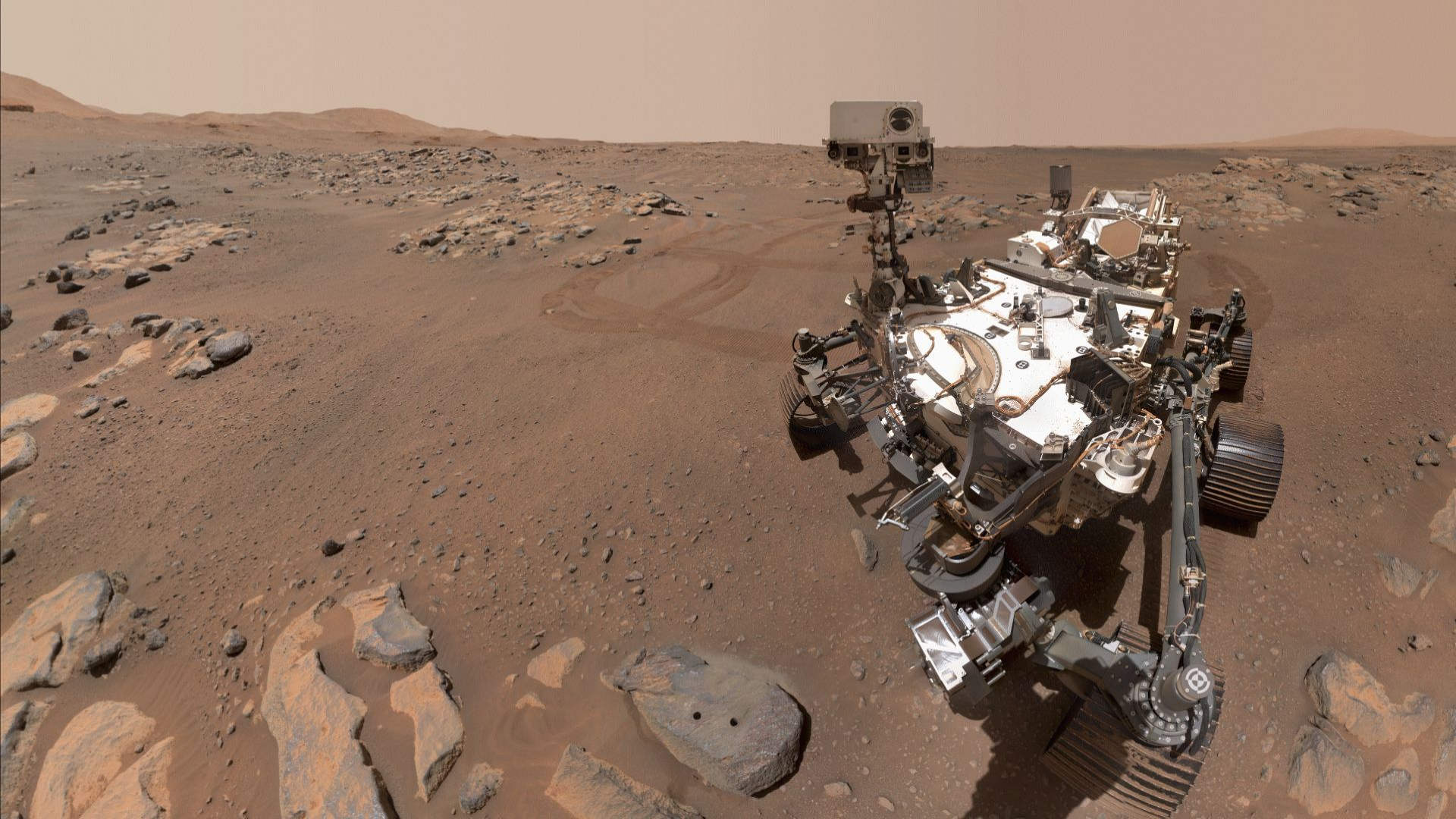


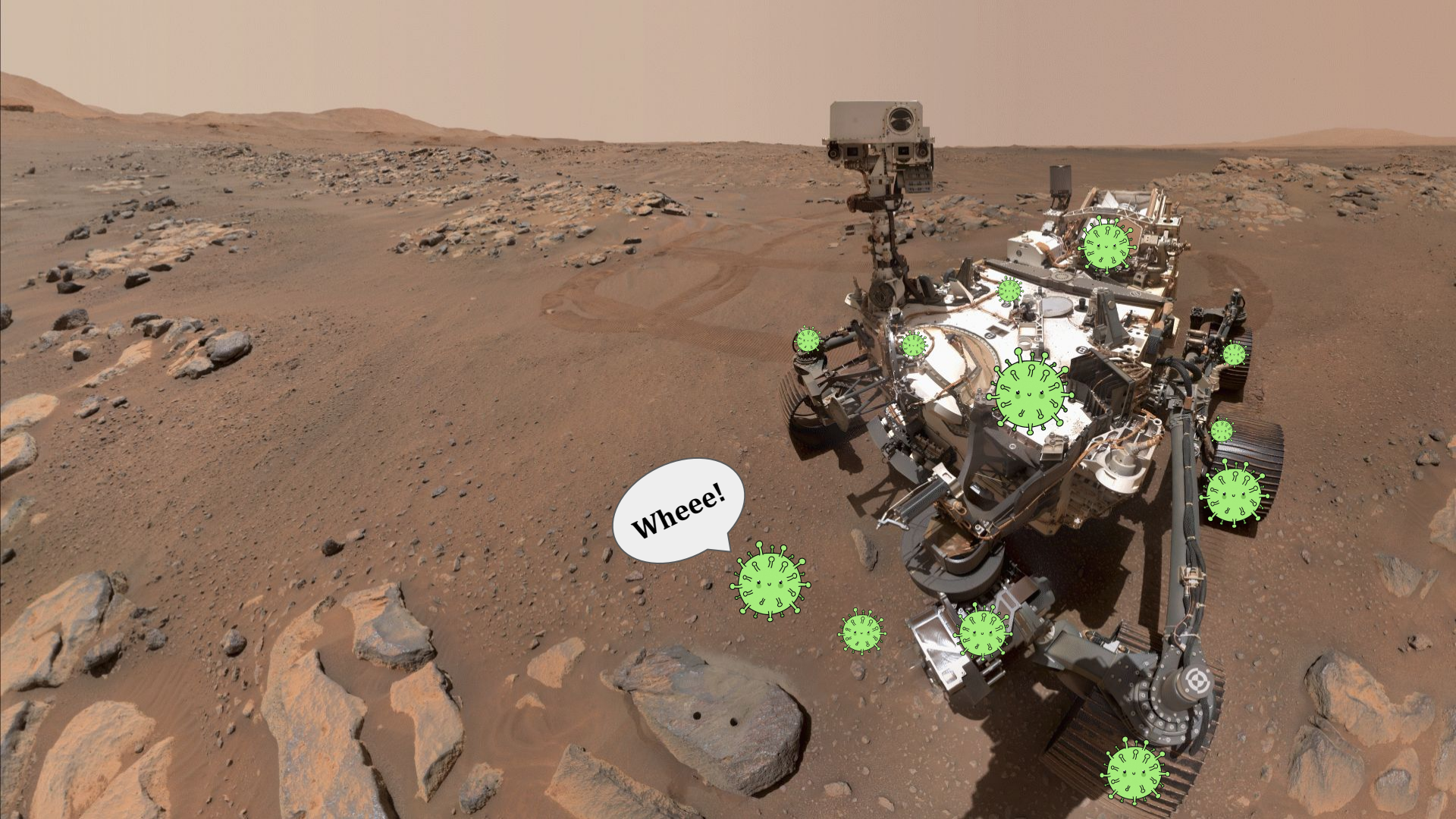
# A comprehensive metagenomics framework to characterize organisms relevant for planetary protection

