Health, Diseases, and Medicine

Mechanisms of Health & Disease Research

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Statistical Genetics and Biostatistics

Dr. Amei Amei

Associate Professor,

Department of Mathematical Sciences

Email: amei.amei@unlv.edu

Expertise

- Statistical inference of stochastic modeling
- Bayesian variable selection
- Statistical methods to detect risk genes and gene-environment interactions underlying complex diseases
- Large-scale sequence-based genetic association studies

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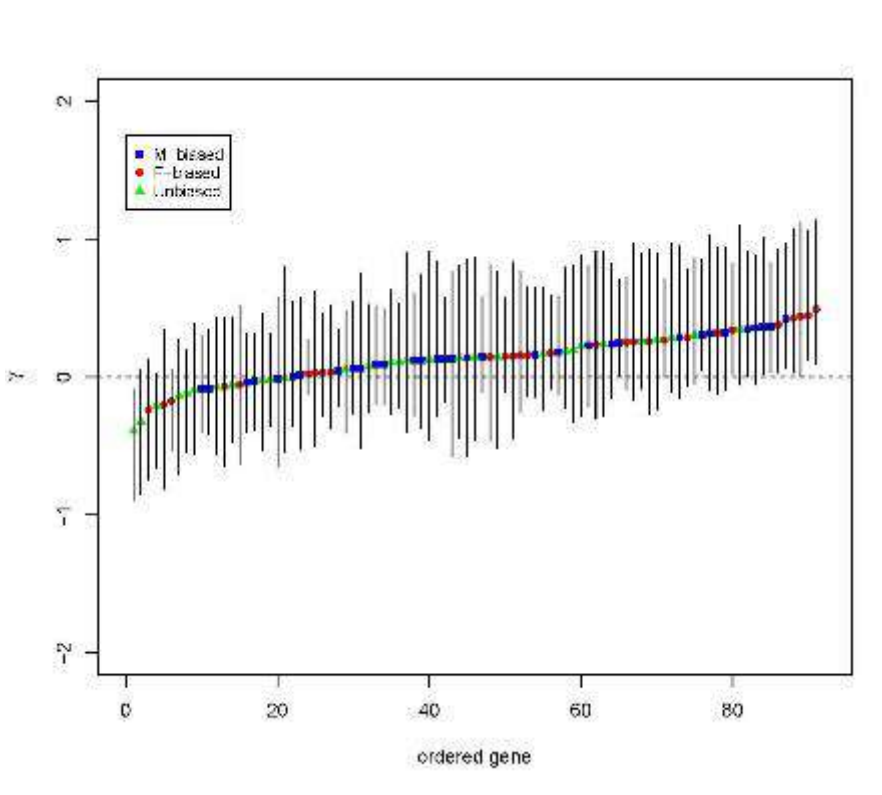
Inference of genetic forces using Poisson random field models

Poisson random field models offer a statistical framework to estimate various genetic parameters such as natural selection intensity, mutation rate and speciation time by comparing the information between intraspecific polymorphism with interspecific divergence in aligned DNA sequences of two sibling species.



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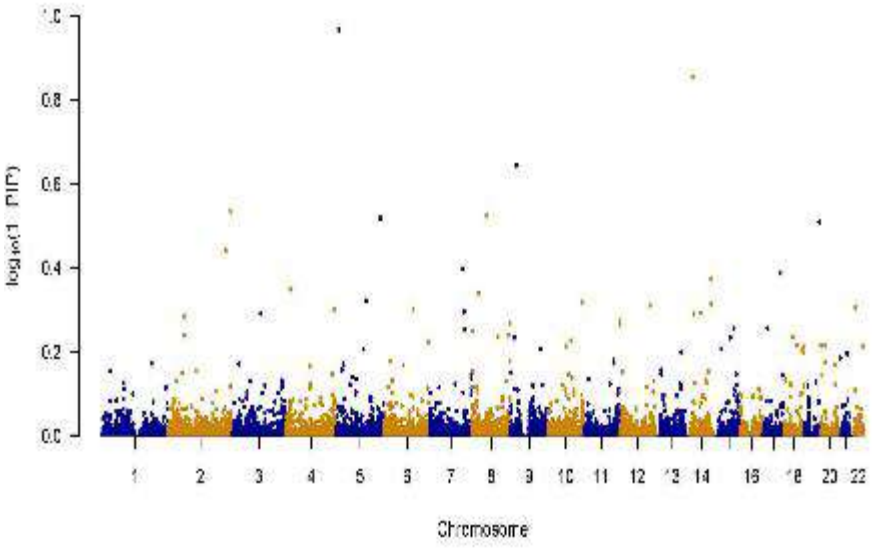
Biological and practical implications of genome-wide association study of schizophrenia using Bayesian variable selection

- Multivariate Bayesian variable selection (BVS) methods could discover association signals that otherwise would need a much larger sample size.

- BVS methods can be used to reanalyze published datasets to discover new risk genetic variants for many diseases without new sample collection, ascertainment, and genotyping.

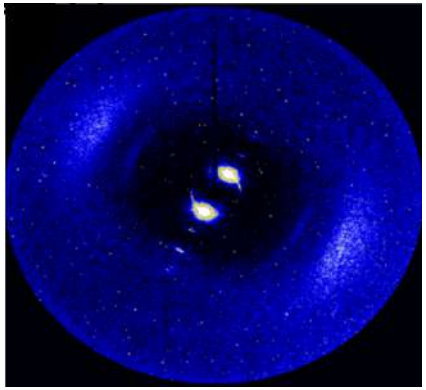


Pradip K. Bhowmik

- Professor Chemistry, Department of Chemistry and Biochemistry
- Fellow, American Chemical Society
- Fellow, Polymer Chemistry Division
- Ph.D., University of Massachusetts at Amherst
- CHE 207, pradip.bhowmik@unlv.edu
- http://ww.unlv.edu/chemistry/bhowmik/

Areas of Expertise

- Organic Chemistry
- Green Chemistry
- Polymer Chemistry
- Materials Chemistry
- Nanostructured Materials
- Anticancer Drugs
- Drugs for Alzheimer's Disease



Research Summary:

Bhowmik and his team are developing the following key areas:

- light-emitting and liquid-crystalline ionic polymers for multitude applications in modern technology
- fire retardants polymers
- nanostructured ionic liquids and ionic liquid crystals for advanced functional materials
- organic salts that emit light for sensors, are excellent lubricants and phase change materials
- cisplatin analogs for cancer therapy

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Medical Geology

Brenda J. Buck, Ph.D.
Director: Forest Inventory and Analysis Information Management Research Group (UNLV-FIA)
Department of Geoscience
Phone: (702) 895-1694
Email: buckb@unlv.nevada.edu

Expertise: Health effects of mineral dust; Asbestos; Heavy Metals; Soil Science/Geology

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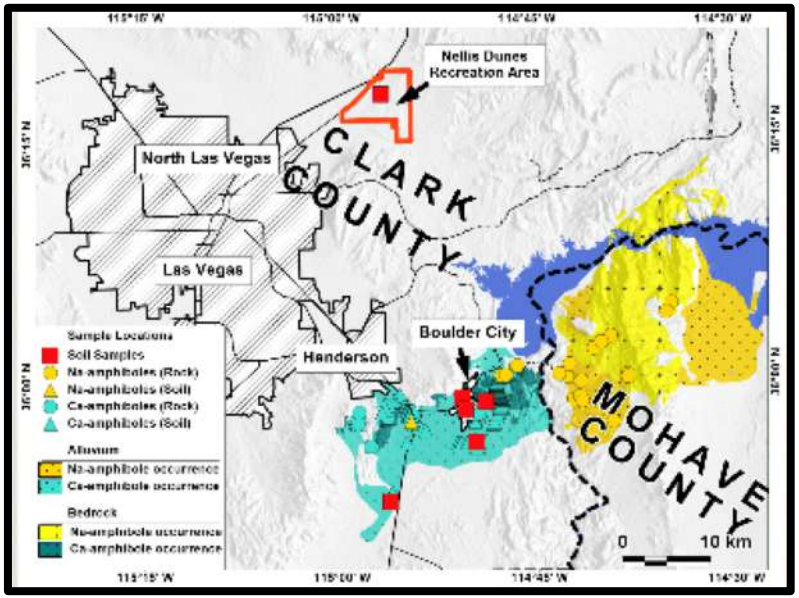
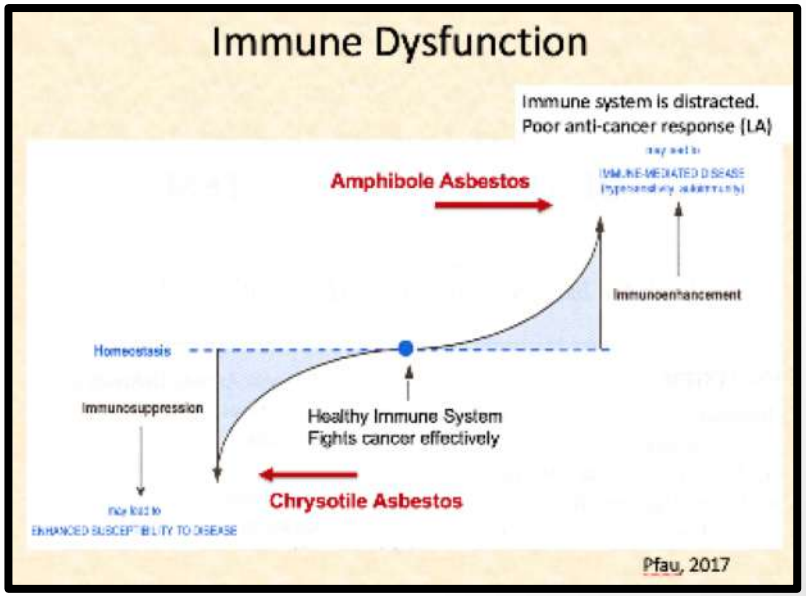
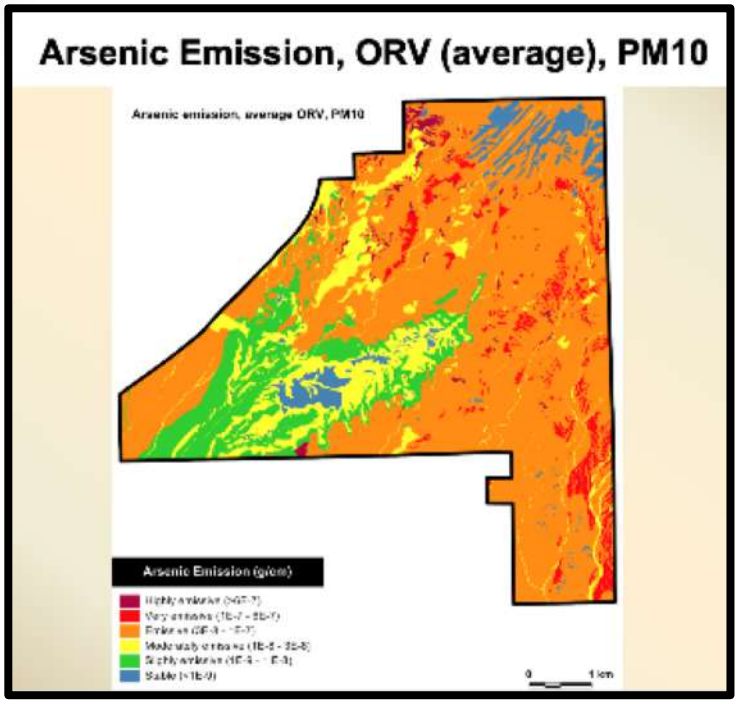
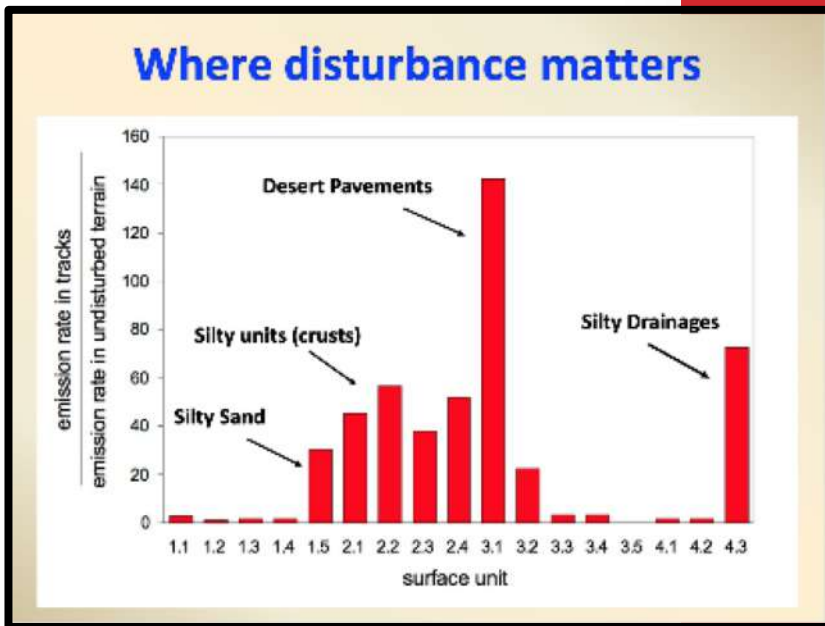
Naturally-Occurring Asbestos & Health Effects of Mineral Dust





