Life and Environment

Life in Extreme Conditions Research

UNLV | COLLEGE OF SCIENCES

Paleohydrology & Extreme Events

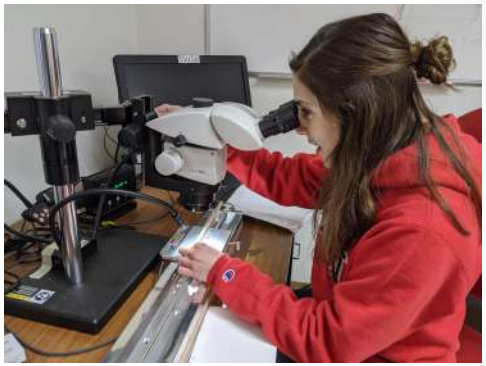
Bethany L. Coulthard
Assistant Professor
Department of Geoscience
bethany.coulthard@unlv.edu

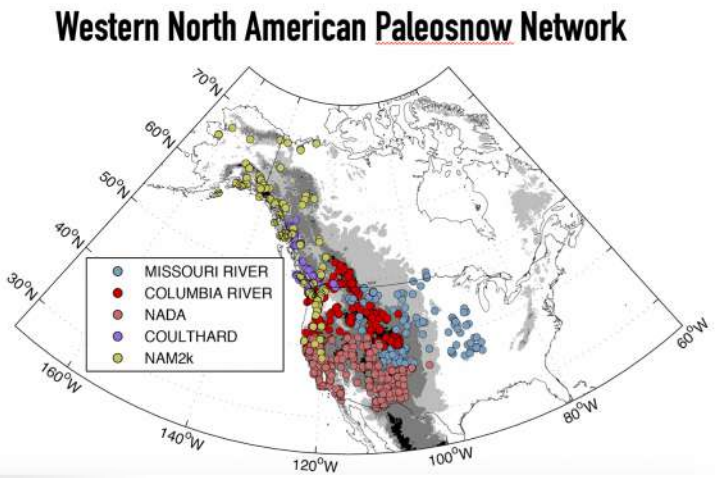
HYTRAC Lab
Hydrology Tree Rings & Climate

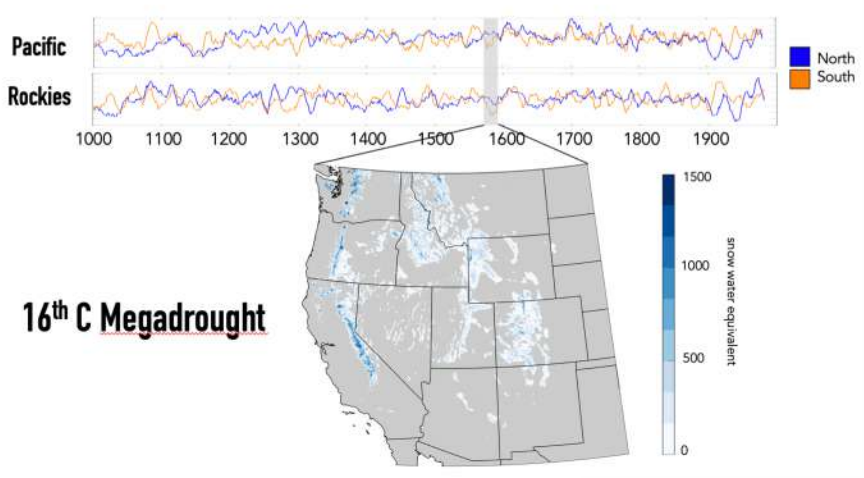
UNLV | COLLEGE OF SCIENCES

Using tree rings to study the influence of climate change on global water cycles relevant to human populations and ecosystems, with an emphasis on freshwater runoff, snowpacks, and forest hydrology.

- Examination of past and future snow droughts across the western North American cordilleras.
- Reconstructing extreme (flood/drought) events in the Fraser Basin, BC, Canada.







Environmental Biology Research

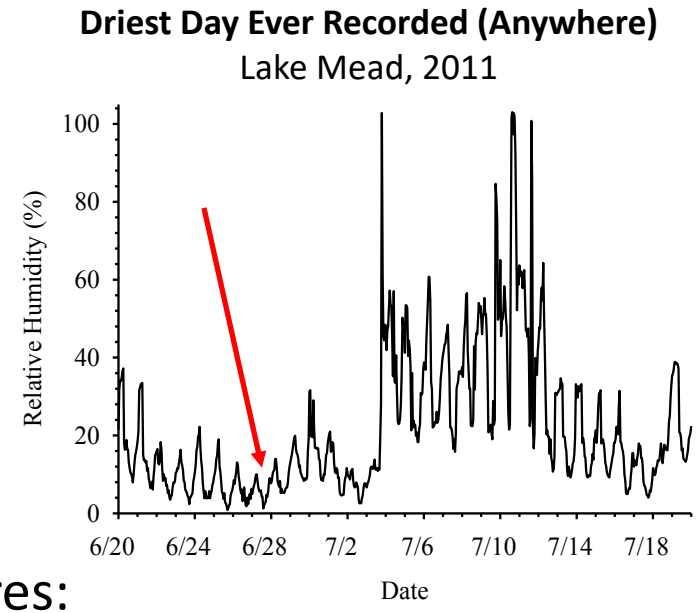
Dr. Allen G. Gibbs
Professor
School of Life Sciences
Phone: 702-895-3203
Email: allen.gibbs@unlv.edu

Expertise

- Environmental physiology
- Insect physiology
- Experimental evolution

Environmental Physiology of Desert Invertebrates

Adaption to water stress:

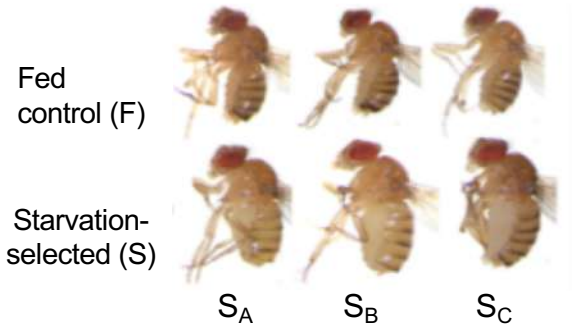


Adaptation to high temperatures:

Experimental Evolution Research Using Fruit Flies

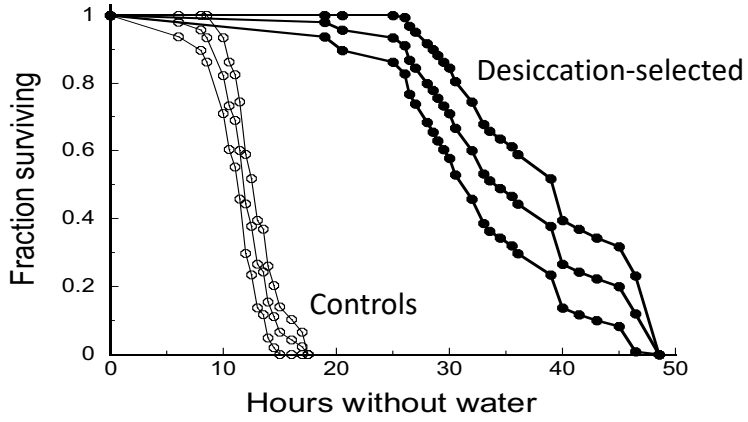
Starvation resistance:

- a fly model for obesity



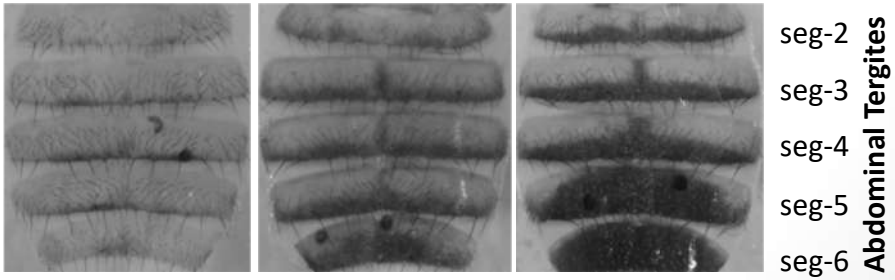
Desiccation resistance:

- understanding responses to desertification



Pigmentation:

- phenotypic correlations of melanization



Astrobiology and Geomicrobiology

Dr. Elisabeth Hausrath
Associate Professor
Department of Geoscience
Phone: 702-895-1134
Email: Elisabeth.Hausrath@unlv.edu

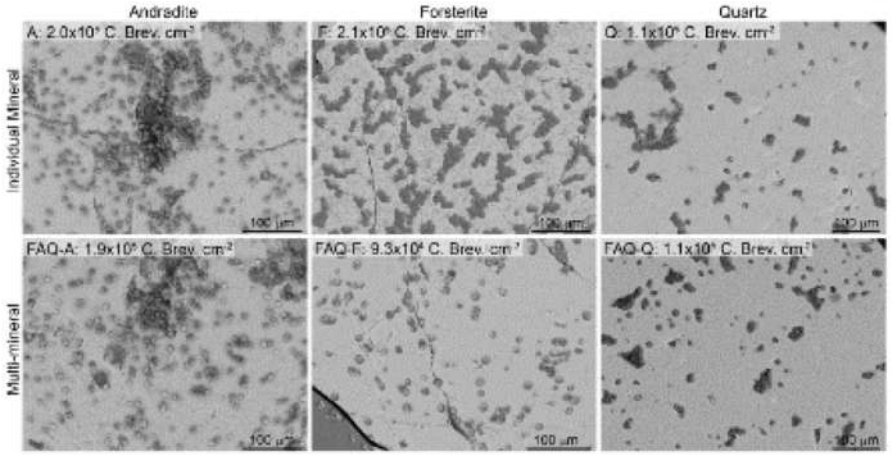
Expertise

- Geomicrobiology
- Biological impacts on water-rock interactions
- Astrobiology

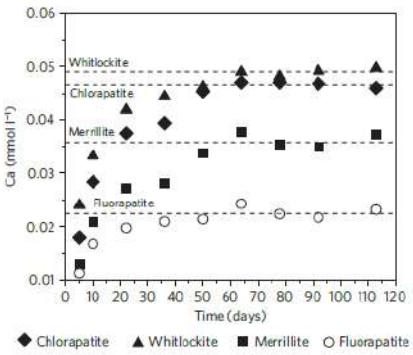
UNLV | COLLEGE OF SCIENCES

Biological Impacts on water-rock interactions

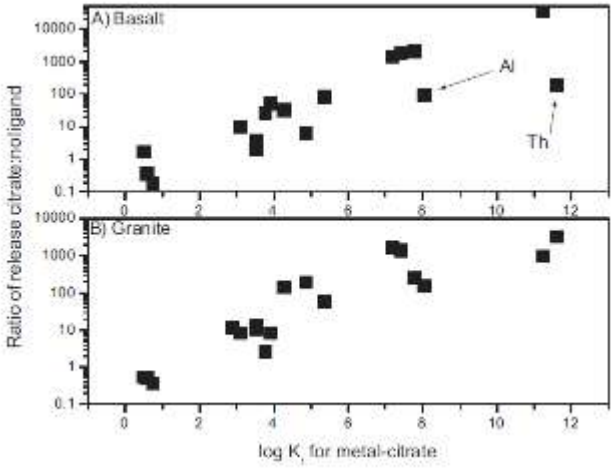
Field studies (e.g. Baumeister et al., 2014)



Laboratory studies (e.g. Phillips-Lander et al., 2020)



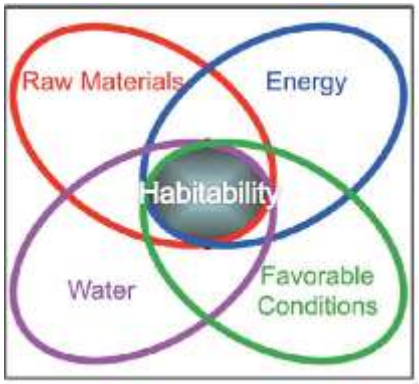
Nutrient release (e.g. Adcock et al.., 2013)



