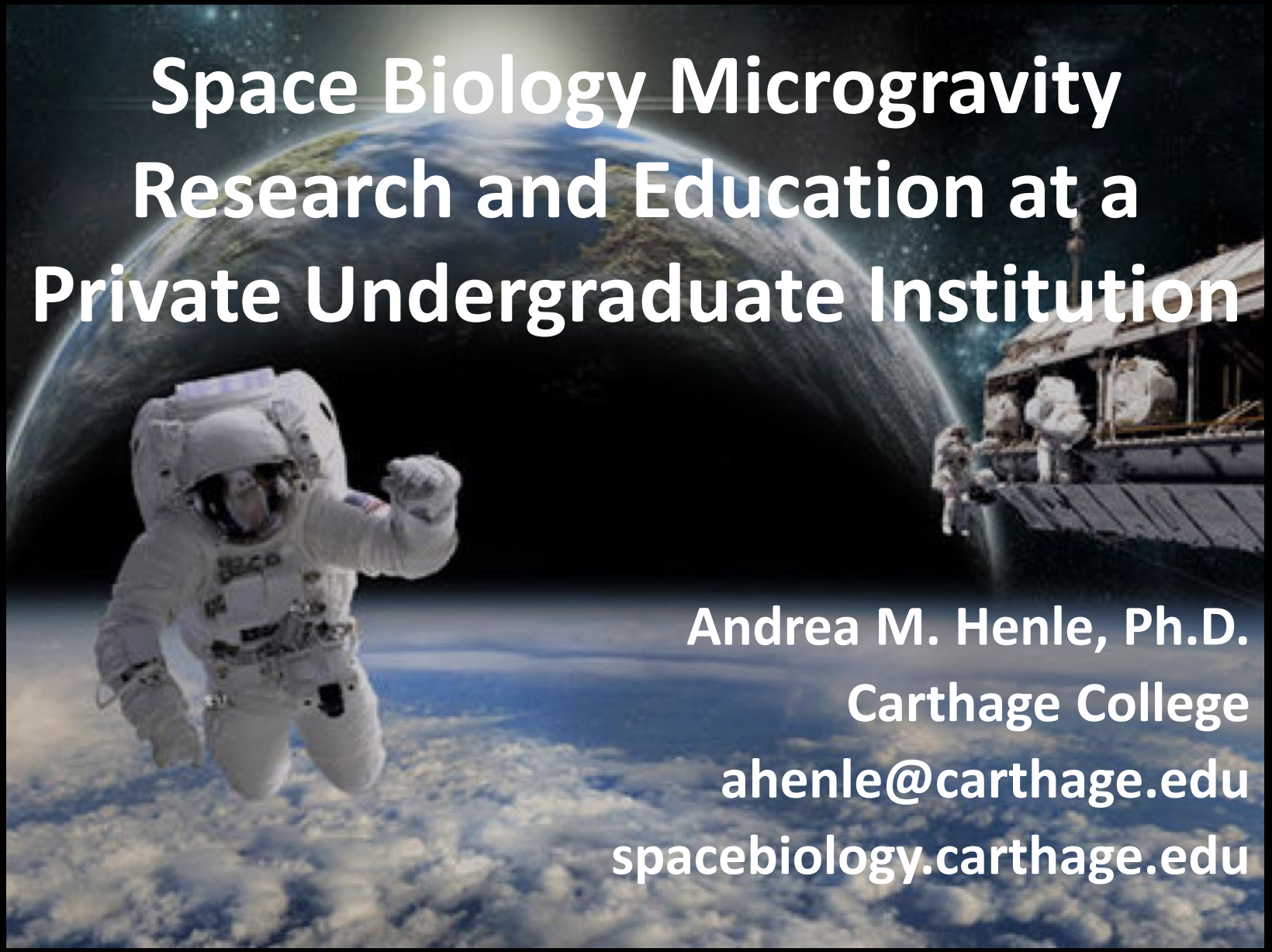
Space Biology Microgravity Research and Education at a Private Undergraduate Institution



