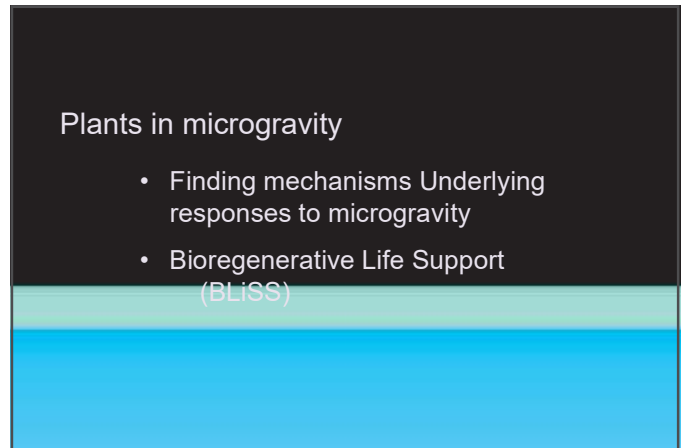
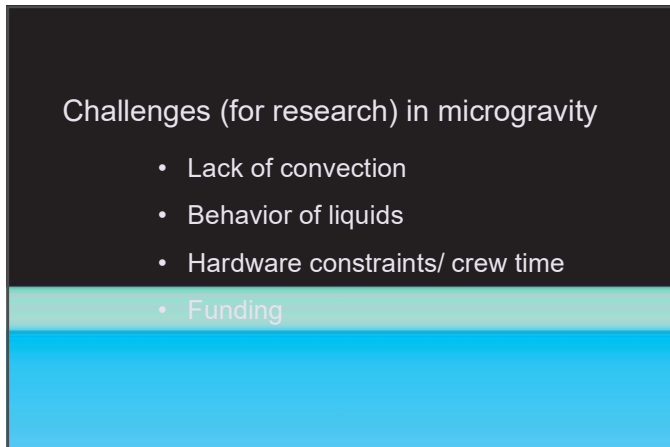




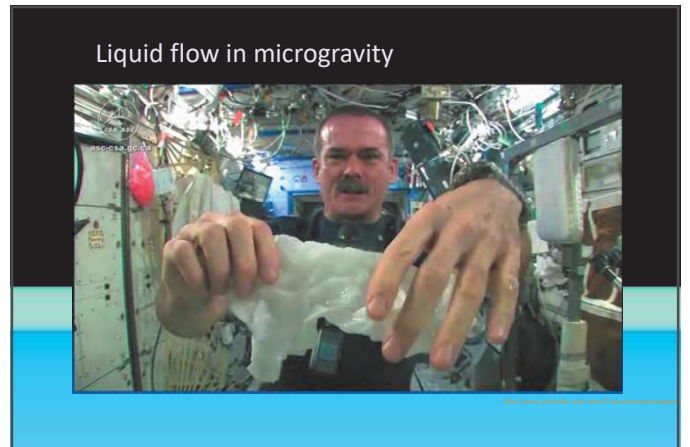
1



2



3



4



5



6

Spaceflight – plant research

Approaches

1. Proteomics
2. RNAseq
 1. sRNA regulation
 2. Gravi-course
3. DNA integrity
4. GeneLab/ AWGs

7

Hardware

- BRIC/PDFU
- Veggie
- Advanced Plant Habitat

8

Petri Dish Fixation Unit (PDFU)



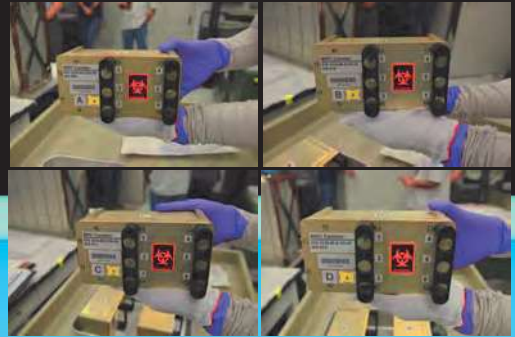
Seeds are plated..

and loaded into
PDFUs!



