








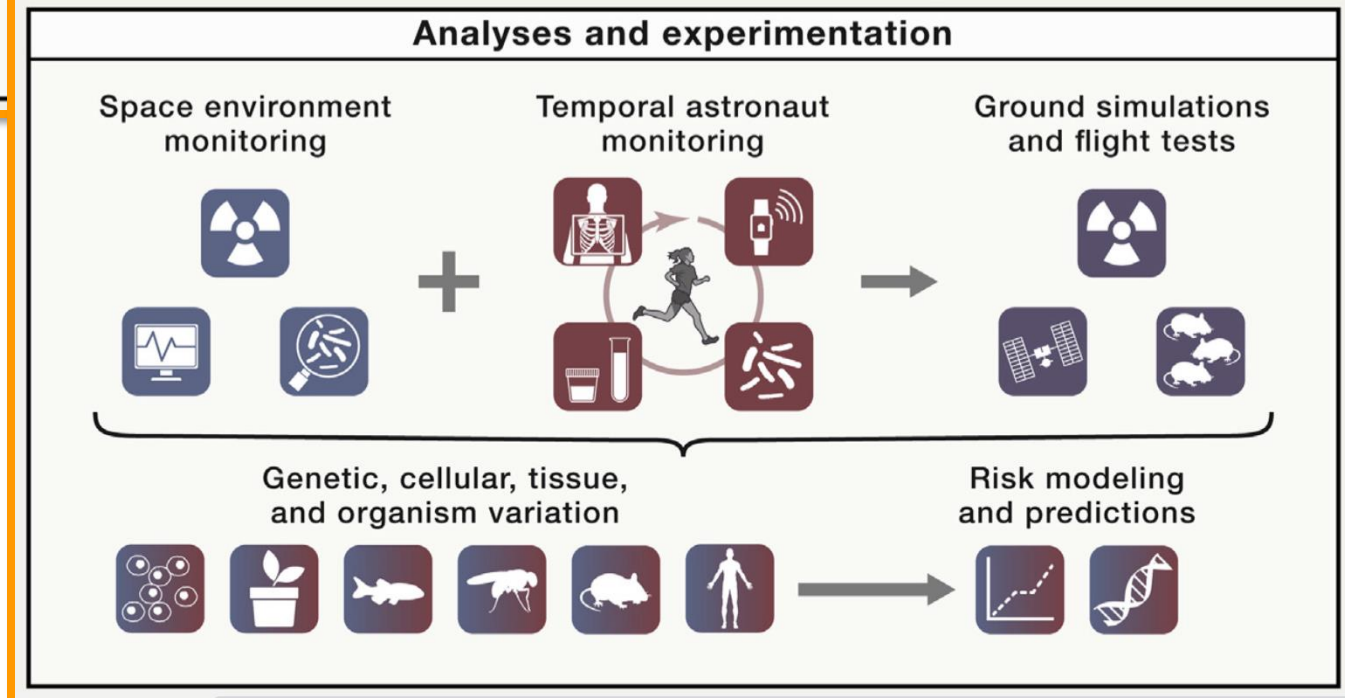
#### Join OSDR AWG's

We look forward to collaborating with you!

