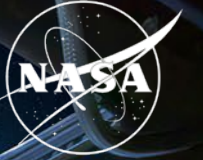


NASA Open Science Data Repository (OSDR) Enables Space Biomedical Research with Inspiration 4 and Model Organism Data, Standards, Pipelines, and Visualization Tools

Kris Peach, PhD
Curation Lead
Open Science Data Repository (OSDR)
Seabrook Solutions
kristen.peach@nasa.gov
she/her

Biological & Physical Sciences

National Aeronautics and
Space Administration



Agenda or Table of Contents

1

Introduction to the Open Science
Data Repository

4

Analysis Working Groups
(AWGs) – Join us!

2

Commercial Astronaut Data

3

Data Access Request System

Intro to NASA's Open Science Data Repository


The Open Science Data Repository (OSDR) enables access to space-related data from experiments and missions that investigate biological responses of terrestrial life to spaceflight.



NEW OSDR Publication!

JOURNAL ARTICLE

NASA open science data repository: open science for life in space

Samrawit G Gebre, Ryan T Scott, Amanda M Saravia-Butler,
Danielle K Lopez, Lauren M Sanders, Sylvain V Costes 

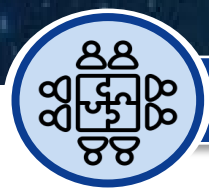
[Author Notes](#)

Nucleic Acids Research, gkae1116,

<https://doi.org/10.1093/nar/gkae1116>

Published: 18 November 2024 **Article history** ▼

<https://academic.oup.com/nar/advance-article/doi/10.1093/nar/gkae1116/7903386?login=true>



CONTRIBUTE



DISCOVER




LEARN



EXPLORE

Submission Portal Dashboard

- Self-service submission portal.
- Allows efficient input of sample and assay level metadata alongside data files.
- Controlled vocabulary and ontologies
- Tailored to specialized needs of spaceflight samples.
- Used for both omics (GeneLab) and non-omics (ALSDA) data submissions.
- Private link for sharing with reviewers and collaborators.

 My Dashboard (1) Help ? + Create New

Sort

All RDSA Studies Experiments

All Submitted In Curation In Review Req Signature Finalized Public Private

Sample Name	Protocol REF	Parameter Value - QA Instrument	Parameter Value - QA Assay	Parameter Value - QA Score	Unit	Extract Name	Protocol REF
Sample1	Nucleic Acid Extraction	BioAnalyzer	NanoChip	8	RIN	Extract 1	Library Construction
Sample2	Nucleic Acid Extraction	BioAnalyzer	NanoChip	9	RIN	Extract 2	Library Construction
Sample3	Nucleic Acid Extraction	BioAnalyzer	NanoChip	9.1	RIN	Extract 3	Library Construction

Unit

gray

gray


http://purl.obolibrary.org/obo/uo_0000134
SOURCE: An absorbed dose unit which is equal to the absorption of one joule of radiation energy by one kilogram.
Description: An absorbed dose unit which is equal to the absorption of one joule of radiation energy by one kilogram of matter.

gram

http://purl.obolibrary.org/obo/uo_0000021
SOURCE: A mass unit which is equal to one thousandth of a kilogram or 10⁻³ kg.
Description: A mass unit which is equal to one thousandth of a kilogram or 10⁻³ kg.

UO

PI 'Private' Workspace

 **Workspace** BETA

File Upload Progress - Complete: 2 - Failed: 0 - Total: 2 ✕ Clear

Do Not refresh your browser while uploads are in progress.

Workspace Files

Selected: 0

Refresh

Drag and Drop a file onto a folder to upload the file to your workspace. Using 0B of 5.0 TB Available Space

☐ dklopez

☐ Experiment

☐ Dataset_2.xlsx 8.17 KB Fri Nov 10 2023

☐ Dataset_1.xlsx 8.17 KB Fri Nov 10 2023



CONTRIBUTE



DISCOVER



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EXPLORE

Data Repository

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
- ☐ Behavior
- ☐ Behavior (Gait)
- ☐ Behavior (Locomotion)

Show more ▾

Organism

- ☐ Rodent
- ☐ Human (Homo sapiens)
- ☐ Plant
- ☐ Cellular Organisms
- ☐ Worm

Show more ▾

Tissue

- ☐ Cells
- ☐ Root
- ☐ Seedlings
- ☐ Liver
- ☐ Leaf



Open Science for Life in Space

Home

About ▾

Data & Tools ▾

Research & Resources ▾

Working Groups ▾

Help ▾

Open Science Data Repository Search

Search Datasets



Sort By:

Release Date ▾

Items per page: 25 ▾ 1 - 25 of 507

Study
OSD-678

Light has a principal role in the Arabidopsis transcriptomic response to the spaceflight environment

Organisms	Factors	Assay Types	Release Date	Description
Arabidopsis thaliana	Spaceflight Ecotype Treatment Genotype	transcription profiling	20-Dec-2024	The Characterizing Arabidopsis Root Attractions (CARA) spaceflight experiment provides comparative transcriptomic data for Arabidopsis thaliana plants grown in both light and dark conditions within the same spaceflight...

Highlights: ogene

Study
OSD-742

Metagenome profiling of feces from mice flown on the RRRM-1 mission

Organisms	Factors	Assay Types	Release Date	Description
Mus musculus	Age Duration Euthanasia Location Spaceflight Dissection Condition	Metagenomic sequencing	13-Sep-2024	In Rodent Research Reference Mission-1 (RRRM-1), forty female BALB/cAnNTac mice were flown on the International Space Station. To assess differences in outcomes due to age, twenty 10-12 week-old and twenty 20-22 week-old mice were flown...