Health Effects of Mineral Dust: Arsenic





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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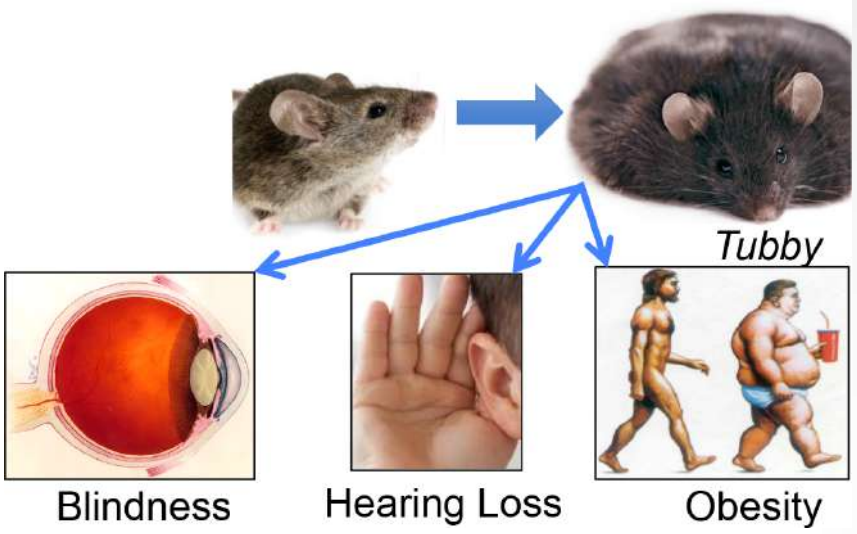
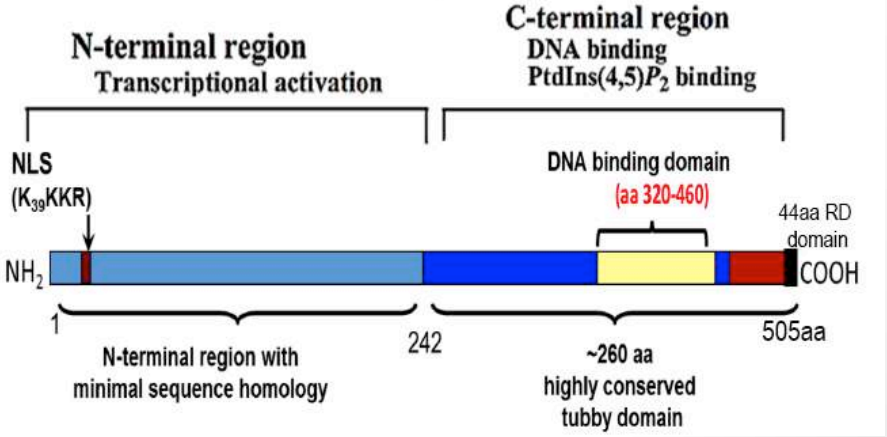
Delineating molecular mechanisms of blindness, hearing loss, and obesity

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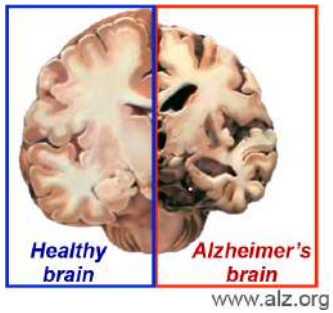
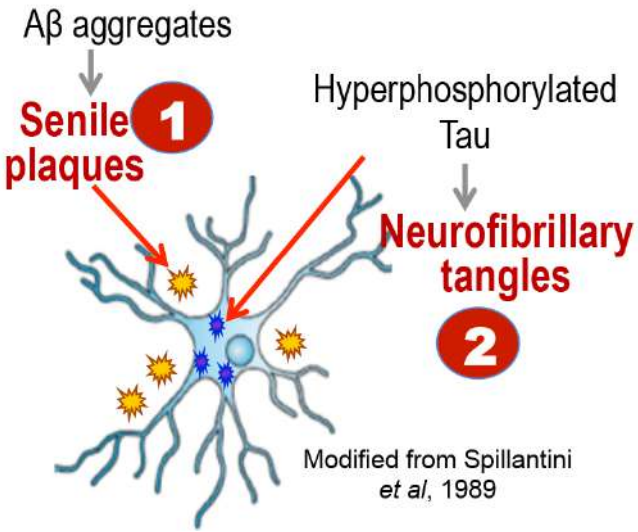
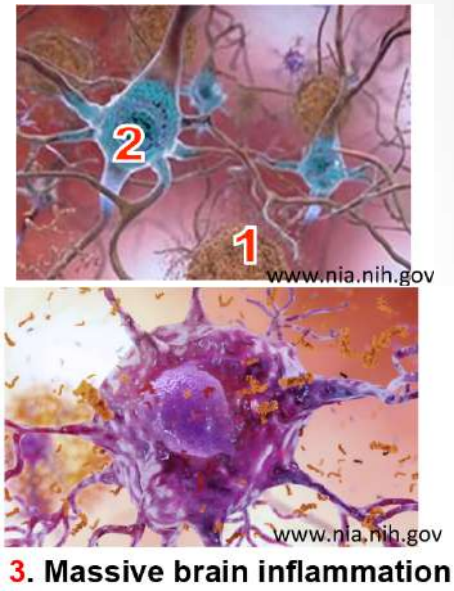
Redirecting phagocytosis of amyloid beta from inflammatory to non-inflammatory pathway

Alzheimer's Disease (AD): Pathological hallmarks



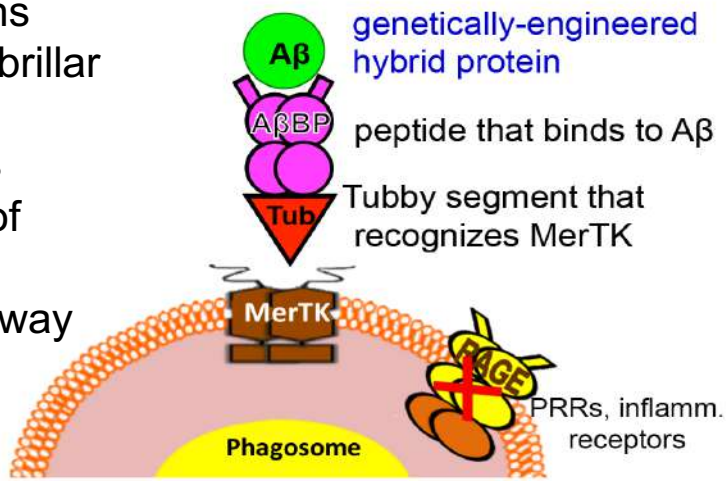




3. Massive brain inflammation

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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Environmental Biology Research