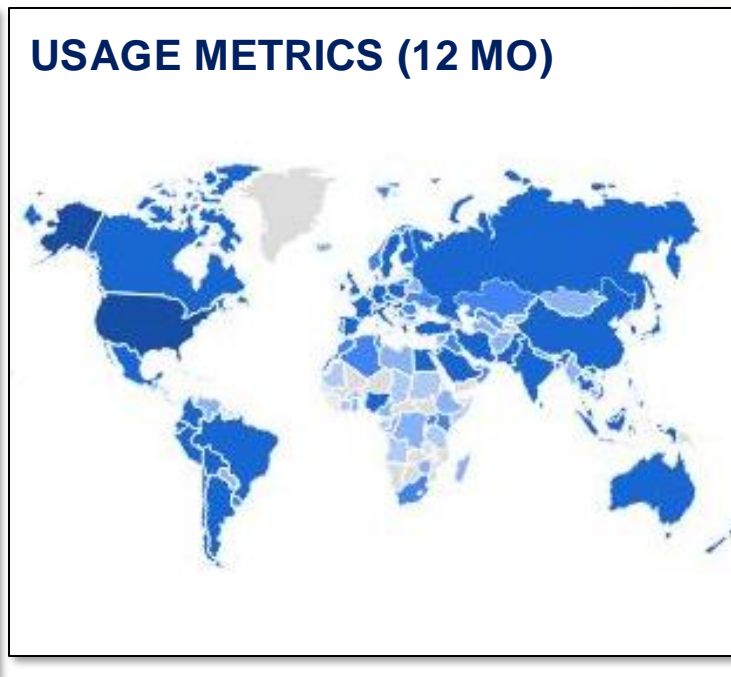
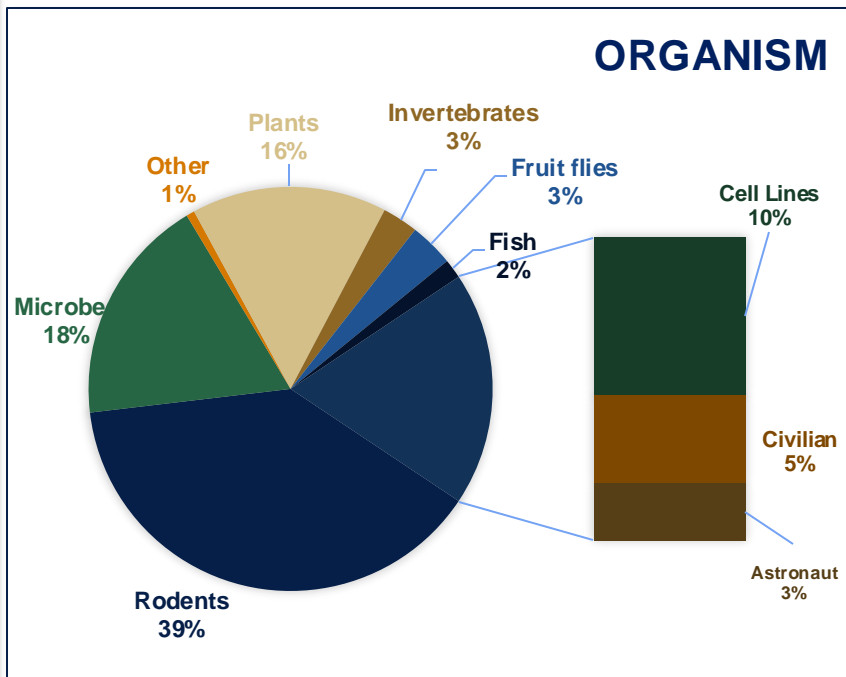
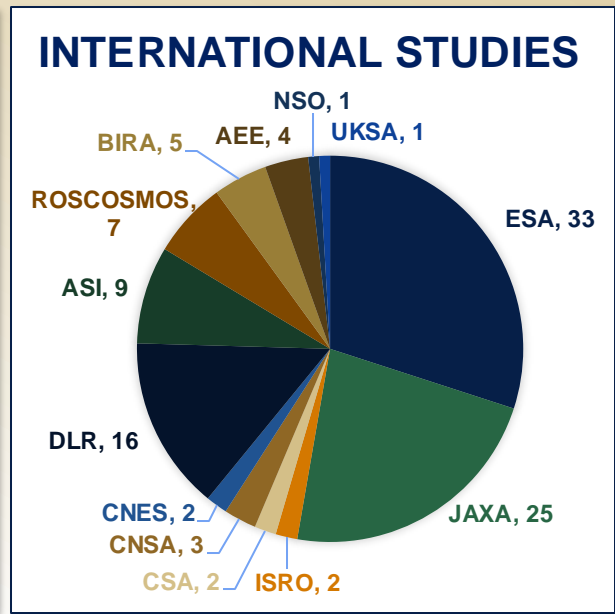
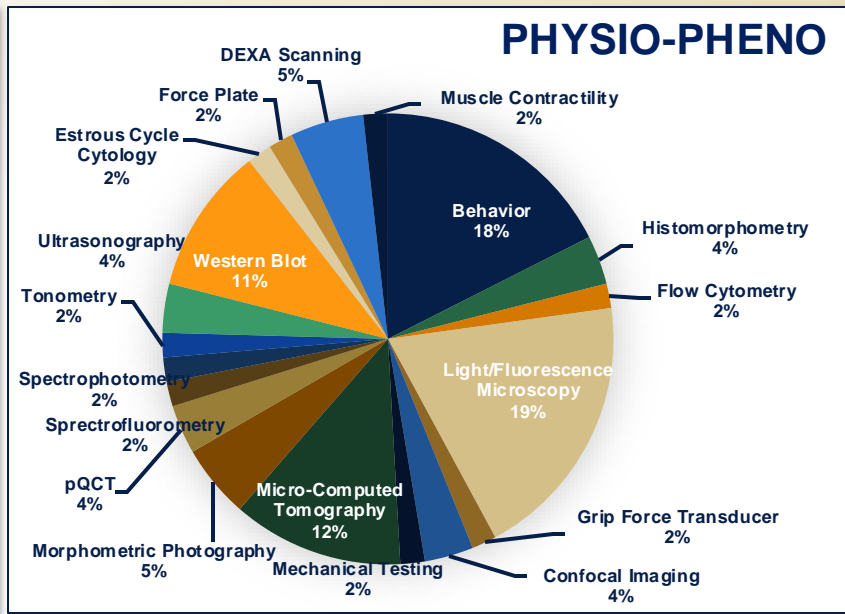
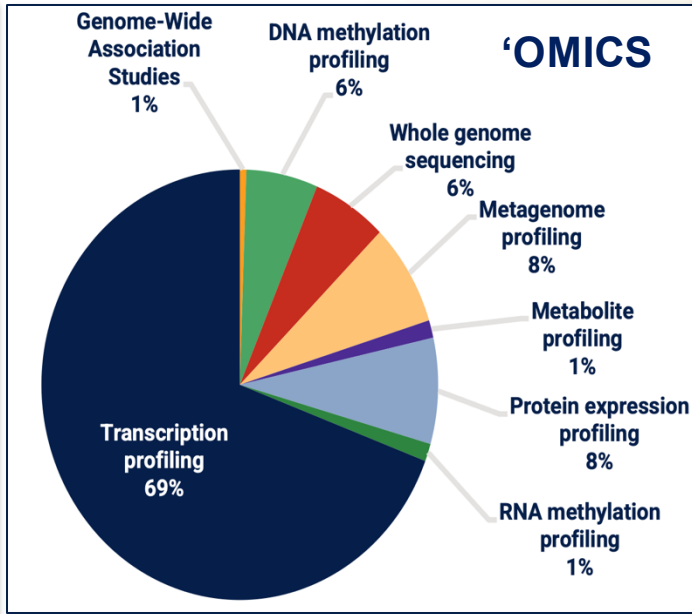
[Interested in participating in an AWG?](#)