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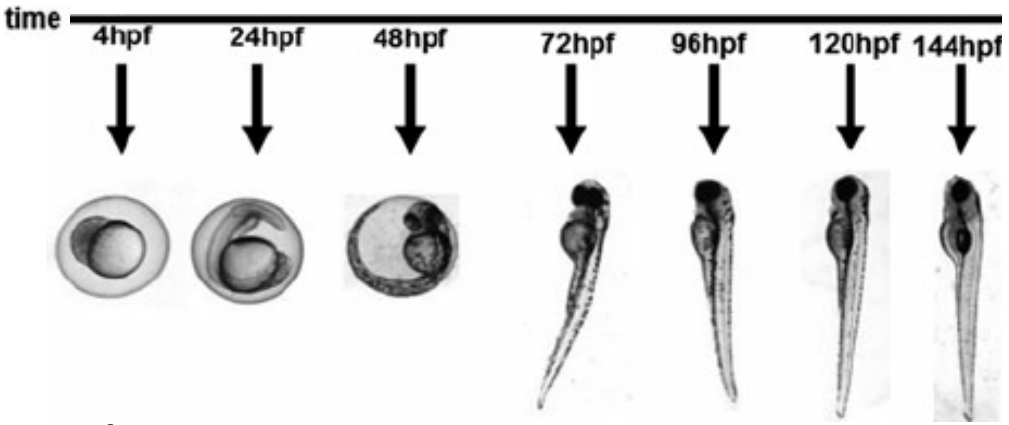
Part 1 – Research

Assessing cellular and molecular changes in simulated microgravity

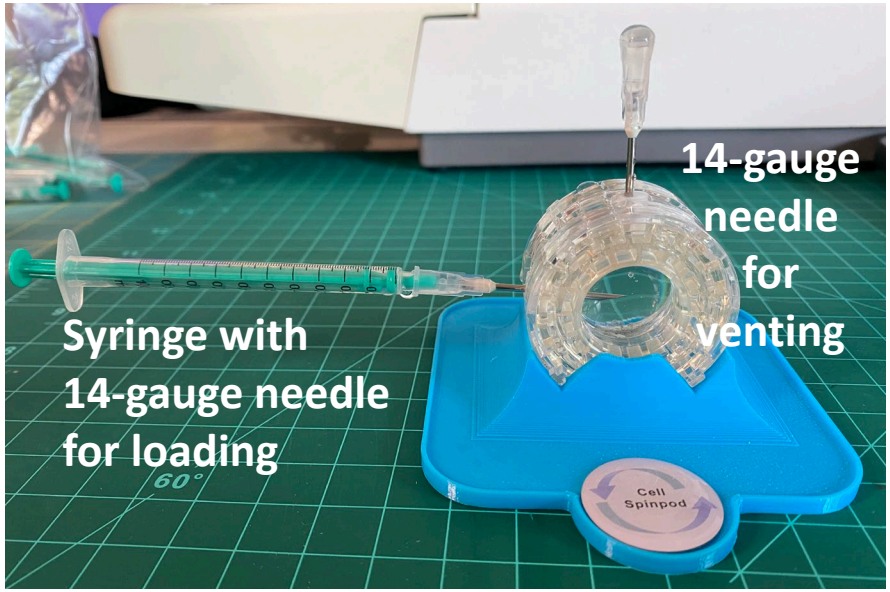


Zebrafish model of uveal melanoma

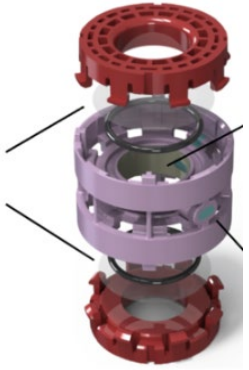
- Most common eye cancer
- Driven by GNAQ/11 hypermutations (Gα proteins)

µG effects on cell migration, signaling, tumor development?

Simulated microgravity with the CoSE SciSpinner and Cell Spinpod



Breathable Thermoplastic Membranes. One on each side of the cell chamber are held in place with an O-ring



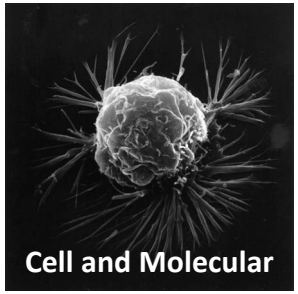
Can space biology be used to engage students in microgravity research and primary literature discussion?