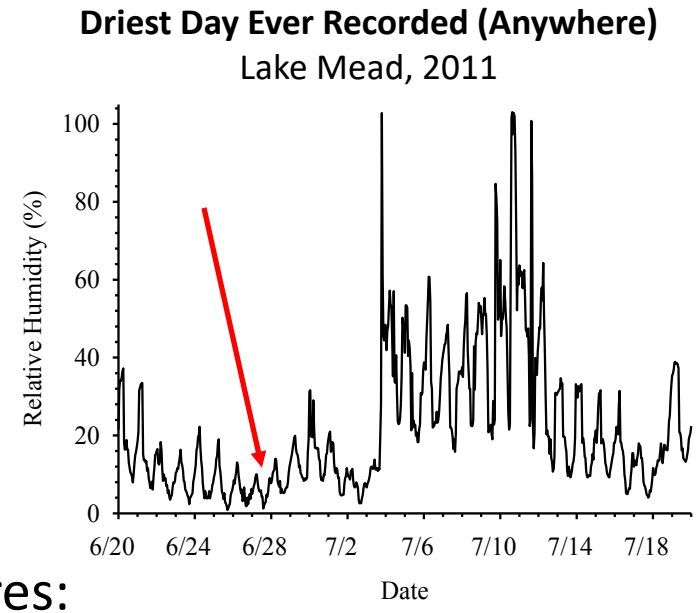
Dr. Allen G. Gibbs
Professor
School of Life Sciences
Phone: 702-895-3203
Email: allen.gibbs@unlv.edu

Expertise

- Environmental physiology
- Insect physiology
- Experimental evolution

Environmental Physiology of Desert Invertebrates

Adaption to water stress:

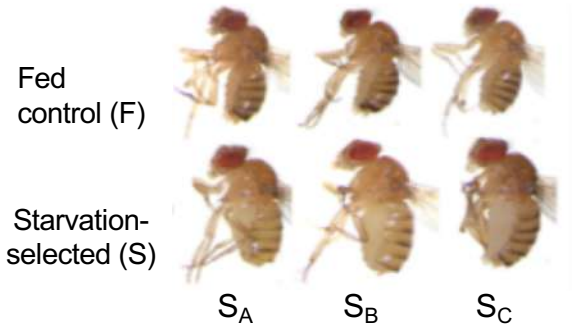


Adaptation to high temperatures:

Experimental Evolution Research Using Fruit Flies

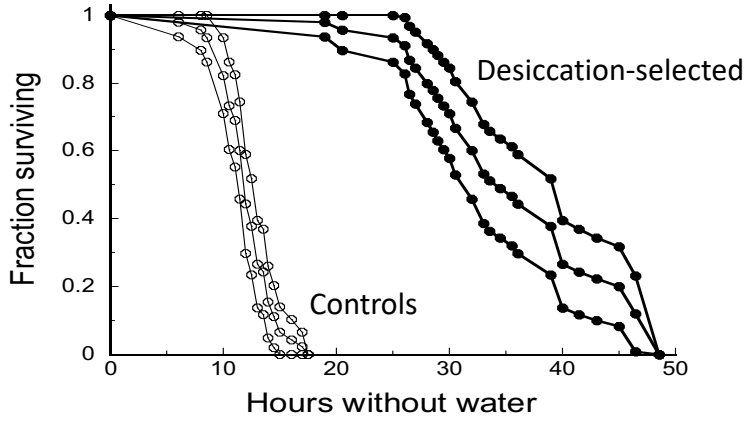
Starvation resistance:

- a fly model for obesity



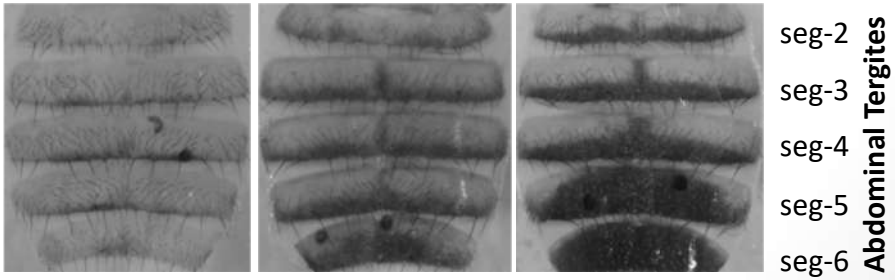
Desiccation resistance:

- understanding responses to desertification



Pigmentation:

- phenotypic correlations of melanization



Dr. Mira Han

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

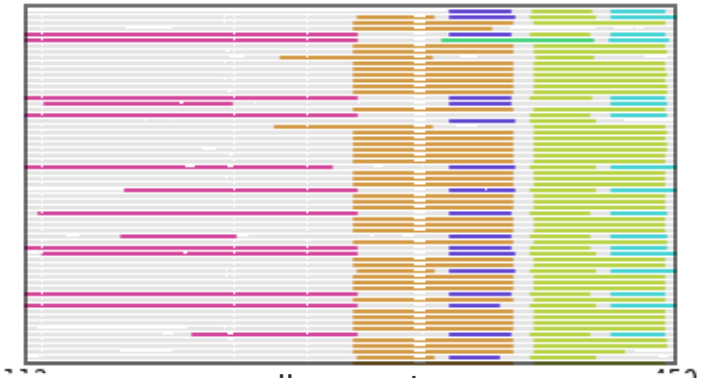
Expertise

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

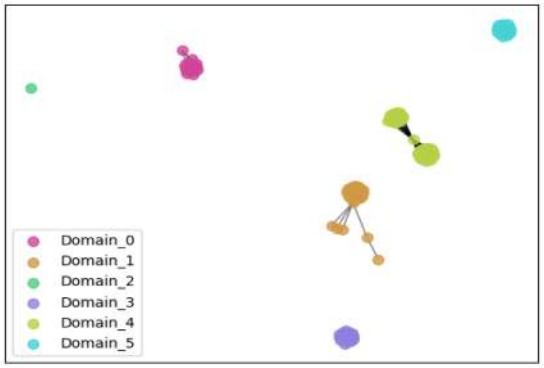
Han Lab – Molecular Evolution

Evolution of domain architecture and interdomain linkers across 148 Amniote genomes

