

School of Life Sciences Faculty Research Areas

Geomicrobiology

Dr. Aude Picard

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Expertise

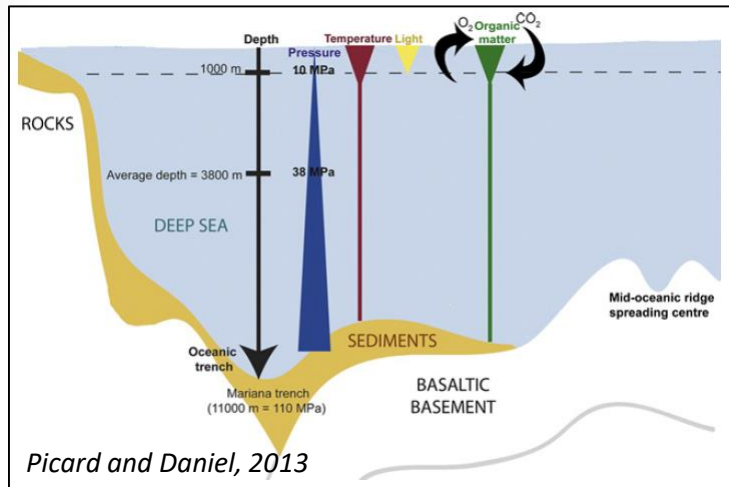
- Anaerobic microbiology
- Microbial physiology
- Biomineralization
- Astrobiology and biosignatures
- Microscopy & spectroscopy

Microbial life in extreme conditions

① Microbial life under high pressure

- What are the pressure limits for microbial life?

High-pressure environments represent the largest habitat for microbial life on Earth



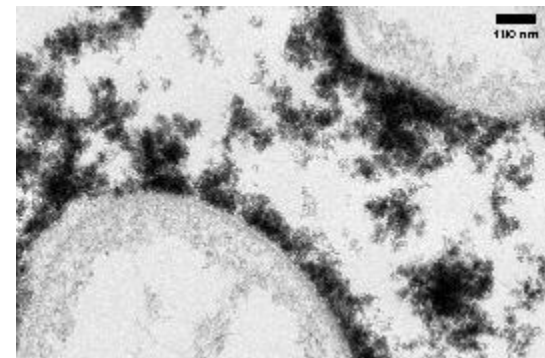
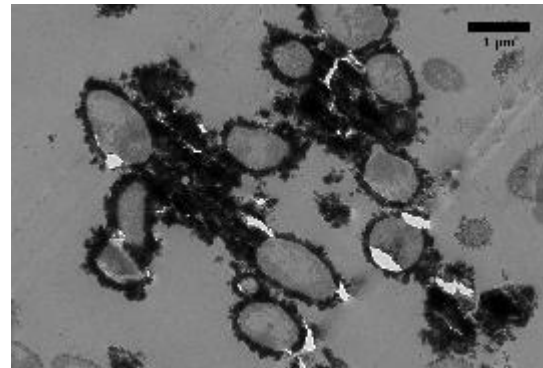
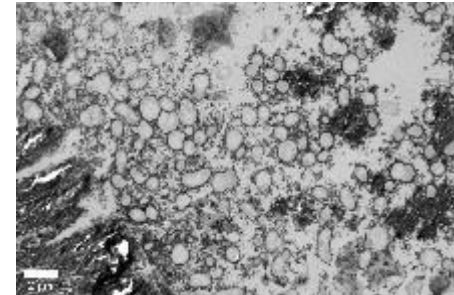
Oceans on icy moons (e.g. Europa) are potential habitats for microbial life in the outer Solar System



② Microbe-mineral interactions

- How do bacteria cope with mineral encrustation?
- Do minerals play a role in long-term survival of bacteria?