9

4 BRICs, 22 plates total/treatment



10

What we got back



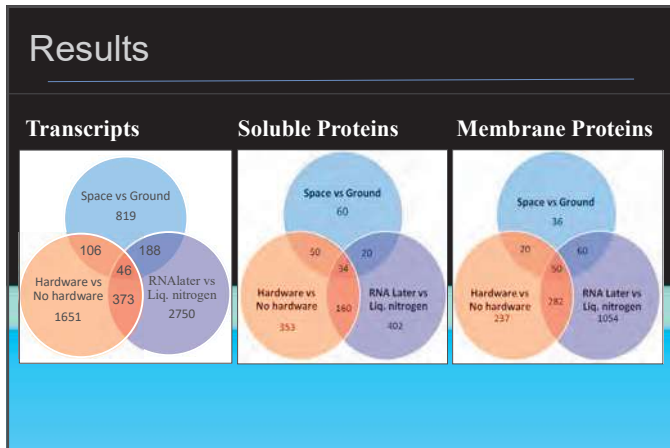
11

Data Sets and Metadata

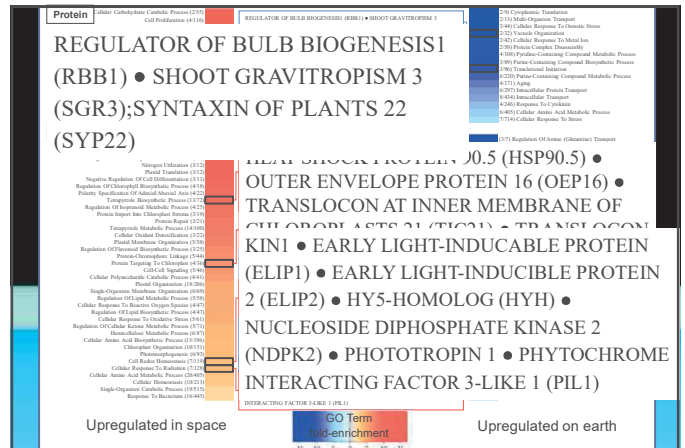
- RNA seq
- Soluble proteins
- Membrane proteins