# Space Travel Introduces Risks for Living Systems

Space risks	
NASA hazards	Risks and health consequences
Distance 	Limited health care support and resources
Confinement 	Fitness
Hostile and closed environments 	Infections
Gravity 	Muscle atrophy
Radiation 	Cancer
	Nutrition and mood Sleep disruption Stress Cardio, immune and hypercapnia Oxidative stress Vision changes Bone loss



522 Studies  
 973 Datasets  
 45 Species  
 >80 Assays  
 >210TB Data



COUNTRY	ACTIVE USERS
United States	48K ↑1,90...
India	1.7K ↑654...
China	1.2K ↑910...
United Kingdom	593 ↑329...
Canada	542 ↑530...
Germany	472 ↑604...
South Korea	470 ↑571...



## Open Science Data Repository Search

Search Datasets



Sort By: Release Date ▾

Items per page: 25 ▾

1 - 25 of 435



### Persistence of Escherichia coli in the microbiomes of red Romaine lettuce (*Lactuca sativa* cv. 'Outredgeous')- does seed sanitization matter?

Organisms	Factors	Assay Types	Release Date	Description
Microbiota	Treatment Seed Sanitization Tissue	Amplicon Sequencing	19-Apr-2024	Seed sanitization via chemical processes removes/reduces microbes from the external surfaces of the seed and thereby could have an impact on the plants,health or productivity. To determine the impact ...

Study  
OSD-385

Highlights: *cgene*



### Transcriptional profiling of heart tissue from mice flown on the RRRM-2 mission

Organisms	Factors	Assay Types	Release Date	Description
Mus musculus	Spaceflight Age Euthanasia Location	transcription profiling	03-Jan-2024	In the Rodent Research Reference Mission (RRRM-2), forty female C57BL/6NTac mice were flown on the International Space Station. To assess differences in outcomes due to age, twenty 12 week-old and twe...

Study  
OSD-580

Highlights: *cgene*



### Transcriptional profiling of tibialis anterior muscle from mice flown on the RR-23 mission

Organisms	Factors	Assay Types	Release Date	Description
Mus musculus	Spaceflight	transcription profiling	12-Dec-2023	The objective of the Rodent Research-23 mission (RR-23) was to better understand the effects of spaceflight on the eyes, specifically on the structure and function of the arteries, veins, and lymphati...

Study  
OSD-576

Highlights: *cgene*



### Ionizing radiation induces transgenerational effects of DNA methylation in zebrafish

Organisms	Factors	Assay Types	Release Date	Description
Danio rerio	Ionizing Radiation Generation	DNA methylation profiling	31-Aug-2023	Ionizing radiation is known to cause DNA damage, yet the mechanisms underlying potential transgenerational effects of exposure have been scarcely studied. Previously, we observed effects in offspring ...

Study  
OSD-524



### General Search Filters

#### Data Source

- GeneLab
- ALSDA
- NIH GEO
- EBI PRIDE
- ANL MG-RAST

#### Data Type

- Study
- Experiment
- Subject
- Biospecimen
- Payload

Show more ▾

### Study Search Filters

#### Project Type

- Ground
- Spaceflight
- High Altitude

#### Assay Type

- Amplicon Sequencing Assay
- Bisulfite Sequencing
- ChIP-Seq
- Behavior (Gait)
- Gel Electrophoresis

Show more ▾

#### Organism

- Description
- Experiments
- Payloads
- Missions
- Protocols
- Samples
- Assays
- Publications
- Files
- Version History
- Visualization




**OSD-666** Version 3

Transcriptional profiling of right quadriceps femoris muscle from mice flown on the RR-23 mission