Transmission electron microscopy images of bacteria encrusted in iron sulfide minerals



Dryland microbes and soil ecology

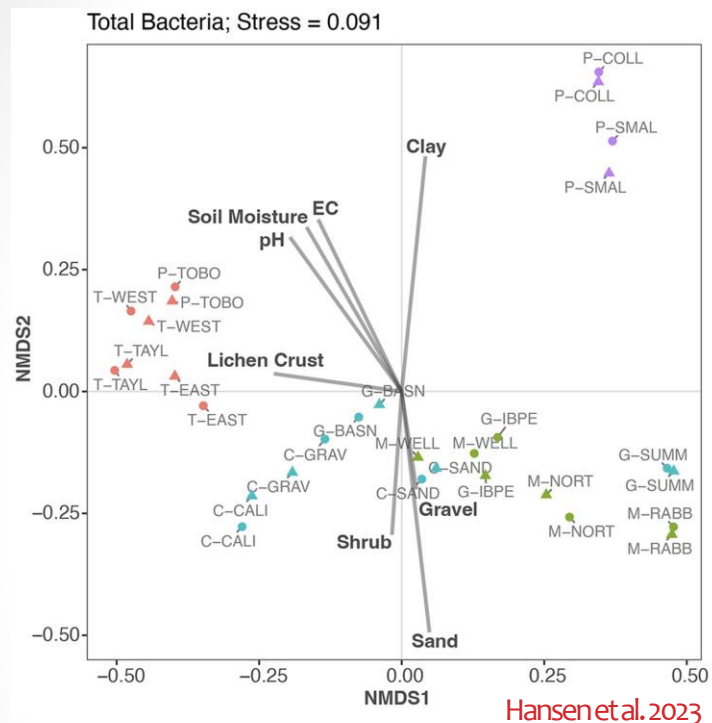
Dr. Nicole Pietrasiak

- Associate Professor of Sustainability in Arid Lands
- School of Life Sciences
- Email: nicole.pietrasiak@unlv.edu

Expertise

- Soil Microbiology and Ecology
- Biological Soil Crusts
- Phycology and Cyanobacteria/Algae Culture Collection
- Soil Science
- Dryland Ecology
- Biogeomorphology

In our lab we investigate what shapes the diversity, abundance, and distribution of desert microbes



Landscape and soil properties select for unique microbiomes



WHEN IS A LINEAGE A SPECIES? A CASE STUDY IN *MYXOCORYS* GEN. NOV. (SYNECHOCOCCALES: CYANOBACTERIA) WITH THE DESCRIPTION OF TWO NEW SPECIES FROM THE AMERICAS¹

Nicole Piatkowski²

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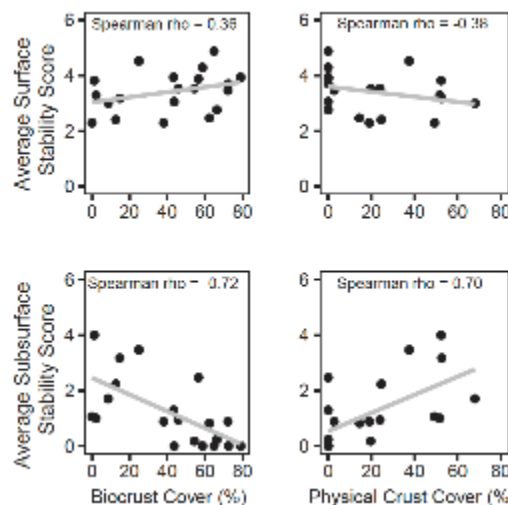
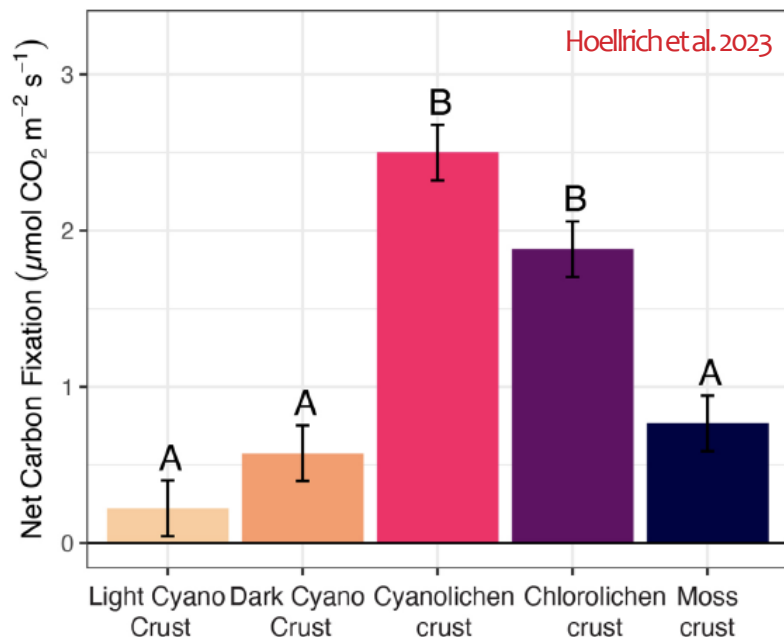
and Jeffrey R. Johansen

