

How can we use open space biology data to learn about model organisms?



Background

A **repository** refers to a central location where information or resources can be stored or managed. The Open Science Data Repository (nasa.gov/osdr) is a repository of both spaceflight omics data (such as genomics, transcriptomics, etc) and non-omics data (behavioral, phenotypical, imagery, video, etc) from experiments using model organisms.

A **model organism** is generally a non-human species that is used to study biological processes, usually in laboratory experimentation. Model organisms tend to have a short generation time, yet have a characterized genome with some similarity to humans. Common examples of model organisms include fruit flies, certain types of fish, and rodents such as mice. For studies of cellular behavior, yeast is also a common model organism.

Objectives

- 1) Search for datasets in the GeneLab Data Repository
- 2) Become familiar with sections of the metadata of a study
- 3) Explore the breadth of model organism data

Datasets

The datasets used in this example will be [OSD-104](#), [OSD-137](#), [OSD-347](#), and [OSD-123](#). Although all of these datasets have lots of information, this set of activities will only be used to explore the model organisms used in the studies and to introduce navigation of metadata housed in the GeneLab Data Repository.

Activity

- 1) **Navigate to each of the datasets.** (Click here for the step-by-step walk-through shown in Steps a-d using OSD-104.)

- a. Open a browser and navigate to <https://osdr.nasa.gov/>



- b. Scroll down and click on the button for “Explore the Data Repository”

Open Science Data Repository

Search and upload spaceflight datasets

Explore the Data Repository →

- c. In the search bar, type *osd-104*, and press the Enter key

Open Science Data Repository Search

A screenshot of the search interface on the Open Science Data Repository website. It features a search bar with the placeholder text "Search Datasets". The text "osd-104" has been entered into the search bar. To the right of the search bar are icons for clearing the search (an 'x') and submitting the search (a magnifying glass).

- d. Click on the hyperlink to navigate to the dataset

Rodent Research-1 (RR1) NASA Validation Flight: Mouse soleus muscle transcriptomic and epigenomic data
<https://genelab-data.ndc.nasa.gov/genelab/accession/GLDS-104>



NASA's Rodent Research (RR) project is playing a critical role in advancing biomedical research on the physiological effects of space environments. Due to the limited resources for conducting biological experiments aboard the International Space Station (ISS) it is imperative to use crew time efficiently while maximizing high-quality science return. NASA's GeneLab project has as its primary objectives to 1) further increase the value of these experiments using a multi-omics systems biology-bas...

Organism: Mus musculus Factor: Spaceflight Assay Type: DNA methylation profil... Accession: GLDS-104 PI/Contact: Galazka, Globus
Release/Publication Date: 27-Feb-2017

- 2) **Click on the buttons for Description, Protocols, Samples, etc. within each of the datasets to explore which model organisms were used.**
- 3) **Create a chart that lists each of the three different types of organisms used in the four studies, then use the web or other resources to search for reasons for what types of studies this model organism is used. Try to notice if different strains of the model organism(s) were mentioned.**

Guiding Questions

- 1) **What model organisms were used in each of the studies? Does the study mention the strain of the organism? If so, what was it?**
(This information will generally be found either in the description or in the protocols sections of the dataset/study)
- 2) **Does the description mention how many of the organisms were involved in the study? If so, how many and what age or sex?**
(This information will generally be found either in the description or in the protocols sections of the dataset/study)
- 3) **What tissues were collected in each of the studies?**
(This information will generally be found either in the description or in the protocols sections of the dataset/study)
- 4) **How are the tissues collected? How do you think that collection methods differ on Earth versus in space?**
(Example responses may address that carcasses can be freshly dissected on Earth rather than using retrieved frozen samples; dissections in space are possible, but face different blood pooling behaviors and require specialized techniques in tissue isolation.)
- 5) **Three out of the four studies in this activity used different model organisms. Why would one model organism be more suitable for that specific research than another (i.e., why choose mice as a model instead of fish for some studies)?**
(Example responses may be the structure of the hind limb of mice is similar to human legs, whereas zebrafish do not have legs. A zebrafish might be a good model organism for embryonic human studies. Fruit flies are good for heart studies.)

Why Does This Matter?

Using a web search or exploring the Publications section associated with the dataset, find at least three academic research articles that use one of the model organisms mentioned in this activity.

What human medical relevance or conditions is/are studied using each of the models?

NGSS Standards

Strands: HS-LS1-2; HS-LS1-3; HS-LS4-1

Practices: Developing and Using Models; Asking Questions and Defining Problems; Analyzing and Interpreting Data

Crosscutting Concepts: Interdependence of Science, Engineering, and Technology; Influence of Engineering, Technology, and Science on Society and the Natural World