Highlights: ogene

Study
OSD-516

Modeling cellular responses to serum and vitamin D in microgravity using a human kidney microphysiological system

Organisms	Factors	Assay Types	Release Date	Description
Homo sapiens	Spaceflight Treatment Sex	transcription profiling	18-Jul-2024	The microgravity environment aboard the International Space Station (ISS) provides a unique stressor that can be used to study the underlying cellular and molecular drivers of pathological changes observed in Earth-based models...

Highlights: ogene

Study
OSD-615

Glycome profiling and immunohistochemistry uncover changes in cell walls of Arabidopsis thaliana roots during spaceflight: Advanced Plant EXperiment (APEX) 03-1 Raw Dataset

Organisms	Factors	Assay Types	Release Date	Description
Arabidopsis thaliana	Spaceflight Growth Time	Glycomic Profile	16-Jul-2024	This study was conducted to uncover the underlying molecular mechanisms by which microgravity impacts the cell wall structure of Arabidopsis thaliana roots using the Vegetable Production System (Veggie) on the International Space Station...

Highlights: alda ogene

Study
OSD-683

Response of Staphylococcus aureus physiology and Agr quorum sensing to low shear modelled microgravity

Organisms	Factors	Assay Types	Release Date	Description
Staphylococcus aureus	Microgravity Simulation Growth Environment	protein expression profiling	02-Jul-2024	Staphylococcus aureus is commonly isolated from astronauts returning from spaceflight missions. Previous studies have shown that microgravity affects the physiology and quorum sensing of S. aureus, which may impact its ability to cause infection in space...

Highlights: ogene





CONTRIBUTE



DISCOVER



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EXPLORE

522

Studies

973

Datasets

45

Species

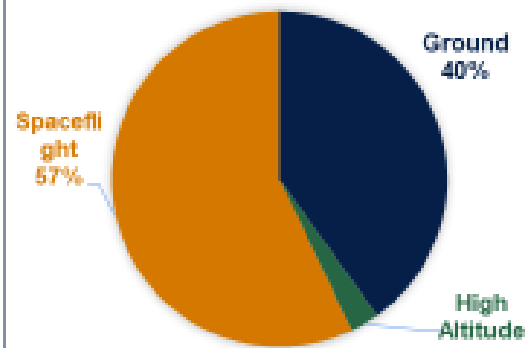
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Assays