Study

420.51 GB


GeneLab ID: GLDS-605 

DOI: 10.26030/7c15-jm96 

Cite this Study

Submitted Date:  
26-Sep-2023

Initial Release Date:  
18-Oct-2023

i **Description** ^

**Description**

The objective of the Rodent Research-23 mission (RR-23) was to better understand the effects of spaceflight on the eyes, specifically on the structure and function of the arteries, veins, and lymphatic vessels that are needed to maintain vision. To this end, twenty male, C57BL/6J, 16-17 weeks-old mice were delivered to the International Space Station (ISS) on SpaceX-21 in a single transporter, transferred to two rodent habitats, and maintained in microgravity for 38 days. Flight mice were then returned to Earth alive (January 13th, 2021). After splashdown in the Atlantic Ocean, mice were transported to Kennedy Space Center via helicopter. The 20 Flight, 20 Habitat Ground Control (HGC), and 20 Vivarium Ground Control (VGC) mice were removed from Rodent Transporters (Flight and HGC) or vivarium cages (VGC), placed into shipping containers, and flown to Texas A and M University. There, mice underwent post-flight procedures, before euthanasia and tissue collection. Flight, HGC and VGC animals were euthanized and dissected on Jan 14th, 17th or 20th of 2021, respectively. Right quadriceps femoris muscle samples were preserved by immersion in liquid nitrogen and stored at -80C until RNA was extracted, and libraries generated and sequenced (target 60 M clusters per sample, PE 150 bp). This dataset features 9 samples from the Flight group, 9 samples from the Habitat Ground Control group, and 9 samples from the Vivarium Ground Control group.

**Factor(s)**

Factor	Ontology: Concept
Spaceflight	<a href="#">Space Flight</a>

**Organism(s)**

[Mus musculus](#)

**Assay(s)**

Measurement	Technology	Device Platform
<a href="#">transcription profiling</a>	<a href="#">RNA Sequencing (RNA-Seq)</a>	illumina

**Project**

<b>Payload Identifier</b>	RR-23
<b>Project Title</b>	<a href="#">Effects of Microgravity on Ocular Vascular Hydrodynamics</a>
<b>Project Type</b>	Spaceflight Study
<b>Flight Program</b>	International Space Station (ISS)
<b>Experiment Platform</b>	Rodent Flight Hardware (Transporter and Habitat)

# Enabling FAIR Science: Metadata Curation



## Samples

### Controlled, Standardized Ontology / Terminology

Select Export Columns

Source Name	Sample Name	Characteristics: Organism	Characteristics: Strain	Characteristics: Genotype	Characteristics: Animal Source	Characteristics: Material Type	Factor Value: Spaceflight	Characteristics: Sex	Characteristics: Age at Launch	Protocol REF	Parameter Value: habitat	Parameter Value: duration	Parameter Value: light cycle	Parameter Value: Enrichment material
RR-23_F2	RR23_R-Quad_FLT_F2	<a href="#">Mus musculus</a>	<a href="#">C57BL/6J</a>	Wild Type	Jackson Laboratory	<a href="#">Right quadriceps femoris</a>	<a href="#">Space Flight</a>	<a href="#">Male</a>	<a href="#">16-17 week</a>	Animal Husbandry	Rodent Flight Hardware (Transporter and Habitat)	<a href="#">38 day</a>	12 h light: 12 h dark. Lights on at 7:00 GMT	Hut
RR-23_F3	RR23_R-Quad_FLT_F3	<a href="#">Mus musculus</a>	<a href="#">C57BL/6J</a>	Wild Type	Jackson Laboratory	<a href="#">Right quadriceps femoris</a>	<a href="#">Space Flight</a>	<a href="#">Male</a>	<a href="#">16-17 week</a>	Animal Husbandry	Rodent Flight Hardware (Transporter and Habitat)	<a href="#">38 day</a>	12 h light: 12 h dark. Lights on at 7:00 GMT	Hut
RR-23_F4	RR23_R-Quad_FLT_F4	<a href="#">Mus musculus</a>	<a href="#">C57BL/6J</a>	Wild Type	Jackson Laboratory	<a href="#">Right quadriceps femoris</a>	<a href="#">Space Flight</a>	<a href="#">Male</a>	<a href="#">16-17 week</a>	Animal Husbandry	Rodent Flight Hardware (Transporter and Habitat)	<a href="#">38 day</a>	12 h light: 12 h dark. Lights on at 7:00 GMT	Hut
RR-23_F5	RR23_R-Quad_FLT_F5	<a href="#">Mus musculus</a>	<a href="#">C57BL/6J</a>	Wild Type	Jackson Laboratory	<a href="#">Right quadriceps femoris</a>	<a href="#">Space Flight</a>	<a href="#">Male</a>	<a href="#">16-17 week</a>	Animal Husbandry	Rodent Flight Hardware (Transporter and Habitat)	<a href="#">38 day</a>	12 h light: 12 h dark. Lights on at 7:00 GMT	Hut

## Assays

### Controlled, Standardized Ontology / Terminology

Assay Name:

Technology Type: RNA Sequencing (RNA-Seq)

