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## **Students Need Bioinformatics Training**

**Biology research is collaborative and computational**, but many students lack bioinformatics education.



# **Open Science for Life in Space**

- NASA GeneLab analyzes & shares space microbiology "omics" data
- Also educating young scientists on methods & logic of microbiology computation

#### **Microbial Amplicon Sequencing**



#### Microbiomes inform us about adaptations of life on Earth and in space

- Microbiome samples collected and DNA extracted
- 2. Gene for 16S ribosome is amplified using PCR
- Genes are sequenced and matched to a database of known organisms
- 4. Determine microbial community composition, diversity, and changes under different environmental conditions, such as:

#### Earth/Ground vs. Space

- Microbiome diversity
- Environment effect on microbiome

# **AstroAmpSeq: Microbial Bioinformatics Education with NASA GeneLab's Amplicon Pipeline**

# AstroAmpSeq: Designed with Best Practice in Mind

**Project-Based Learning (PBL) is an evidence-supported teaching approach that** ensures students gain key knowledge, understanding, and success skills.

- Better than traditional lecture
- Student-driven inquiry for a real research interest
- Student skills: teamwork, independence, and iterative design
- Measurable objectives rooted in Bloom's Taxonomy
- Fun and meaningful final deliverables

#### **Design Elements of AstroAmpSeq** (Gold Standard PBL)

Authenticity Student Voice & Choice Reflection Critique & Revision Public Product Challenging Problem or Question Sustained Inquiry

### **AstroAmpSeq 5-Day Outline**



# Accessible, Adaptable Curriculum

#### AstroAmpSeq...

- Taught virtually or in-person (or hybrid!)
- Runs on a personal computer using Jupyter Notebooks
- Modular: stand-alone or fits into a larger curriculum
- Supports students of a variety of educational backgrounds

### What comes next? Iterative Design!



## **References & Acknowledgements**

- 1. NASA GeneLab. <u>https://genelab.nasa.gov/</u>.
- 2. Larmer, John. "Gold Standard PBL: Essential Project Design Elements." PBLWorks, 22 July 2020, https://www.pblworks.org/blog/gold-standard-pbl-essentialproject-design-elements.
- 3. Lee, Michael D. "A full example workflow for amplicon data." https://astrobiomike.github.io/amplicon/dada2\_workflow\_ex

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