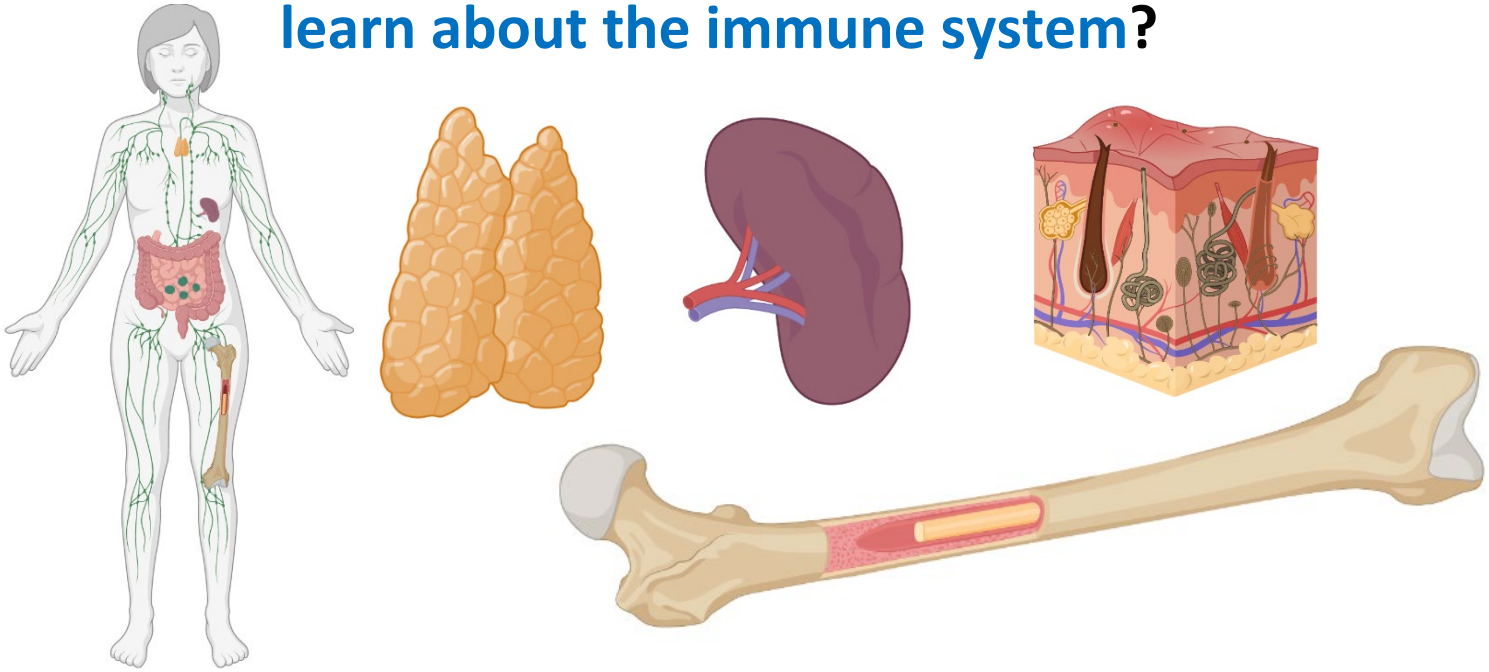
# How can we use open space biology data to learn about the immune system?



## Background

Our **immune system** protects our bodies in a variety of ways. Two major ways in which these defenses are categorized are the **innate** and the **adaptive** systems. An organism's innate immunity tends to include non-specific protections including physical barriers such as skin or mucus, with the purpose of preventing spread and entry of pathogens. Adaptive immunity is a response based on exposure to specific pathogens, and specialized cells are produced and deployed for the purpose of neutralizing pathogens.

Several organs, spread around the body, are included in the immune system. Many of these organs are highly affected during spaceflight, and researchers are interested in the effects on those organs and tissues and the pathways and processes associated with them.

## Objective

1) Navigate using the search tool of the Open Science Data Repository
2) Recognize organs of the immune system

## Datasets

For this activity, you will use the Open Science Data Repository in order to look for datasets that pertain to the organs of the immune system.

# Activity

1) Navigate to the Open Science Data Repository (https://www.nasa.gov/osdr/)
2) Scroll down and click on the *Explore the Data Repository* button


3) Type “immune response” into the search bar.
4) Scroll through the filtered list that is populated after your search. Which datasets are listed and what is the name of their associated study? (Answers may vary depending on new sets that have been made available since the time of publication of this activity, and at the time of publication, you would see OSD-575 and OSD-656 listed.)

5) Either using the initial search, **your own new keyword searches, or using the list of organs listed**, populate the table with a study associated with each of the organs of the immune system and use web or other resources to describe the function of that organ. (Note: At the time of publication of this activity, not all organs listed will have an associated OSD, and hence the column for OSD could be left blank.)

| Organ Name | Immune Function of the Organ | Associated OSD(s) |
|---|---|---|
| Skin | | |
| Lymphatic vessels | | |
| Lymph nodes | | |
| Thymus | | |
| Mucus membranes | | |
| Bone marrow | | |
| Spleen | | |
| Tonsils | | |

# Guiding Questions

1) **Which major organs of the immune system are represented in the data repository?**
   *(Lungs, thymus, skin)*
2) **Which model organism did most of these studies use?**
   *(Mus musculus (mouse))*
3) **Do all organisms have both an innate and adaptive immune system? Explain your response using evidence.**
4) **In some cases, the adaptive immune system attacks itself, rather than only foreign pathogens. These conditions are called autoimmune disorders. Many are manifested through disorders of the skin. Why do you think this is the case based on what you know of the immune system and its organs?**
   *(Answers may vary)*
5) **Advanced Extension: Find a study pertinent to one of the immune system organs/tissues within the Open Science Data Repository that uses transcriptomics and analyze the set to identify genes that are upregulated in spaceflight.**
   *(A step-by-step lesson using a spleen dataset is available in the Teacher Created Resources.)*

# Why Does This Matter?

**Using a web search or exploring the Publications section associated with one of your datasets, find at least three academic research articles that involves a study about an organ of the immune system and the effects of spaceflight factors on it. Two factors that you could consider are exposure to radiation or microgravity.**

**Although the papers discuss spaceflight factors, how are those related to factors on Earth? What medical implications exist?**

# 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