Technology Platform: Illumina

Select Export Columns

Sample Name	Protocol REF	Parameter Value: QA Instrument	Parameter Value: QA Assay	Parameter Value: QA Score	Extract Name	Protocol REF	Parameter Value: Spike-in Quality Control	Parameter Value: Spike-in Mix Number	Protocol REF	Parameter Value: Library Selection	Parameter Value: Library Layout	Protocol REF	Parameter Value: Read Depth	Parameter Value: rRNA Contamination
RR23_R-Quad_FLT_F2	Nucleic Acid Extraction	Agilent 4200 TapeStation	Agilent RNA ScreenTape Assay	8.4 RINe	RR23_R-Quad_FLT_F2	Spike-in Protocol	ERCC ExFold RNA Spike-In Mix	Mix 1	Library Construction	Ribo-depletion	PAIRED	GeneLab raw data processing protocol	<a href="#">101335022 read</a>	<a href="#">0.61 percent</a>
RR23_R-Quad_FLT_F3	Nucleic Acid Extraction	Agilent 4200 TapeStation	Agilent RNA ScreenTape Assay	8.3 RINe	RR23_R-Quad_FLT_F3	Spike-in Protocol	ERCC ExFold RNA Spike-In Mix	Mix 1	Library Construction	Ribo-depletion	PAIRED	GeneLab raw data processing protocol	<a href="#">98135600 read</a>	<a href="#">0.5 percent</a>
RR23_R-Quad_FLT_F4	Nucleic Acid Extraction	Agilent 4200 TapeStation	Agilent RNA ScreenTape Assay	7.7 RINe	RR23_R-Quad_FLT_F4	Spike-in Protocol	ERCC ExFold RNA Spike-In Mix	Mix 1	Library Construction	Ribo-depletion	PAIRED	GeneLab raw data processing protocol	<a href="#">106203766 read</a>	<a href="#">0.52 percent</a>
RR23_R-Quad_FLT_F5	Nucleic Acid Extraction	Agilent 4200 TapeStation	Agilent RNA ScreenTape Assay	7.9 RINe	RR23_R-Quad_FLT_F5	Spike-in Protocol	ERCC ExFold RNA Spike-In Mix	Mix 1	Library Construction	Ribo-depletion	PAIRED	GeneLab raw data processing protocol	<a href="#">105949962 read</a>	<a href="#">0.69 percent</a>