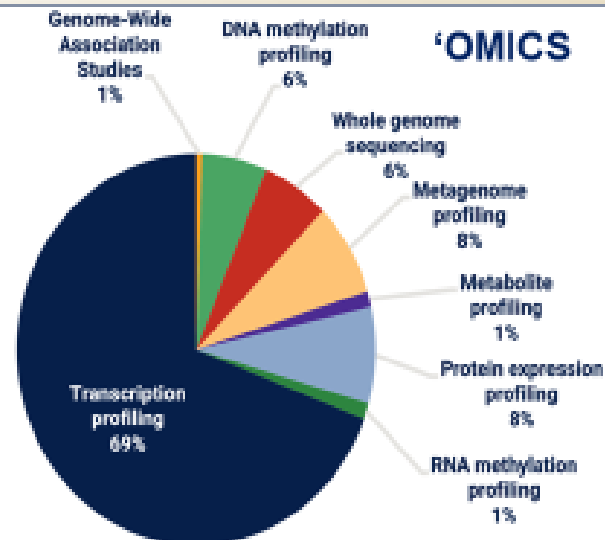
>210TB

Data

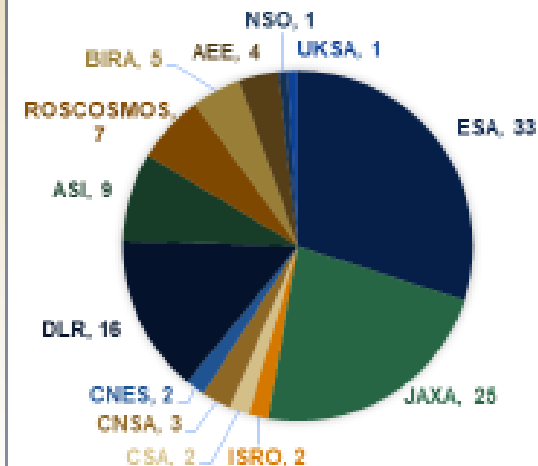
STUDY TYPE



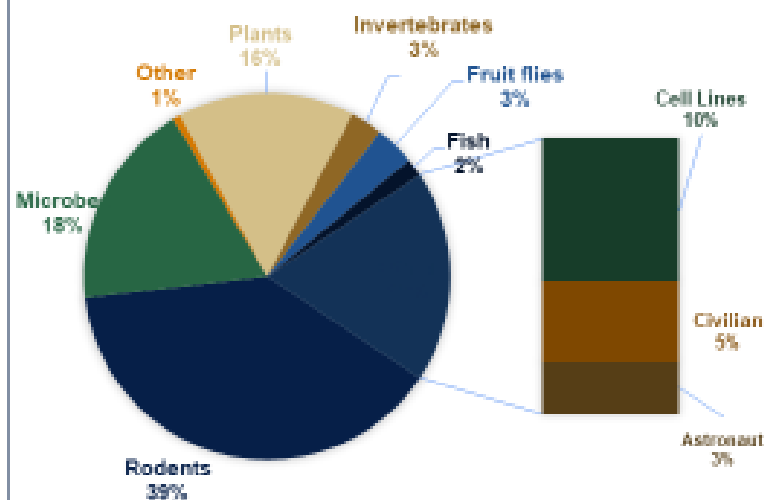
'OMICS



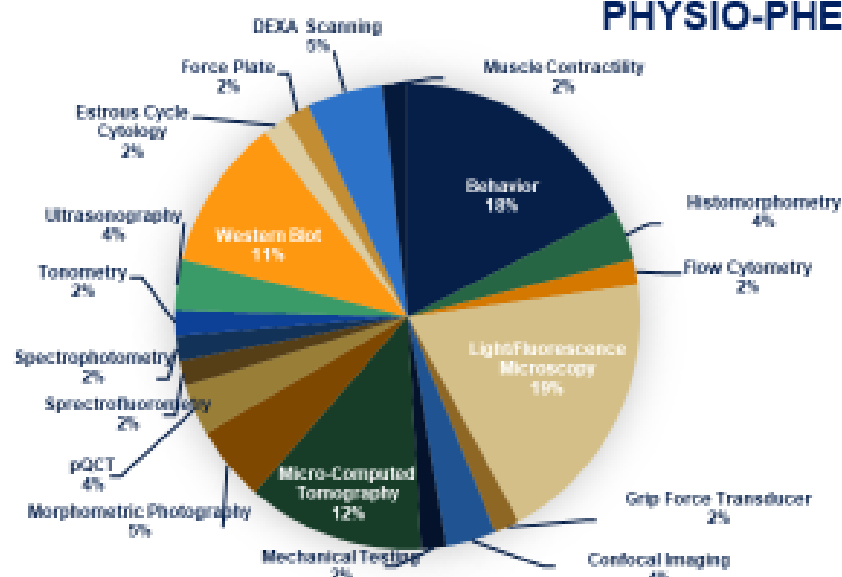
INTERNATIONAL STUDIES



ORGANISM

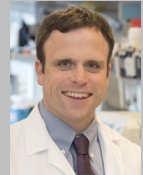


PHYSIO-PHENO

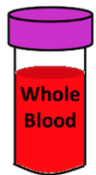


INSPIRATION

Chris Mason



Weil Cornell Medicine



OSD-569

GLDS-561

- Nanopore Direct RNAseq
- Epitranscriptomics
- RNAseq (short-read)
- Clonal Hematopoiesis
- WGS

LSDS-7

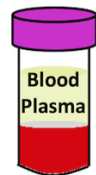
- Complete Blood Count



OSD-570

GLDS-562

- snRNAseq/snATACseq
- scTCR-seq/scBCR-seq



OSD-571

GLDS-563

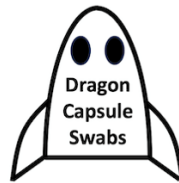
- Proteomics
- Metabolomics
- cfDNAseq
- cfRNAseq



OSD-572

GLDS-564

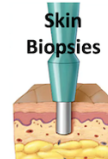
- Metagenomics
- Metatranscriptomics



OSD-573

GLDS-565

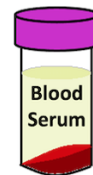
- Metagenomics
- Metatranscriptomics



OSD-574

GLDS-566

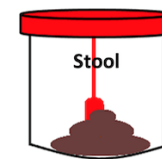
- Spatial Transcriptomics
- Metagenomics
- Metatranscriptomics



OSD-575

LSDS-8

- Comprehensive Metabolic Panel
- Cytokine Panel
- Immune Panel



OSD-630

GLDS-599

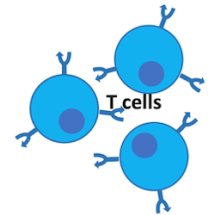
- Metagenomics



OSD-656

LSDS-64

- Immune Panel



OSD-687

GLDS-618

- CUT&RUN ChICseq

Studies



Mission and Payload Details

Payloads

Identifier	Name	Type	Description
Inspiration4 Crew	Inspiration4 Crew	Space Flight	The Inspiration4 mission launched

Missions

Identifier	Start Date
SpaceX Inspiration4	09/16/2021



Detailed Sample Metadata

Select Export Columns

Source Name	Sample Name	Characteristics: Organism	Characteristics: Material Type	Characteristics: Sex	Factor Value: Spaceflight
C001	C001_plasma_L-92_CPT	Homo sapiens	Plasma	Male	pre-flight



Raw and Processed Experiment Data, Methods

OSD-571

Study Metadata Files

Proteomics Data Files

RNA-Seq

GeneLab Processed RNA-Seq Files

Whole Genome Sequencing Data

GeneLab Processed Whole Genome Sequencing

Metabolomics Data Files

Protocols

Export All

Collect All

Samples

Assay - genome sequencing - nucleotide sequencing - Illumina HiSeq 2500

Assay - metabolite profiling - mass spectrometry - Agilent 6550 iFunnel Quadrupole-Time-of-Flight (Q-TOF) Mass spectrometer

Assay - protein expression profiling - mass spectrometry - Bruker timsTOF Pro 2 - Bruker timsTOF Pro

Assay - protein expression profiling - mass spectrometry - Q Exactive HF Hybrid Quadrupole-Orbitrap Mass Spectrometer from ThermoFisher - Q Exactive

Assay - transcription profiling - RNA Sequencing (RNA-Seq) - Illumina

DOIs, citation, license

Publication Information

nature

The Space Omics and Medical Atlas (SOMA) and international astronaut biobank

Authors: Eliah G. Overbey, JangKun Kim, Braden T. Tierney, Jiwon Park, Nadia Houeib, Alexander G. Lucero, Sebastian Garcia Medina, Namita Damle, Deena Najjar, Kiril Gerginov, Evan Matthew MacKay, Annaliese Schweickart, Christopher R. Chen, Maria A. Sierra, Melissa F. Valenzuela, Enayal Dantas, Theodore M. Nelson, Egle Okonkwo, Gabriel Deards, Jonathan Fo Mulane, Seth Stravers Tighe, Steven Westover, Chandrima Bhattacharya, Serena Lucotti, Jeremy Wan Hirschberg, Jacqueline Proszynski, Marissa Burke, Ashley Kleiman Lauren M. Sanders, Lynn E. Taylor, Christan O. Patel, Sharib A. Khan, Mir Suhail, Syed G. Byhaq, Burhan Alam, Aaron S. Gajadhar, Lucy Williamson, Punit Tansil, Qiu Yang, Jessica Chu, I. Boddicker, Junhua Zhao, Bryan Lipins, Ryan T. Scott, Rachel R. Gilbert, San-Hui Lai, Rishi, Andrew Akomane, Sanyon Kruglyak, Steven Levy, Ishara Arjyapala, Joanne Beer, Gregging Zhang, Scott M. Smith, Brian E. Crocoll, Sara R. Zwart, Inna Matal, David C. Lyden, Françoise Garrett-Bakelman, Jan Krumsiek, Quying Chen, Dawson Miller, Joe Shuga, Stephen Williams, Corey I. Kelly, L. Botton, Susan M. Bailey, Richard Granstein, David Furman, Ari M. Melnick, Sylvain V. Costes, Bader Shraih, Min Yu, Anil S. Menon, Jaime Mateus, Cem Meydan, Christopher E. Mason DOI: 10.1038/s41586-024-07029-y