Signatures of biological alteration (e.g. Hausrath et al., 2009)

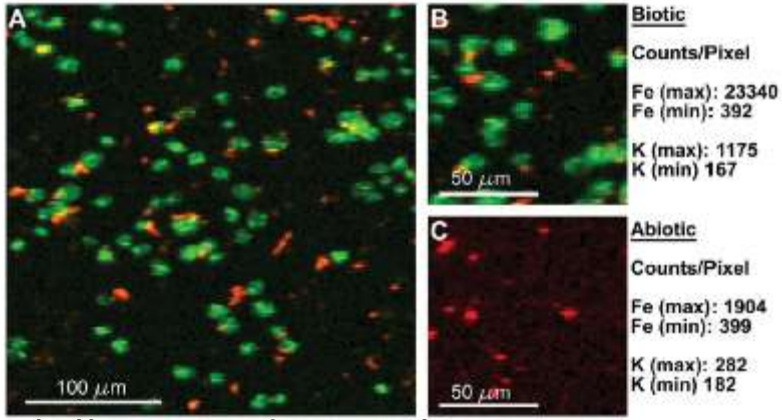
Astrobiology

Habitability



Hays et al., 2017

Potential biosignatures



Phillips-Lander et al., 2020

Mars 2020 and Mars Sample Return

NASA.gov

Dr. Allyson Hindle

Assistant Professor

School of Life Sciences

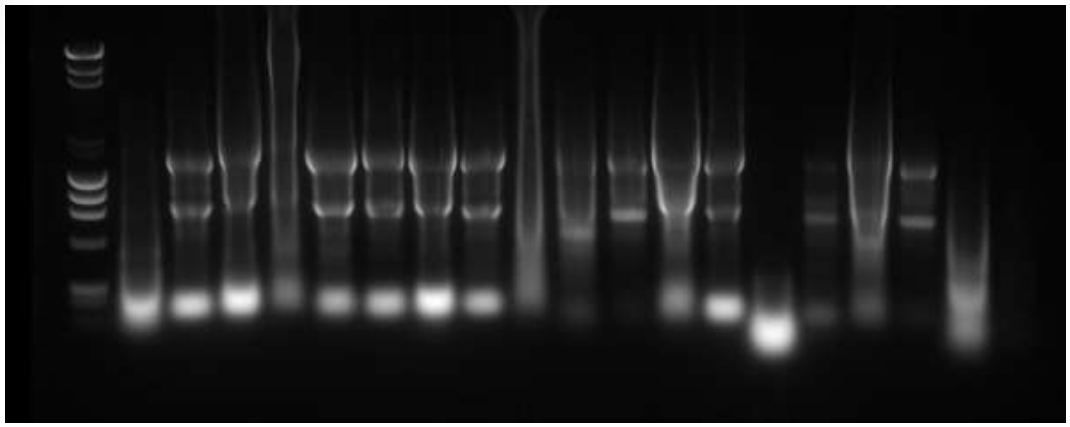
Phone: 702-895-4521

Email: allyson.hindle@unlv.edu

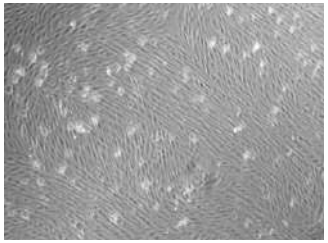
Expertise

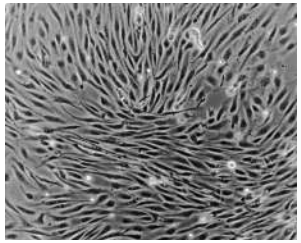
- Molecular mechanisms of hypoxia tolerance in hibernating and diving mammals
- Cardiovascular and blood pressure regulation
- Comparative genomics, biomarker discovery and bioinformatics
- Cell line resource development for non-model systems

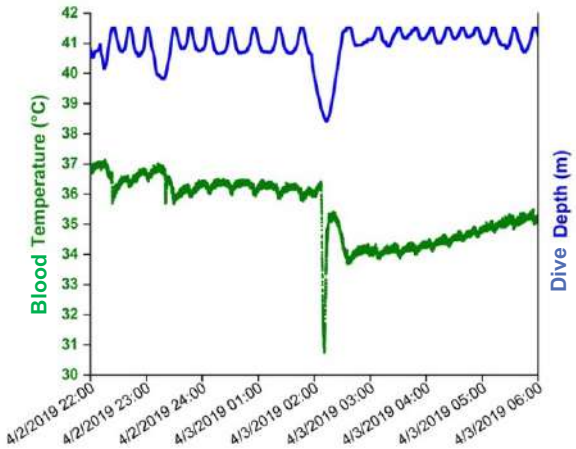
Cardiovascular protection of deep divers