# Enabling FAIR Science: Omics Data Processing

## Build consensus data processing pipelines with the scientific community



### Raw Sequence Data

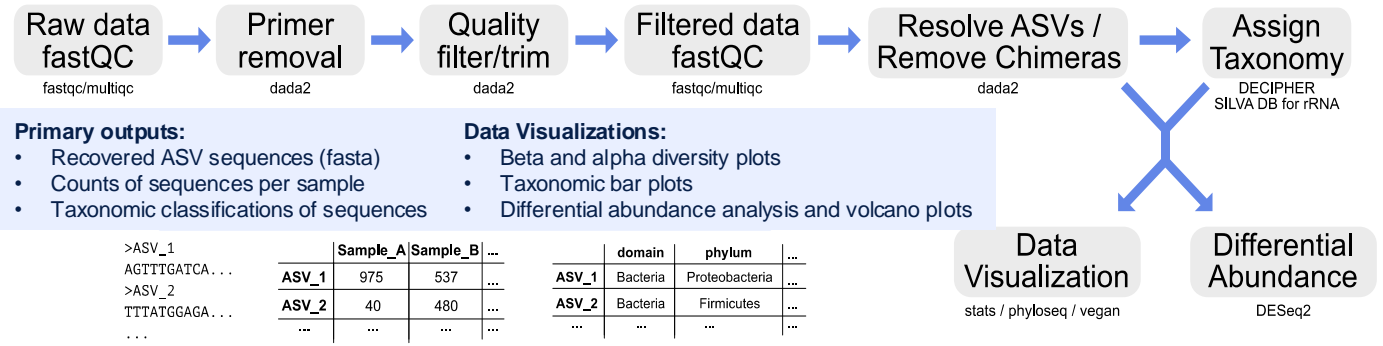
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TGTCACTACAACCAGCTGTGCCTGTGCTATTGCAGTTACACAGTGTCACTACAACCAACTGTGCTGTGCTATTGCAGTTACACAGTGTCACTACAACCAGCAGATC
+
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
```



### Processed Amplicon Sequence Data: Differential Abundance Analysis

ASV_ID	family	genus	Group.Mean_(FLT)	Group.Mean_(GC)	log2FC_(FLT)v(GC)	stat_(FLT)v(GC)	padj_(FLT)v(GC)
ASV_16S_1	Tannerellaceae	Parabacteroides	38674.17	33866.03	0.19	1.16	0.51
ASV_16S_10	Lachnospiraceae	NA	382.22	1622.88	-2.09	-2.60	0.05
ASV_16S_100	Tannerellaceae	Parabacteroides	0.00	8.47	-5.62	-1.85	NA
ASV_16S_101	Erysipelotrichaceae	Holdemania	0.00	12.07	-6.13	-2.02	NA
ASV_16S_102	Tannerellaceae	Parabacteroides	8.23	0.00	5.53	1.82	NA
ASV_16S_103	Peptostreptococcaceae	NA	0.00	7.48	-5.44	-1.79	0.24

### Amplicon Sequencing Data



**Files**

Study Files Selected: 5

**OSDR API**

**OSDR AWS s3**

- OSD-137
  - Study Metadata Files
  - Histology
  - RNA-Seq
  - Whole Genome Bisulfite Sequencing
  - GeneLab Processed RNA-Seq Files
    - Differential Expression Analysis Data
      - GLDS-137\_rna\_seq\_contrasts.csv 407.0 B Fri Feb 17 2023
      - GLDS-137\_rna\_seq\_differential\_expression.csv 25.5 MB Fri Feb 17 2023
      - GLDS-137\_rna\_seq\_SampleTable.csv 855.0 B Fri Feb 17 2023
    - Merged sequence data
    - Trimmed sequence data
    - Aligned sequence data

## Data Visualization

Filter: Assay technology type, Organization, Tissue, Factor. Number of studies: 294. Color: mission. Parameters: duration. Library selection: ISS, DOSTEL1, ISS, DOSTEL2, ISS, Lidal, ISS, REM. Measurement: Total dose rate, Total flux. Time period: Start: 04/01/2022, 12:00 AM; End: 04/02/2022, 12:00 AM. Retrieved data: CSV, TSV, JSON, HTML.

