School of Life Sciences Faculty Research Areas

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Wildfire, Conservation, and Restoration Ecology Research

Dr. Scott Abella

Associate Professor

School of Life Sciences

Email: scott.abella@unlv.edu

Websites: https://www.unlv.edu/people/scott-abella

https://abellaappliedecologylab.wordpress.com/home/

Expertise

- Fire ecology
- Restoration ecology
- Ecological conservation practices
- Forest health

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We perform fire ecology research that assists local and national wildland fire management efforts in changing environments

UNLV biology students implementing post-fire habitat restoration research

Before-after wildfire in Red Rock Canyon National Conservation Area, just outside Las Vegas. We study fire effects, fuel management, and restoration strategies.

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Cellular Neurophysiology Lab

Dr. Darrin Brager

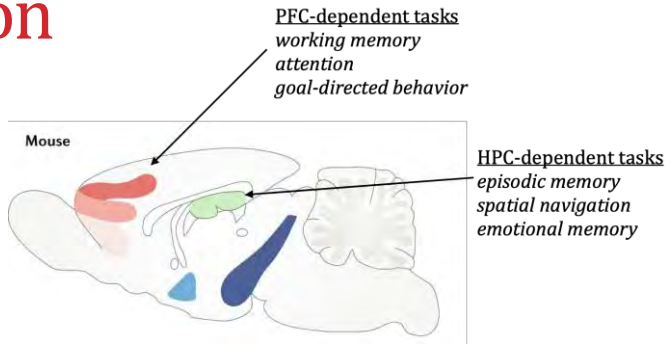
- Assistant Professor
- School of Life Sciences
- Email: darrin.brager@unlv.edu

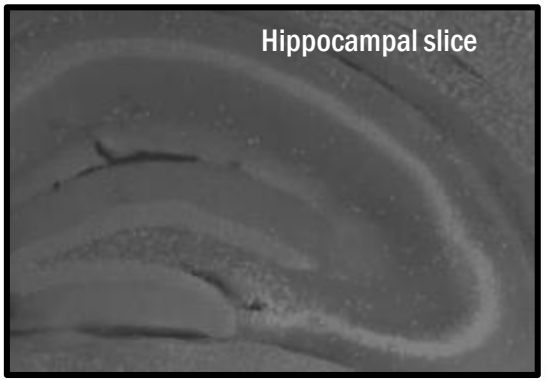
Expertise

- Whole-cell and patch clamp recording
- Synaptic transmission and plasticity
- Imaging and optogenetic investigation of neural circuits

Models of neurological dysfunction

- Our lab is interested in the cellular and molecular mechanisms of brain function. Our research seeks to establish a mechanistic link between pathological neuron function, with an emphasis on voltage-gated ion channels, and behavioral phenotypes.
- Our research includes the neuronal pathophysiology in rodent models of neurological disease – including Fragile X syndrome, temporal lobe epilepsy, depression, and tuberosclerosis.





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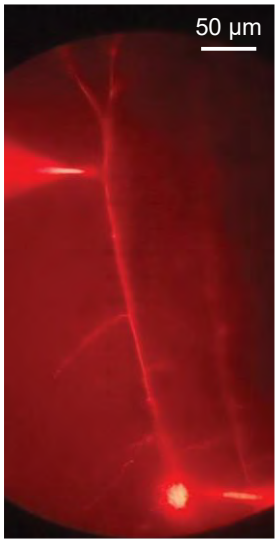
Studying the nervous system at the cellular level

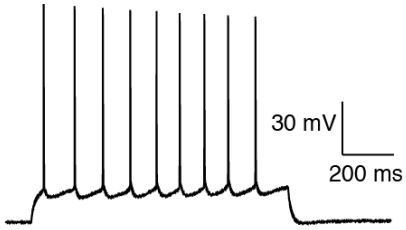
We employ a broad array of approaches including the preparation of acute brain slices, electrophysiological recording including direct dendritic and patch clamp recording, electrical and optogenetic stimulation, and Ca^{2+} imaging. We use biochemical and histological approaches to complement these techniques.



Dye-filled pyramidal neuron

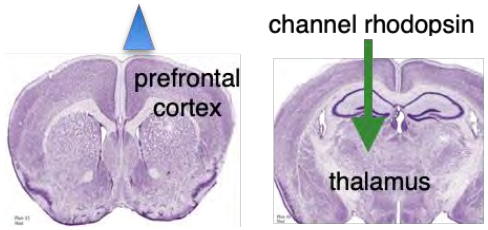
Electrophysiological recordings

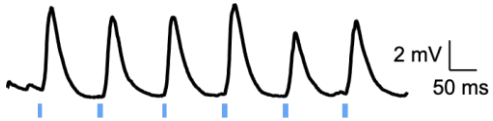
Patch clamp of single K^+ channels



Current clamp of action potentials

Optogenetic circuit mapping





Optogenetic activation of thalamic inputs to the prefrontal cortex

Link to publications

- https://www.ncbi.nlm.nih.gov/myncbi/darrin.brager.1/bibliography/public/

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School of Life Sciences

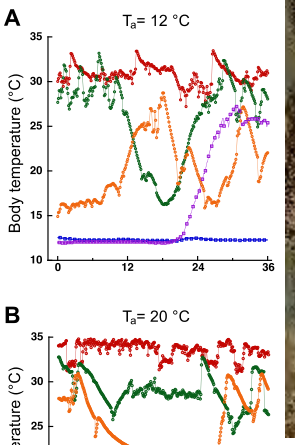
Dr. Frank van Breukelen
Professor and Director
School of Life Sciences
Phone: 702-895-3944
Email: frank.vanbreukelen@unlv.edu

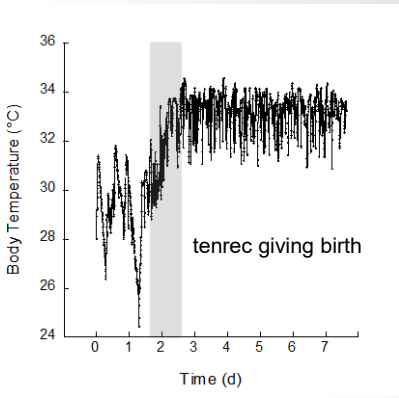
Expertise

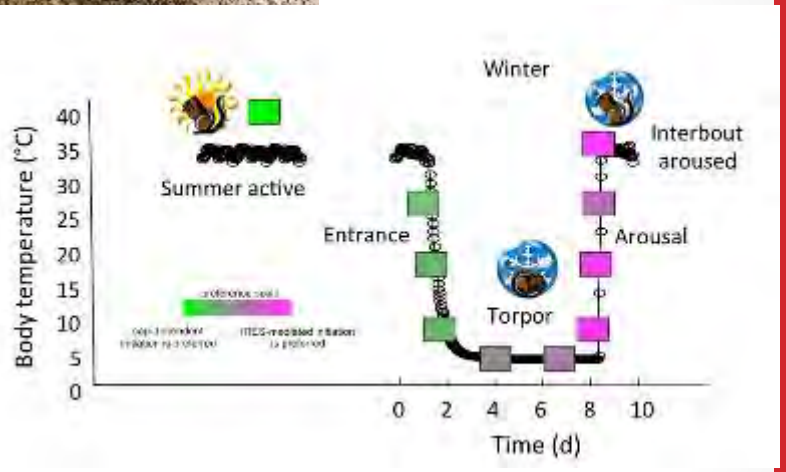
- Metabolic depressions like mammalian hibernation
- Life in extreme environments

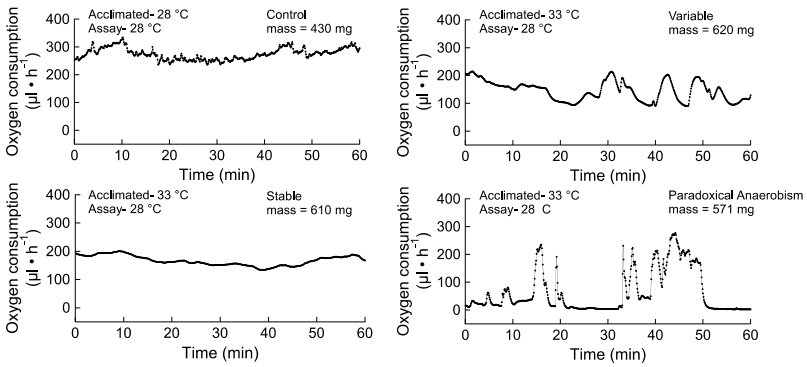
Areas of research

- 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









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Studies on Degenerative Diseases: Blindness and Alzheimer's Disease

Dr. Nora B. Caberoy
Associate Professor
School of Life Sciences
Phone: 702-774-1501
Email: nora.caberoy@unlv.edu

Expertise:

- Phagocytosis
- Retinal cell biology
- Retinal degenerative diseases (*Retinitis pigmentosa*, Age-related macular degeneration)
- Functional proteomics by phage display
- Alzheimer's disease therapy