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We also describe species and genera new to science and society.

And we identify and quantify the roles microbes play in dryland ecosystem functioning and soil health



Microbes are part of our dryland biodiversity. They prevent soil loss, increase soil fertility, control nutrient cycling, and contribute to carbon sequestration.

Dryland microbes are crucial for maintaining sustainable arid lands.

Stovall et al. 2023

Behavioral & Evolutionary Genetics

Dr. Donald K. Price

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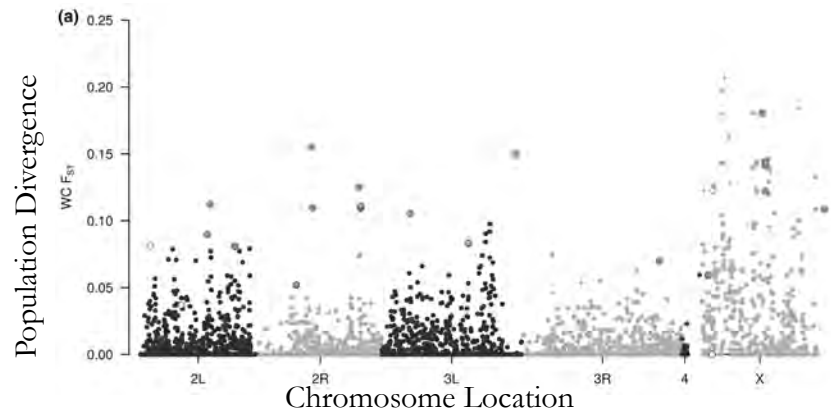
donald.price@unlv.edu

Expertise

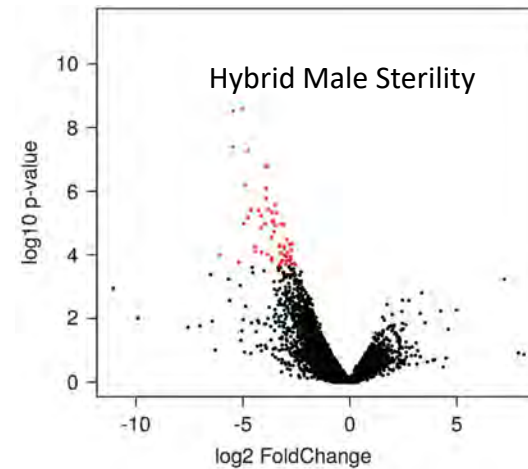
- **Behavioral Genetic Analysis**
- **Quantitative Genetics**
- **Genome-wide Gene Expression Analysis**
- **Adaptative Comparative Genomic Analysis**
- **Hawaiian Evolutionary Biology**
- **Biodiversity and Speciation**