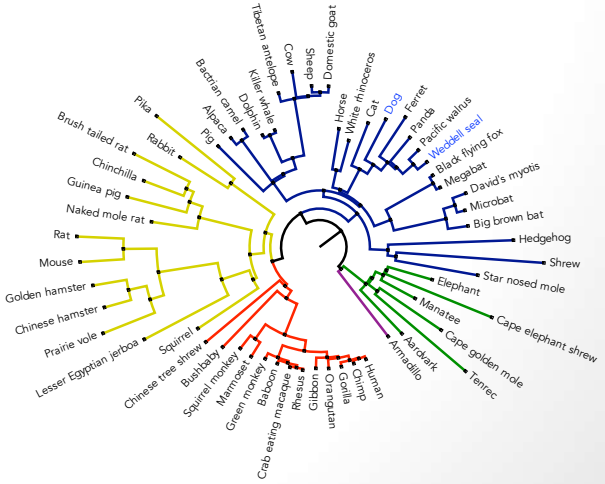


```
                                ****:****  *: ***:*****:*****:* **:: *******:**
SSAQEMFTYICNHIKYATNRGNLRSAITVFPQRAPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNGRFDV
SSAQEMFTYICNHIKYATNRGNLRSAITVFPQRAPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNSRFDV
NSAQEMFTYICNHIKYATNRGNLRSAITVFPQRAPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNGRFDV
SSAQEMFTYICNHIKYATNRGNLRSAITVFPQRAPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNGRFDV
SSAQEMFTYICNHIKYATNRGNLRSAITVFPQRASGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNGRFDV
SSAQEMFTCICNHIKYATNRGNLRSAITVFPQRTPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCVQHGWTPGNGRFDV
RSAQEMFTYICNHIKYATNRGNLRSAITVFPQRCPGRGDFRIWNSQLVRYAGYRQQDGSVRGDPANVEITELCIQHGWTPGNGRFDV
----------------------SAITIFPQRTDGKHDFRVWNSQLIRYAGYKQPDGTILGDPANVEFTETPAAP----------
....220.......230.......240.......250.......260.......270.......280.......290.......300
```