Secretome profiling reveals acute changes in oxidative stress, brain homeostasis, and coagulation following short-duration spaceflight

Authors: Nadia Houeib, JangKun Kim, Eliah G. Overbey, Richa Batra, Annaliese Schweickart, Laura Patras, Serena Lucotti, Krista A. Ryon, Deena Najjar, Cem Meydan, Namita Damle, Chir Beharshi, Gabriel Tobias, Fanny Vetter, Jeremy Wan Hirschberg, Ashley Kleiman, Evan E. Altshin, Matthew MacKay, Quying Chen, Dawson Miller, Aaron S. Gajadhar, Lucy Williamson, Purv Gross, Bader Shraih, Jan Krumsiek, Jaime Mateus, Xiao Mao, Inna Matal, Christopher E. Mason DOI: 10.1038/s41587-024-08841-w

Collection of Biospecimens from the Inspiration4 Mission Establishes the Standards for the Space Omics and Medical Atlas (SOMA)

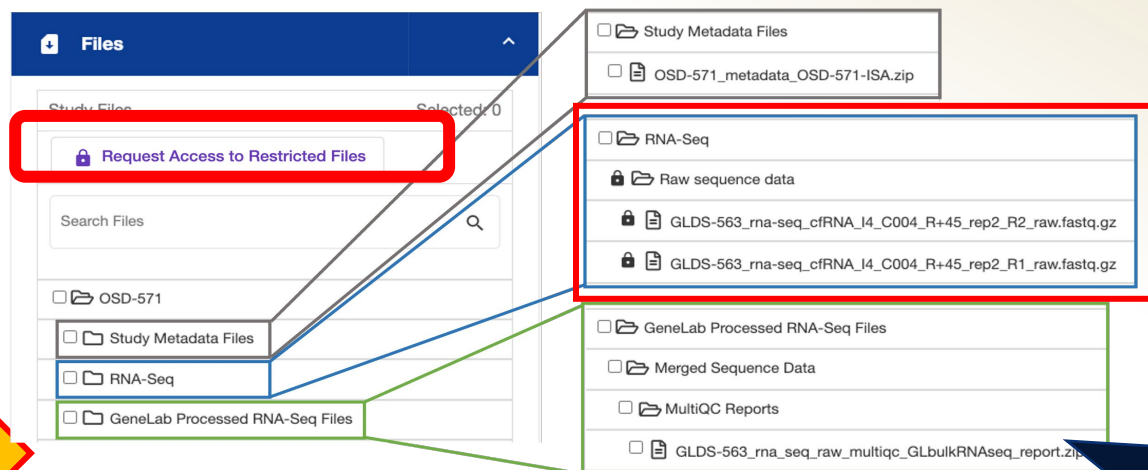
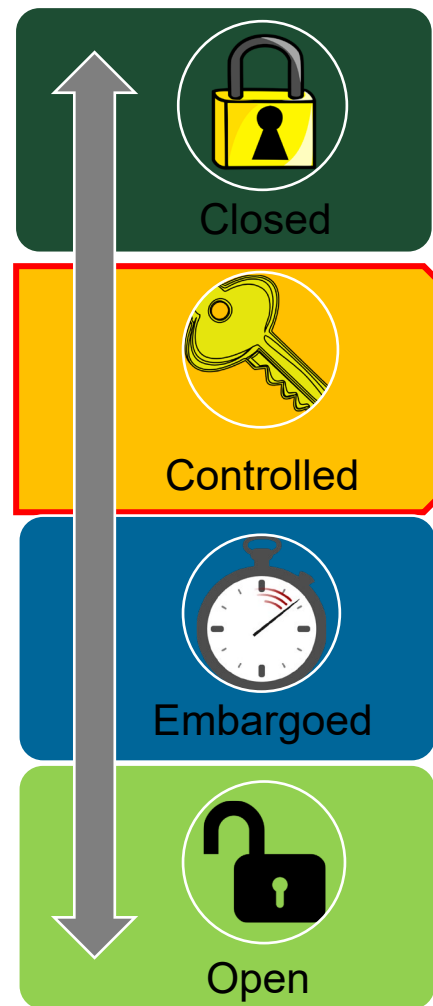
Authors: Eliah G. Overbey, Krista Ryon, JangKun Kim, Braden Tierney, Remi Klotz, Veronica Ortiz, Sean Mullane, Julian C. Schmidt, Matthew MacKay, Namita Damle, Deena Najjar, Inna M. Hirschberg, Jacqueline Proszynski, S. Arand Narayanan, Caleb M. Schmidt, Evan E. Altshin, Lucinda Innes, Mario Mejia Sadermaga, Michael A. Schmidt, Richard D. Granstein, Bader Shraih DOI: 10.1038/s41587-024-08806-z