Kinesin Light Chain gene family

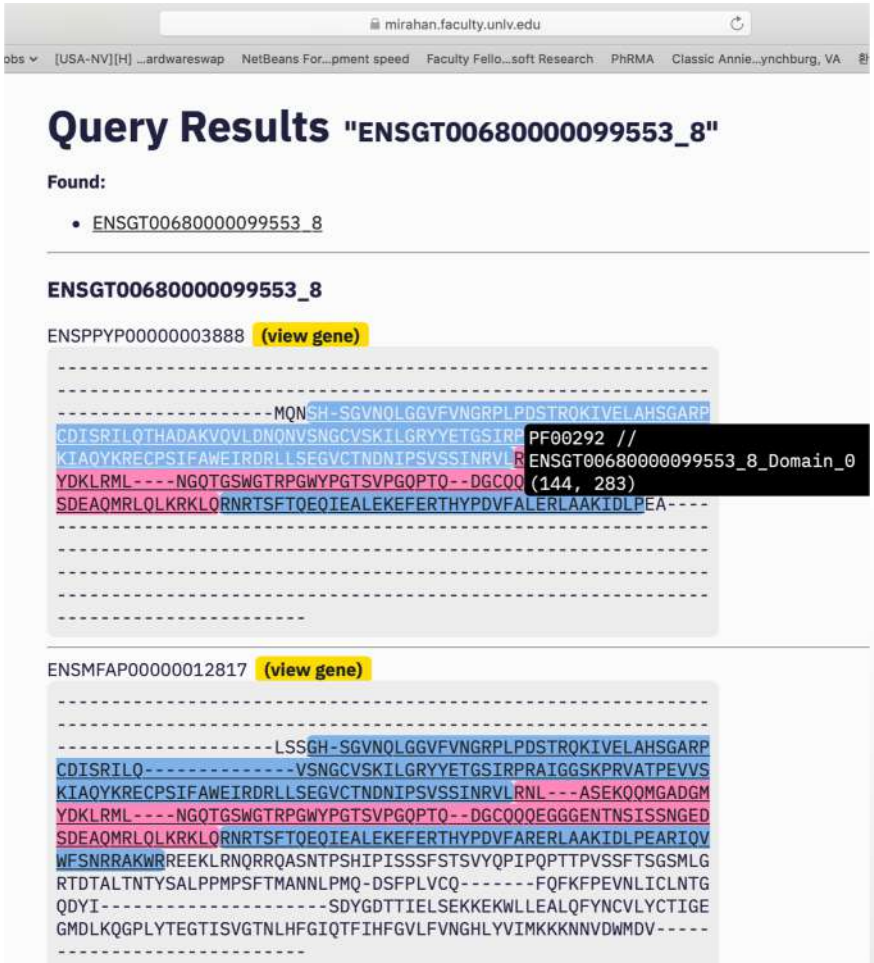


alignment



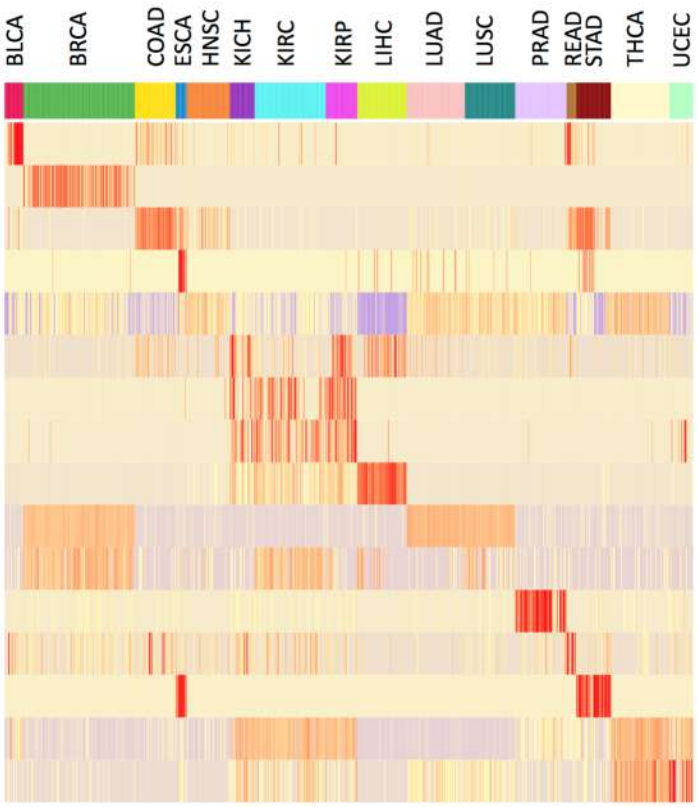
Domain homology across proteins

Database of homologous domains and linkers

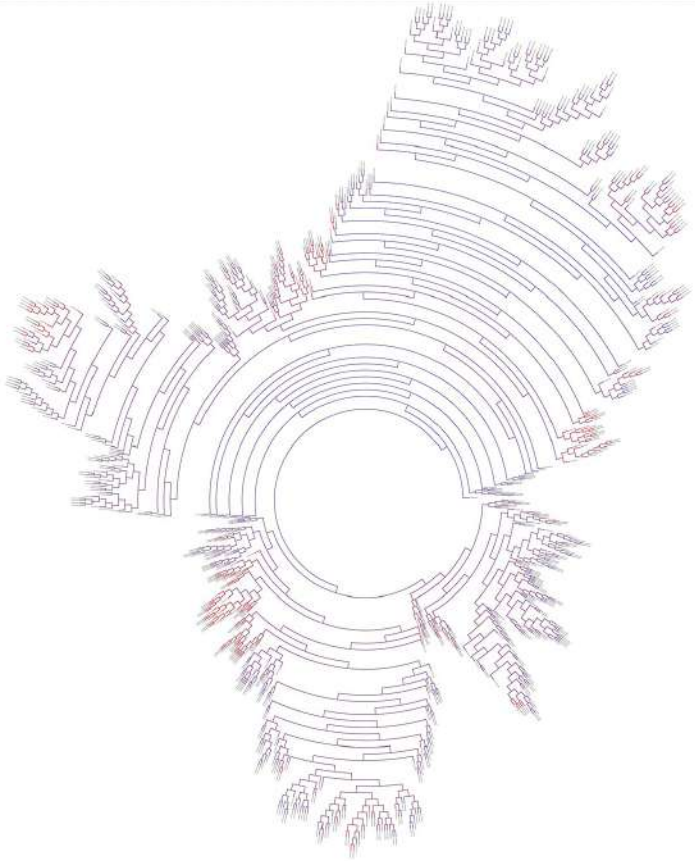


Han Lab – Transposon Genomics

Transposons in host regulation and disease



Tissue specific transposon expression



Predicted NANOG binding based on ancestral reconstruction of RLTR13D6 transposons

Dr. Allyson Hindle

Assistant Professor

School of Life Sciences

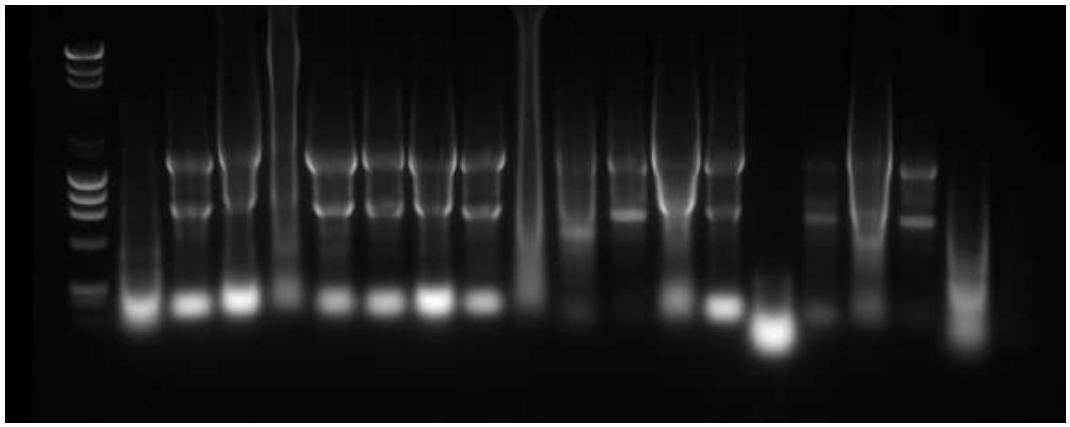
Phone: 702-895-4521

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



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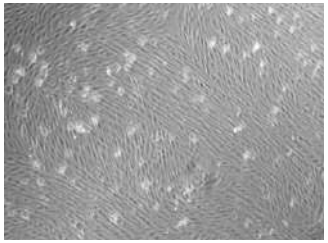
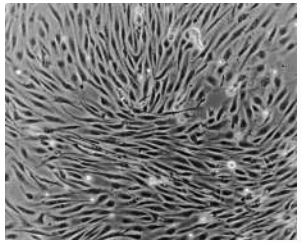
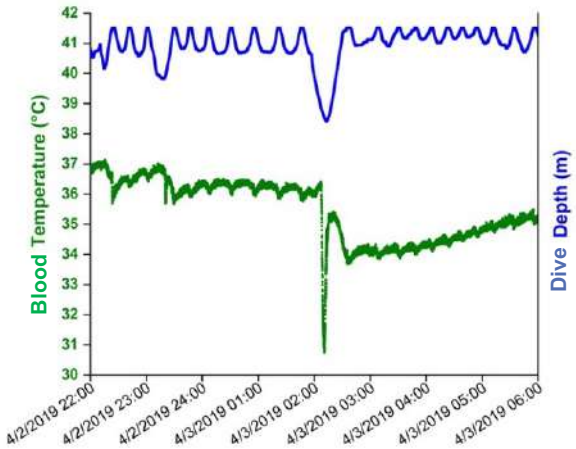
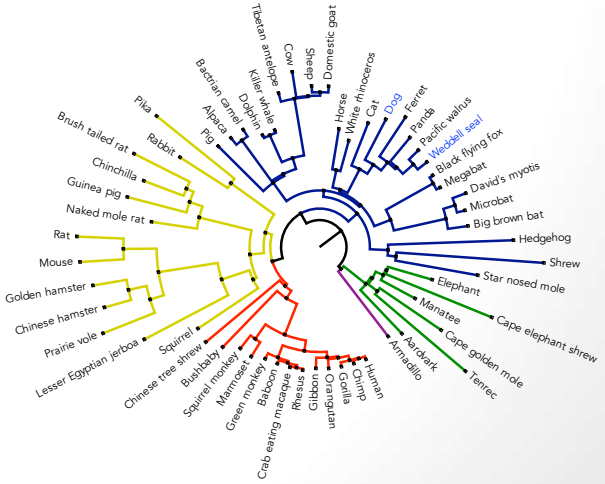
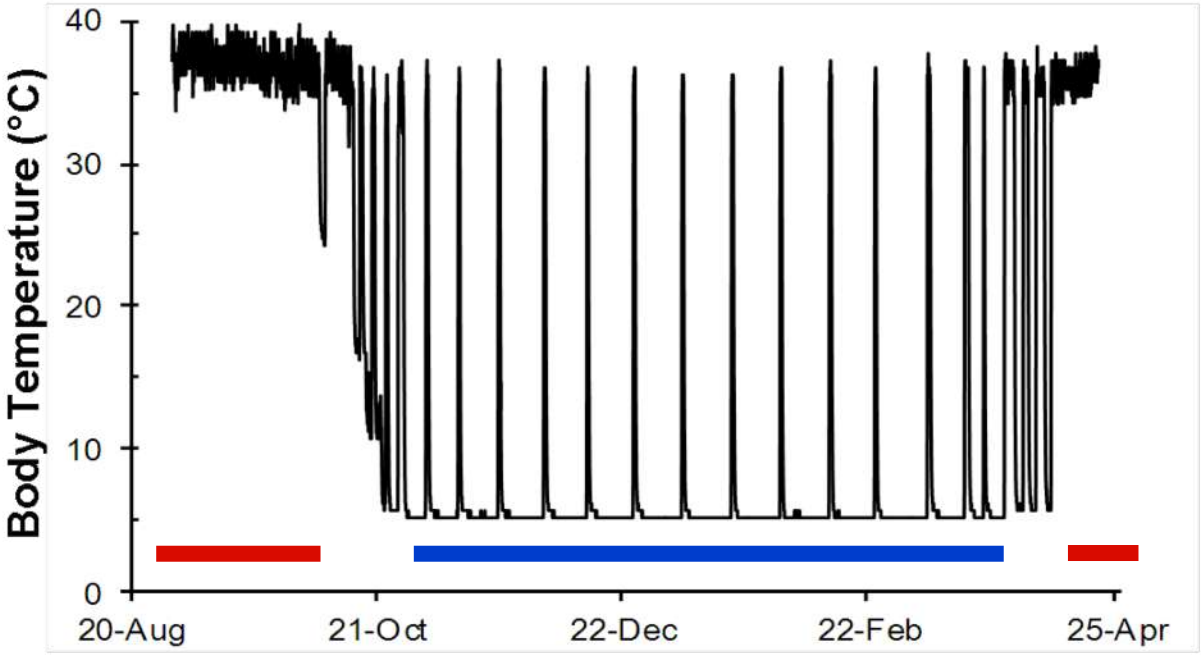






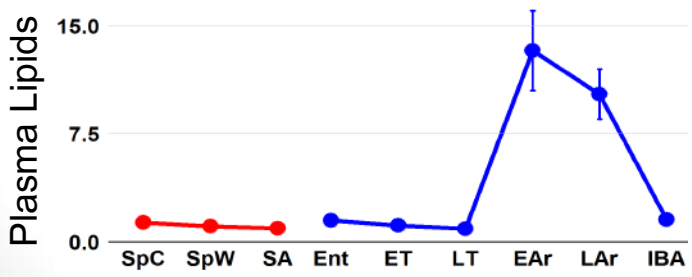


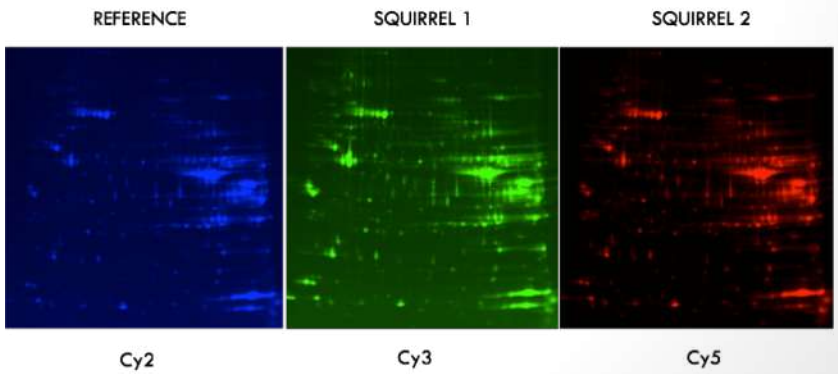
Metabolic control of small hibernators



SUMMER

WINTER



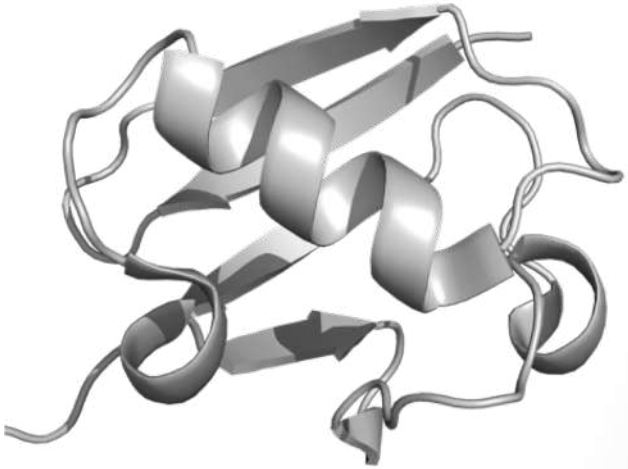


Ubiquitin-mediated protein degradation

Dr. Gary Kleiger
Associate Professor
Department of Chemistry and Biochemistry
gary.kleiger@unlv.edu

Expertise

- Structural biology
- Proteomics
- Enzyme kinetics and biophysical assays
- Cell biology



Protein structure of Ubiquitin.