- Course: “Space Biology: Human Health & Disease from Space to Earth”
- Upper Level Biology Elective (w/lab) for Junior & Senior Biology Majors
- Combined lab and lecture classes
  - Class meets 2x/week
  - 3 hr/class

Spring 2018 and 2020 Space Biology students

Learning Objective: Students will be able to critically read, analyze, discuss, and present primary literature articles from the field of space biology

Space Bio - Past & Present
Spaceflight Opportunities & Engineering



Cancer
Immune Response

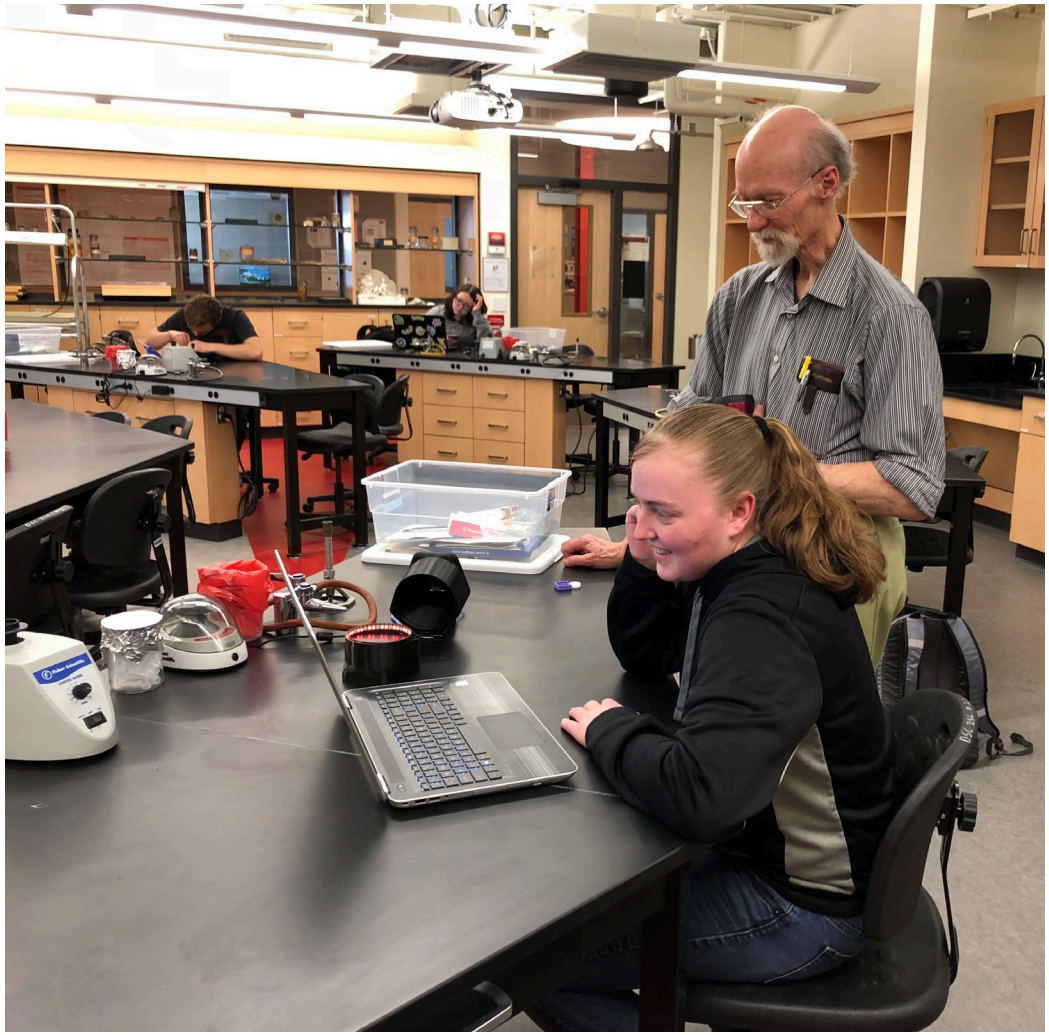
Plant Growth
Space Applications
Biotechnology