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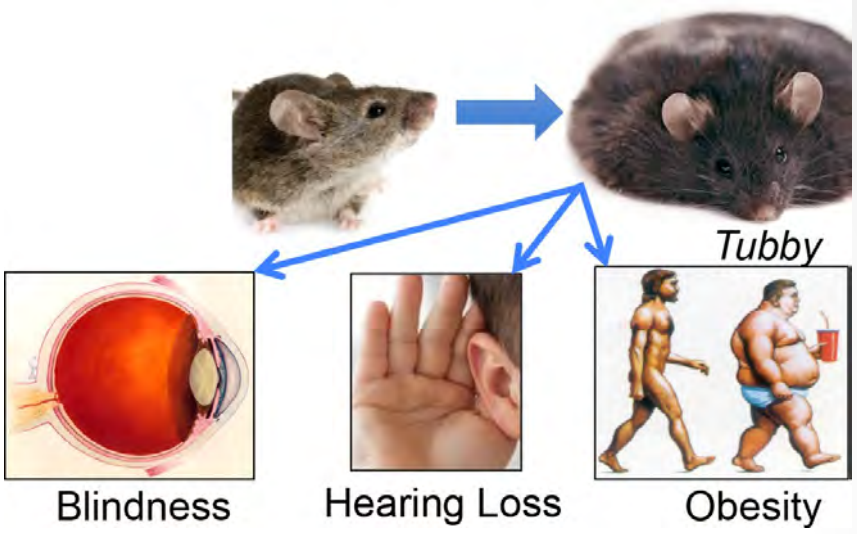
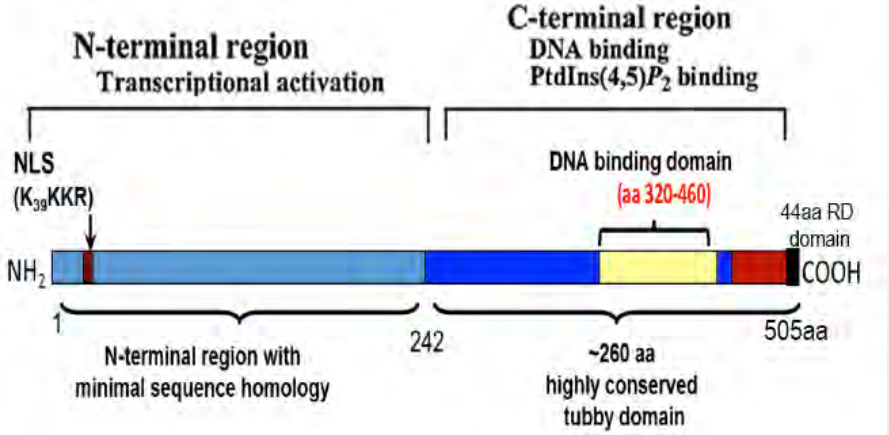
Delineating molecular mechanisms of blindness, hearing loss, and obesity

Mutation in Tubby gene resembles human syndromes:

- Hearing and/or vision - *Usher's, Retinitis pigmentosa*
- Obesity and sensory deficits - *Bardet Beidl, Alstrom's*
- Pathological mechanisms unknown



- Characterizing Tubby as a transcription factor
- Globally identifying genes regulated by Tubby
- Unraveling Tubby protein-protein interaction network



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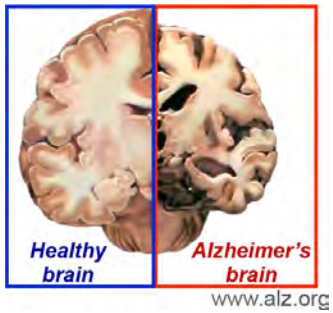
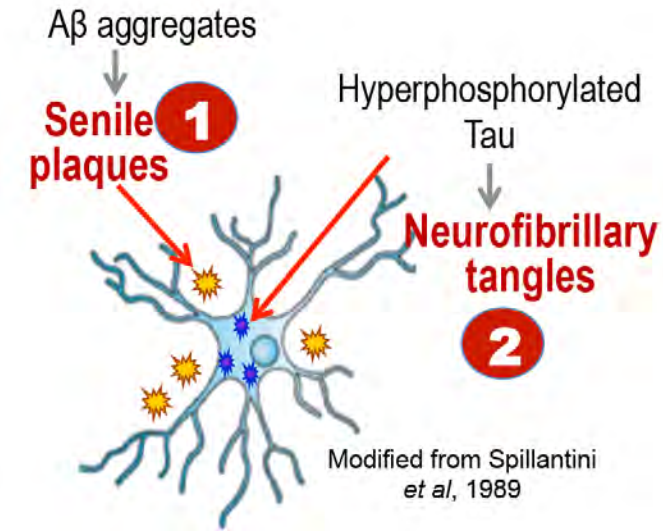
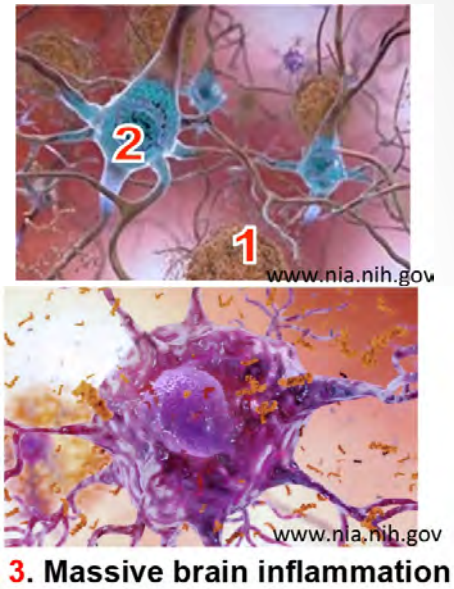
Redirecting phagocytosis of amyloid beta from inflammatory to non-inflammatory pathway

Alzheimer's Disease (AD): Pathological hallmarks



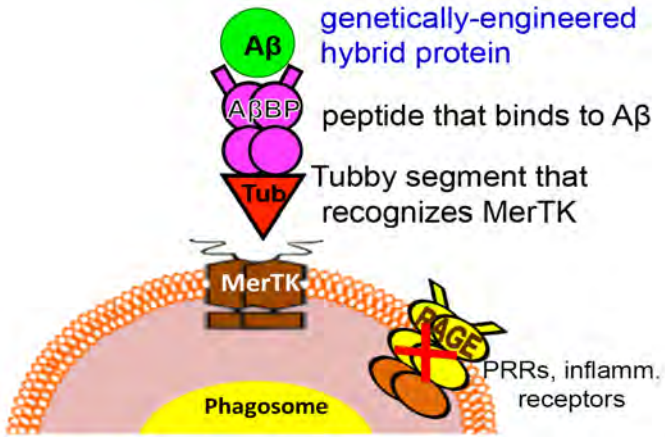




3. Massive brain inflammation

Strategy:

- engineer hybrid proteins
- binds oligomeric and fibrillar amyloid beta
- sequesters and directs phagocytic clearance of amyloid beta through non-inflammatory pathway



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Investigating collective cell behaviors

- **Dr. Joseph Campanale**
- Assistant Professor
- School of Life Sciences
- Email: joseph.campanale@unlv.edu
- Website: Campanale Lab

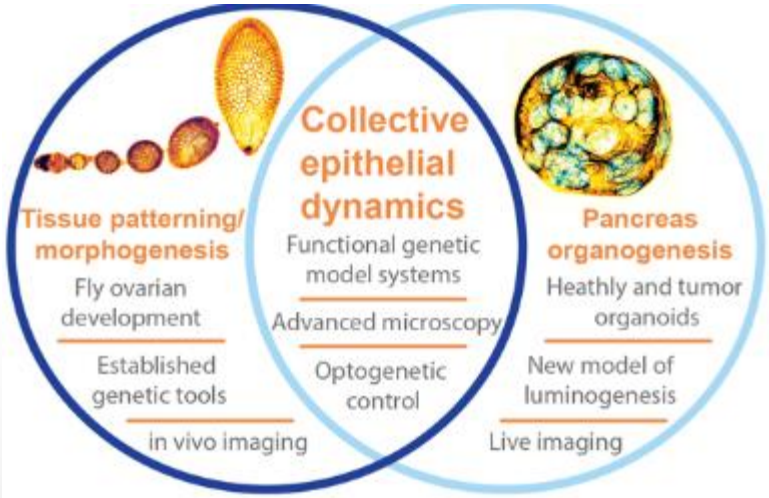

Fig.1: Using flies and mammilian organoids to study collective epithelial dymanics deployed in development.

Expertise

- Collective cell migration
- Cancer cell biology
- Developmental biology
- Fruit fly genetics
- Pancreatic organoid morphogenesis
- 4-Dimensional live cell microscopy

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How do cells coordinate collective movements to establish barriers?

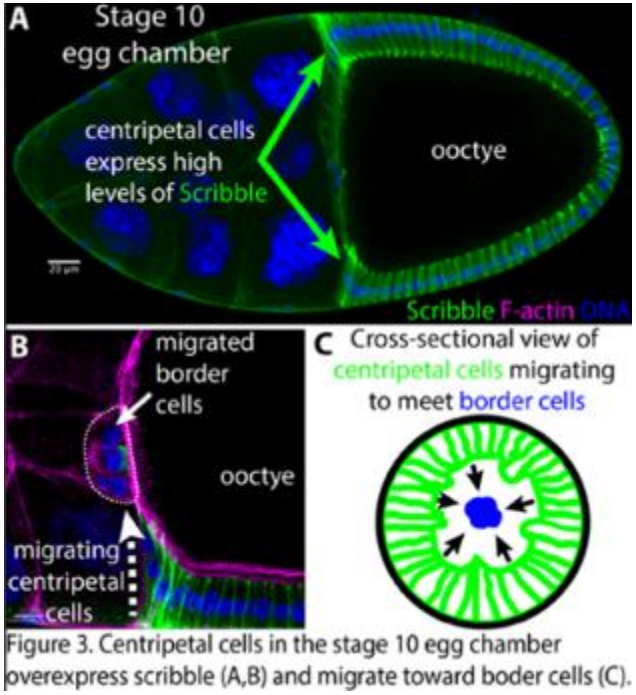

Figure 3. Centripetal cells in the stage 10 egg chamber overexpress scribble (A,B) and migrate toward boder cells (C).