Danko et al. 2021







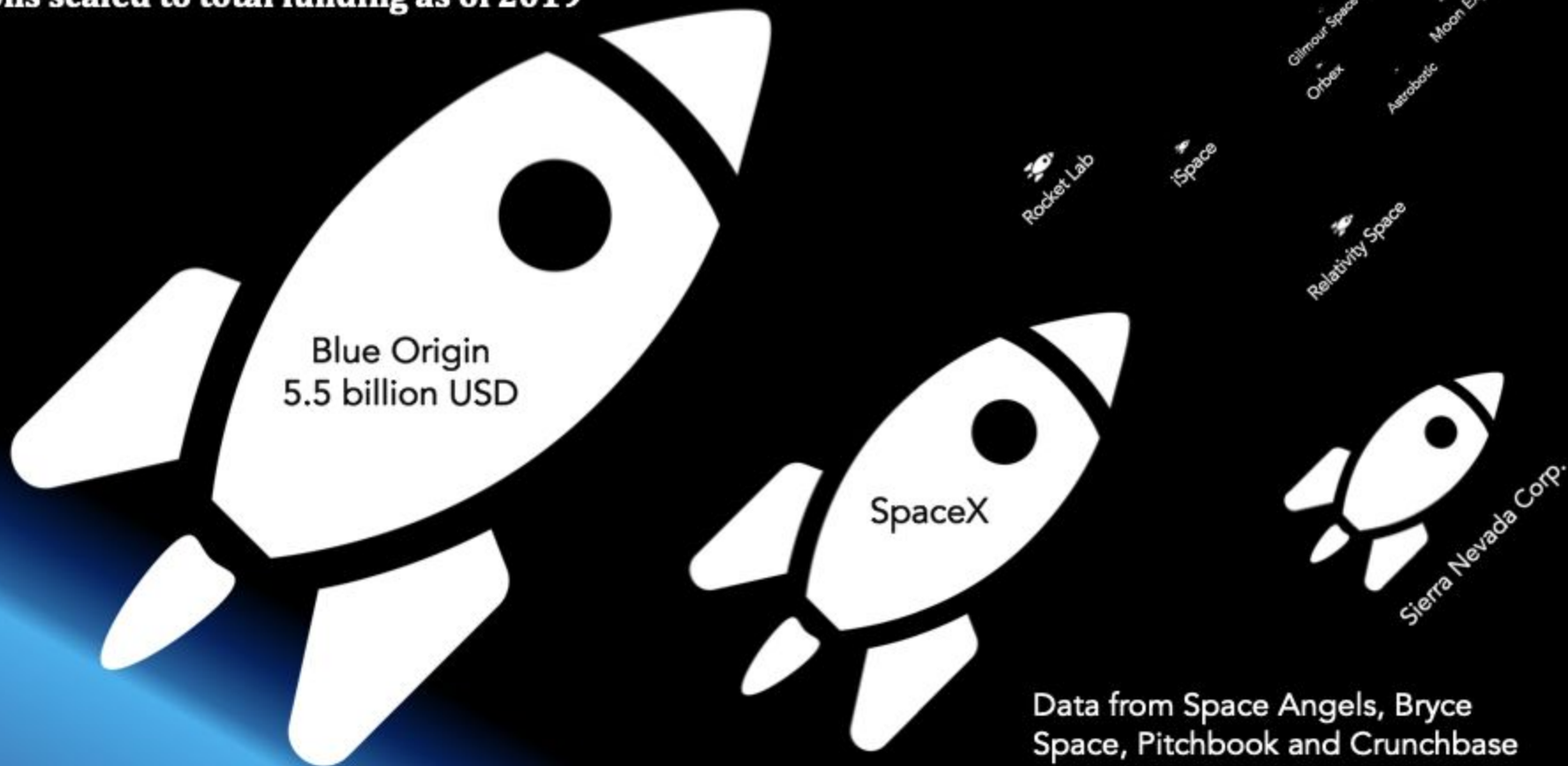


Wheee!

# Current State of Affairs

A simplified summary of private space economics

Icons scaled to total funding as of 2019



Data from Space Angels, Bryce Space, Pitchbook and Crunchbase



**Moon Express**  
**Funding: 51 million USD**



**Planetary protection measures for Viking  
Landers: ~100 million USD, 10 - 14% of  
mission cost**

# Aims

- Identify baseline bioburden in Spacecraft Assembly Facilities
- Create a reproducible pipeline for sampling and assessing cleanroom contamination
- Identify common attributes of cleanroom microbes in order to guide future planetary protection measures