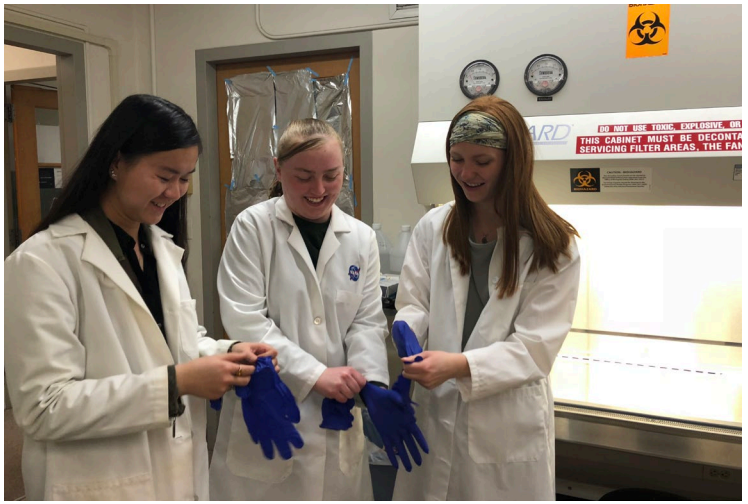
SPACE BIOLOGY

Microbiome
Planetary Protection
Genomics

Bone Loss
Skeletal Muscle Alterations
Neuromuscular Development
Circadian Rhythms & Sleep

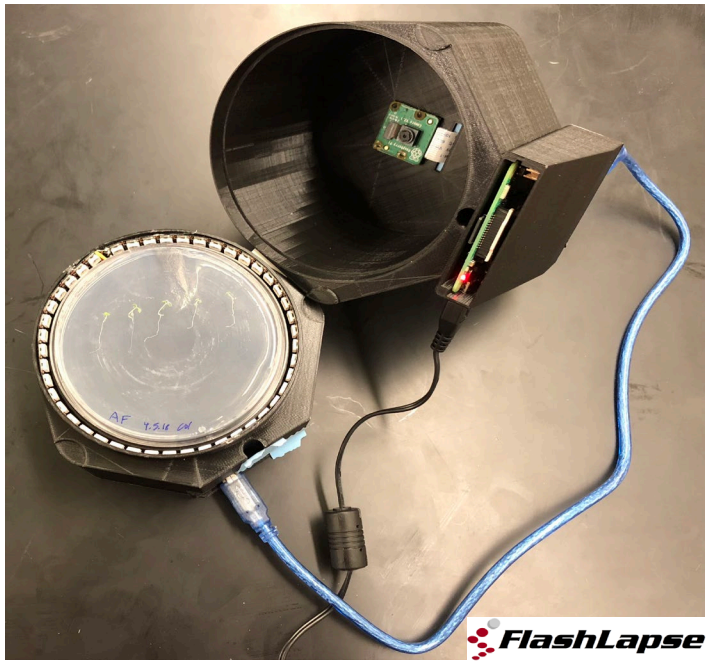
Learning Objective: Students will be able to engage in conversation and ask questions of professional scientists in the field of space biology

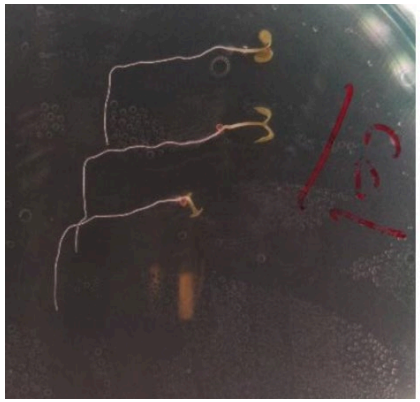


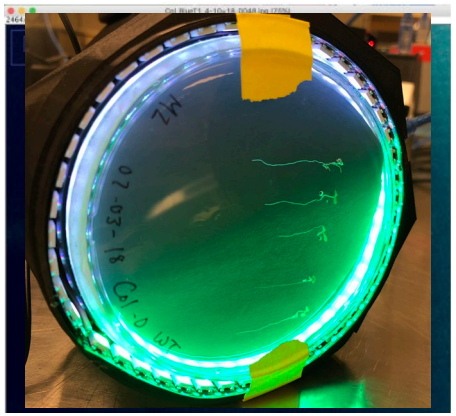


Student Learning Objectives - Lab

- Use bioinformatics databases containing NASA GeneLab data to identify candidate genes involved in the microgravity response in *Arabidopsis thaliana*. Test seeds with those mutant genes in a 3D-printed gravitropism device (FlashLapse).
- Utilize image analysis software to analyze data collected from their experiments.