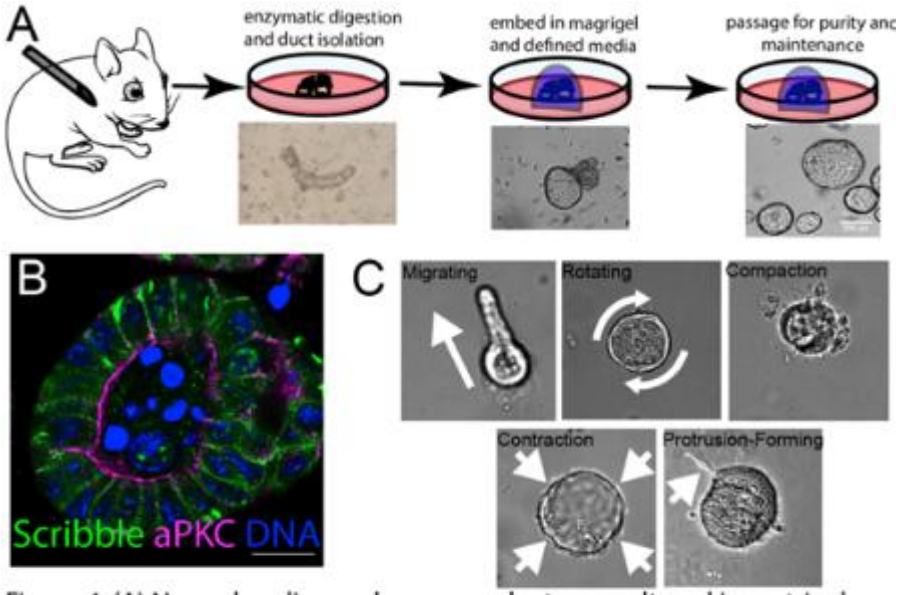

Figure 4. (A) Normal or diseased pancreas ducts are cultured in matrigel before maitenance. (B) Normal organoids are apicobasally polarized and (C) exhibit a range of behaviors during development.

Centripetal cells (CFCs) found in fruit fly eggs offer an unexplored *in vivo* model of epithelial sheet migration. My lab uses these untapped experimental pace to understand the basic principles of how cells migrate as sheets *in vivo* and answer questions such as: 1) What role does epithelial cell polarity signaling play in CFC movement; and 2) Does polarity signaling regulate CFC cell-cell adhesion during migration?

Polarity complex interactions are well-established in many epithelia; however we lack a detailed understanding of their functions and regulation across organs. We aim to discover the role of polarity in pancreas morphogenesis using live imaging, organoid culture, and developmental biology to ask: 1. What epithelial behaviors drive pancreas development? 2. What mechanistic roles do polarity complex proteins play in controlling these behaviors? 3. What emergent cell properties underlie duct morphology? And 4. Are these properties mechanically controlled?

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Dr. Dale Devitt
Professor
Director - Center for Urban Water Conservation
School of Life Sciences
Phone 702-895-4699

Expertise

Soil Plant Water Relations
Water Management
Evapotranspiration
Salinity

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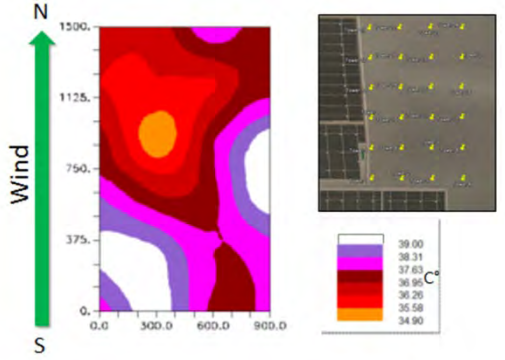
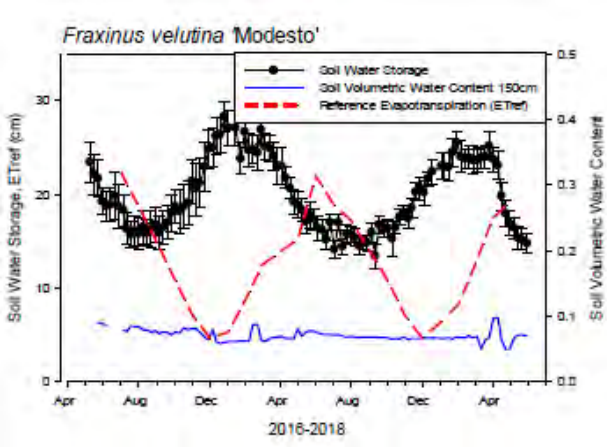
Current Research

- Assessing the impact of large scale solar development on desert ecosystems.



- Tree grass water use tradeoffs in urban landscapes



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10 acre research facility in North Las Vegas dedicated to conducting applied and basic water related research.

Response (growth, flower and seed production) of desert perennial shrubs to altered precipitation

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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

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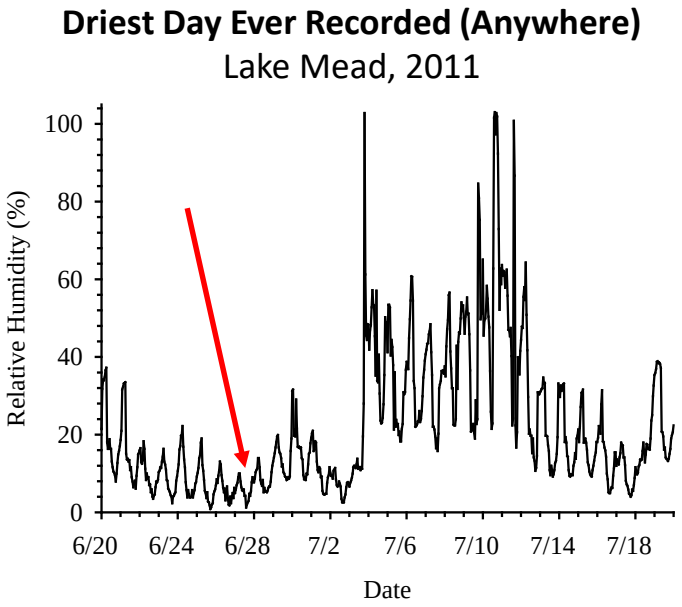
Environmental Physiology of Desert Invertebrates

Adaption to water stress:

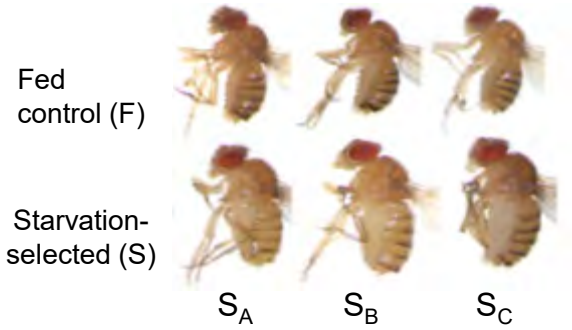


Adaptation to high temperatures:

Experimental Evolution Research Using Fruit Flies

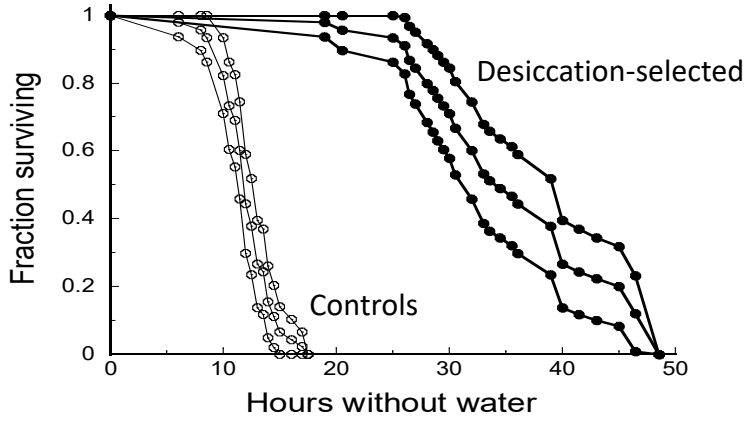
Starvation resistance:

- a fly model for obesity



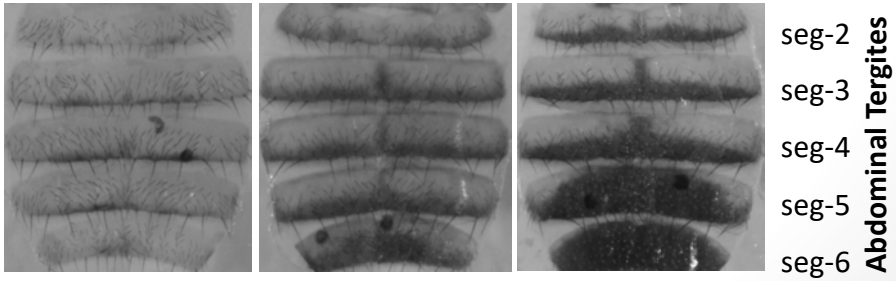
Desiccation resistance:

- understanding responses to desertification



Pigmentation:

- phenotypic correlations of melanization



Guha Lab

- **Dr. Prasun Guha, Ph.D.**
- Assistant Professor
- NIPM/School of Life Sciences
- Email: prasun.guha@unlv.edu
- Website: https://guhalab.faculty.unlv.edu/

Expertise: Guha lab has primarily two major focuses.

A] The lab aims to integrate cell signaling and epigenetic mechanisms of Crohn's disease, with special emphasis on the leaky gut.

B] Our 2nd lab interest is to unravel the role of inositol signaling influencing nuclear functions.