**Cat. 1      DNA Samples**

**Cat. 2      Facility Surface Wipe Samples**

**Surface**

**Cat. 3      Filter Solution**

**Cat. 4      Vacuum Particle Solution**

**Air**

**Cat. 5      DNA Replicate Samples**



**ISO 5**

Most Secure

**ISO 6**

**ISO 7**

**ISO 8**

Least Secure



**ISO 5**

**12**

**ISO 6**

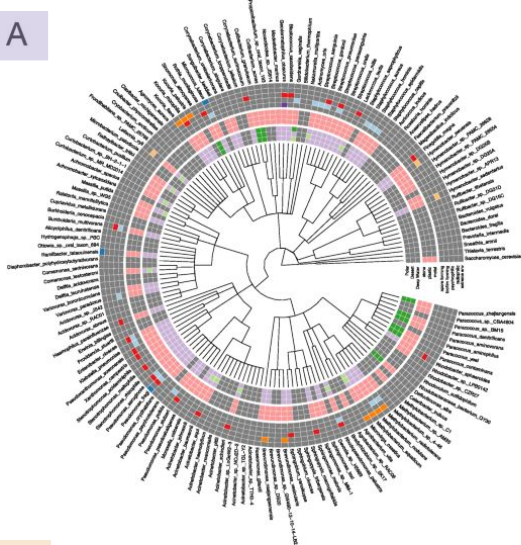
**ISO 7**

**ISO 8**

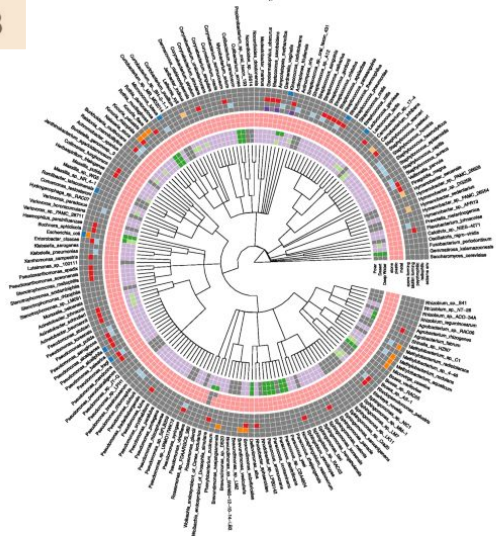
**12**



A



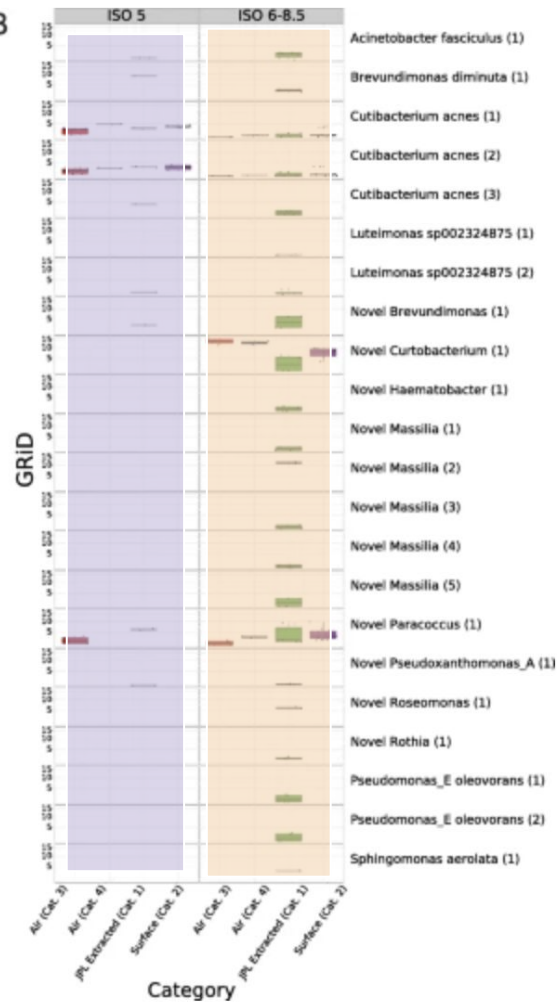
B

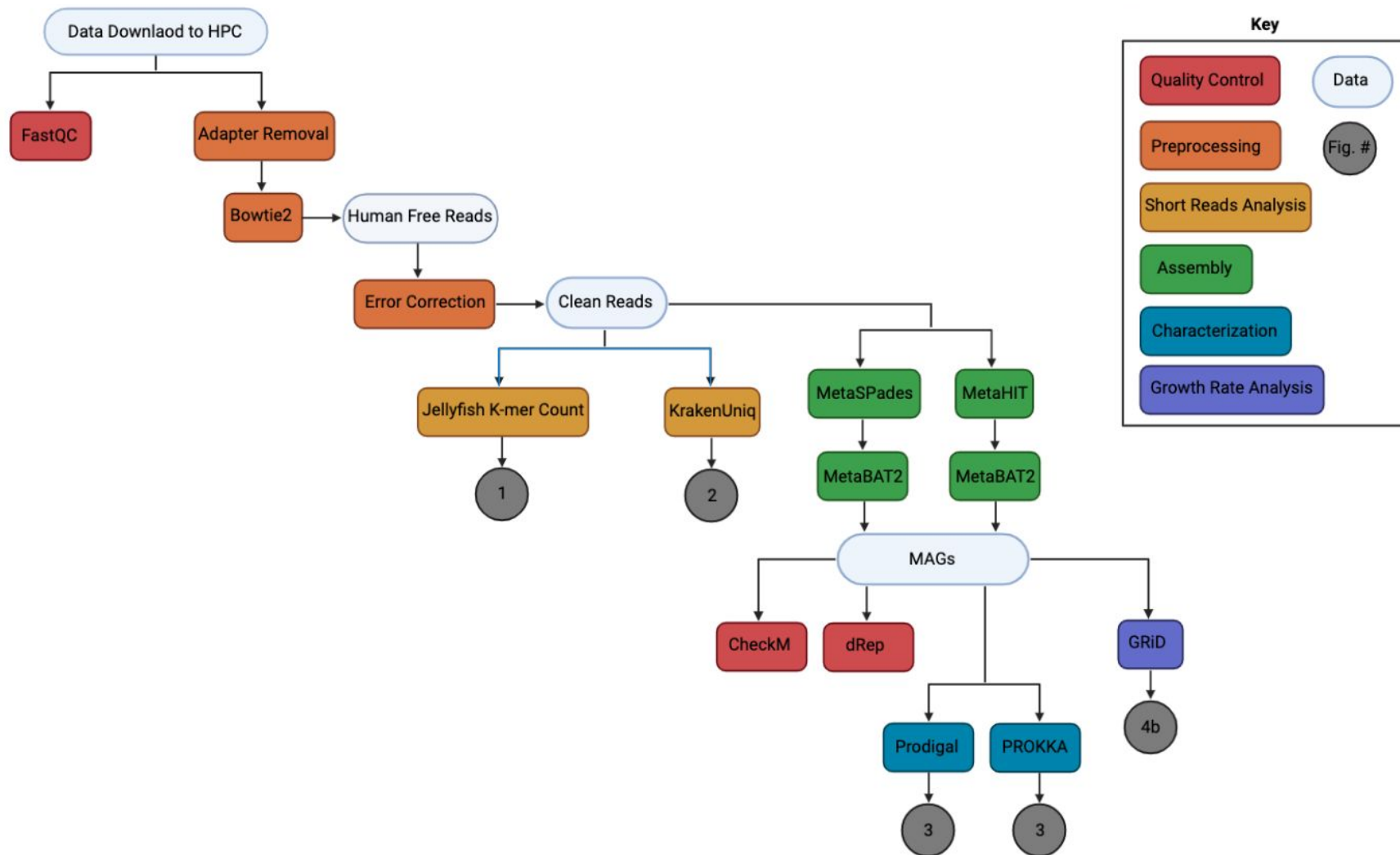


Value

- Biofilm Forming
- Extremophile
- Never Observed
- Observed in some
- Often Present
- Psychrophilic
- Psychrophilic Genus
- Radiophilic Genus
- Rarely Observed
- Spore Forming

B





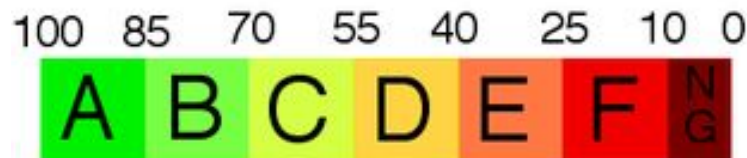


# Quantification of Reproducibility: Ease of use

Starting 'grade' of 100

Penalties:

- -1 per missing version number
- -2 per tool setting/flag not specified
- -5 per paid tool
- -8 per step/tool not outlined in manuscript or pipeline



# Quantification of Reproducibility: Results

- Comparison of produced figures
- PERMANOVA to determine if significant differences exist between initial and reproduced data → ALDEx2 to identify over/under-representation of taxa

# Initial Reproducibility Assessment

## Tools and provided information



- Standard assembly with default settings
- Quality assessment measured well defined
- Commonly used tools (dRep, Prodigal, etc)

## Roadblocks

- Deprecated pipeline
- Some missing code
- Non-standard data repository
- Some version numbers missing
- Mixed databases used for annotation

# Questions?



**Percy the Mars Rover** @PercyRover · Aug 29



I laser holes into rocks because the alternative is sitting in silence on this desolate planet listening to the shrieks of loneliness coming from my gaping radioactive heart

 18

 74

 697