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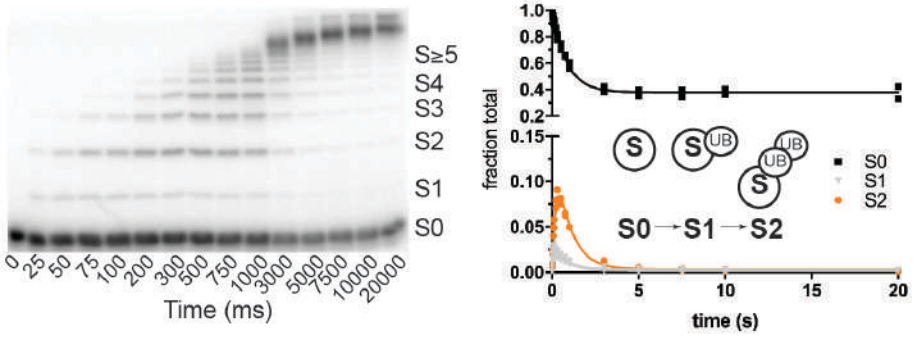
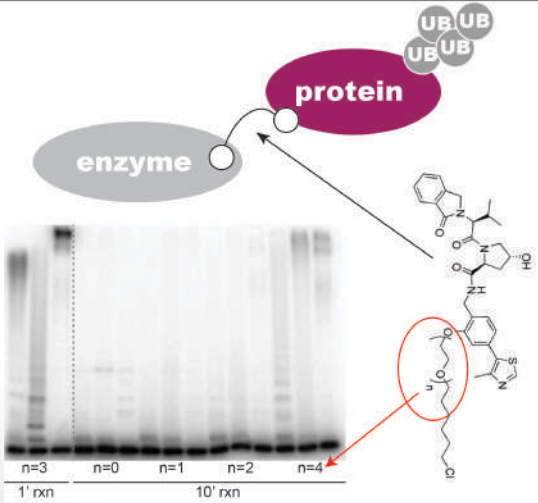
Uncovering how the enzymes that promote protein degradation function in human cells.

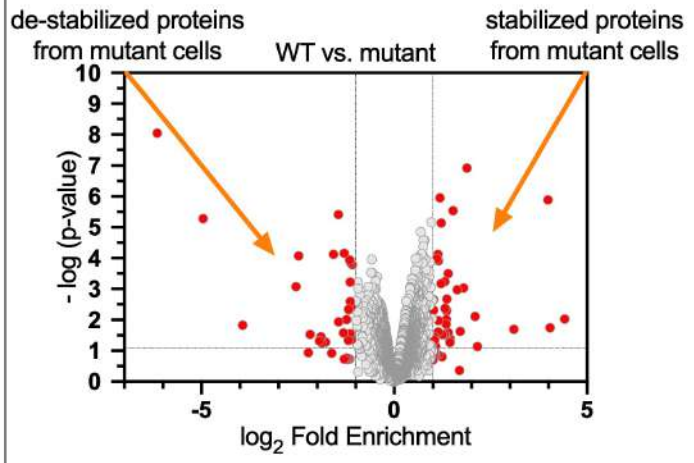
Kinetics help us understand how enzymes select protein targets for modification with ubiquitin.





Small molecule inducers of protein degradation can be used to treat human disease. We study the mechanism of how they function both in test tubes and cells.

High-resolution mass-spectrometry tells us how mutations in enzymes that lead to human disease affect the stabilities of key human cellular proteins.



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The Kleiger lab partners with both industry and academic labs to help discover treatments for human diseases such as cancer.

Mass-spec proteome exploration with Dr. Don Kirkpatrick at Genentech Inc.

How to utilize small molecules to induce the degradation of disease-causing proteins with Dr. Craig Crews (Yale and founder of Arvinas Inc.).

Cryo-EM and structural biology with Max Planck Institute of Biochemistry Director Dr. Brenda Schulman.

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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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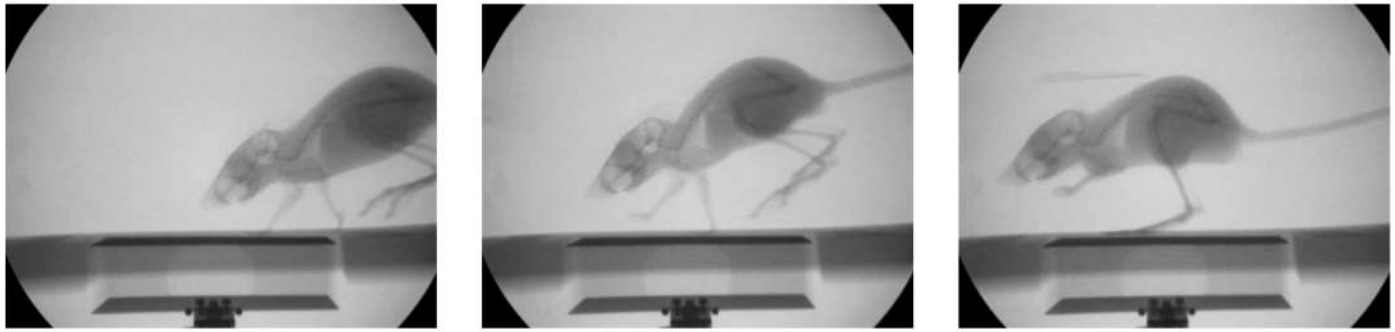
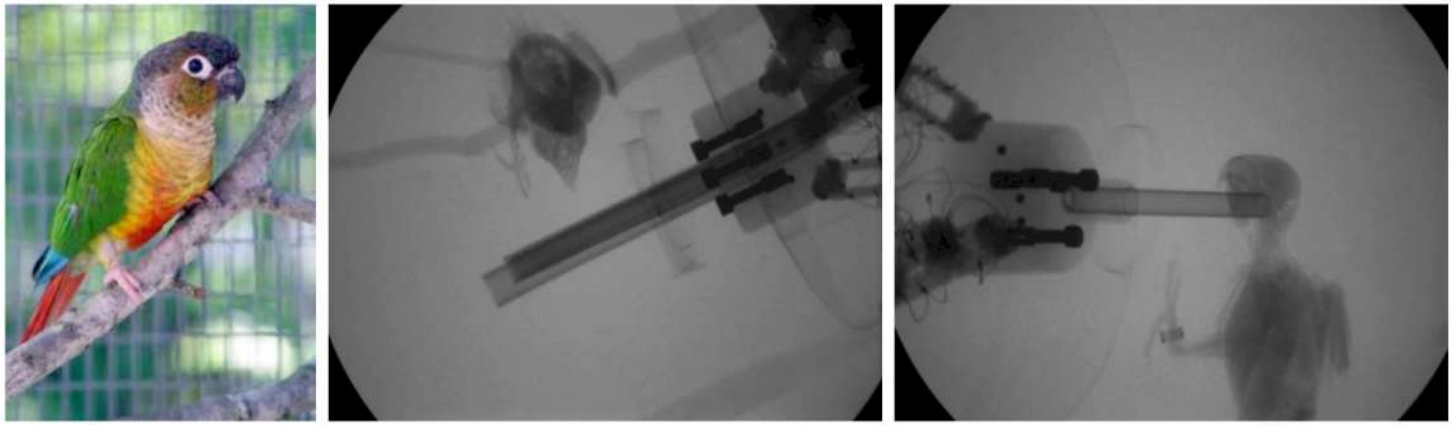
Locomotion

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

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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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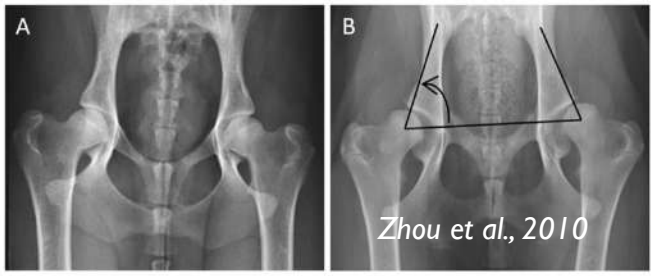
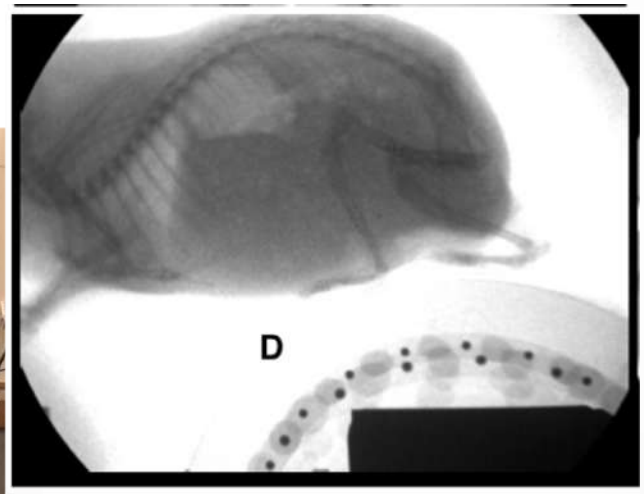
Joint dysfunction and osteoarthritis