Evolutionary Genetics

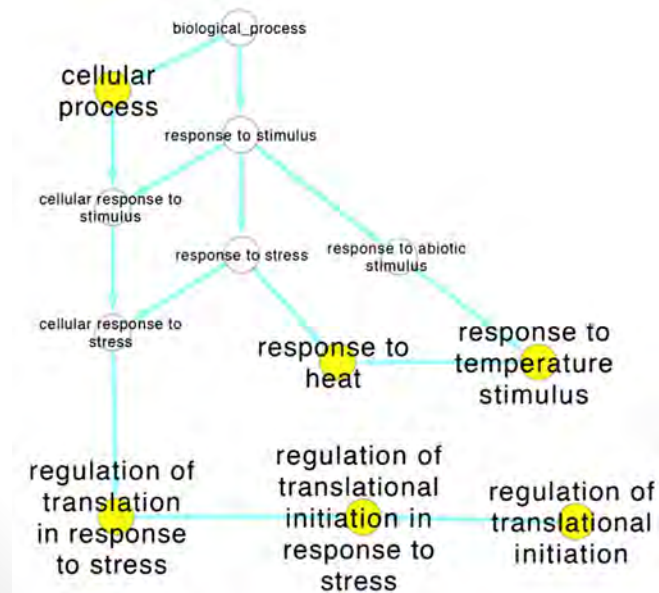
Population Genomic Analysis of Adaptation