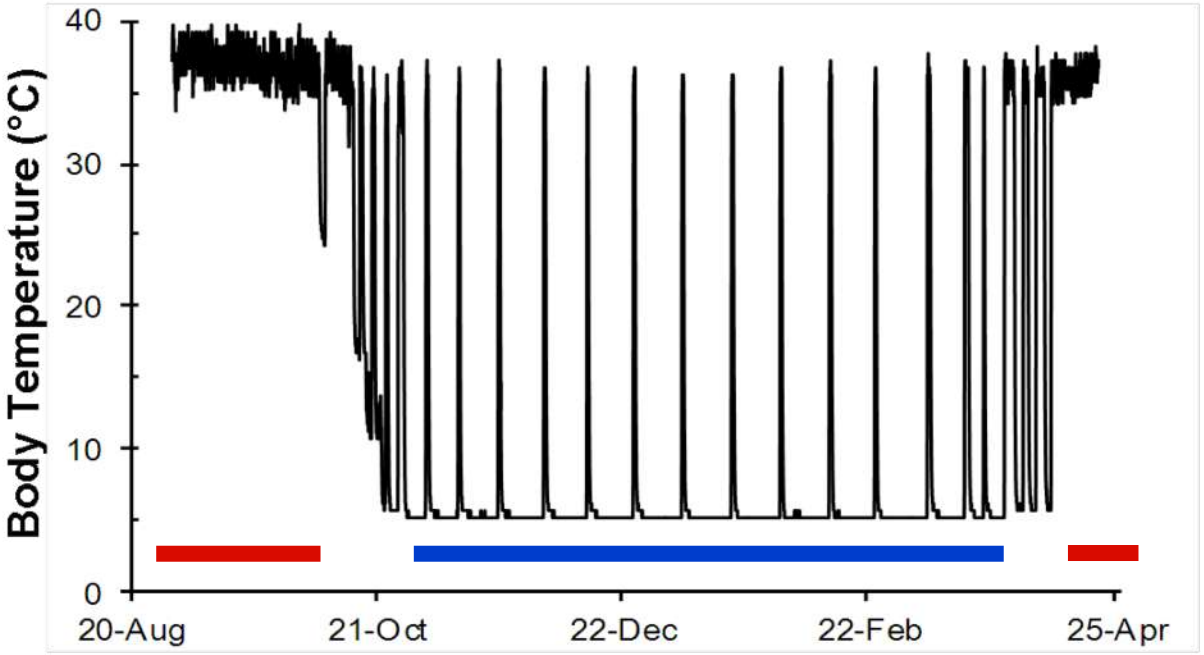






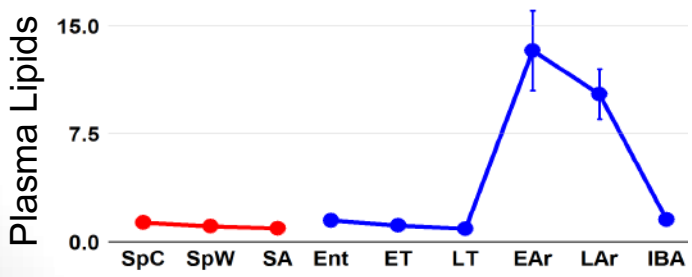


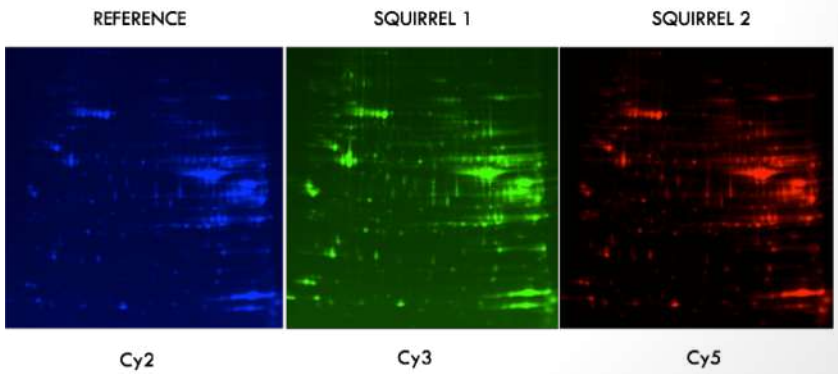
Metabolic control of small hibernators



SUMMER

WINTER





Geomicrobiology

Dr. Aude Picard

Assistant Research Professor

School of Life Sciences

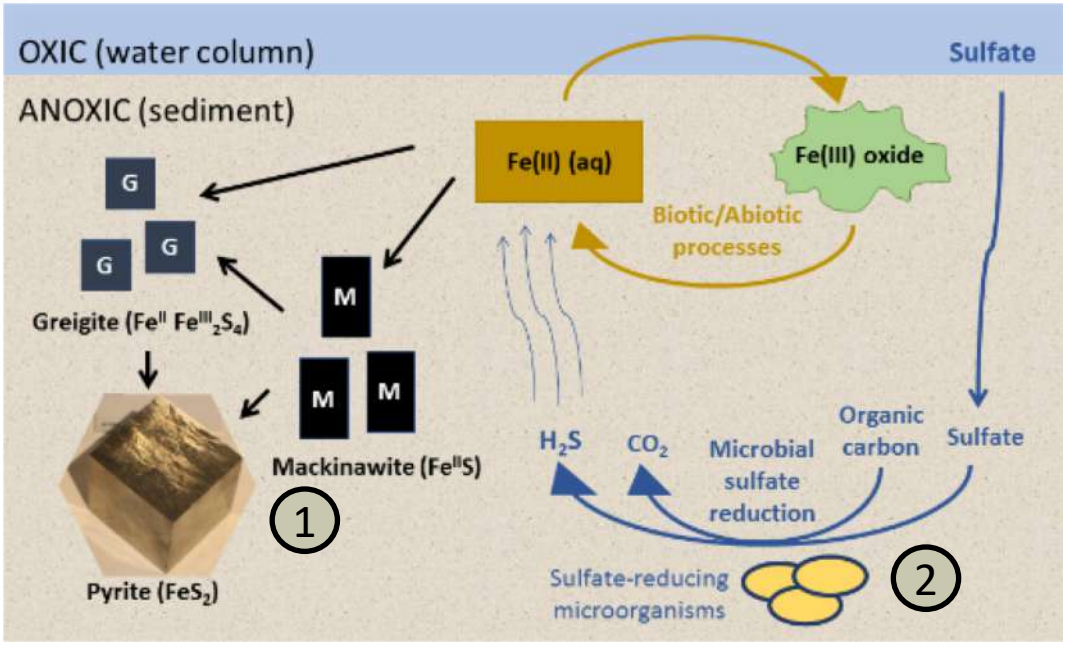
audeamelie.picard@unlv.edu

Expertise

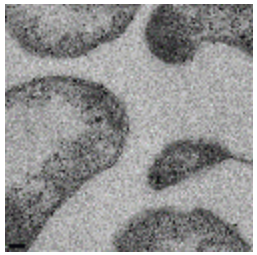
- Anaerobic microbiology
- Biomineralization
- Astrobiology and biosignatures
- Microscopy & spectroscopy

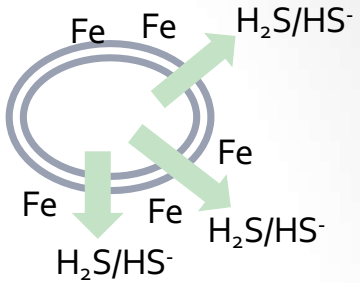
Biogeochemistry of Fe, S and C in anoxic environments

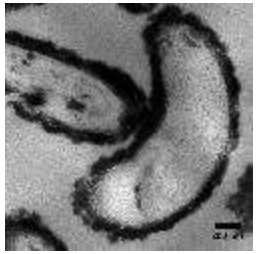
Iron sulfide mineral formation in anoxic environments



2 Microbe-mineral interactions in anoxic environments



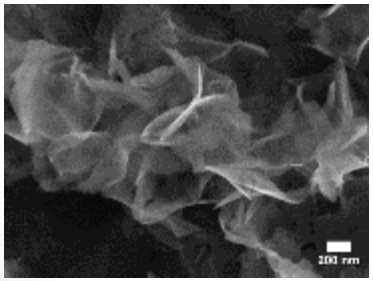




Bacteria become encrusted in Fe-rich environments

- Do minerals play a role in the physiology of bacteria?
- How do bacteria cope with mineral encrustation?

1 Properties of biominerals



Minerals produced with microorganisms have unique physical and chemical properties

- What is the reactivity of biominerals?
- What are the applications of biominerals?

3 Can we use biominerals for the search of life on Mars?

Credits: NASA/JPL-Caltech/MSSS

- Are properties of biominerals unique enough to record life in anoxic environments?

Extremophiles

Dr. James Raymond

Adjunct Research Professor

School of Life Sciences

Phone: 702-895-3268

Email: raymond@unlv.nevada.edu

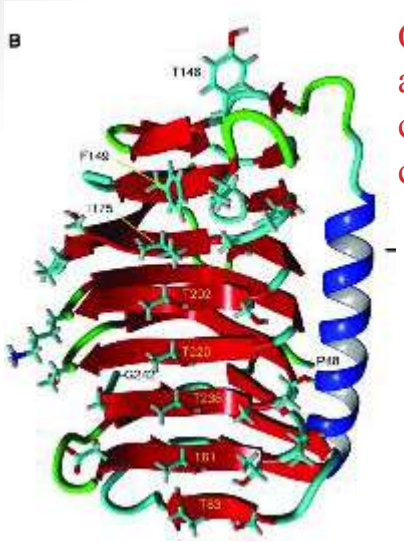
Expertise

- Adaptations to cold environments
- Snow algae
- Ice-binding proteins
- Horizontal gene transfer

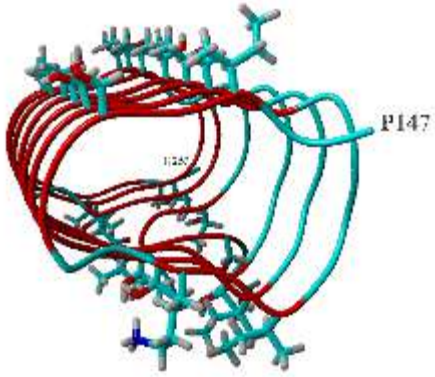
UNLV | COLLEGE OF SCIENCES

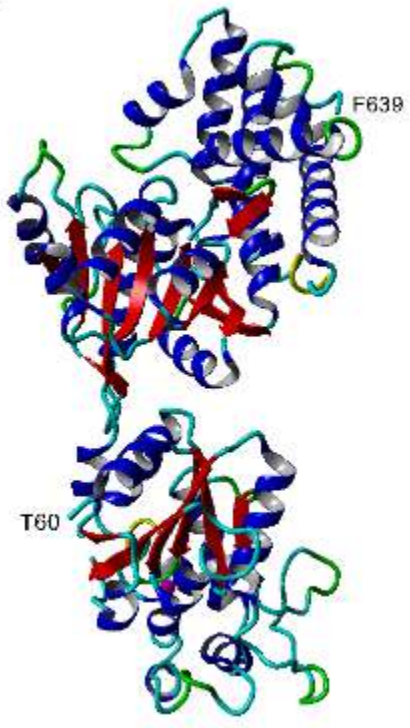
Much of the Earth's surface is exposed to extreme conditions such as freezing, high temperature and hypersalinity.