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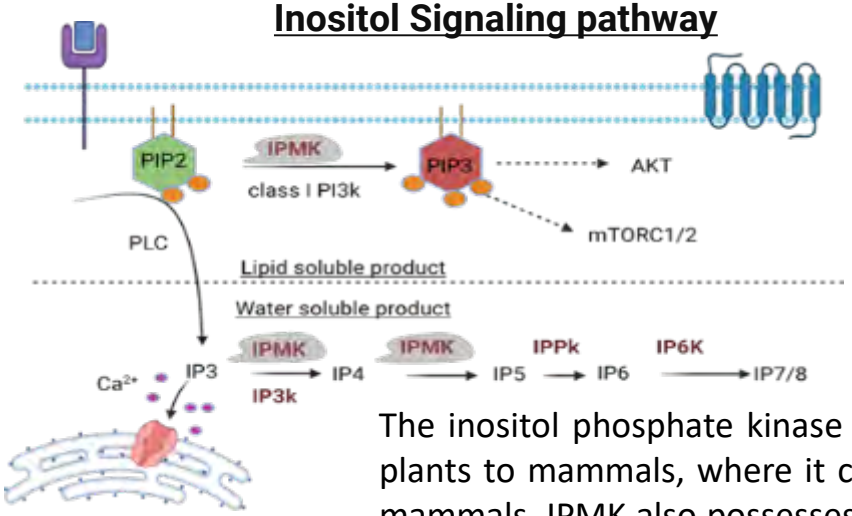
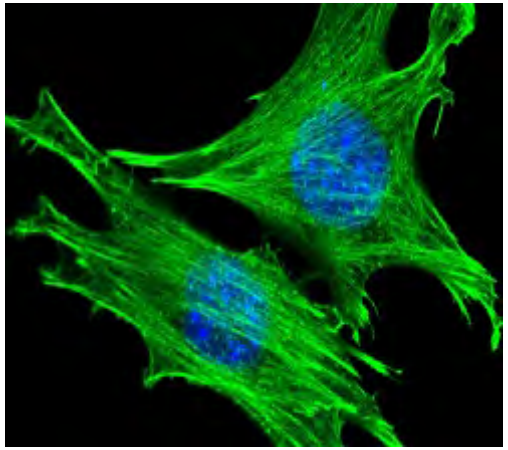
Inositol Signaling pathway



The inositol phosphate kinase function of **IPMK** is conserved from plants to mammals, where it converts IP3 to IP4 and IP4 to IP5. In mammals, IPMK also possesses phosphatidylinositol 3-kinase (PI3K) activity, generating phosphatidylinositol (3,4,5)-trisphosphate (PIP3), a second messenger that promotes cellular growth and cancer progression. We are interested in exploring the physiological importance of IPMK and inositol signaling in cell and animal models.

Confocal imaging of actin cytoskeleton staining (Green)



Cell Migration

The primary threat for cancer is the phenomenon called metastasis. Cell migration and invasion are critical for metastasis. We are interested in studying the mechanism of cell migration.

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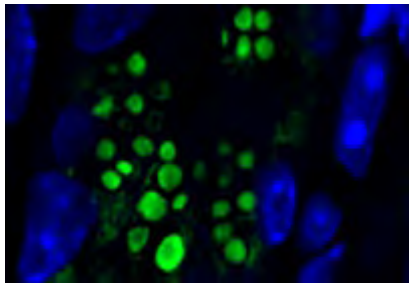
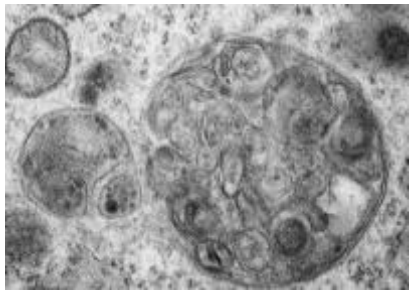
Confocal Imaging of Intestinal Paneth cell granules in green



Crohn's Disease

According to GWAS study and mutation analysis IPMK is linked to intestinal carcinoid and crohn's diseases. Our lab is currently investigating role of inositol signaling in intestinal function.

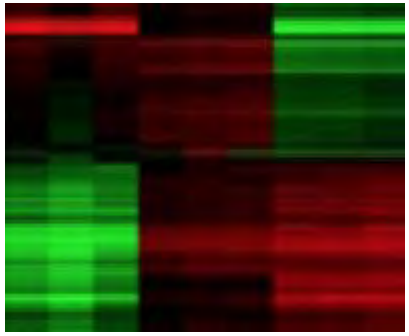
Trans mission electron microscopy of Autophagic vesicle



Autophagy

Autophagy is fundamental to maintaining cellular homeostasis and is linked to cancer and neurodegenerative disorders. However, the role of autophagy in controlling nuclear function is unknown. Our lab is currently investigating how autophagy impacts nuclear events.

Gene expression analysis



Genetics & Epigenetics

The nucleus is the brain of any cell. Our lab's major interest is to study how nuclear function influences disease progression, emphasizing cancer and neurodegenerative disorders.

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Han Lab

Dr. Mira Han

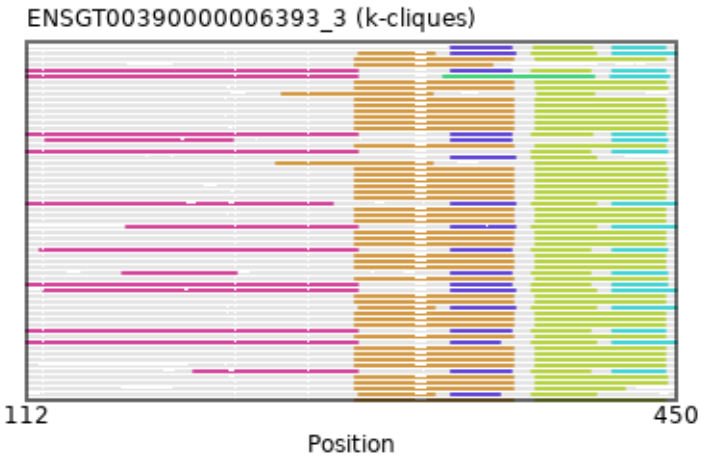
- Associate Professor,
- School of Life Sciences
- Phone: 702-774-1503
- Email: mira.han@unlv.edu

Expertise

- Molecular Evolution
- Genomics of transposons
- Next generation sequence analysis

Han Lab – molecular evolution

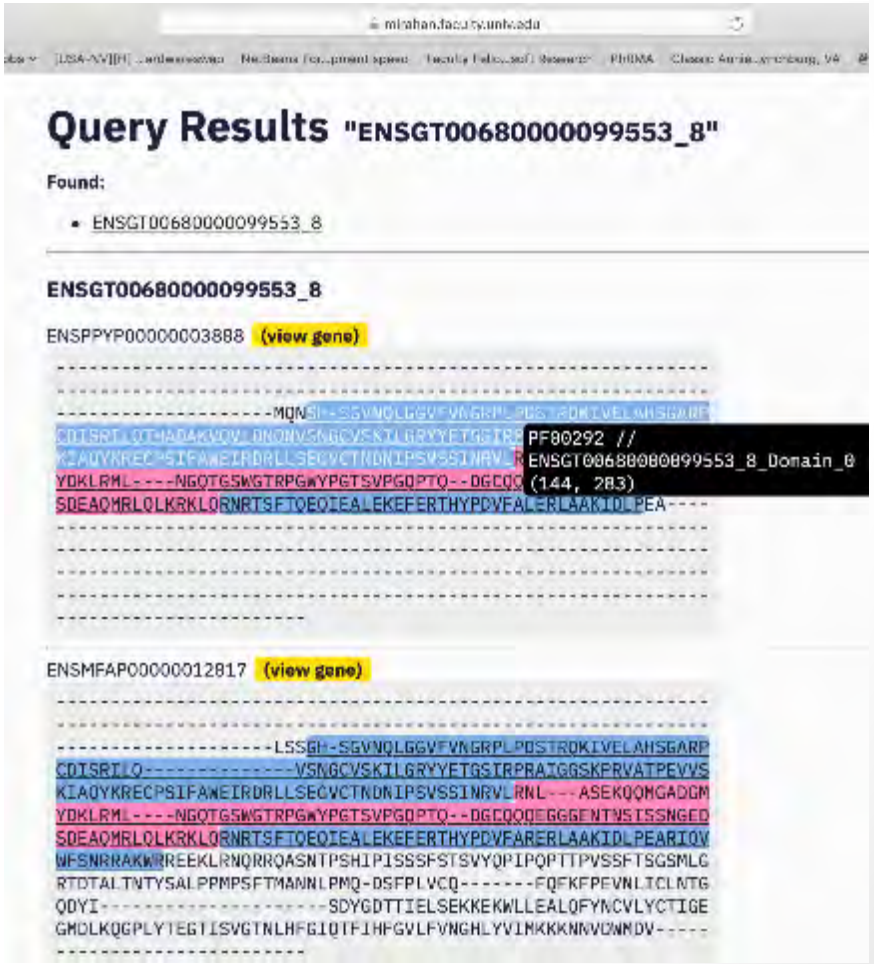
Evolution of domain architecture and interdomain linkers across 148 Amniote genomes