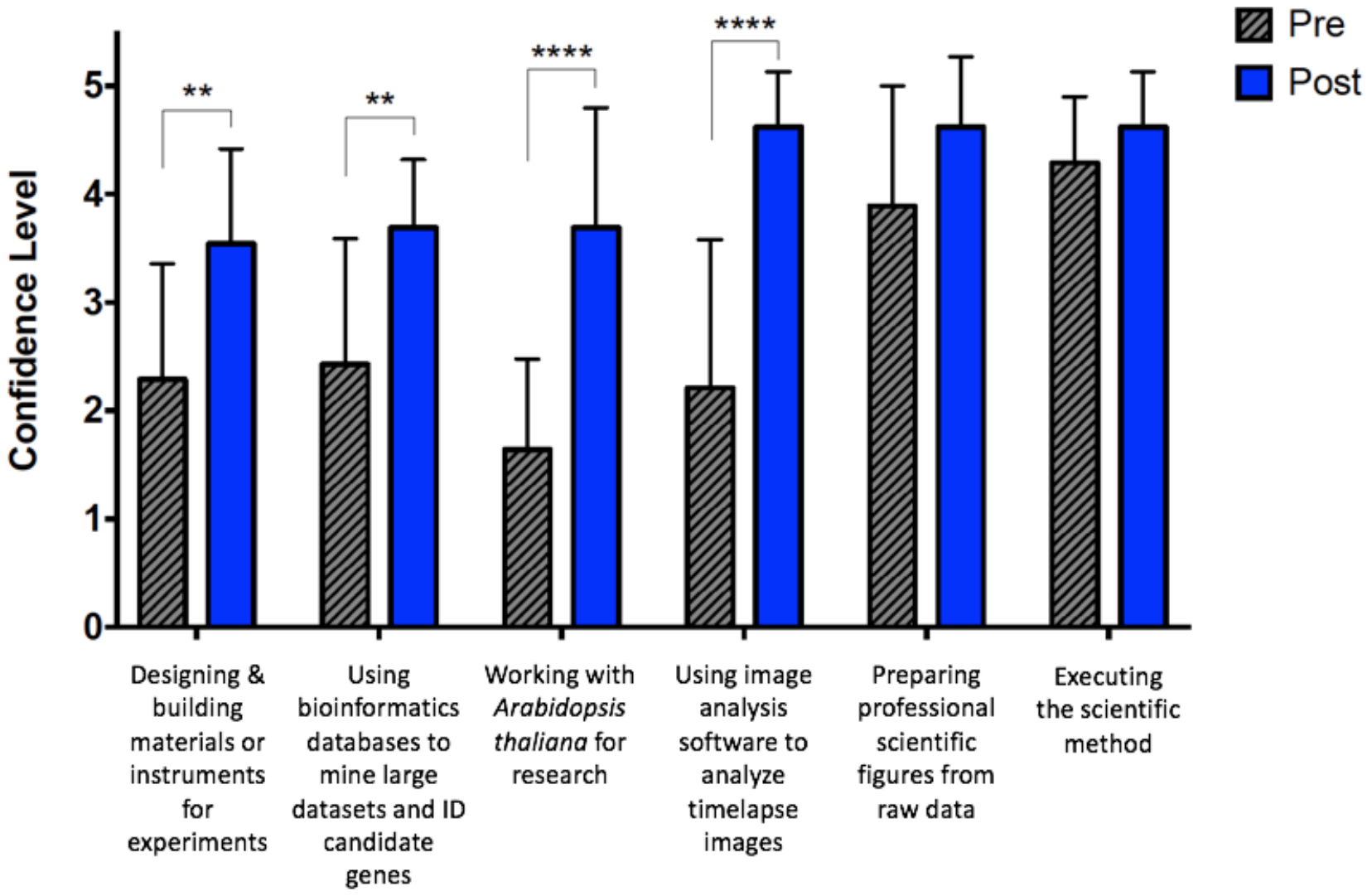




Results

	Area	Angle	%Area
1	0	128.245	0
2	0	111.054	0
3	0	122.481	0
4	0	123.559	0

Assessment Data - Laboratory Skills

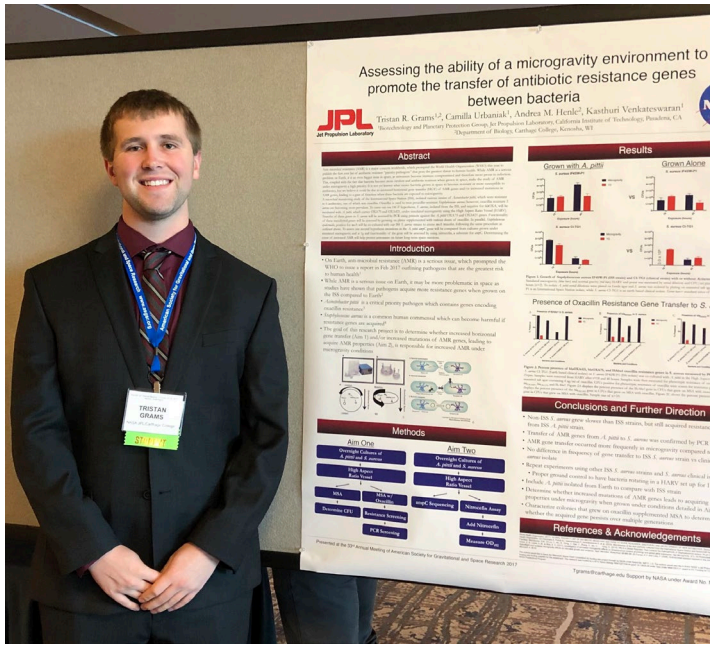


Part 2 - My background

- **2006** – B.A. in **biochemistry**, College of St. Benedict, MN
- **2012** – Ph.D. in biomedical sciences – **immunology** from Mayo Clinic
- **2015** – Completed post-doctoral research and teaching fellowship in **cancer biology** at MIT and SUTD (Singapore)