## Time Series Plots

Spacecraft, Instrument (hover to reveal full list): ISS, DOSTEL1, ISS, DOSTEL2, ISS, Lidal, ISS, REM. Measurement: Total dose rate, Total flux. Time period: Start: 04/01/2022, 12:00 AM; End: 04/02/2022, 12:00 AM. Scale: Linear, Log. Retrieved data: CSV, TSV, JSON, HTML.

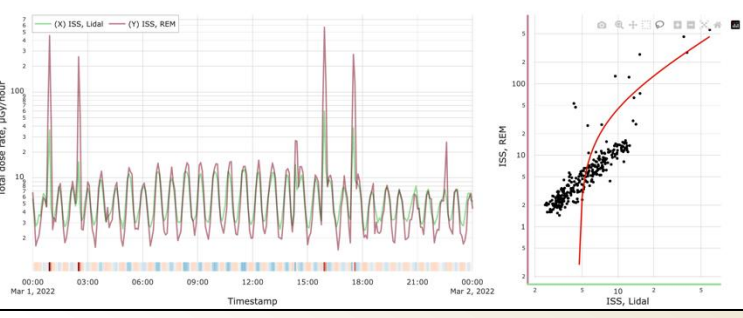
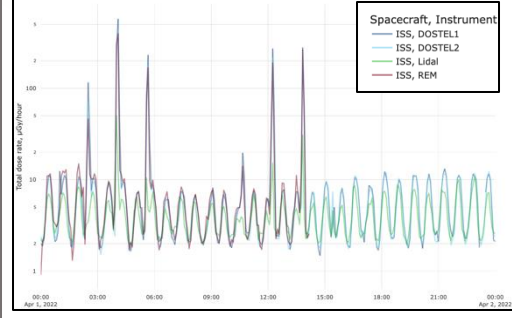
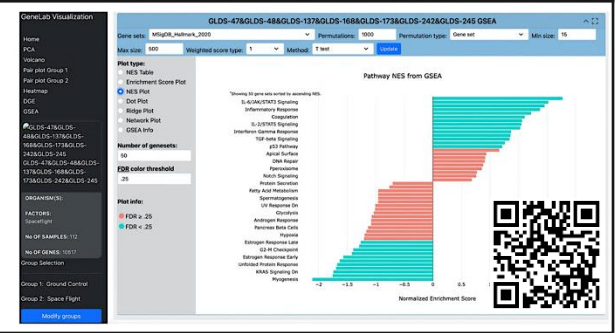
## RADLAB

## Compare Two Detectors

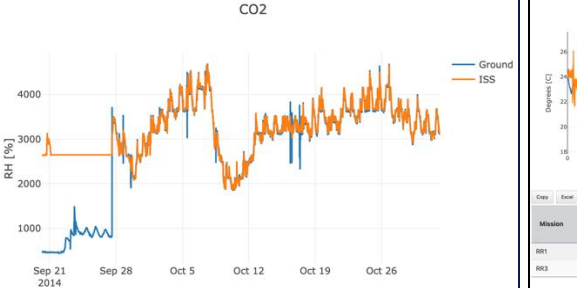
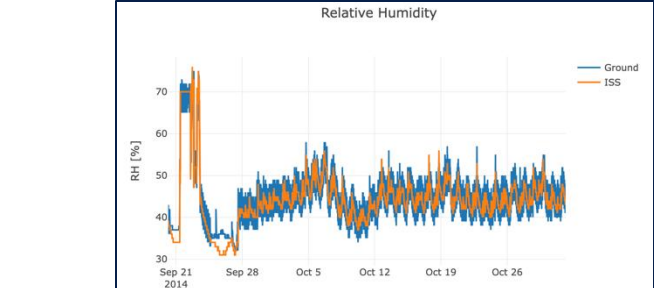
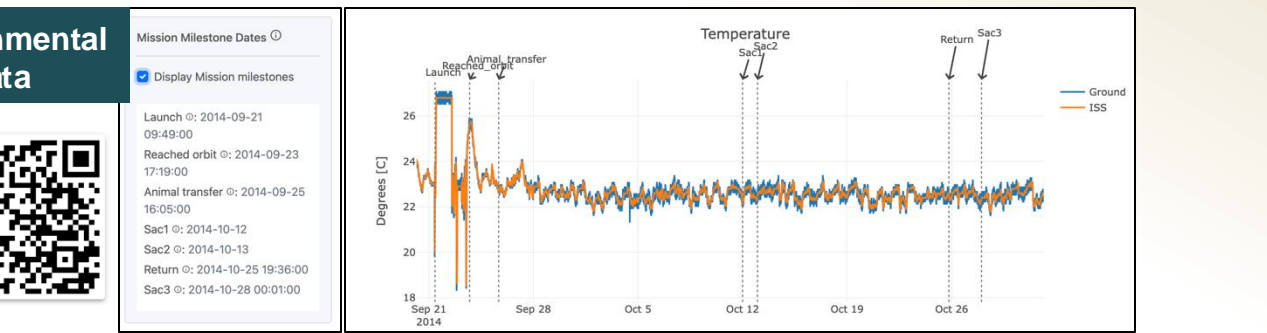
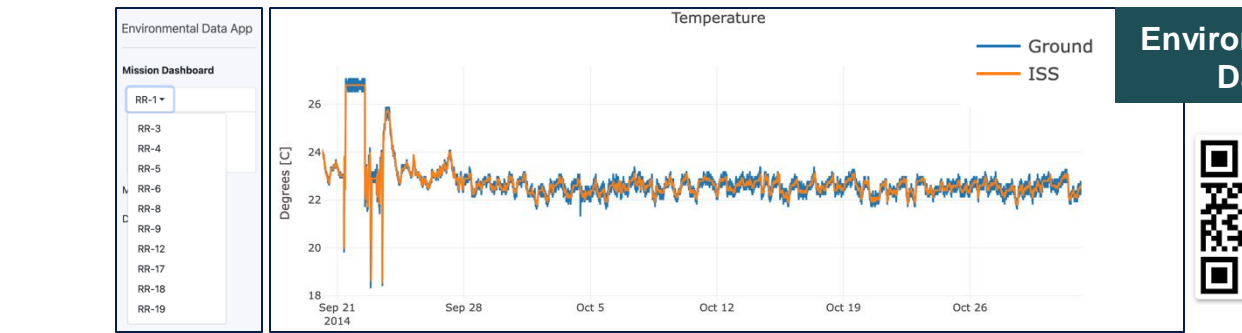
Spacecraft, Instrument (X axis): ISS, Lidal. Spacecraft, Instrument (Y axis): ISS, REM. Measurement: Total dose rate, Total flux. Time period: Start: 03/01/2022, 12:00 AM; End: 03/02/2022, 12:00 AM. Time series scale: Linear, Log. Pair plot scale: Linear, Log. Retrieved data: CSV, TSV, JSON, HTML.

GenLab Visualization

ENSEMBL	Symbol	LOG2FC	PVAL	ADJP
ENSMUSG00000002344	Axl1	-1.810689226	5e-10	0.000009919
ENSMUSG00000004309	Dapl4	0.958731559	1.42e-8	0.000587777
ENSMUSG00000002338	Dapl4	-1.2759234691	3.85e-8	0.000191999
ENSMUSG00000002080	Apoa4	-1.237393607	1.34e-7	0.000390109
ENSMUSG00000002302	Atf2b2	-1.144528104	1.52e-7	0.000289287
ENSMUSG00000002388	Slk3a2	-1.1589323708	2.28e-7	0.000452668
ENSMUSG00000002444	Gy2	0.5475928642	0.0000019883	0.001788306
ENSMUSG00000002179	Linc14b	-0.5423245458	0.0000012277	0.001788804
ENSMUSG00000004821	Cux6b	0.6027348845	0.0000014541	0.001788804
ENSMUSG00000000673	Slk4l1	-1.488018062	0.0000015841	0.002705442



## Environmental Data



### Temperature Ground

Mission	Min temperature Ground (Degrees [C])	Max temperature Ground (Degrees [C])	Mean temperature Ground (Degrees [C])	Standard Deviation temperature Ground (Degrees [C])	Median temperature Ground (Degrees [C])
RR1	18.30	27.10	22.76	0.82	22.60
RR3	20.40	28.10	23.36	0.97	23.70