CAMBank: CPT Field Processing v1

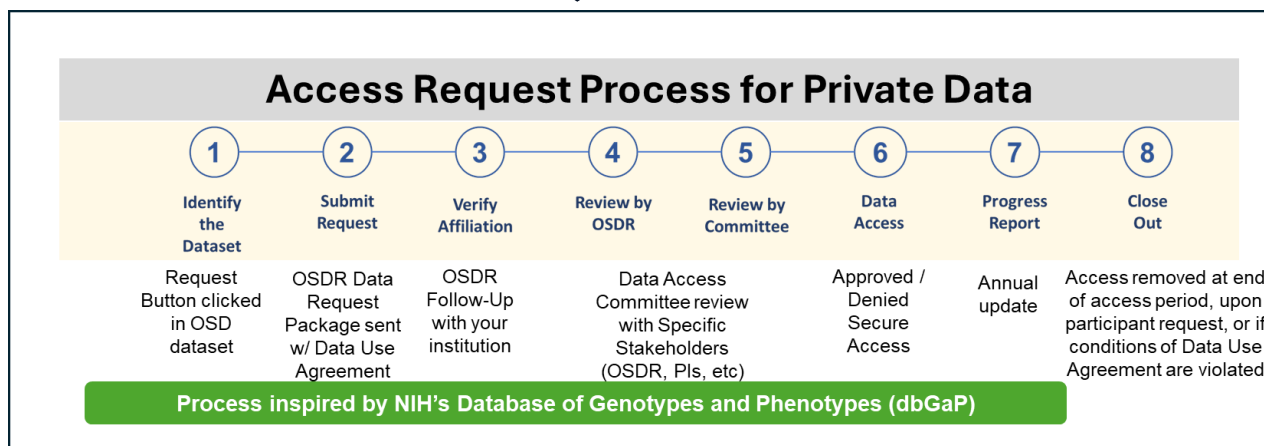
Authors: Eliah G. Overbey, Krista A. Ryon, JangKun Kim, Christopher E. Mason DOI: 10.17554/protocols.io/kvvgc338g/v1

Controlled Access Data

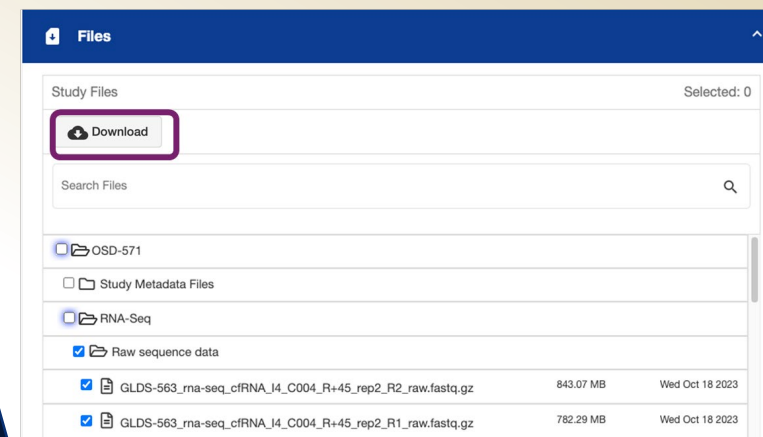
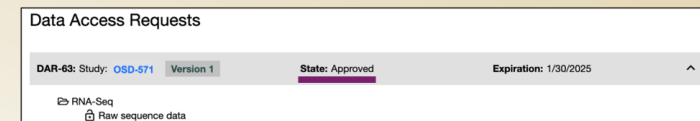
The Continuum