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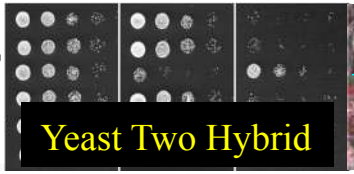
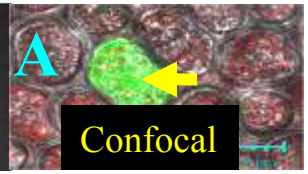
Dr. Jeffery Shen
Professor,
School of Life Sciences
Phone: 702-895-4704
Email: jeffery.shen@unlv.edu

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





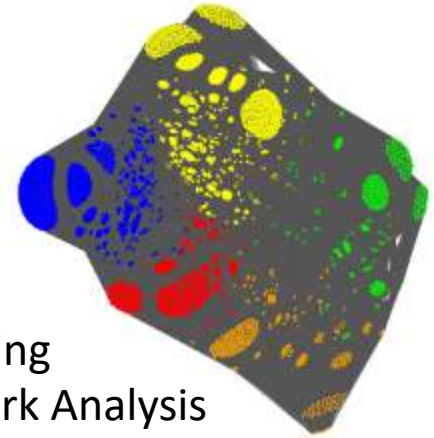
BMC Genomics, 2016, 17:102
Plant Science, 2015, 236:214-222
Front. Plant Science,2015; 6: 1145
Trends in Plant Sci, 2010, 15: 247

Short Read Assembly Algorithm

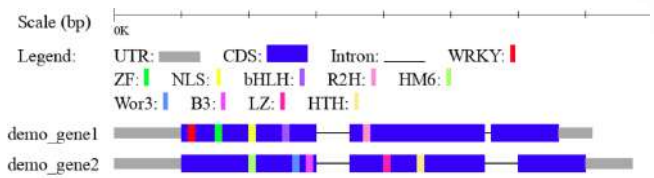
for Genome and Transcriptome Analysis

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



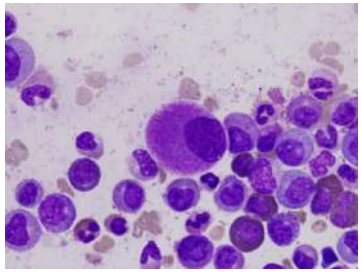
Promoter and Coding Region Structures

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

Biochemistry – Interrogate Cell Signaling Pathways by Molecular, Genetic and Proteomic Approaches

Dr. Hong Sun
Associate Professor
Department of Chemistry and Biochemistry
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Email: hong.sun@unlv.edu

Expertise

- Cell signaling
- Cancer cell biology
- Stem cell biology
- Mouse conditional knockout models

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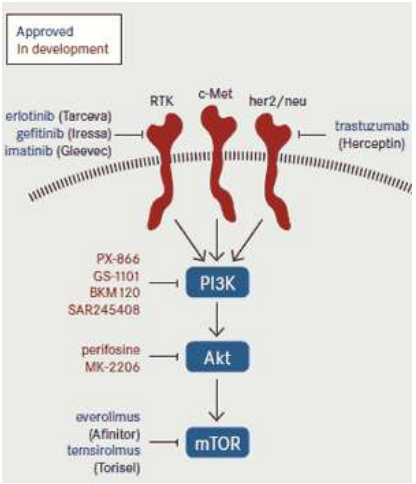
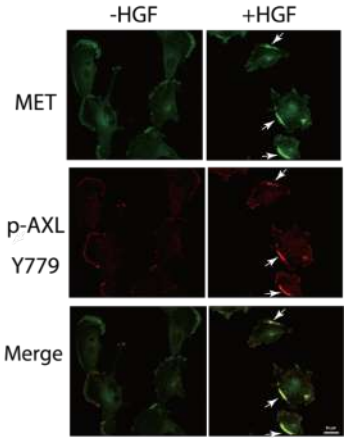
Regulation of cell surface receptor RTKs localization and activation

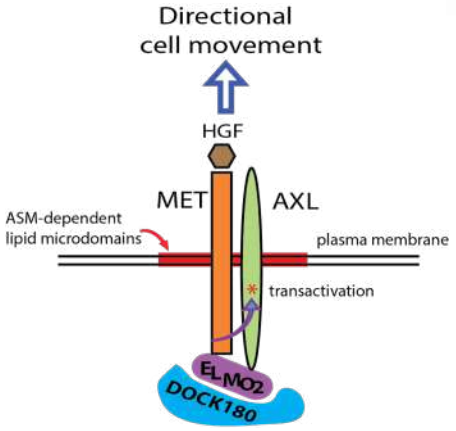
Problem: cancer cells often have multiple receptors (RTKs) activated on cell surface, making targeting inefficient



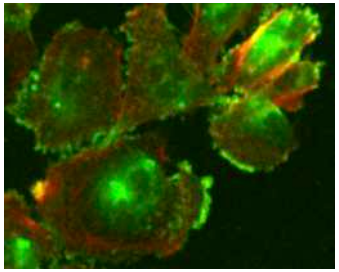
Co-activation of AXL-MET RTKs:
HGF (ligand for MET) also activates AXL, detected by antibodies for p-AXL-Y779



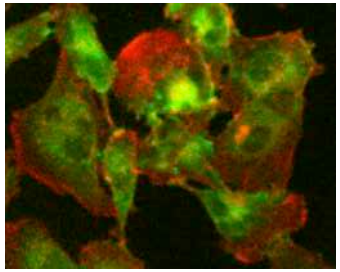
A novel mechanism discovered for RTK-Co-activation and signaling for cancer cell migration and invasion



Li et al., J. Biol. Chem. (2018) 293:15397-15418.

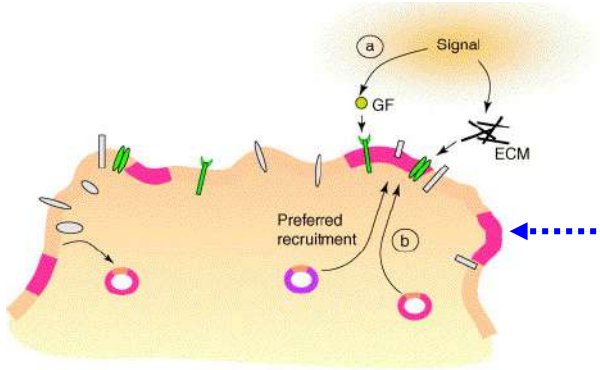


Vehicle



ASM Inhibitor

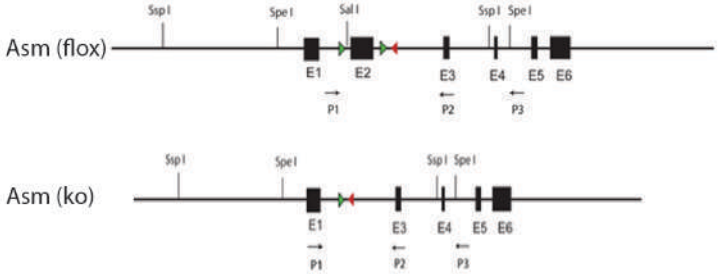
ASM inhibition prevents the MET RTK to be transported to the cell surface, as revealed by immunostaining (MET, green label; and a control cell surface protein, red label).
Zhu et al, J. Cell Science (2016) 129, 4238-4251.



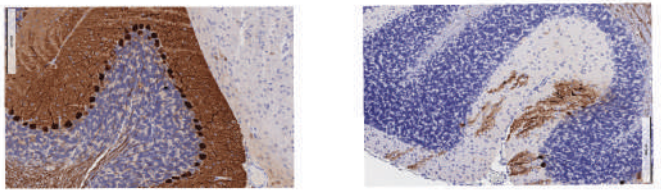
Mass-Spectrometry analyses revealed that the ASM-regulated local lipid microdomains were enriched with many signaling molecules.
Xiong et al. Biol. Open (2019) 8, bio040311.

Regulation of stem cell maintenance: insights from the genetic studies in novel mouse knockout models

A. Gene locus

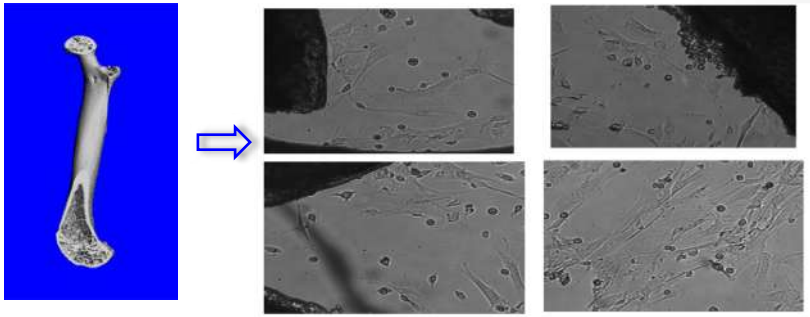


B. Loss of Purkinje neurons in cerebellum



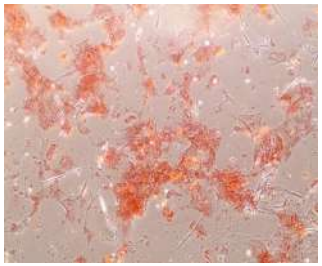
Purkinje neurons immunostained with D28K antibody.