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.

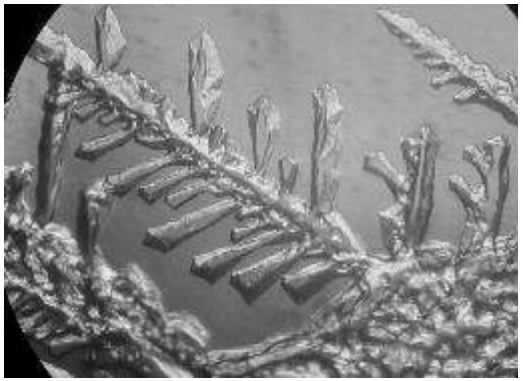


Ice-binding proteins. Above, from a snow alga from the Austrian Alps.[1] Below, from a grass growing on the coast of the Arctic Ocean.[2]





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)

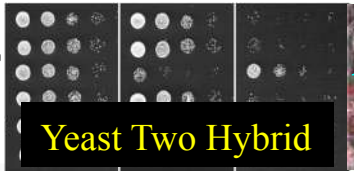
UNLV | COLLEGE OF SCIENCES

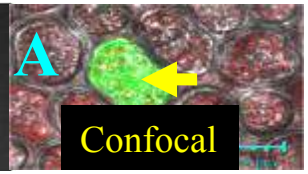
Dr. Jeffery Shen
Professor,
School of Life Sciences
Phone: 702-895-4704
Email: jeffery.shen@unlv.edu

Expertise

- Big Data Analysis to Study Biology, Agriculture and Medicine
- Molecular Mechanisms Controlling Plant Responses to Drought Heat, and Salinity
- Seed Germination, Tissue Culture and Plant Transformation
- Molecular Basis of Leukemia (in collaboration with Dr. J. Cheng at the University of Chicago Medical School)
- Nutrition of Cereal Crops (in collaboration with Dr. Christine Bergman, Ph.D. and R.D. at UNLV)

Molecular Basis of Drought Stress Responses and Seed Germination





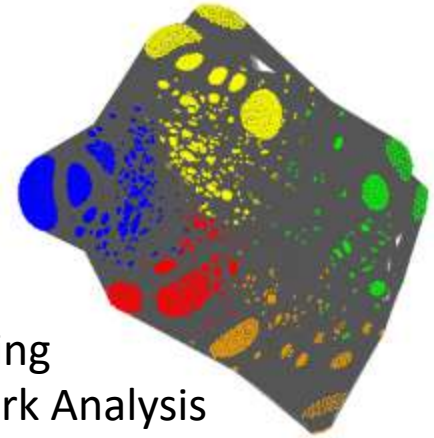
BMC Genomics, 2016, 17:102
Plant Science, 2015, 236:214-222
Front. Plant Science,2015; 6: 1145
Trends in Plant Sci, 2010, 15: 247

Short Read Assembly Algorithm

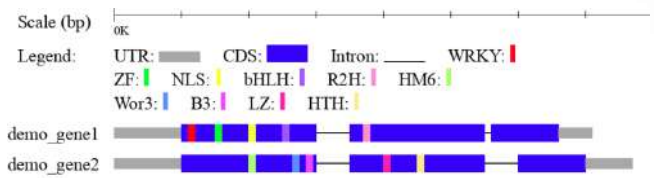
for Genome and Transcriptome Analysis

http://shenlab.sols.unlv.edu/shenlab/software/Tiling_Assembly/tiling_assembly.html

DNA Research, 2015, 22: 319-329
Genomics, 2014, 103:122-134



Signaling network Analysis



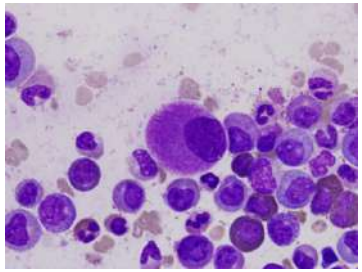
Promoter and Coding Region Structures

http://shenlab.sols.unlv.edu/shenlab/software/TSD/transcript_display.html

Bioinformatics, 2016, 32:2024-2025
Plant Cell Environ. 2017, 40:2004-2016

Molecular Basis of Leukemia

(in collaboration with Medical School, University of Chicago)



Cytogenetically normal refractory cytopenia with multilineage dysplasia (CN-RCMD)

Nature Communications, 2018, 9:1163
Leukemia, 2013, 27: 1291-1300

STEM Education Research

Dr. Jenifer C. Utz

Associate Professor in Residence

School of Life Sciences

Phone: 702-895-3386

Email: jenifer.utz@unlv.edu

Expertise

- Undergraduate STEM education
- Digital learning resources
- Mammalian hibernation

UNLV | COLLEGE OF SCIENCES

Facilitating academic achievement for a diverse undergraduate population

- Effects of self-testing:

Voluntary Web-Based Self-Assessment Quiz Use is Associated With Improved Exam Performance, Especially for Learners with Low Prior Knowledge

Jenifer C. Utz, PhD[1] and Matthew L. Bernacki, PhD[2]
[1]School of Life Sciences, College of Sciences, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154
[2]Learning Analytics Initiative, College of Education, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154
jenifer.utz@unlv.edu, matt.bernacki@unlv.edu

Abstract
This study examined students' voluntary use of digital self-assessment quizzes as a resource for learning in a large anatomy and physiology lecture course. Students (n = 238) could use 16 chapter quizzes and four analogous unit quizzes to rehearse and self-assess knowledge. Most students (75%) engaged in occasional use of self-assessment quiz items; repeated use was uncommon (12%), as was lack of use (13%). Exam performance differed between quiz use groups. Quiz use improved exam performance more among students who entered the course with low prior knowledge of concepts from the prerequisite course. Cumulatively for all students and all exams, repeated self-assessment quiz users significantly outperformed occasional users (+7.5%) and non-users (+11.9%) on course exams. Incorporation of optional learning resources can enhance the learning success of students.