Min		Max	Mean	Standard Deviation	Median

### Temperature ISS

Mission	Min temperature ISS (Degrees [C])	Max temperature ISS (Degrees [C])	Mean temperature ISS (Degrees [C])	Standard Deviation temperature ISS (Degrees [C])	Median temperature ISS (Degrees [C])
RR1	18.80	26.80	22.76	0.81	22.60
RR3	18.80	24.80	21.37	0.97	21.70
Min		Max	Mean	Standard Deviation	Median



# Open Science Analysis Working Groups (AWGs)



[Join an AWG!](#)

## ANIMAL

226 members



## MULTI-OMICS

351 members



## MICROBIAL

216 members



## PLANTS

176 members



## AI/ML

323 members



## ALSDA

(Physiological/BioMedical)

224 members



## FEMALE REPRO

88 members



## HUMAN

39 members



## RADLAB

67 members



92

Enabled Publications linked to OSDR

109

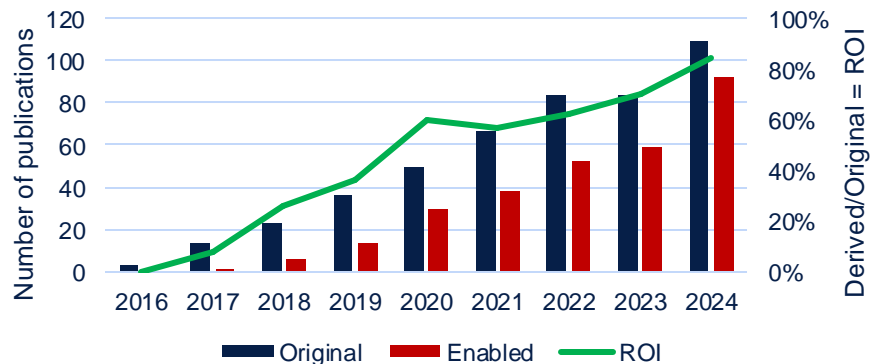
Original Publications linked to OSDR

150+

Datasets used in enabled publications



ROI grows faster than publications linked to original



## Collaborate on Data Mining/Publications



Cell Press Package 2020:  
The Biology of Spaceflight

<https://www.cell.com/c/the-biology-of-spaceflight>

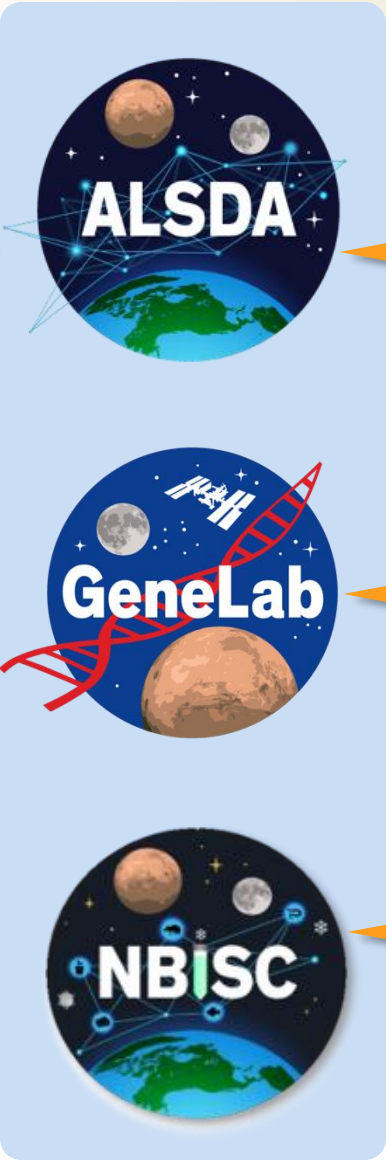
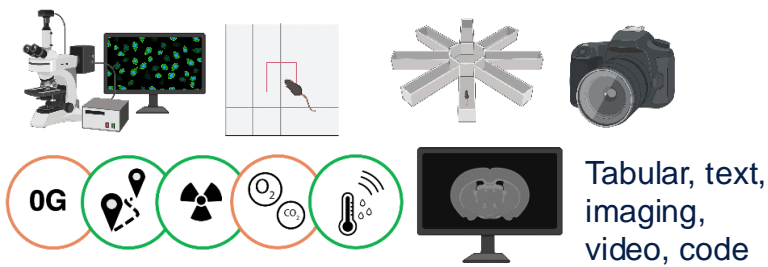


Nature Portfolio Collection 2024:

Space Omics and Medical Atlas across orbits (SOMA)

<https://www.nature.com/collections/ebdbcahdgc>

## Physiological/Phenotypic/Imaging/ Environmental Telemetry Data



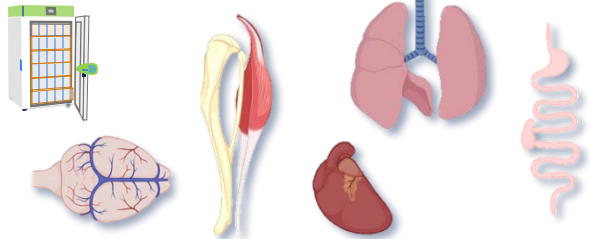
**NASA Open Science Data Repository (OSDR)**  
*nasa.gov/osdr/*

- **Single Submission Portal (BDME)**
- **User Interface/Website Tool for RDSAs** (Research Data Submission Agreements)
- **Workspace**
- **Maximally Open Access with Necessary Controls for Sensitive Data**
- **Data Maximally FAIR**
  - Findable, Accessible, Interoperable, Reusable
  - Transparency, Inclusivity, and Reproducibility

## Molecular/Omics Data



## Biospecimens



**Support:** NASA SMD, BPS, SB, HRP