alignment

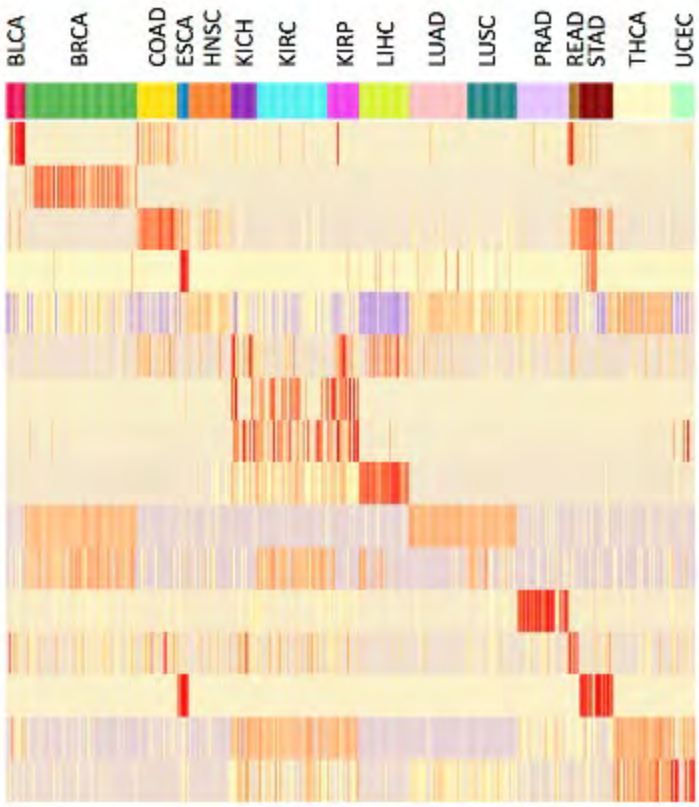
Domain homology across proteins

Database of homologous domains and linkers

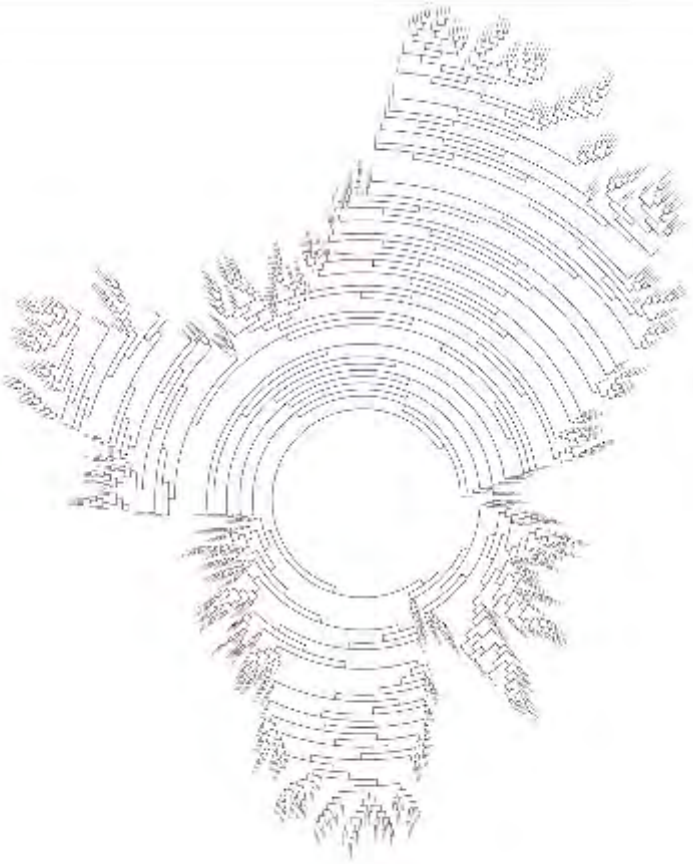


Han Lab – transposon genomics

Transposons in host regulation and disease



Tissue specific transposon expression



Predicted NANOG binding based on ancestral reconstruction of RLTR13D6 transposons

Microbial Diversity & Ecology

Dr. Brian Hedlund
Professor
School of Life Sciences
Phone: 702-895-0809
Email: brian.hedlund@unlv.edu

Expertise

- Microbial diversity exploration
- Cultivation of recalcitrant microorganisms
- Systems biology

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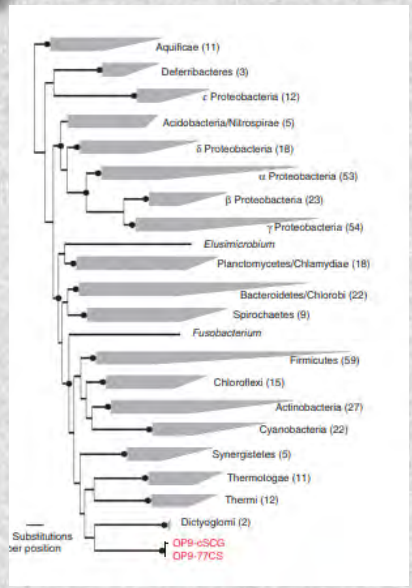
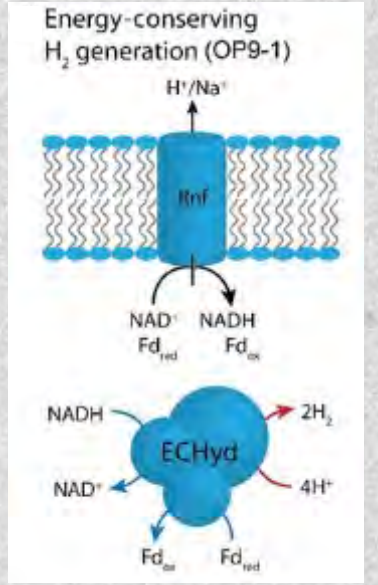
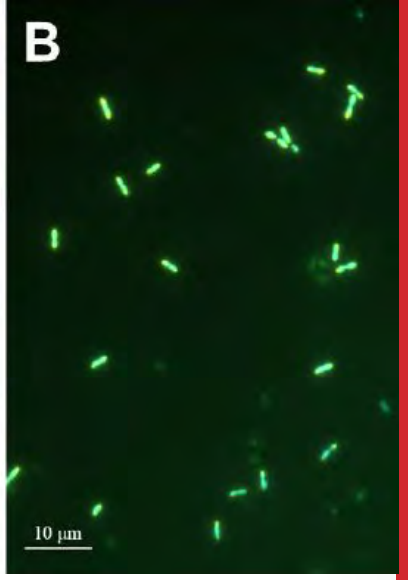
Exploring microbiology's "dark matter"

- Environmental genomics
- Genome-enabled cultivation
- Transcriptomics, proteomics, metabolomics
- Stable-isotope experiments







Big questions

- What is the function of billions-year-old microbial lineages that have never been cultivated in any lab? Why have they rebuked microbiologists for centuries?
- How can we organize and communicate microbial diversity effectively?
- How does thermal stress affect biology?
- How can we use microbial diversity to solve human problems?

https://hedlund.faculty.unlv.edu/

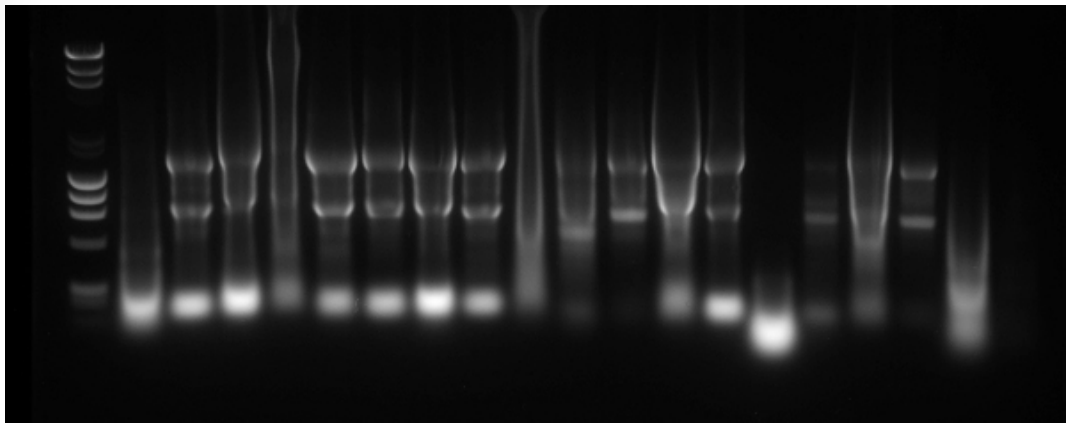
Integrative Physiology

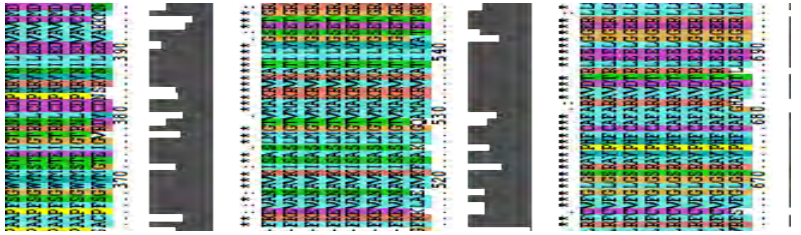
Dr. Allyson Hindle
Assistant Professor
School of Life Sciences
Phone: 702-895-4521
Email: allyson.hindle@unlv.edu

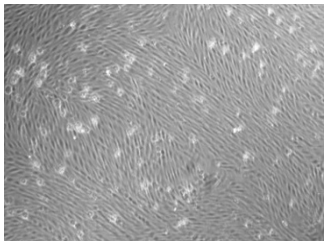
Expertise

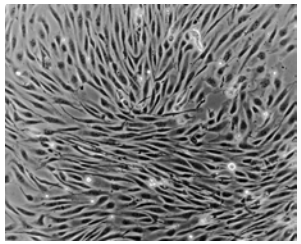
- molecular mechanisms of hypoxia tolerance in hibernating and diving mammals
- cardiovascular and blood pressure regulation
- comparative genomics, biomarker discovery and bioinformatics
- cell line resource development for non-model systems