- Effects of skill training:

American Psychological Association
Journal of Educational Psychology
© 2019 American Psychological Association
ISSN: 0022-0663
2020, Vol. 112, No. 4, 765–781
http://dx.doi.org/10.1037/edu0000405

Can a Brief, Digital Skill Training Intervention Help Undergraduates "Learn to Learn" and Improve Their STEM Achievement?

Matthew L. Bernacki
University of North Carolina, Chapel Hill

Lucie Vosicka and Jenifer C. Utz
University of Nevada, Las Vegas

Students who drop out of their science, technology, engineering, and math (STEM) majors commonly report that they lack skills critical to STEM learning and career pursuits. Many training programs exist to develop students' learning skills and they typically achieve small to medium effects on behaviors and performance. However, these programs require large investments of students' and instructors' time and effort, which limits their applicability to large lecture course formats commonly employed in early undergraduate STEM coursework. This study examined whether brief, digital training modules designed to help students apply learning strategies and self-regulated learning principles effectively in their STEM courses can impact students' behaviors and performance in a large biology lecture course. Results indicate that a 2-hr *Science of Learning to Learn* training had significant effects on students' use of

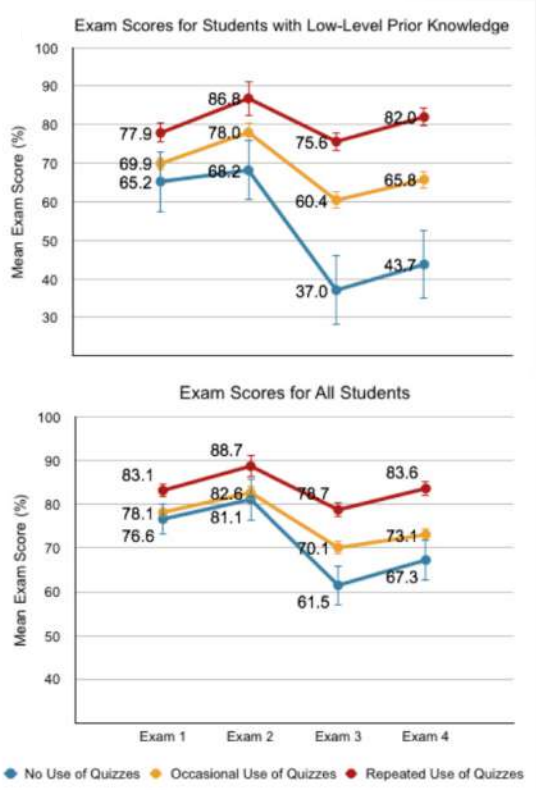


Figure 3. Effect of Self-Assessment Quiz Use on Exam Performance Symbols represent means ± standard error of the mean.

UNLV | COLLEGE OF SCIENCES

Developing the Skill and Will to Succeed in STEM Scholarship Program

A primary goal of this scholarship program is to diversify and increase the number of students entering STEM professions

- The School of Life Sciences welcomed the first cohort of 17 Succeed in STEM Scholarship recipients in 2019
- Over $420,000 of scholarship support will be distributed across the lifetime of this 5-year program

UNLV | COLLEGE OF SCIENCES

Hibernation physiology

- Rewarming from torpor:

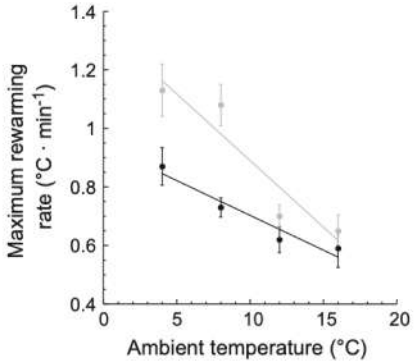


Fig. 3. Effect of ambient temperature on maximum rate of rewarming for natural and prematurely induced arousal from torpor. Symbols represent means ± SE for natural (black) and induced (gray) arousal; $n = 5$. There is a significant effect of T_a on the maximum rate of rewarming for both natural and induced arousals, $p < 0.05$, $r^2 = 0.93$, $r^2 = 0.88$ respectively. There is a significant effect of arousal type on the maximum rate of rewarming, $p < 0.05$.