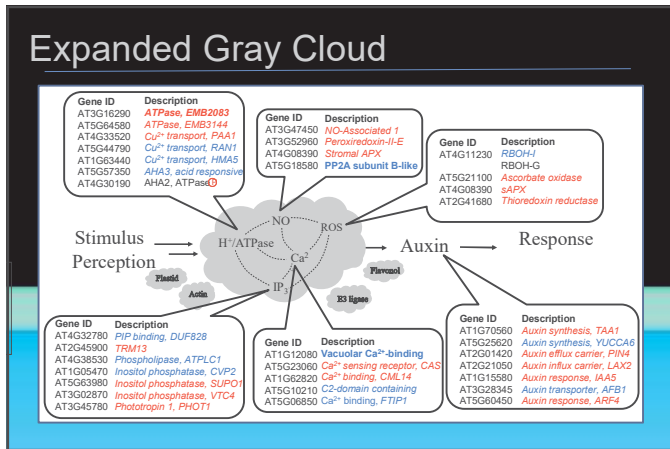
12



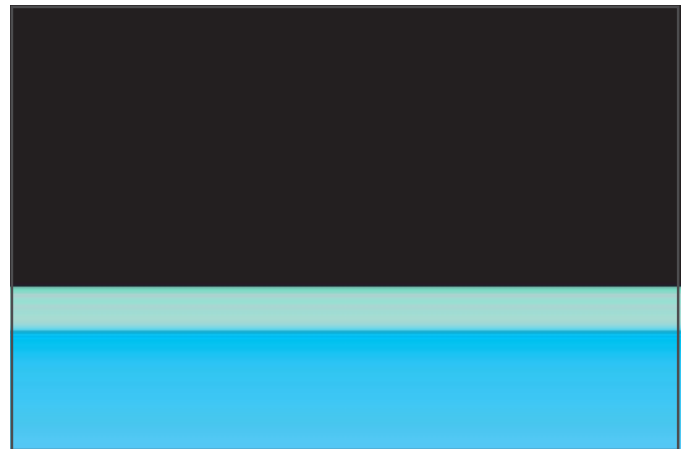
13



14



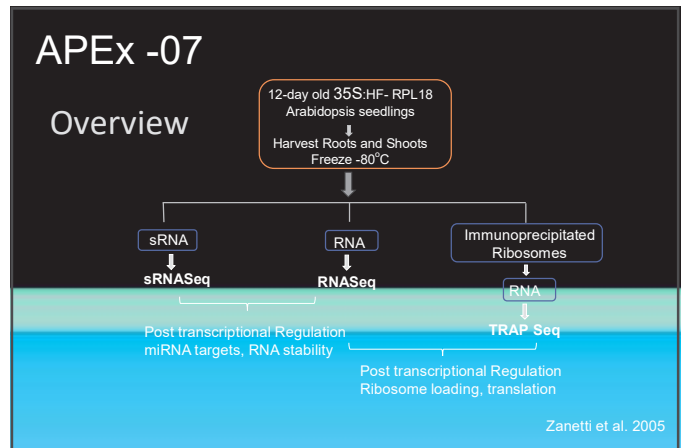
15



16

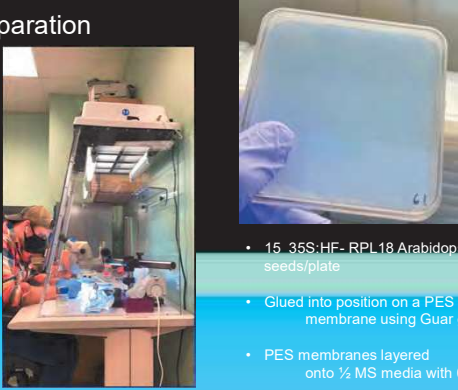


17



18

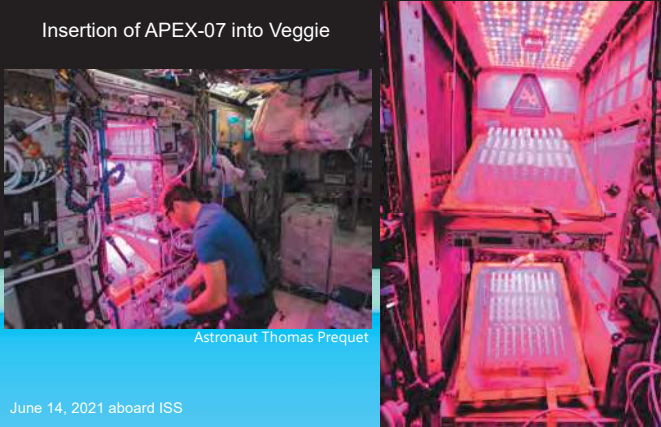
Preparation



- 15 35S::HF-RPL18 Arabidopsis seeds/plate
- Glued into position on a PES membrane using Guar gum
- PES membranes layered onto ½ MS media with 0.8 % agar