C. Mesenchymal stem cells (MSCs) cultured from bones



D. ASM mutant MSCs failed to become bone-forming cells

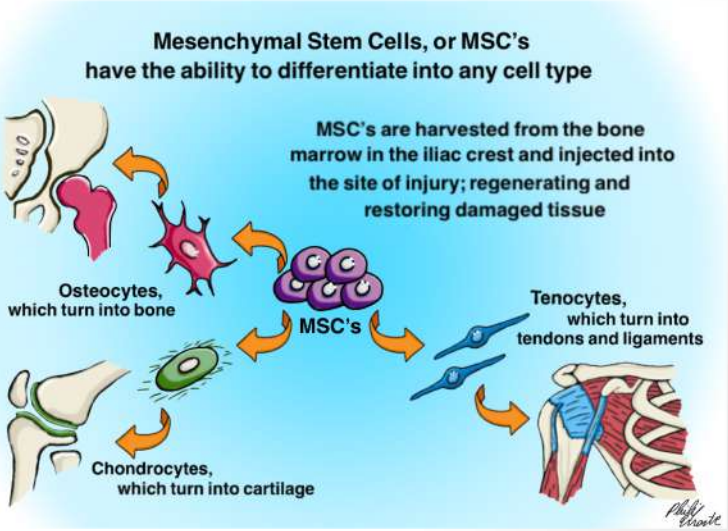
Wild-type MSCs



ASM mutant MSCs

(*in vitro* differentiation assay, then stained with alizarin red)

E. Potentials of MSCs for tissue repair



Aridland Population Biology and Evolution

Dr. Daniel Thompson
Associate Professor
School of Life Sciences
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Email: daniel.thompson@unlv.edu

Expertise

- Evolutionary genetics
- Population and evolutionary ecology
- Insect – plant interactions
- Conservation ecology - endemic insects
- Quantitative genetics, Phenotypic plasticity, and Developmental Reaction Norms
- Multivariate Statistical Analysis
- Animal movement, Habitat Selection, and Spatial ecology

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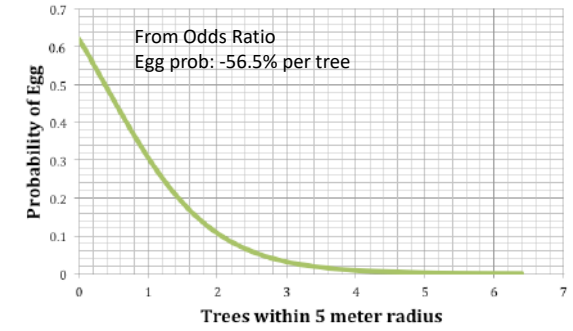
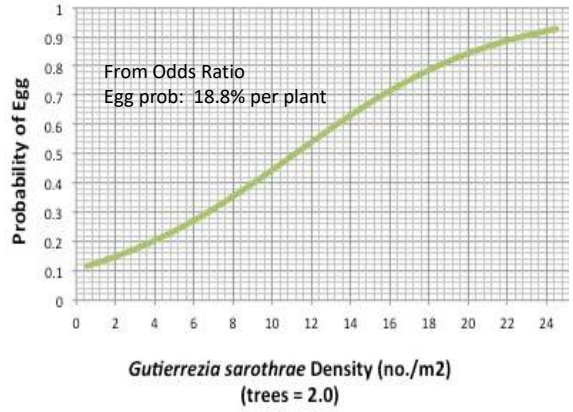
Research on Larval Host Plant Selection of the Endangered Endemic Mt Charleston Blue Butterfly (*Icaricia shasta charlestonensis*) Informs Habitat Conservation and Restoration in Spring Mountains National Recreation Area

- Tree Density has a strong negative effect on female butterfly host plant selection and egg-laying (Logistic regression of egg occurrence versus density of bristlecone .pines).
- Tree encroachment on open slopes and ridges constricts butterfly reproduction– particularly on ridgelines with high quality butterfly habitat.
- Nectar plants such as *Gutierrezia sarothrae* have a positive effect on the likelihood of a female's selection of a larval host plant for egg deposition.
  - Avoidance of trees and attraction to nectar determine a female butterfly's placement of eggs on larval host plants.
  - Ongoing fieldwork investigates caterpillar (larva) growth, foodplant requirements, and interactions with mutualistic ants to further understand the essential characteristics of butterfly habitat. This new information is being used by the US Forest Service and the US Fish and Wildlife Service to guide conservation and management decisions in the Spring Mountains, Clark County, Nevada.

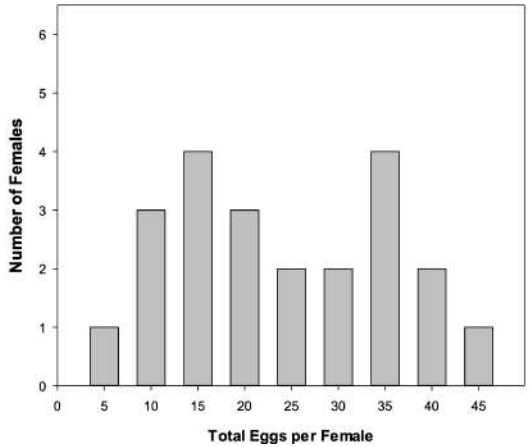




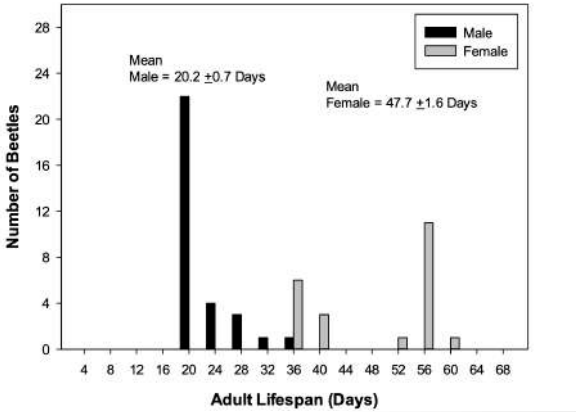
Ecological research on Giuliani's Dune Scarab Beetle (*Pseudocotalpa giulianii),* Big Dune, Nevada, --guiding management decisions of the B.L.M.

Giuliani's Dune Scarab Beetle (*Pseudocotalpa giulianii*) is a rare beetle endemic (known to occur only at) Big Dune and Lava Dune, Nye County, Nevada. Little is known about the beetle's life history, egg to adult stage development, larval food, and habitat requirements. Research conducted with Dr. Leslie DeFalco (USGS) in 2019 and 2020 has established:

- Adults do not feed, dwell in the sand, and emerge at sundown each evening for 3 weeks, late April – May
- Male beetles emerge from sand and fly every night for an average of 52.2 min to mate, while female beetles remain buried in sand after initial emergence and mating.
- Female beetles, on average, deposit one egg per day after mating.
- Female beetles have an average lifespan of 47.7 + 1.6 days.
- Male beetles have an average lifespan of only 20.2 + .7 days.
- The longer female lifespan, their apparent cessation of emergence following mating, and their deposition of single eggs scattered through sand has important implications for the conservation of this rare species.
- Laboratory experiments have revealed that beetle larvae hatch within 2 – 3 weeks from eggs and develop at a slow rate with an estimated 2 to 3 years of growth prior to pupation and adult emergence. To date, feeding experiments indicate that dry plant debris scattered in the sand is an essential food source. Further experiments are being conducted to determine whether larvae feed on roots of desert plants and to measure energy storage in fat tissue that apparently fuels adult activity and mating.
- Research findings are informing Bureau of Land Management (BLM) decisions about managing recreational activity at Big Dune and restoring beetle habitat following disturbance by recreational off-road vehicles..



Total eggs per female beetle obtained in the laboratory, April 29 to June 12



Average lifespan for 30 male beetles and 22 female beetles, observed from April 19 to June 12 in the laboratory

Regeneration and Stem Cell Biology

Ai-Sun (Kelly) Tseng, Ph.D.

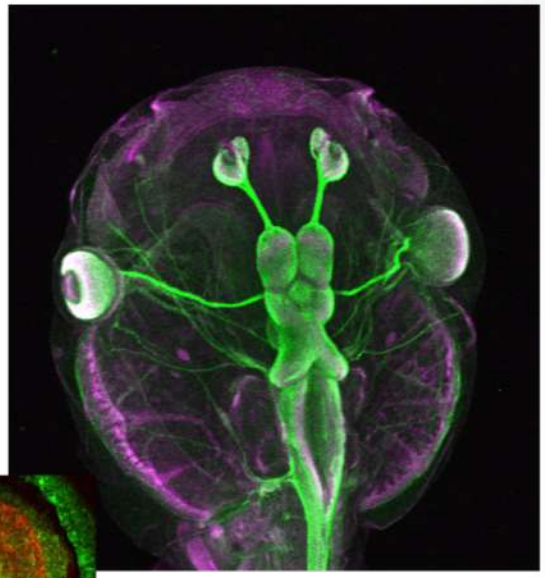
Associate Professor, School of Life Sciences

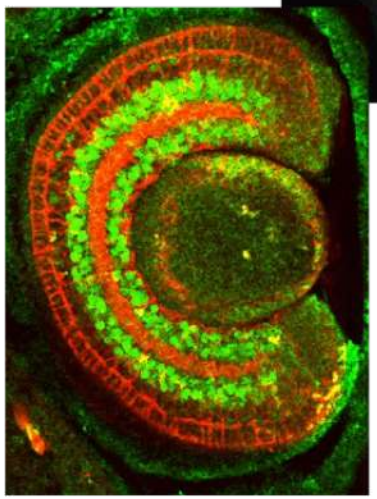
Adjunct Associate Professor, School of Medicine

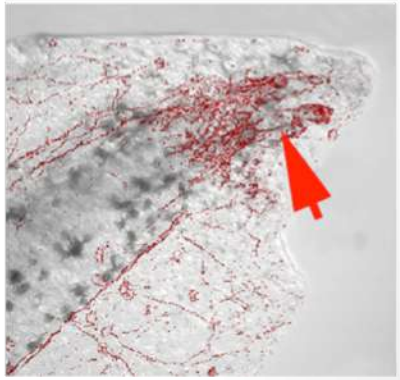
Phone: 702-895-2095

Email: kelly.tseng@unlv.edu

Website: http://tseng.faculty.unlv.edu







Expertise

- Eye regeneration
- Limb regeneration
- Stem cell biology
- Bioelectrical signaling
- Cell proliferation and growth