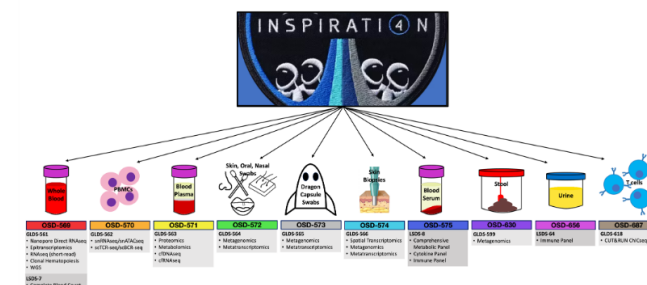
**If
Approved**



Data Access Info Available On DAR Portal

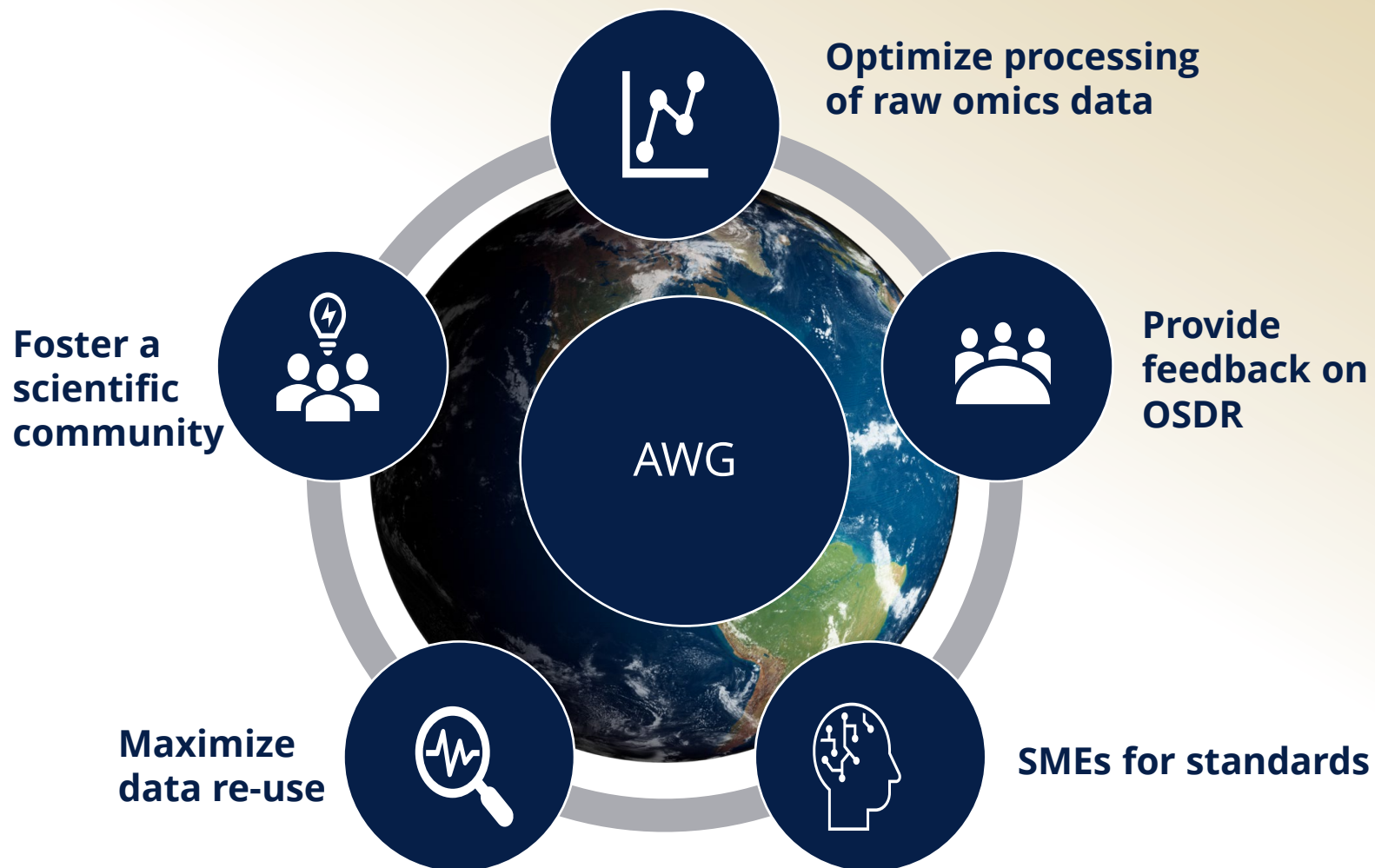


Present your discoveries at
the human AWG!



Community Engagement - AWGs

- Launched in 2018, we currently have 9 groups: Animal, Microbes, Multi-Omics, Plants, ALSDA, AI/ML, Female Reproduction, RadLab and Human AWG.
- We host yearly workshops, virtual symposiums and events
- Overall, we have had over 1000 members, with 800 current active members.
- AWG Forum space for transparent and open communication



NEW OSDR AWG Forum space

493 New
AWG
Members in
2024
(January-
October)

853 current
members as
of Oct 25th

The screenshot displays the 'Open Science for Life in Space' forum interface. On the left is a navigation sidebar with a hamburger menu icon at the top. Below it is a white box with the text 'Open Science for Life in Space'. The sidebar lists several topics: 'Topics', 'AWG Group Member ...', 'AWG Meeting Calendar', 'About', 'Users - Public View', and 'FAQ'. Below these is a 'CATEGORIES' section with five items: 'AWG Discussions' (blue square), 'AWG Projects' (blue square), 'Announcements/Jobs' (red square), and 'New OSDs/data/articles' (orange square). The main content area features a header with the title 'New Database Publication for OSDR “Open Science for Life in Space” - great overview to read if new to the AWG & OSDR' and a sub-header 'New OSDs/data/articles metadata-standards, data-standards, database'. Below the header is a post by user 'rtscott2001', identified as the 'OSDR POC for AWG & ALSDA AWG Chair'. The post text reads: 'Want to engage in space biology or space health? Check out new database publication about the NASA Open Science Data Repository (OSDR) 🎉 It covers data, metadata, standards, tools, community, publications, and trainings 🚀 Proud to see it as part 2025 issue within NAR Nucleic Acids Research.' Below the text is a link to 'https://doi.org/10.1093/nar/gkae1116' with a '23' comment count. On the right side of the post, there are icons for 3 replies and a '1d' timestamp. A vertical timeline on the far right shows the date 'Nov 19' and a '1 / 1' indicator.

Open Science
for Life in Space

Log In

Topics

AWG Group Member ...

AWG Meeting Calendar

About

Users - Public View

FAQ

CATEGORIES

- AWG Discussions
- AWG Projects
- Announcements/Jobs
- New OSDs/data/articles

New Database Publication for OSDR “Open Science for Life in Space” - great overview to read if new to the AWG & OSDR

New OSDs/data/articles metadata-standards, data-standards, database

rtscott2001 OSDR POC for AWG & ALSDA AWG Chair 3 1d

Want to engage in space biology or space health? Check out new database publication about the NASA Open Science Data Repository (OSDR) 🎉 It covers data, metadata, standards, tools, community, publications, and trainings 🚀 Proud to see it as part 2025 issue within NAR Nucleic Acids Research.

OSDR integrates NASA GeneLab, the NASA Ames Life Sciences Data Archive, and the NASA Biological Institutional Scientific Collection.

