



## Bioinformatics Bite #2: Intro to Omics

Worksheet  
Student Materials

### OVERVIEW

This activity introduces the term “omics”, what it entails, examples of omics studies, and applications of omics.

### KEY CONCEPTS

- Omics are the study of collective sets of molecular information.
- Applications of omics study include the refinement of medical technologies.
- Statistical tools are used to assess omics data.
- Many NASA studies and research include omics data.

### OBJECTIVES

- Students will be able to create a functional definition of the term “omics”.
- Students will be able to define characteristics that define different types of omics.
- Students will be able to list statistical tools relevant to omics studies.
- Students will learn to navigate at last one NASA website with omics resources and data.

## BIOINFORMATICS BITE #2: OMICS

### Part 1: What IS Omics?

Interact with the resources listed and linked and take notes on their information in the highlighted portions of the table.

Resource	Notes---What is Omics?
Watch Videos: <a href="#">Introduction to Omics</a> <a href="#">Omics: Advancing Personalized Medicine from Space to Earth</a>	
Read Text: <a href="#">What is Omics (Excerpt)</a>	

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Using the information you collected in the above table, use your own words to define what is meant by omics.

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## Part 2: Oh-So-Many Types of Omics!

Your teacher will assign you one of the types of omics and you will watch the video/read the resources, and conduct research to fill out your row of the chart (unless you get epigenomics & microbiomics, you need to do detailed notes on both, since there is only one column to research).

When you are done, you will collaborate with other students to get the information you need to fill out the rest of the chart.

Omics Type (& Resources)	Omics Definition	Analytical Tools Used to Conduct Omics Analysis
<b>Genomics</b> <a href="#">Genomics Video</a> <a href="#">Omics Types (Excerpt)</a> <a href="#">Omics Analytical Tools (Excerpt)</a>		
<b>Transcriptomics</b> <a href="#">Transcriptomics Video</a> <a href="#">Omics Types (Excerpt)</a> <a href="#">Omics Analytical Tools (Excerpt)</a>		
<b>Proteomics</b> <a href="#">Proteomics Video</a> <a href="#">Omics Types (Excerpt)</a> <a href="#">Omics Analytical Tools (Excerpt)</a>		
<b>Metabolomics</b> <a href="#">Metabolomics Video (#1)</a> <a href="#">Metabolomics Video (#2)</a> <a href="#">Omics Types (Excerpt)</a> <a href="#">Omics Analytical Tools (Excerpt)</a>		
<b>Phenomics</b>	"Morphological, molecular, physiological and biochemical	

	characterization”	
<b>Ionomics</b>	“Identification, characterization, and distribution of elements”	
<b>Epigenomics</b> <a href="#">Epigenomics Video</a>		
<b>Microbiomics</b> <a href="#">Microbiomics Video</a>		

Read **Omics Statistical Tools (Excerpt)** and answer the question below.

What types of statistical tools can be used for omics analysis?

### Part 3: The Twin Study: NASA Omics in Space

**Watch:** [Fireworks in Space: NASA’s Twins Study Explores Gene Expression](#)

Complete the “True or False” activity about the omics teams’ results of the NASA Twin Study with a partner using this [link](#). Time your partnership, see how fast you can go and get them all right! Check with your teacher if you got it right, and start the clock again if you didn’t!

In the picture, there is differentiation between Dr. and PhD. I have used “doctor” interchangeably, as both are technically doctors. Feel free to set your own parameters for your students or use this as a discussion for what the title “Doctor” means!

Statement	T/F	If F, rewrite the statement so it is true. (Just write N/A if T)	What omics team (Researchers and Topics?)
Scott reacted the same to the flu vaccine before, during, and after the mission, which proved the immune system responded appropriately in space.			
Microbiome health was not maintained during space.			
Scott showed signs of inflammation in space.			
Scott’s fluids shifted to his lower body and there were structural changes to his eyes.			
Scott’s degree of epigenetic changes were different from Mark’s on Earth.			
Scott’s carotid artery wall thickened in space.			
Gene expression changed in space and the majority retained that change on Earth. DNA damage was observed.			

**Watch:** [Three Key Findings from NASA’s Twin Study](#)

Looking back at all the different omics teams' results from the true/false activity, pick your favorite one and complete the following questions.

Student answers will vary, so this is just an example of one choice. Encourage detail and research!

Omics Team: <b>Gene Expression</b>	<a href="#">Picture Link</a> (referenced above)	<a href="#">Article Link</a> (Look for a section on your omics team and read that--and more if you wish!)
General Notes--->		

How does your omics team's results could potentially help improve the space experience/health for astronauts?

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#### Part 4: Bringing the Information to the People: NASA GeneLab

Interact with the resources provided and take notes on their information in the highlighted portions of the table.

Resource	Notes---How does the GeneLab use omics datasets?
Watch Video: <a href="#">NASA GeneLab: Omics database for spaceflight experiments</a>	
Read Text: <a href="#">Omics and Gene Lab (Excerpt)</a>	

Go to <https://genelab.nasa.gov> and explore! Write at least three cool things you learned/interacted with AND where you found it on the website!

1. _____
2. _____
3. _____

## Part 5: Learning Aims and Evaluation

Please rate where you personally are at, with regards to the learning aims, at the end of the lesson and why.

### Rating Scale

1- I do not understand it at all yet.

2- I understand parts of it, but I need my teacher and/or classmates' support to answer questions.

3- I understand it and can complete an assignment by myself.

4- I understand it so well I can teach others and apply my knowledge to new situations.

**Learning Aim #1:** Students will be able to define what omics means and give examples of some of the main omics fields.

**My Evaluation of Learning Aim #1 and Explanation:**

**Learning Aim #2:** Students will be able to describe some of the analytical and statistical tools used in omics to analyze and interpret data.

**My Evaluation of Learning Aim #2 and Explanation:**

**Learning Aim #3:** Students will be able to explain how NASA (and specifically NASA GeneLab) uses omics datasets.

**My Evaluation of Learning Aim #3 and Explanation:**

## References

GeneLab for High Schools Bioinformatics Manual. Available at [ url ]

Omics - Exploring Space Through You. NASA Video Gallery. <https://www.nasa.gov/hrp/omics-videos>

GeneLab Database. <https://genelab.nasa.gov/>

NASA GeneLab: Omics database for spaceflight experiments. (October 2018). YouTube. <https://www.youtube.com/watch?v=evPRRuM6KFA>

Three Key Findings from NASA's Twins Study. (April 2019). NASA Video on YouTube. <https://www.youtube.com/watch?v=hU0cD3kWnKY>

NASAS's Twins Study Results Published in Science Journal. (April 2019). Human Research. NASA.gov. <https://www.nasa.gov/feature/nasa-s-twins-study-results-published-in-science>

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