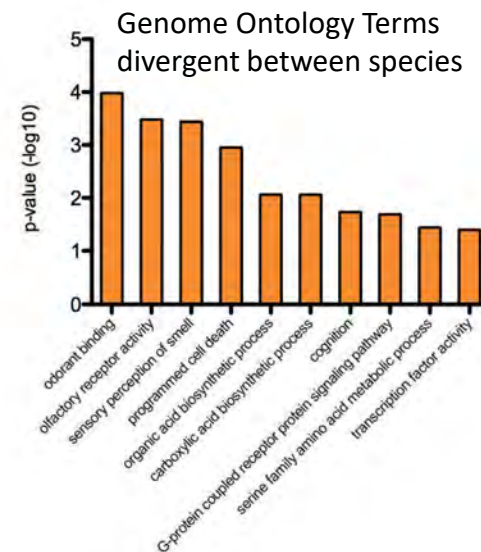
Genome-wide Gene Expression Analysis



Genomic Analysis of Physiological Adaptation



Comparative Genomic Analysis



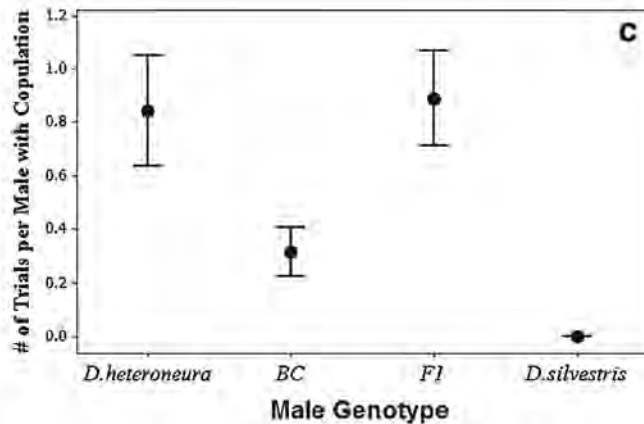
Behavioral Genetics

Hawaiian picture wing *Drosophila*

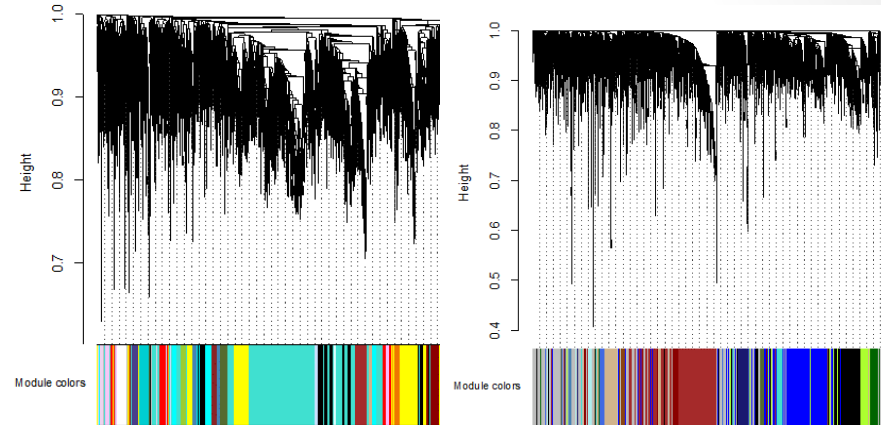


Hawaiian Islands

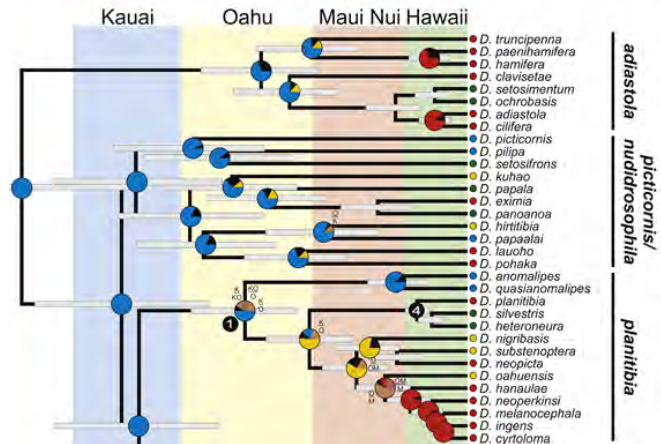
Behavioral Reproductive Isolation



Behavioral Gene Expression Correlation Networks



Hawaiian picture wing Phylogenetic Analysis



Extremophiles

Dr. James Raymond

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Expertise

Adaptations to cold environments

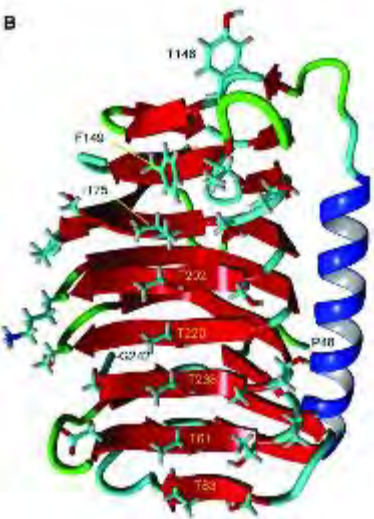
Snow algae

Ice-binding proteins

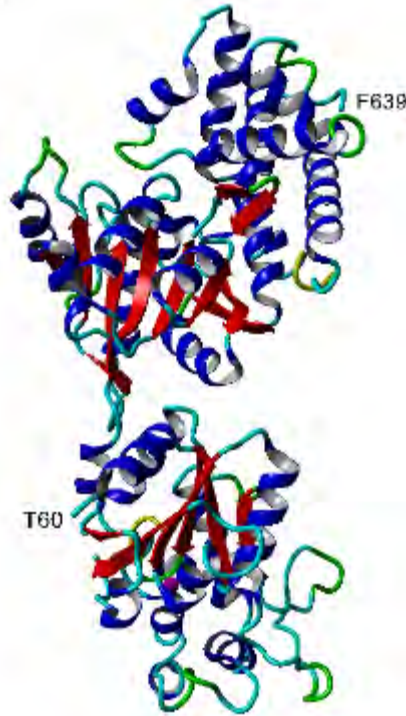
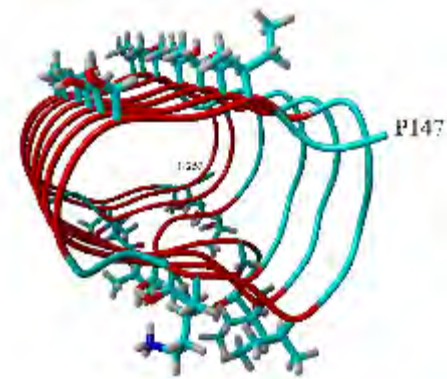
Horizontal gene transfer