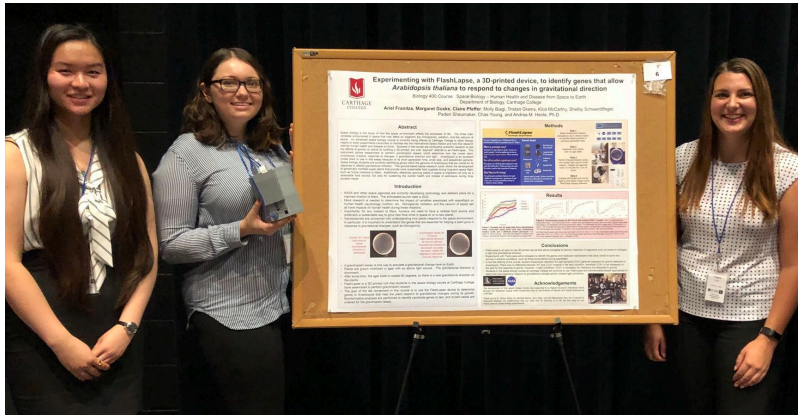
Discovering space biology

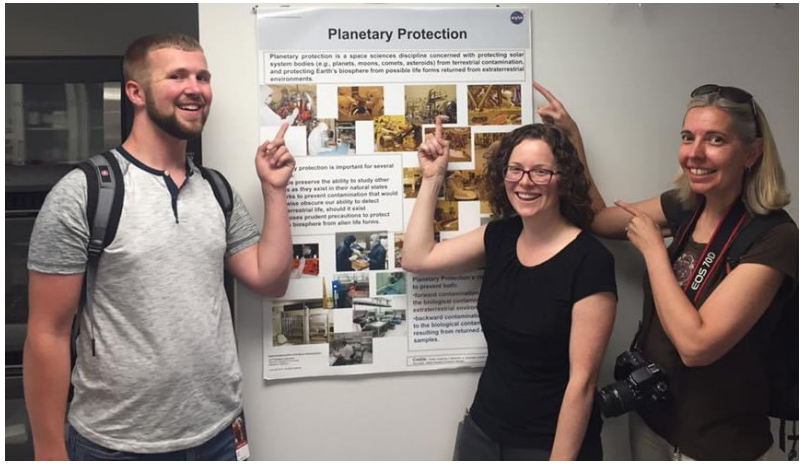
- **2013** – Visit to KSC visitor center while on vacation as a post-doctoral fellow
- **2015** – Join Carthage College as faculty
  - Host institution for Wisconsin Space Grant Consortium (WSGC)
- **2015** – Join American Society for Gravitational and Space Research (ASGSR) and attend annual meeting
- **2015, 2017, 2018, 2022** – WSGC Research Infrastructure and Higher Education Incentives grants
  - Student researchers at Carthage College
  - Teacher researchers from Kenosha Unified School District
- **2016** – collaborate with Dr. Venkat (JPL) to assess HEPA filter samples from ISS for bacteriophages (an extension of HHMI SEA-PHAGES Phage Hunters curriculum)



Discovering space biology

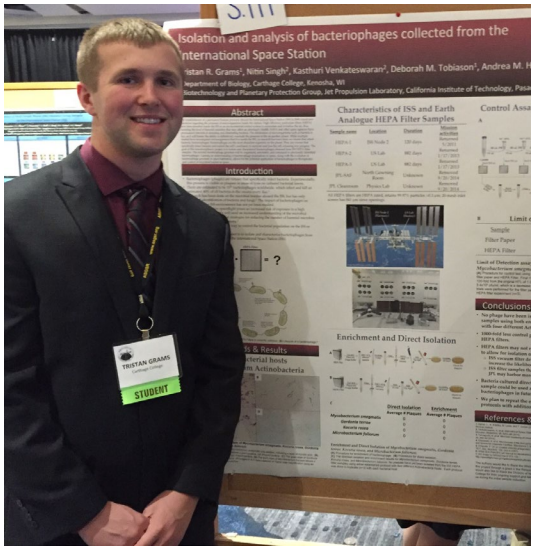
- **2017 - current** – collaborate with Dr. Simon Gilroy and Dr. Richard Barker (UW-Madison) on space bio education research projects
- **2018 and 2020** – undergraduate space biology course offered at Carthage
- **2020** – Thora Halsted Young Investigator Award from ASGSR
- **2021 - 2022** – cohort 2 of NASA-STAR program