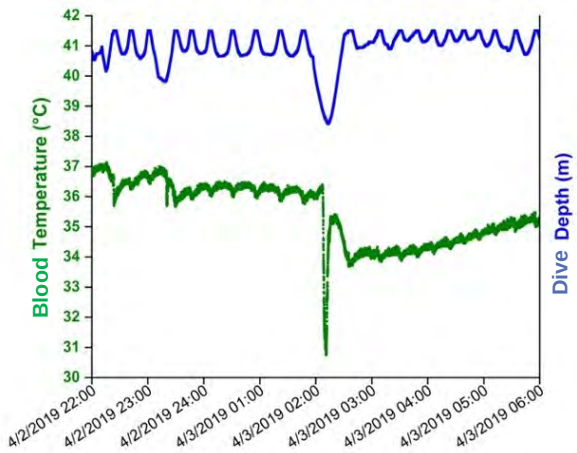
Cardiovascular protection of deep divers

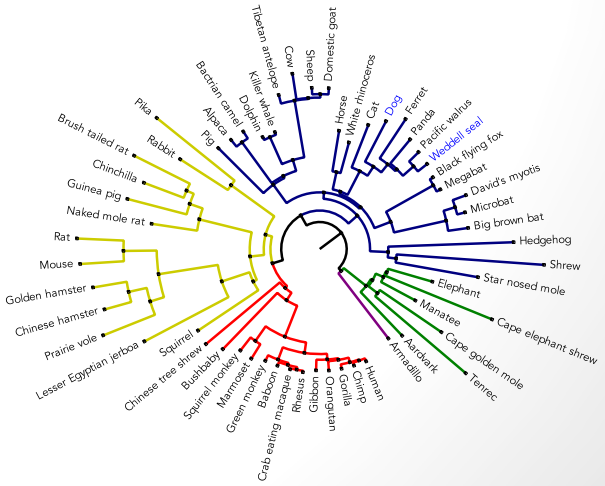




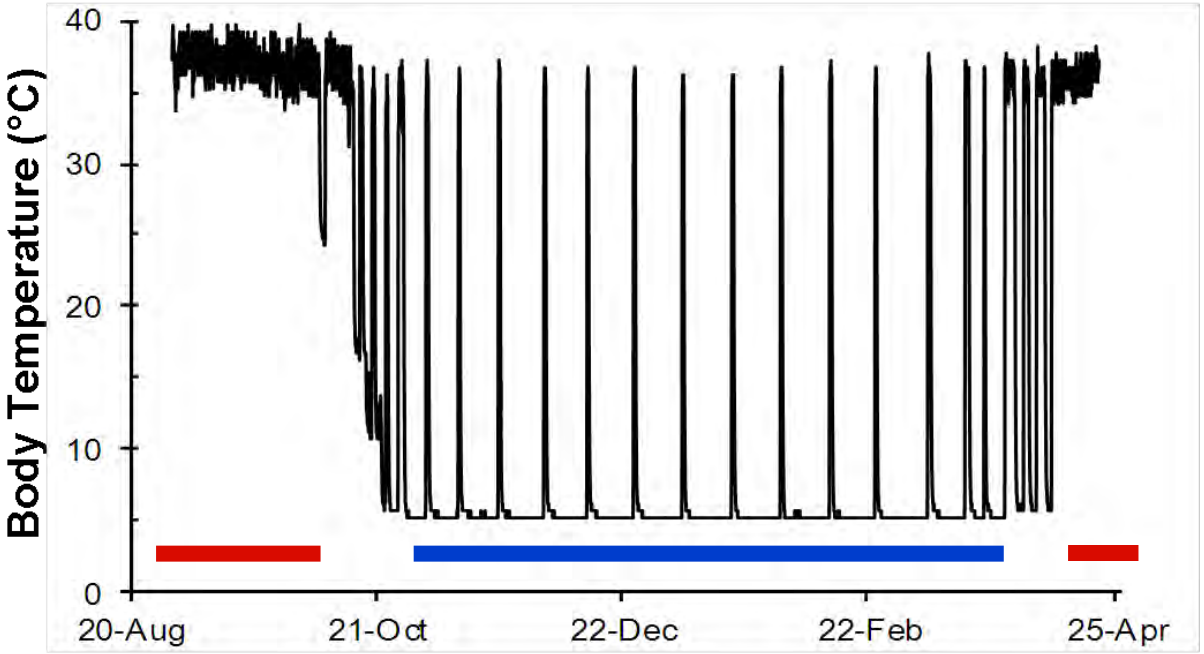






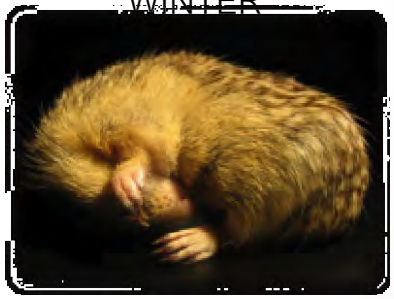


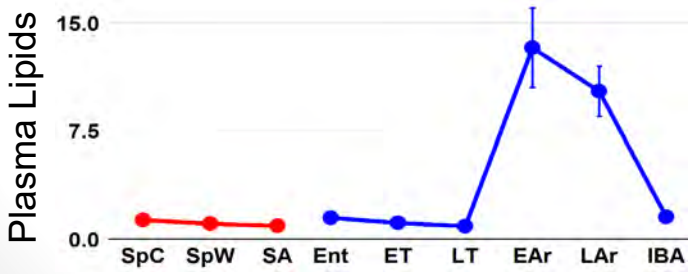
Metabolic control of small hibernators

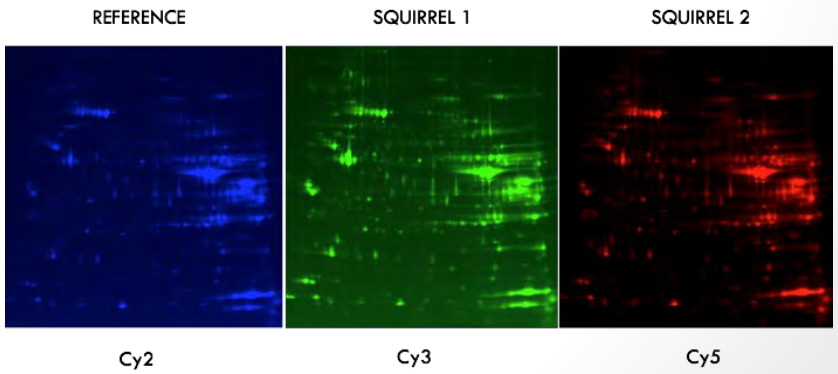


SUMMER

WINTER







Comparative Biomechanics: Evolutionary, Environmental, & Applied

David V. Lee

Associate Professor

School of Life Sciences

Phone: 702-895-0807

Email: david.lee@unlv.edu

Web: Laboratory of Comparative Biomechanics

Expertise:

Locomotion and gait

Animal biomechanics

X-ray motion analysis

Joint dysfunction

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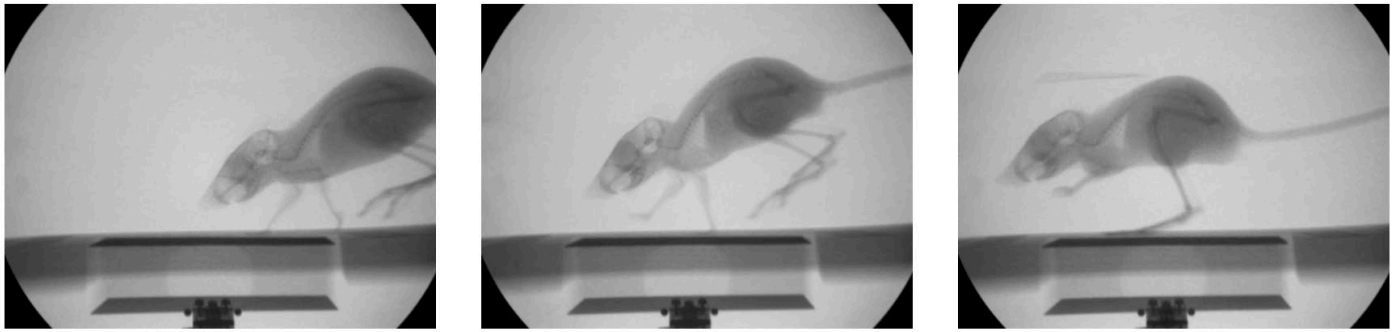
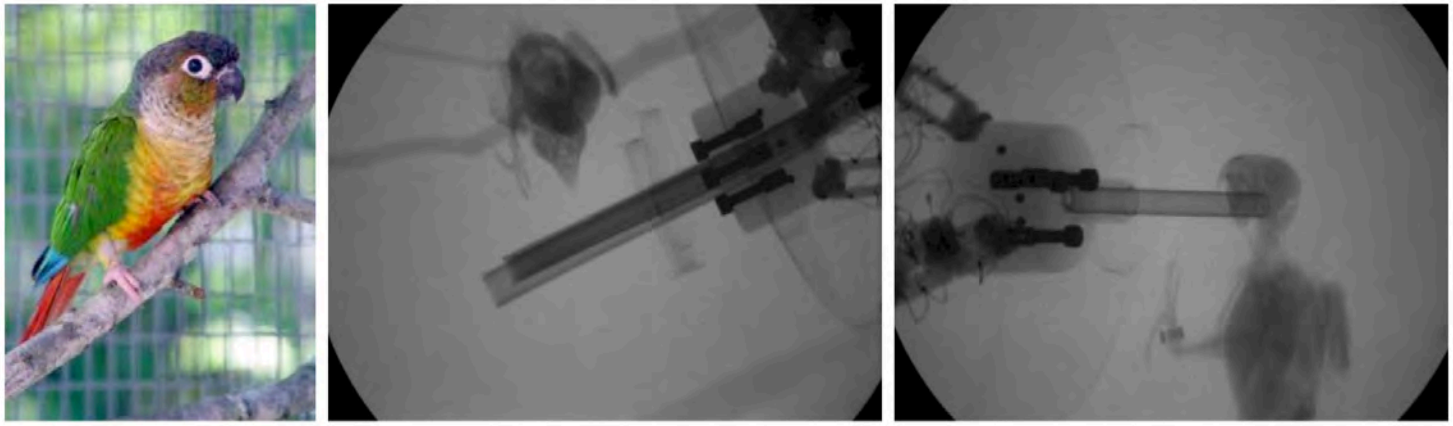
Locomotion

The *Laboratory of Comparative Biomechanics* explores fundamental questions in different modes of animal locomotion, including walking, running, hopping, climbing and digging.