<https://doi.org/10.1093/nar/gkae1116> 23

Nov 19

1 / 1

Nov

1d

AWGs Accelerate Data Mining & Publications

Cell Press 2020 – the Biology of spaceflight

- A coordinated package of 29 scientific papers published in five *Cell Press* journals
- 9 papers utilize data or resources in GeneLab



Nature Portfolio Collection 2024: Space Omics and Medical Atlas

- **44 publications** across **25 countries** and **100 institutions**
- **111 AWG Members** participated in the Nature Press Package across **43 publications**
- **13 OSDR Members** participated in the Nature Press Package across **17 publications**
- **Global Reach** with 650 news articles, >1,300 posts with 7M+views on X, and over 100,000 accesses across all publications

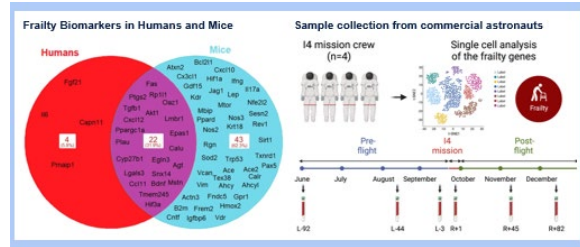
AWGs have published over 30 publications utilizing data in OSDR

<https://osdr.nasa.gov/bio/data/publications.html>



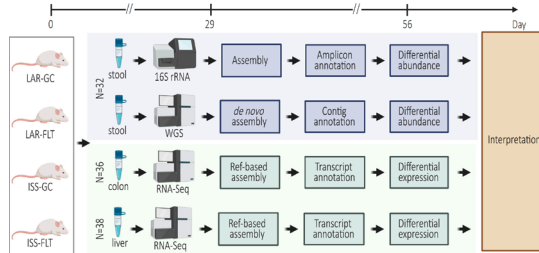
Recent Science Findings

Collaborative AWG Publications



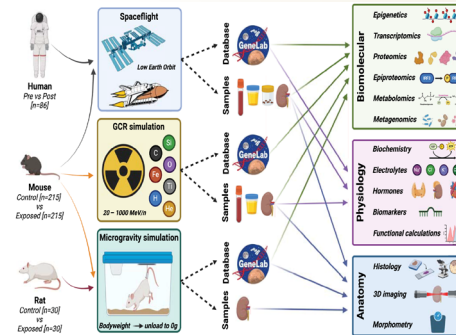
Aging and Frailty Biomarkers are Altered by Spaceflight

Camera, A.,... Karouia, F., ...Beheshti A. Aging and putative frailty biomarkers are altered by spaceflight. *Sci Rep* 14, 13098 (2024). <https://doi.org/10.1038/s41598-024-57948-5>



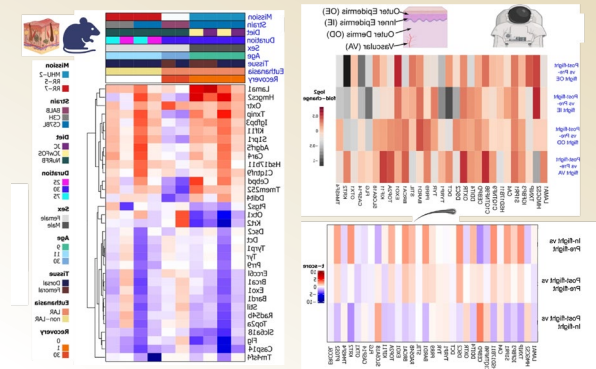
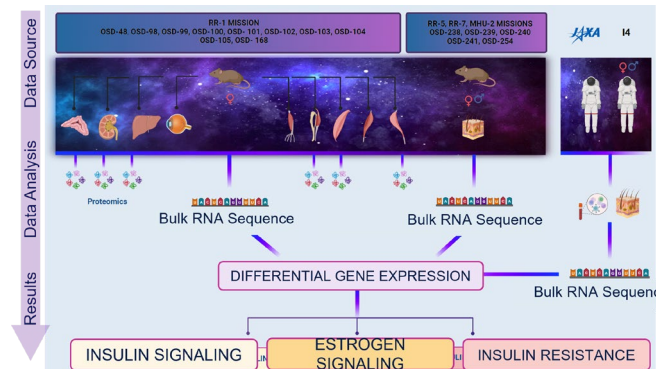
Multi-Omics Analysis Reveals Impact of Spaceflight Stress on Mice Gut Microbiome and Physiology

Gonzalez, E., Lee, M.D., ... Karouia, F., Barker, R., Galazka, J., Brereton, N.J.B. Spaceflight alters host-gut microbiota interactions. *npj Biofilms Microbiomes* 10, 71 (2024). <https://doi.org/10.1038/s41522-024-00545-1>



Cosmic Kidney Disease: A study into spaceflight-induced renal dysfunction

Siew, K., Nestler, K.A., Nelson, ... C., Boyko, V., Degoricija, L., Gebre, S., Polo, S.L., Scott, R.T., Saravia-Butler, A.M., Sanders, L.M., Costes, S.V., Almeida, E.A.C., Galazka, J.M., ... et al. Walsh, S.B. Cosmic Kidney Disease: The Effects of Spaceflight and Galactic Cosmic Radiation on Renal Structure and Function. *Nat Communications* 15, 4568 (June 2024). <https://doi.org/10.1038/s41467-024-49212-1>



Spaceflight Induces Molecular Alterations in Skin

Cope, H., Elsberg, J., ... Parthasarathy, H., Unadkat, H., Chatrathi, M., Claudio, J., Reinsch, S., ... Beheshti, A. Transcriptomics analysis reveals molecular alterations underpinning spaceflight dermatology. *Nature: Communications Medicine* 4, 106 (2024). <https://doi.org/10.1038/s43856-024-00532-9>

Spaceflight induces changes in gene expression profiles linked to insulin and estrogen