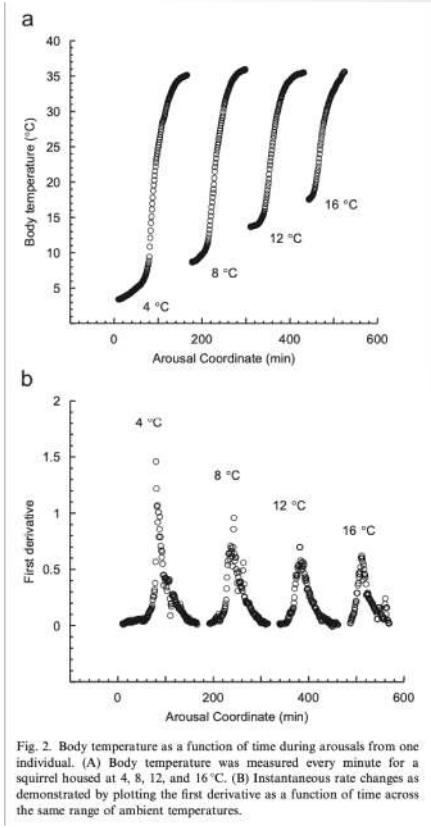
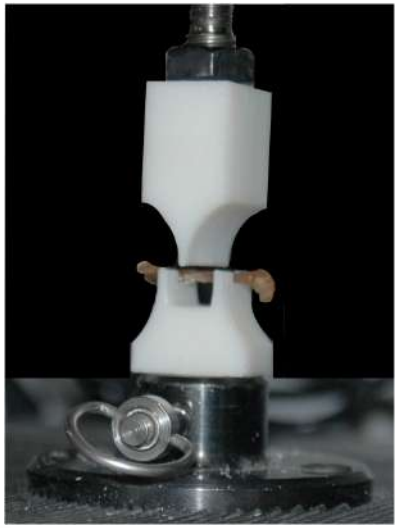
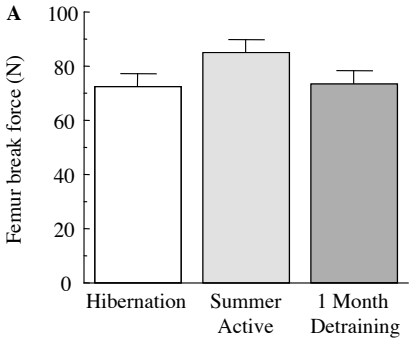
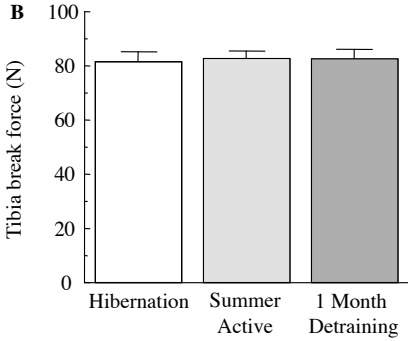


Fig. 2. Body temperature as a function of time during arousals from one individual. (A) Body temperature was measured every minute for a squirrel housed at 4, 8, 12, and 16 °C. (B) Instantaneous rate changes as demonstrated by plotting the first derivative as a function of time across the same range of ambient temperatures.

- Resistance to bone disuse atrophy:







UNLV | COLLEGE OF SCIENCES

School of Life Sciences

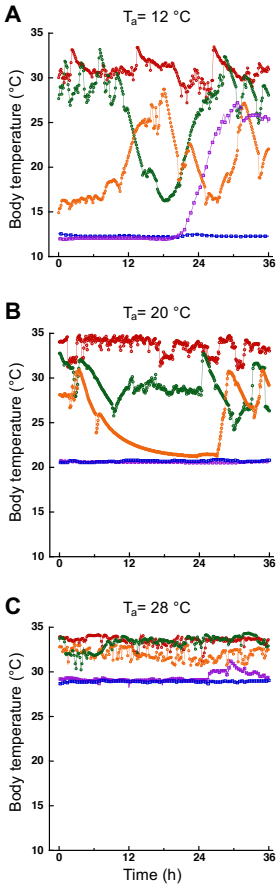
Dr. Frank van Breukelen
Professor and Director
School of Life Sciences
Phone: 702-895-3944
Email: frank.vanbreukelen@unlv.edu

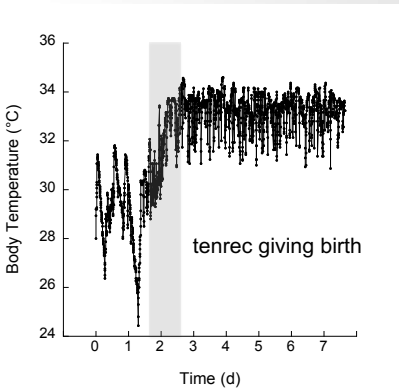
Expertise

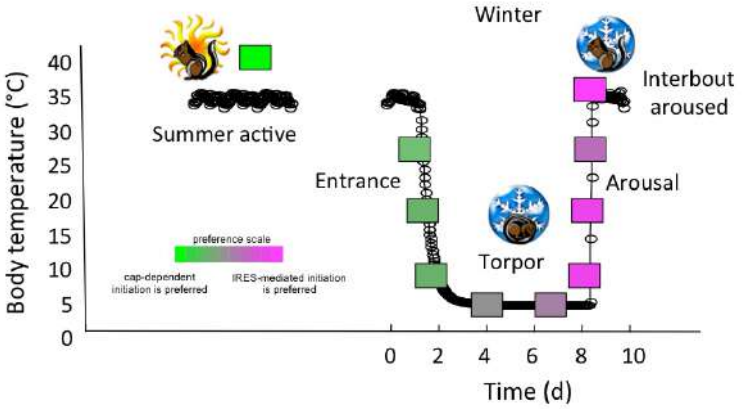
- Metabolic depressions like mammalian hibernation
- Life in extreme environments

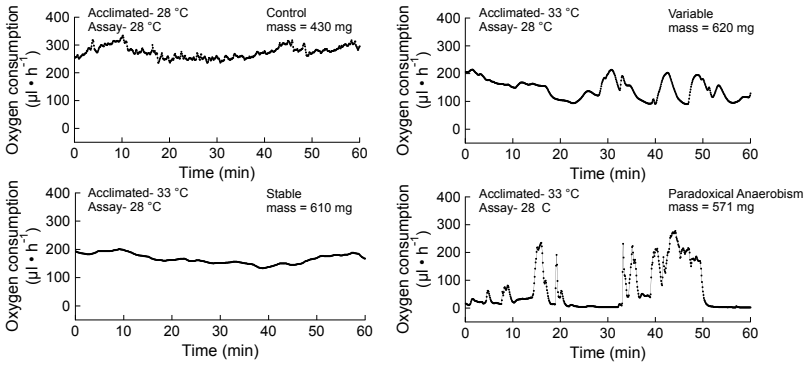
Areas of research

- Hibernation in tenrecs and ground squirrels
- Paradoxical anaerobism in pupfish
- We use a variety of approaches from whole animal physiology to biochemistry to understand how animals live in extreme environments









UNLV | COLLEGE OF SCIENCES