X-ray video of a kangaroo rat on a miniature force platform showing different gaits



X-ray video of a parrot climbing a force-torque ladder in vertical and horizontal views

Human gait and prosthetics

We take a broadly comparative approach to understanding human walking dynamics and the function of both passive and active foot-ankle prostheses in restoring dynamics and speed.

Ground reaction forces are measured to determine dynamics in every instance of the stride

Comparing human, avian, and robotic bipedalism based on whole-body dynamics

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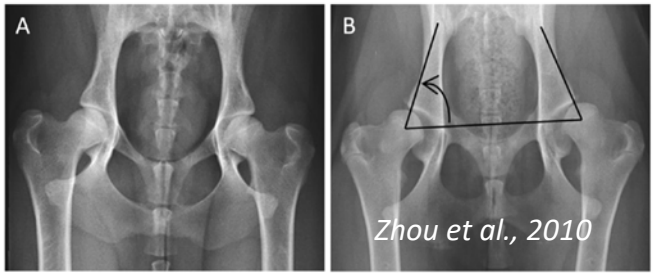
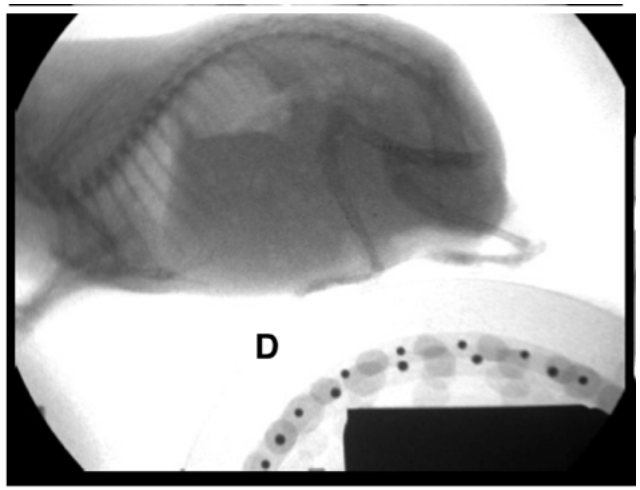
Joint dysfunction and osteoarthritis

Joint dysfunction is a pathway to osteoarthritis and our laboratory investigates mechanical aspects of joint dysfunction preceding spontaneous hip and knee osteoarthritis. We are beginning to use the canine hip dysplasia model to understand biomechanical and genetic determinants of joint health.



Gait laboratory for force and x-ray motion analysis of canine gait



X-ray video of spontaneous osteoarthritis in the guinea pig

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Computational Biology

- **Dr. Qian (Chris) Liu**
- Assistant Professor of Nevada Institute of Personalized Medicine (NIPM)
- School of Life Sciences
- Email: qian.liu@unlv.edu
- Website: https://www.unlv.edu/people/qian-liu, https://qgenlab.org

Expertise

- Deep Learning
- Bioinformatics
- Modification Detection
- Long-read Data Analysis
- RNA-Seq Data Analysis
- Protein Functional Analysis

Research interests

Dr. Liu currently works on the development of deep learning/machine learning-based tools to conduct long-read data analysis.

This includes, but not limited to, the estimation of short tandem repeats, DNA modification detection, RNA modification detection, and RNA-seq data analysis. Besides, Dr. Liu is also interested in functional analysis of proteins.

The ultimate goal of Dr. Liu's research is to accelerate and facilitate genetic discoveries for human disease studies.

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Meiselman Lab: Vectors and Dormancy

- **Dr. Matthew R. Meiselman**
- Assistant Professor of Neurophysiology
- School of Life Sciences
- Email: matthew.Meiselman@unlv.edu
- Website: meiselmanlab.com

Expertise

- Dr. Meiselman completed his PhD. In Cell, Molecular, and Developmental Biology at University of California-Riverside before studying neurobiology during his Postdoctoral work at Cornell University
- Dr. Meiselman focuses on the molecular and neural components which comprise dormancy (an extended depression of metabolism and behavior).
- Mosquitoes, ticks, and other medically-relevant arthropods depend on this state change for survival during winter or dry seasons
- We use the genetically tractable fruit fly as an “engine for discovery” to learn about this state, with the goal of applying this knowledge to other species to curtail the contraction of vector-borne disease

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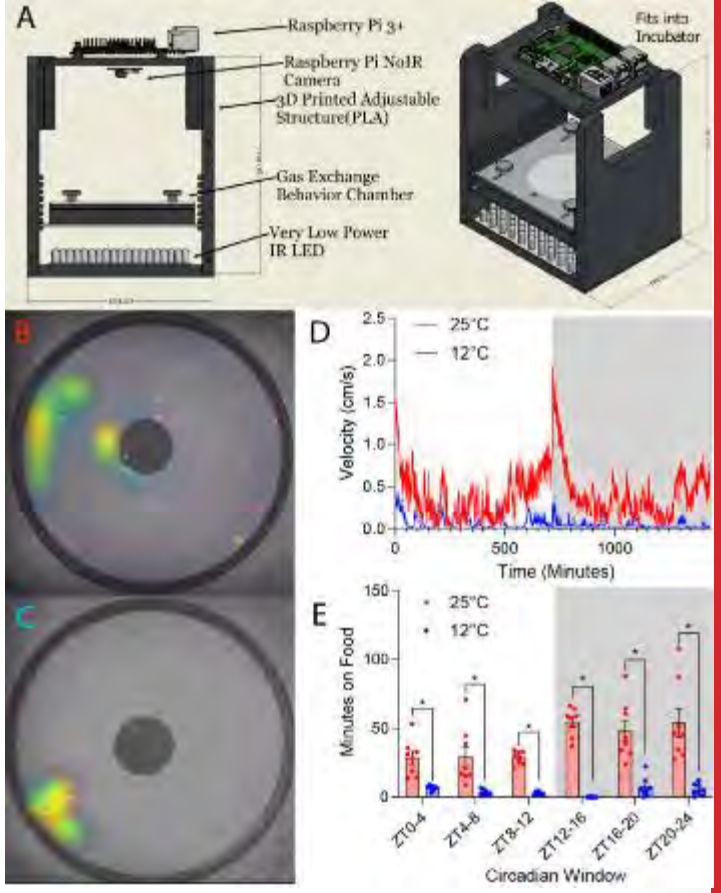
Our lab currently has two main projects:

1. We are searching for neurons that control dormancy in *Drosophila melanogaster*. By using transgenic activators and inhibitors of neural activity, we are attempting to induce dormancy (normally a response to cold) in warm conditions, and to prevent induction of dormancy in cold conditions. We are also searching for **ethological signatures of dormancy,** such as changes in circadian rhythmicity, sleep or photopreference, which can complement our metabolism-oriented definition.



2. We are attempting to understand the drivers of tick questing (hunting) behavior. We are using custom-built apparati and high-resolution video analysis to determine how tick circadian rhythm or activity levels respond to ambient temperature, humidity and lighting conditions. This may lead to better information linking climatic conditions to tick bite risk.

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Tree physiological ecology

- **Dr. Drew Peltier**
- Assistant Profess
- School of Life Sciences
- Email: drew.Peltier@unlv.edu
- Website: drewpeltier.com

Expertise

- Dendroecology (tree rings)
- Tree mortality
- Ecophysiology
- Radiocarbon
- Bayesian statistics

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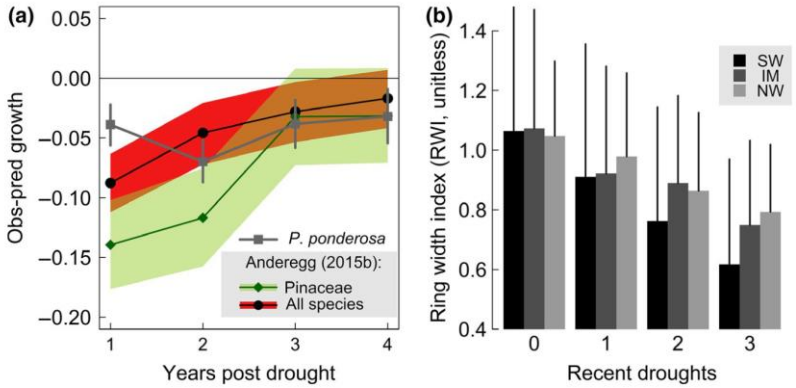
What do trees 'remember?'