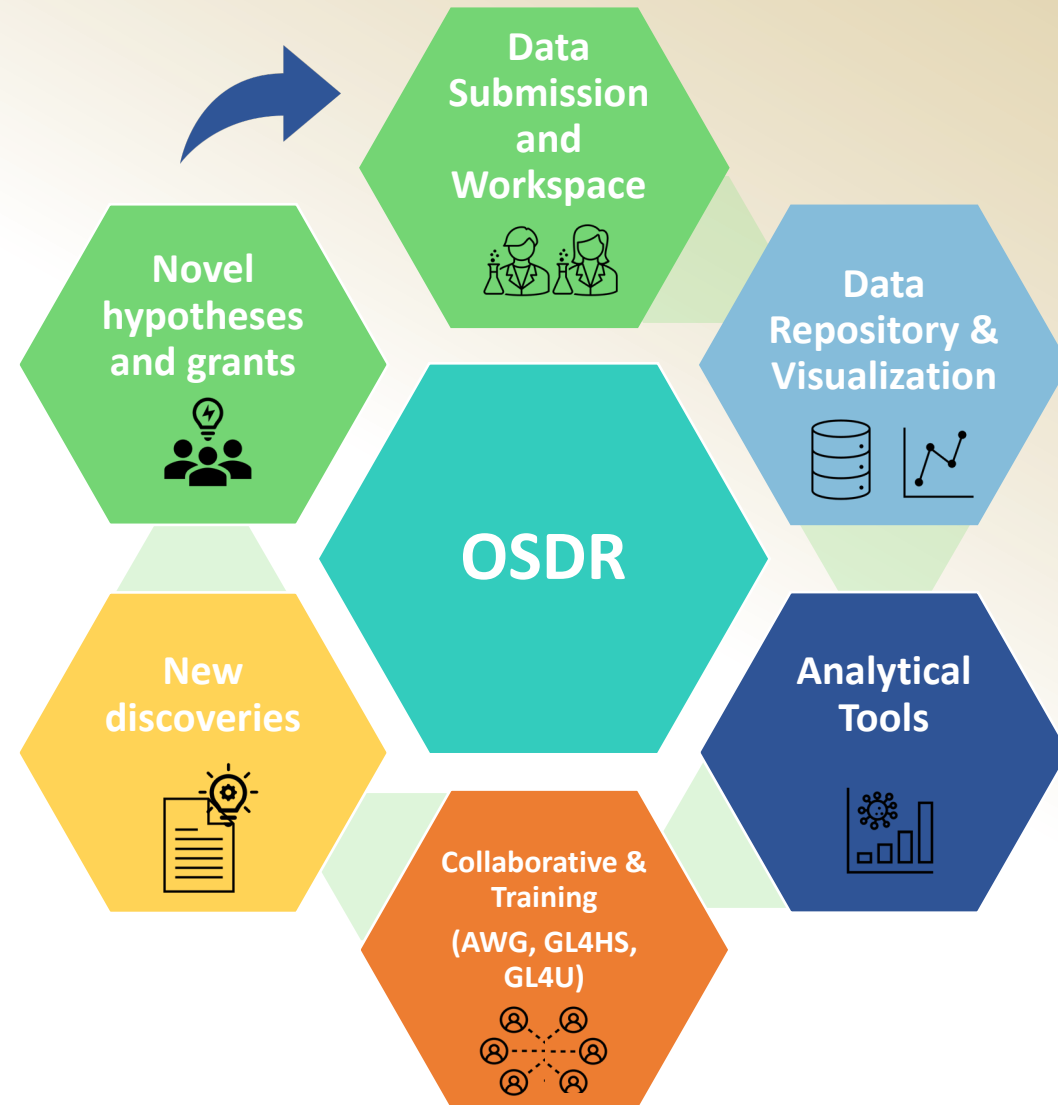
Mathyk, B.A., Tabetah, M., Karim, R., ... Beheshti, A. (2024). Spaceflight induces changes in gene expression profiles linked to insulin and estrogen. *Nature: Commun Biol* 7, 692. <https://doi.org/10.1038/s42003-023-05213-2>

BIOLOGICAL OPEN SCIENCE ECOSYSTEM

Join us today!

- **FAIR Data Portal:** Self-service submission portal with standard metadata templates, private workspace, and sharing capabilities.
- **Open Data Repositories:** Diverse datasets (microbes to humans) with visualization for discovery.
- **Bioinformatics Tools:** User-friendly analysis tools for students, scientists, and researchers.
- **Global Impact:** 600+ members, training programs, and **research enabled by data reuse.**

Open access data enables discovery of new hypotheses and new ideas for grant proposal. Data from those new research experiments are generated and deposited back into OSDR.



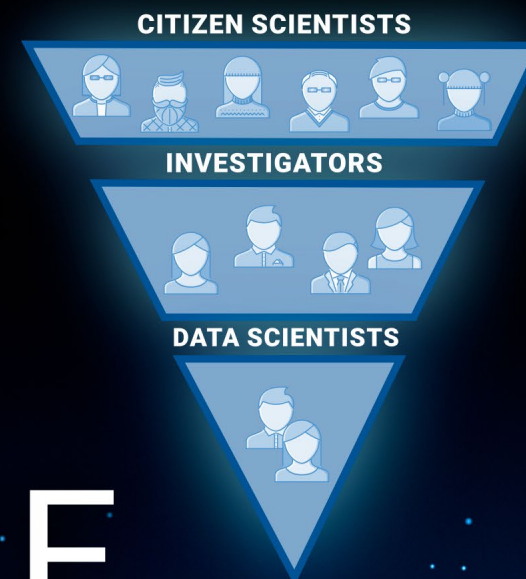
THANK YOU!

OSDR Team

\$ GeneLab funded
by BPS
\$ ALSDA and
NBISC funded by
BPS and HRP



SCIENTIFIC COMMUNITY

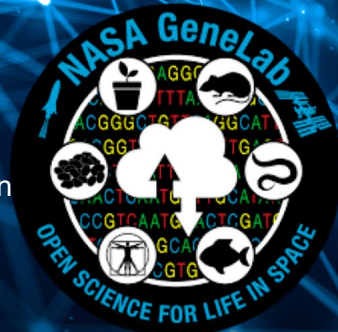


OPEN SCIENCE

DATA REPOSITORY



San-huei Lai Polo
Alec Vallota Eastman
Rachel Gilbert
Skylar D'Angiolillo



GENELAB
OMICS

+

ALSDA
PHENOTYPIC