- **2022** – B-SURE participant (NASA-funded program - TRISH)
- **2022 - current** – simulated µG research on zebrafish.
- **Mentoring students** – research opportunities, support seeking grants, applying for summer programs, graduate programs, space biology course, and attending conferences.

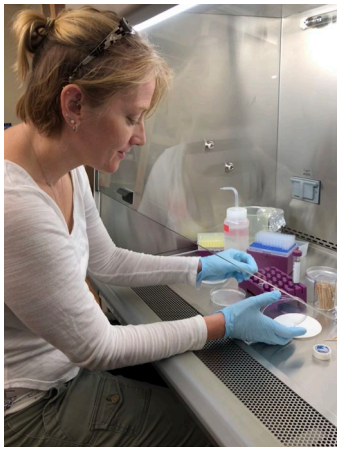




Acknowledgements

- **Wisconsin Space Grant Consortium**
- **NASA-STAR program**
- **NASA HRP TRISH B-SURE Program**
- **ASGSR**
  - Education & Outreach committee
- **Space Biology partners (guest lecturers)**
  - Dr. Danny Riley (Medical College of WI)
  - Drs. Simon Gilroy & Dr. Richard Barker (UW-Madison)
  - Dr. Martha Vitaterna (Northwestern)
  - Dr. Anna-Lisa Paul (University of FL)
  - Drs. Kasthuri Venkateswaran & Dr. Camilla Urbaniak (NASA JPL)
  - Dr. Joseph Tash (Univ. of Kansas Medical Center)
  - Dr. Kevin Crosby (Carthage)
- **Students enrolled in space biology in spring 2018 & 2020**
- CoSE Instruments & Cell Spinpod (research instrumentation)





Questions?


Space Biology Education
Resources and Speaker Database
https://spacebiology.carthage.edu
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