19

Insertion of APEX-07 into Veggie



Astronaut Thomas Prequet

June 14, 2021 aboard ISS

20

June 16, 2021 at Kennedy Space Center

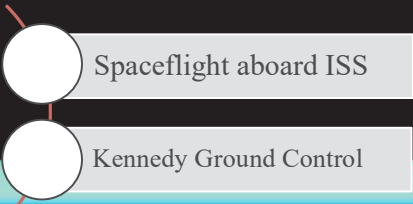


21



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Experimental Treatments



Spaceflight aboard ISS

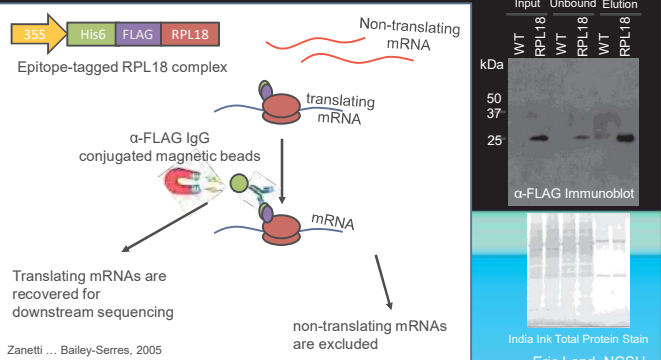
Kennedy Ground Control



NASA GeneLab Open Science for Exploration

23

Optimization of immunocapture methods of polysomal complexes for limiting tissue of spaceflight



Epitope-tagged RPL18 complex

Non-translating mRNA

translating mRNA

mRNA

non-translating mRNAs are excluded

Translating mRNAs are recovered for downstream sequencing

Zanetti ... Bailey-Serres, 2005

	Input	Unbound	Elution
	WT	RPL18	WT
	WT	RPL18	WT
	WT	RPL18	WT

kDa

50

37

25

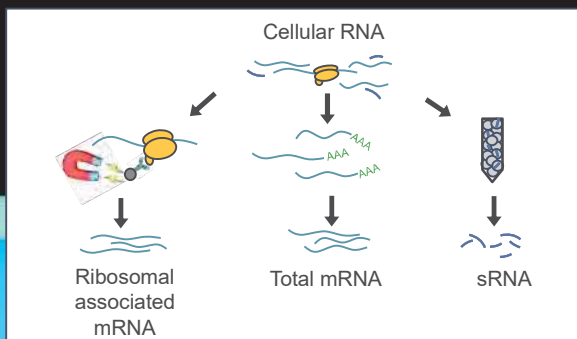
α-FLAG Immunoblot

India Ink Total Protein Stain

Eric Land, NCSU

24

3 RNA Populations

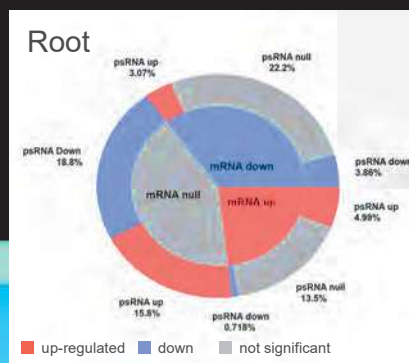


Data Sets and Metadata

- mRNA, shoot
- mRNA, root
- small RNAs, shoot
- small RNAs, root
- Ribosome associated RNA, shoot
- Ribosome associated RNA, root

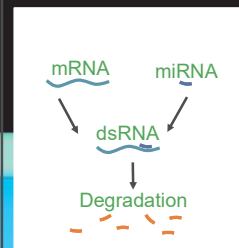


Root



Emma L.J. Canaday

miRNA Regulation



Ath-miR397 LFC = -4.3
Targets lignan and beta tubulin

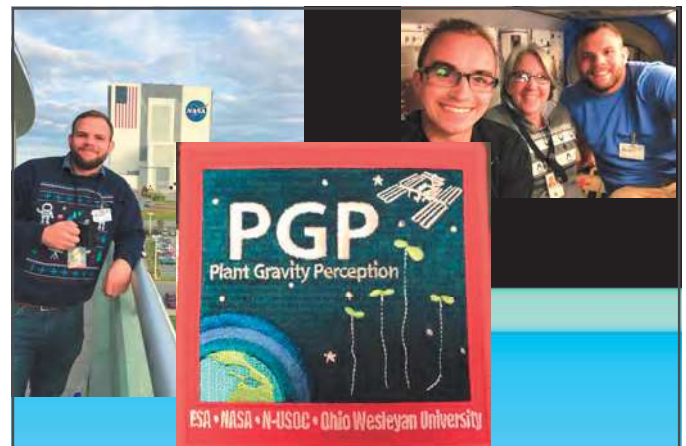
Ath-miR167c LFC = 2.9
Targets arf family

