School of Life Sciences
Faculty Research Areas
Ecology, Conservation, and Restoration Ecology Research

Dr. Scott Abella
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Expertise
Fire ecology
Restoration ecology
Plant Ecology
Statistical and ecological community analysis

Web and link to publications
https://www.unlv.edu/people/scott-abella
https://abellaappliedecologylab.wordpress.com/
We perform fire ecology research that assists local and national wildland fire management efforts in changing environments. Before-after wildfire in Red Rock Canyon National Conservation Area, just outside Las Vegas. We study fire effects, fuel management, and restoration strategies. UNLV biology students implementing post-fire habitat restoration research.
One of several topics in plant ecology we are studying is forest decline and ways to conserve forests, both in western and eastern North America.

**Forest decline after a 15-year “perfect storm” of invasion by hemlock woolly adelgid, drought, and hurricanes**

Scott R. Abella

**Abstract** Invasions by introduced pests can interact with other disturbances to alter forests and their functions, particularly when a dominant tree species declines. To identify changes after invasion by the insect hemlock woolly adelgid (*Adelges tsugae, HWA*), coinciding with severe droughts and hurricanes, this study compared tree species composition of eastern hemlock (*Tsuga canadensis*) forests on 11 plots before (2001) and 15 years after (2016) invasion in the southern Appalachian Mountains, USA. Losses of hemlock trees after HWA invasion were among the highest reported, with a 90% decline in density, 86% decline in basal area, and 100% mortality for individual-stimulated winds in 2004; pest-related declines of deciduous tree species otherwise likely benefiting from hemlock’s demise; death of deciduous trees when large hemlocks fell; and competition from aggressive understory plants including doghobble (*Leucothoe fontanesiana*), rosebay rhododendron (*Rhododendron maximum*), and *Rubus* spp. Models of forest change and ecosystem function should not assume that deciduous trees always increase during the first decades after HWA invasion.

**Keywords** Deciduous forest - Introduced forest pest - Jocassee Gorges - Rhododendron - Southern

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**Rapid mortality of old eastern hemlock trees, North Carolina. Tree death affects wildlife habitat, watersheds, and carbon storage.**

Map of studies aimed at reducing hazardous fuels in western mixed conifer forests as part of a West-wide data synthesis we assembled to review western frequent-fire forest conservation.

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**UNLV COLLEGE OF SCIENCES**
Studies on Degenerative Diseases: Blindness and Alzheimer’s Disease

Dr. Nora B. Caberoy
Associate Professor
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Expertise:
• Phagocytosis
• Retinal cell biology
• Retinal degenerative diseases (*Retinitis pigmentosa*, Age-related macular degeneration)
• Functional proteomics by phage display
• Alzheimer’s disease therapy
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
Redirecting phagocytosis of amyloid beta from inflammatory to non-inflammatory pathway

Alzheimer’s Disease (AD): Pathological hallmarks

1. Senile plaques
2. Neurofibrillary tangles
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

Aβ aggregates
Hyperphosphorylated Tau
Modified from Spillantini et al, 1989

Aβ
peptide that binds to Aβ
tubby segment that recognizes MerTK

genetically-engineered hybrid protein

MerTK
PRRs, inflam. receptors
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
Current Research

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

• Tree grass water use tradeoffs in urban landscapes
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
Environmental Biology Research

Dr. Allen G. Gibbs
Professor
School of Life Sciences
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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
Cell Signaling Lab

- Dr. PRASUN GUHA
  - Assistant Professor
  - NIPM and School of Life Sciences
  - Email: Prasun.guha@unlv.edu
  - Website: https://guhalabs.faculty.unlv.edu/

Expertise

- Cancer Biology, Inflammatory biology, Neuroscience, and Cell and Molecular biology.
- Major focus is genomics and cell signaling
- Understanding the molecular mechanism of inositol signaling in controlling nuclear function
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.
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.

**Transmission 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.
Han Lab

Dr. Mira Han
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• School of Life Sciences
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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

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
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Expertise
• Microbial diversity exploration
• Cultivation of recalcitrant microorganisms
• Systems biology
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
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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

**Plasma Lipids**

**REFERENCE**

**SQUIRREL 1**

**SQUIRREL 2**
Comparative Biomechanics: Evolutionary, Environmental, & Applied

David V. Lee
Associate Professor
School of Life Sciences
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Web: Laboratory of Comparative Biomechanics

Expertise:
Locomotion and gait
Animal biomechanics
X-ray motion analysis
Joint dysfunction
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.
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
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.
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
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.
Dryland ecology, hydrology and climate dynamics

Dr. Matthew Petrie
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Expertise:
Vegetation ecology and near-surface hydrology
Forest regeneration
Climate dynamics and climate change forecasting
Extreme events
Landscape ecology
Manipulative field experimentation
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.