Much of the Earth's surface is exposed to extreme conditions such as freezing, high temperature and hypersalinity.

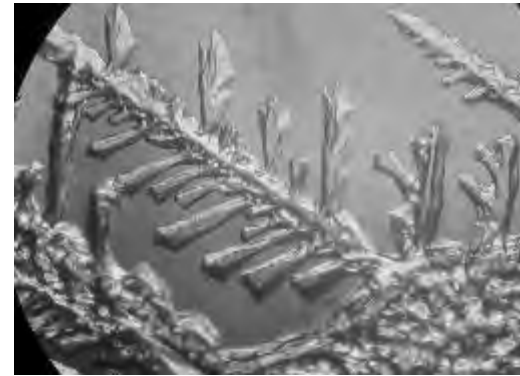
Organisms living in these regions have developed some remarkable adaptations that not only reveal the beauty of Nature, but also may have commercial applications (e.g., low-calorie ice cream) as well as provide clues to the presence of life in other worlds.



Ice-binding proteins.
Above, from a snow alga from the Austrian Alps.¹
Below, from a grass growing on the coast of the Arctic Ocean.²



An unusual enzyme found only in a few species of algae. This one is from an alga that lives in a saline lake in Antarctica. The alga uses the enzyme to make glycerol so that it can remain in osmotic equilibrium with the lake water.³



Demonstration of how many proteins produced by microorganisms affect the growth of ice by binding to its surface. Here, proteins from a polar cyanobacterium distort the growth of a growing ice crystal.

References

1. Raymond and Remias (2019)
2. Sformo and Raymond (2020) (Submitted)
3. Raymond, Morgan-Kiss and Stahl (2020) (Submitted)

Undergraduate Education

Kurt M. Regner, Ph.D.

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Expertise

Plant Pathology

Microbiology education

Active learning

Problem-based learning

Undergraduate Research Programs

Classroom based research experiences

<https://www.unlv.edu/lifesciences/moereu>

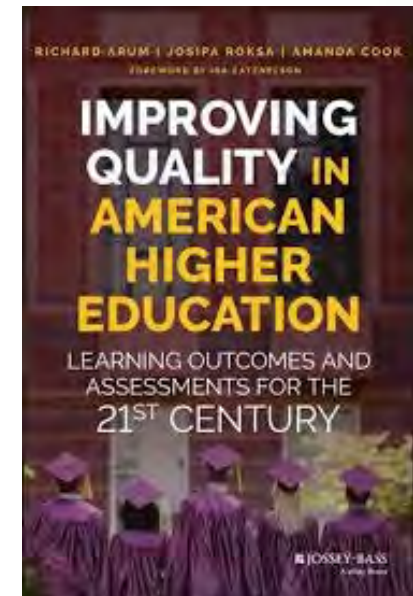
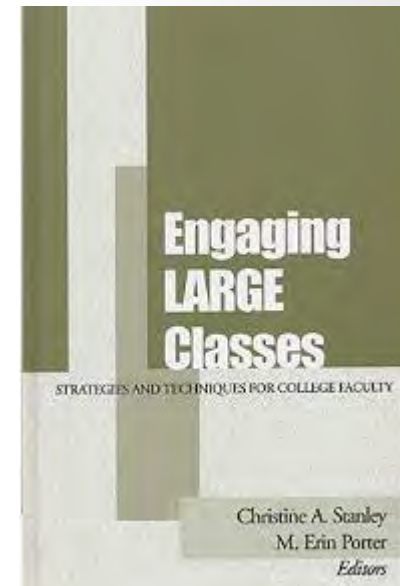