Fire: *Redwood trees resprout from 1000+ year old buds, using 50-100 year old energy reserves.*



Drought: *Ponderosa pine ring width shows multi year legacies as drought becomes more frequent.*

Bark beetles: *Giant sequoia use 100+ year old energy reserves to survive bark beetle attack (note tree climber)*

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Dryland ecology, hydrology and climate dynamics

Dr. Matthew Petrie
Assistant Professor
School of Life Sciences
ph: 702-895-5844
e: matthew.petrie@unlv.edu

Expertise:

Vegetation ecology and near-surface hydrology
Forest regeneration
Climate dynamics and climate change forecasting
Extreme events
Landscape ecology
Manipulative field experimentation

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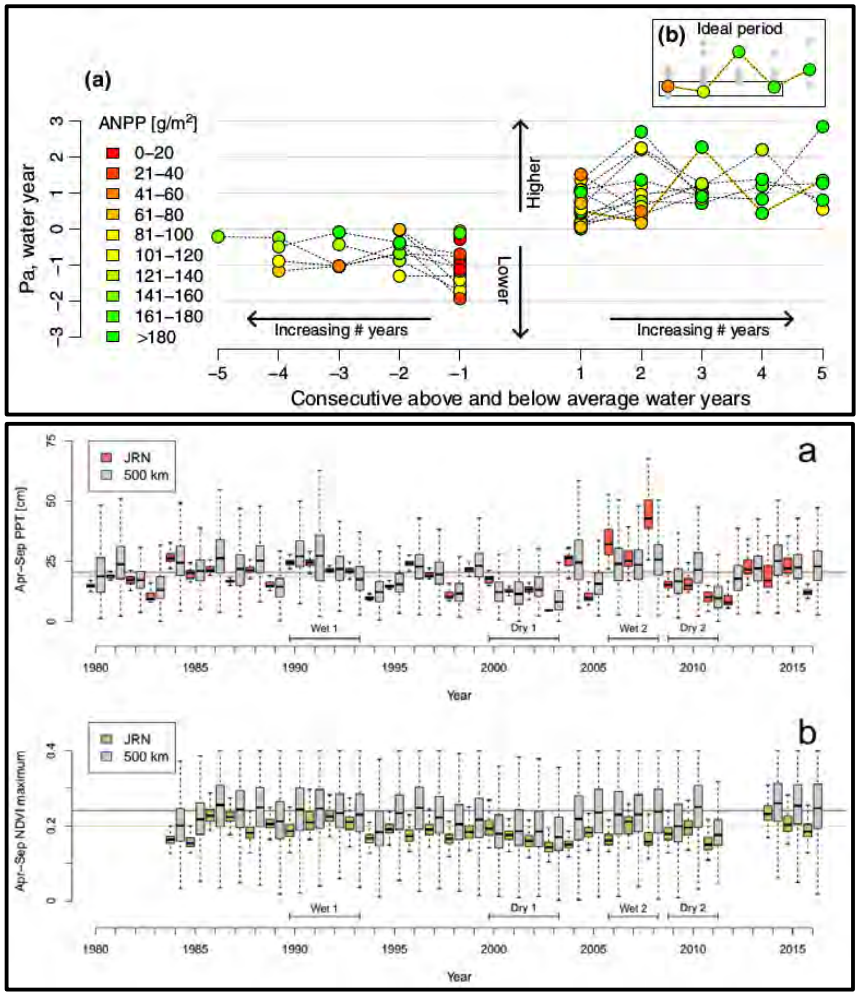
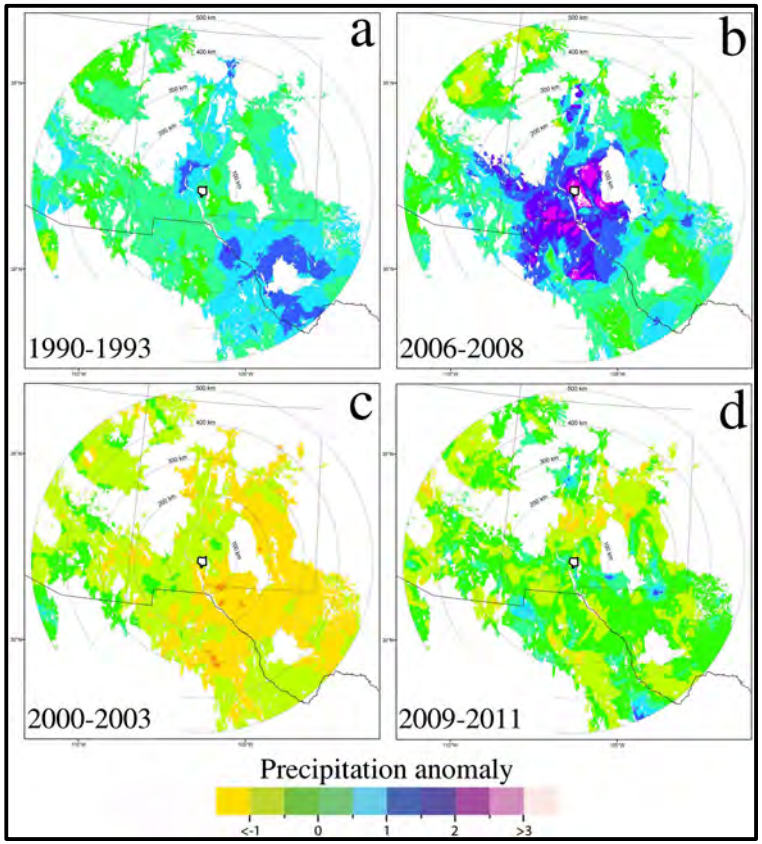
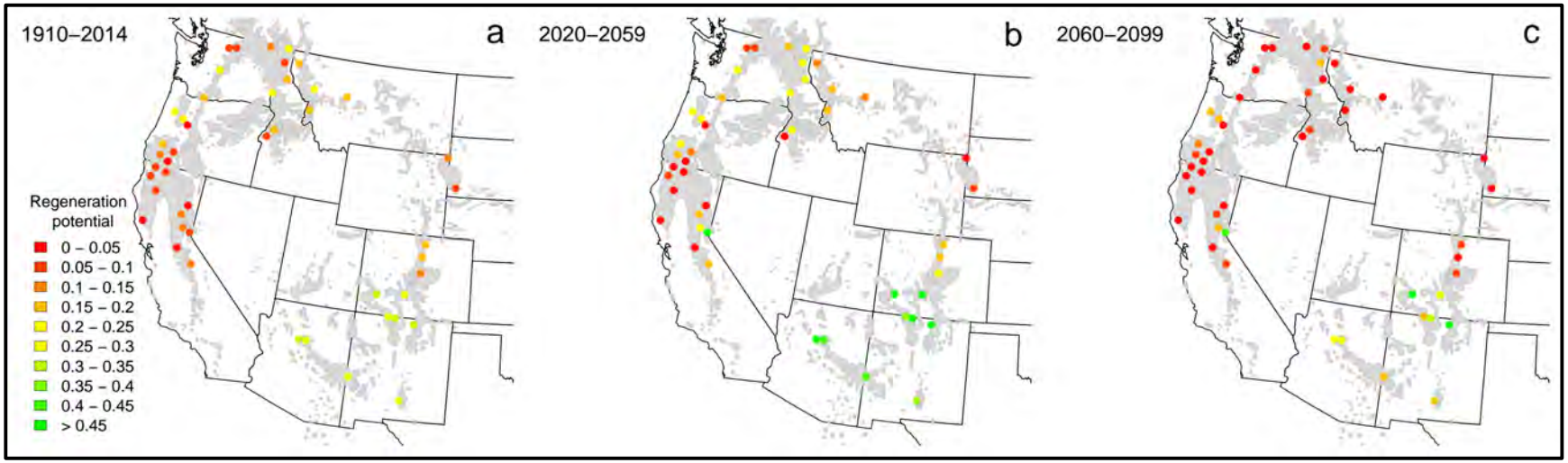
Linking extreme climate events and ecological dynamics across space and time

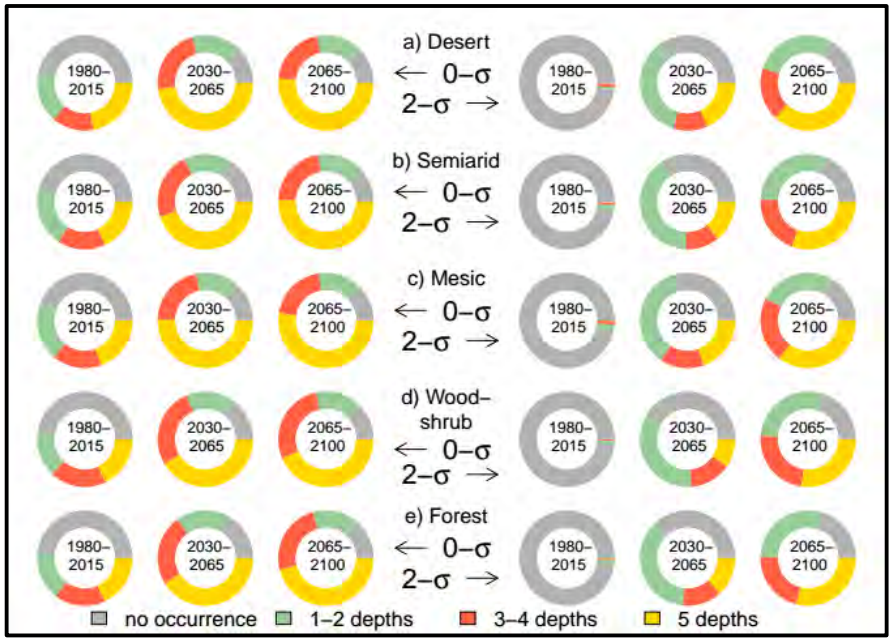




Above: Disentangling locally- and regionally-observed ecological responses to multiyear high and low rainfall periods. Multiyear periods are a key component of understanding climate impacts to arid and semiarid regions. Our research focuses on the physical mechanisms that shape ecological responses, providing a foundation for understanding the effects of local and regional extreme events in a changing climate.

Forecasting climate change impacts





Above: Natural forest regeneration may decline substantially throughout the western US in the 21st century. We study how climate, landscape properties, and the stress tolerance of tree populations will shape the future of western forests.

Left: Forecasts for increasing belowground extreme temperature events in a changing climate. We use downscaled climate model projections to forecast the increasing occurrence of moderate (0-σ) and very high (2-σ) extreme temperature events throughout multiple depths in the soil profile for ecosystems of the central and western US.