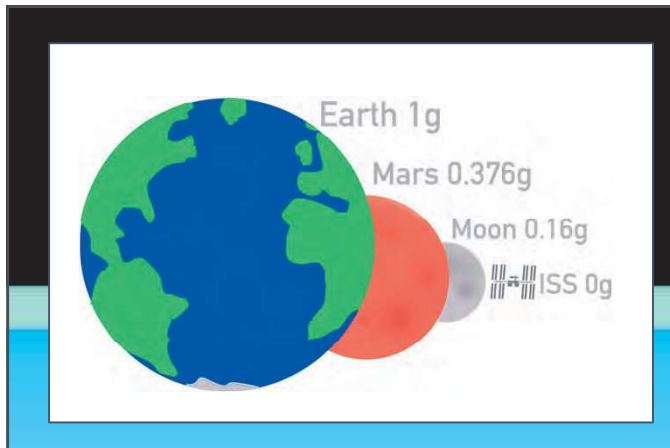
Ath-miR319 a and b LFC = 1
Targets myb family

Ath-miR159b LFC = 1
Targets myb and tcp

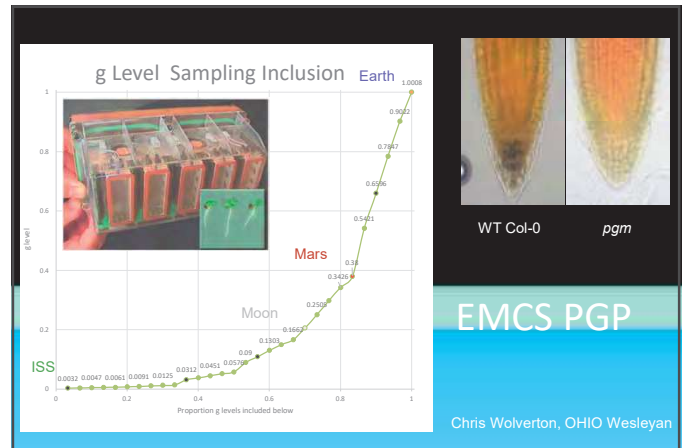
Emma L.J. Canaday

European Module Cultivation System





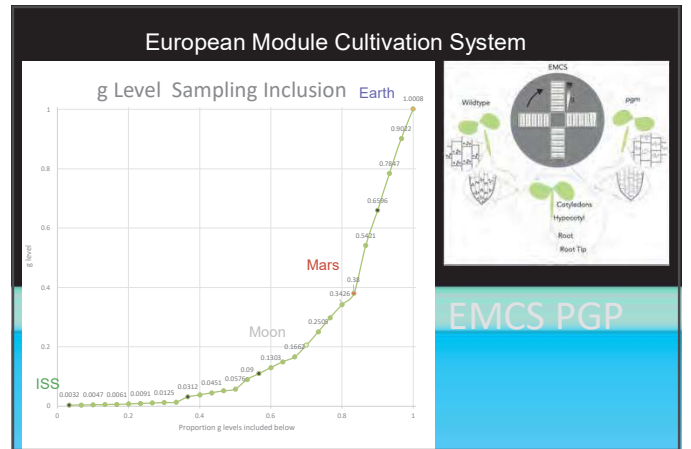
31



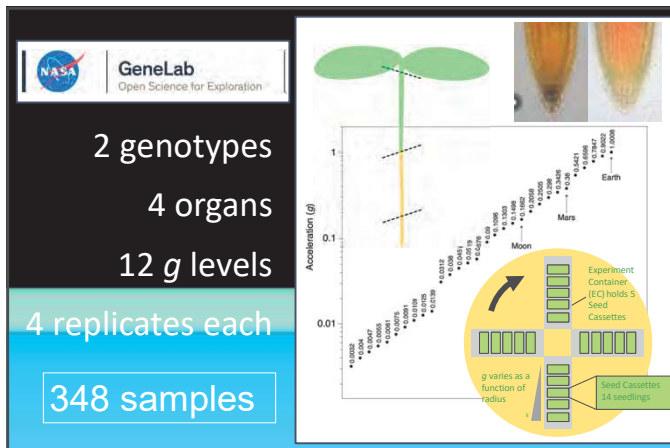
32



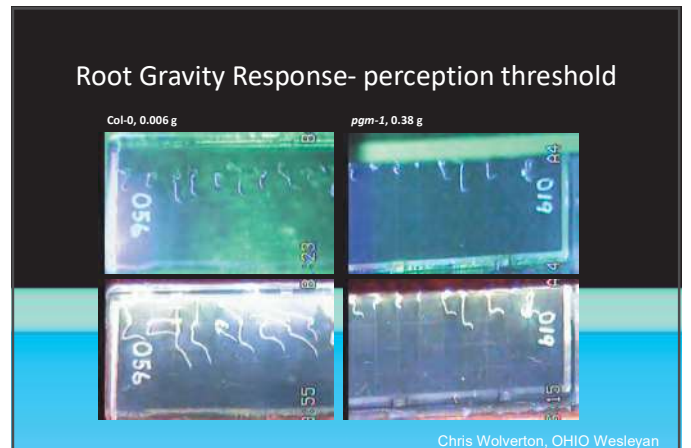
33



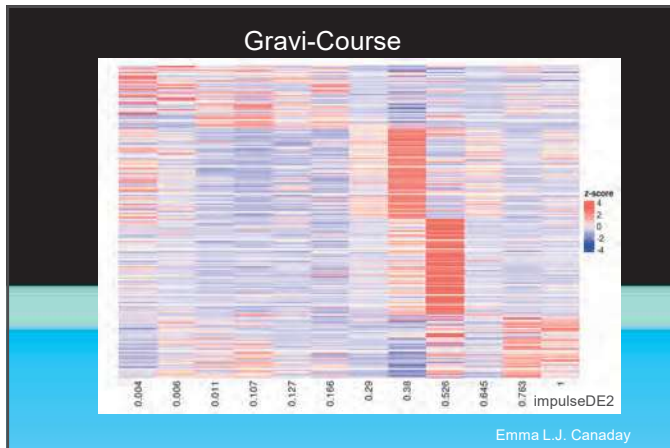
34



35



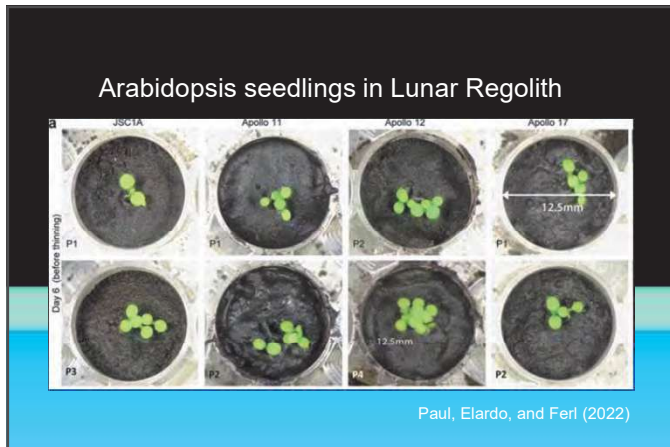
36



37



38



39

- Overview and recommendations for research on plants and microbes in regolith-based agriculture – Fackrell et al. (2024) npj Sustainable Agriculture

40

GeneLab Open Science Data Repository (OSDR)

41

GLARE: Discovering Hidden Patterns in Spaceflight Transcriptome Using Representation Learning – Seo, et al.

- Uses ML approach trained on Single Cell RNAseq to find new patterns in existing spaceflight data.

42



Acknowledgements

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 # 80NSSC22K0366




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"Remember the seed in the Styrofoam cup: the roots go down and the plant goes up and nobody really knows how or why"

- Robert Fulgham, [All I really Need to Know I Learned in Kindergarten](#)

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