Teaching Approach

Challenge the students to take responsibility for their learning

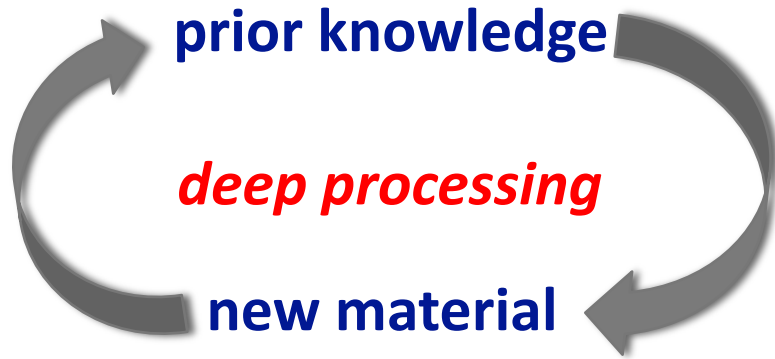
Professor's responsibilities

- Integrate concepts
- Explain the relevance
- Manage content
- Provide resources
- Evidence-based practices
- Active and engaging lectures
- Implement a variety of assessment
- Provide timely feedback
- Treat the students with respect
- Fosters Educational Equity



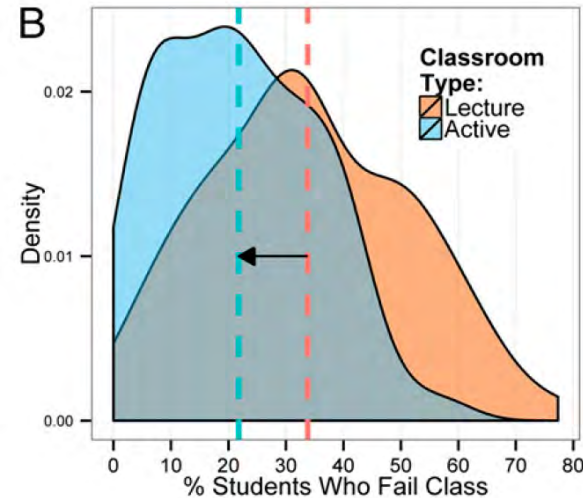
Active Learning

Writing, thinking and discussion in class



Low stakes methods

- Discussions
- Minute Paper
- Murkiest Point
- Draw and Explain
- Class Participation
- Think Pair and Share



- Meta-analysis of 225 studies
- Active learning improved exam scores by 6.0%
- Active learning resulted in increases of a half grade: C- to C
- Students were 1.5x more likely to fail in traditional lectures

Tanner, K.D., 2013. Structure matters: twenty-one teaching strategies to promote student engagement and cultivate classroom equity. CBE-Life Sciences Education 12(3):322-331

Freeman, S., et al. 2014. Active learning increases student performance in science, engineering, and mathematics. PNAS 111(23):8410-8415

Biol 207 Phage Discovery (4 cr)

Bacteriophage biology is used as a model to introduce science students to the process of science, developing communication / collaboration skills and employing quantitative reasoning.

Course-based Research Experience

- Attracts students to STEM careers
- Improves freshman retention and graduation
- Largest gains are from students traditionally underrepresented in science

US needs 1 million STEM graduates for a competitive global economy

Research Experiences for Undergraduates

Mechanisms of Evolution

- 10-wk summer research internship
- Research opportunities for students underrepresented in science
- Professional development activities
- Raise public awareness of evolution as a critical component of science literacy
- Enhance UNLV research infrastructure

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