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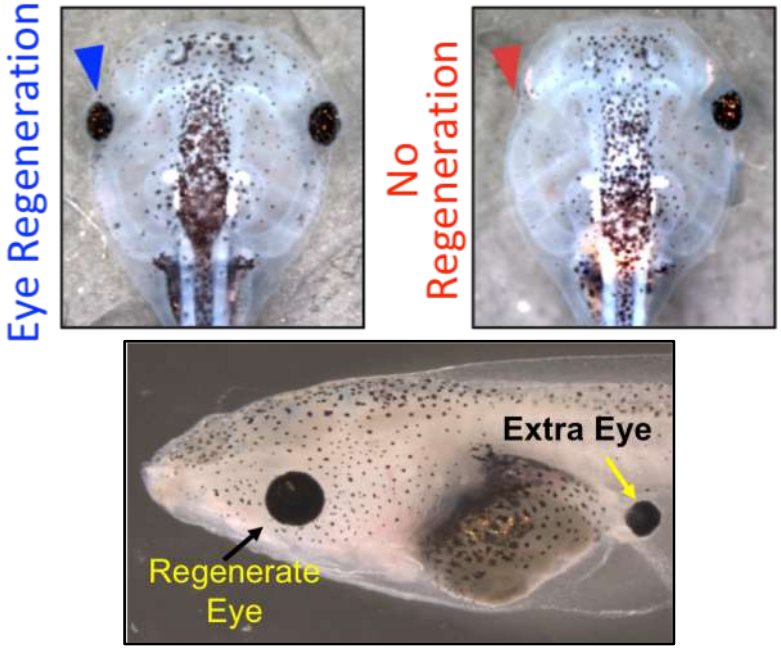
Understanding Vertebrate Organ Regeneration

Kelly Tseng

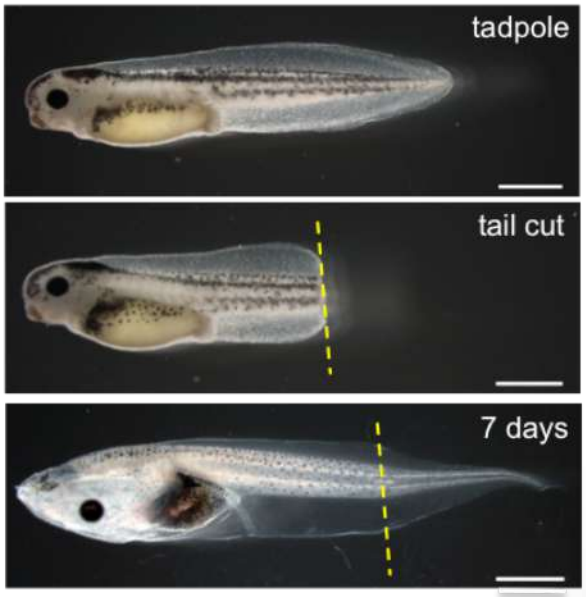
Why Can Some Animals Regenerate Body Parts but Others Cannot?

Goal: understand natural regeneration using a model system with high regenerative ability (clawed frog)

Eye Regeneration



Spinal Cord Regeneration



Projects:

1) Identify and define mechanisms that drive tissue regeneration
2) Develop successful strategies to regenerate lost tissues and organs

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Understanding Vertebrate Organ Regeneration

Kelly Tseng

Recent Publications:

- Kha, C. X., Guerin, D.J., and Tseng, K. A.-S. (2020) Studying *in vivo* Retinal Progenitor Cell Proliferation in *Xenopus laevis*. In: Mao CA. (ed) *Retinal Development. Methods in Molecular Biology*, *2092:19-33*. Humana, New York, NY.
- Kha, C. X, Guerin, D.J., and Tseng, K. A.-S. (2019) Using the *Xenopus* Developmental Eye Regrowth System to Distinguish the Role of Developmental Versus Regenerative Mechanisms. *Frontiers in Physiology*, May 8;10:502. doi: 10.3389/fphys.2019.00502.
- Kha, C. X., and Tseng, K. A.-S. (2018) Developmental Dependence for Functional Eye Regrowth in *Xenopus laevis. Neural Regeneration Research, 13*:1735-38.
- Kha, C. X., Son, P. H. , Lauper, J., and Tseng, K. A.-S. (2018) A Model to Investigate Developmental Eye Repair in *Xenopus laevis. Experimental Eye Research, 169*:38-47.
- Tseng, A.-S. (2017). Seeing the future: using *Xenopus* to understand eye regeneration. *genesis: The Journal of Genetics and Development, 55*(1-2), e23003. http://dx.doi.org/10.1002/dvg.23003

http://tseng.faculty.unlv.edu

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Bacterial Physiology Research

Dr. Boo Shan Tseng
Assistant Professor
School of Life Sciences
Phone: (702) 895-2700
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Expertise:

- *Pseudomonas aeruginosa*
- Biofilms
- Bacterial stress response
- Antimicrobial susceptibility
- Cystic fibrosis lung infections

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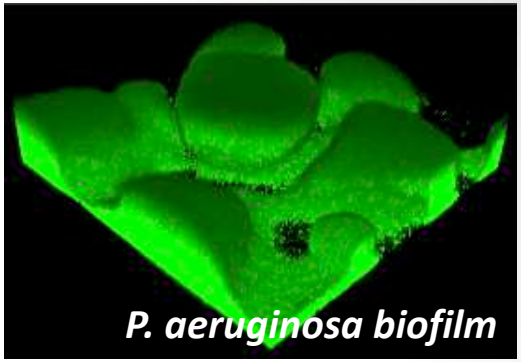
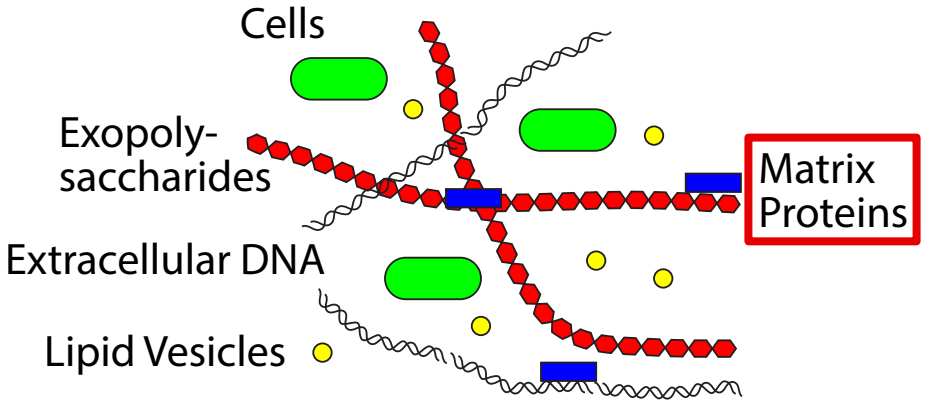
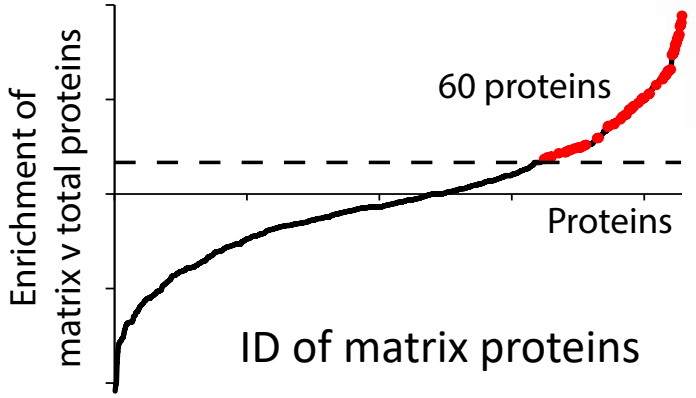
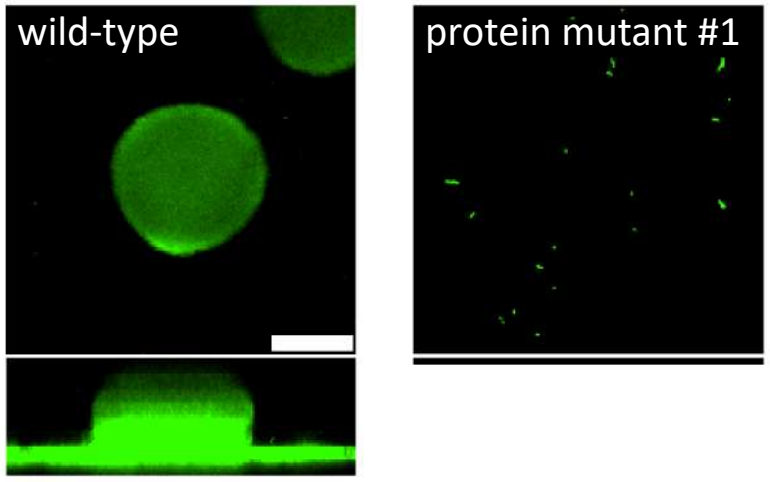
Identifying the roles of biofilm matrix components



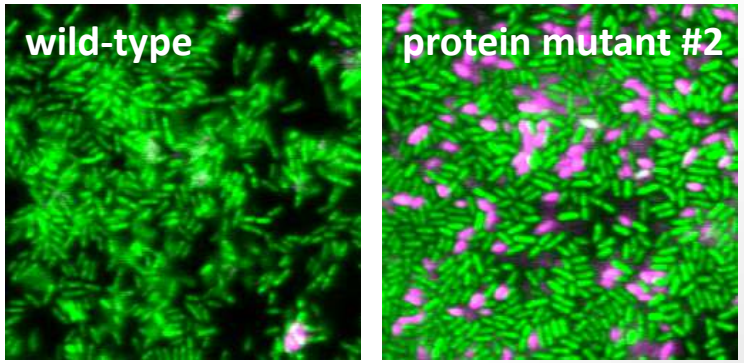




Functions in biofilm formation

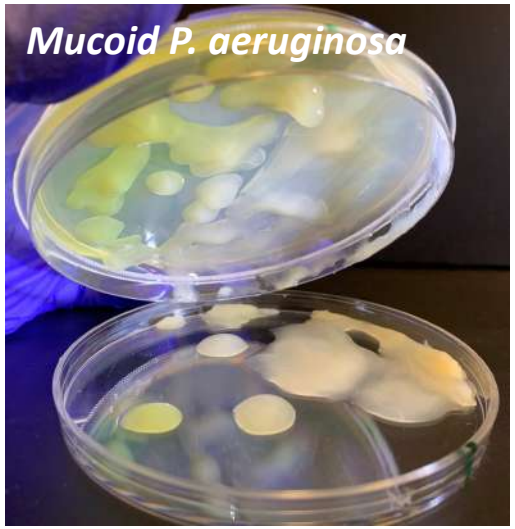


Functions in antimicrobial susceptibility

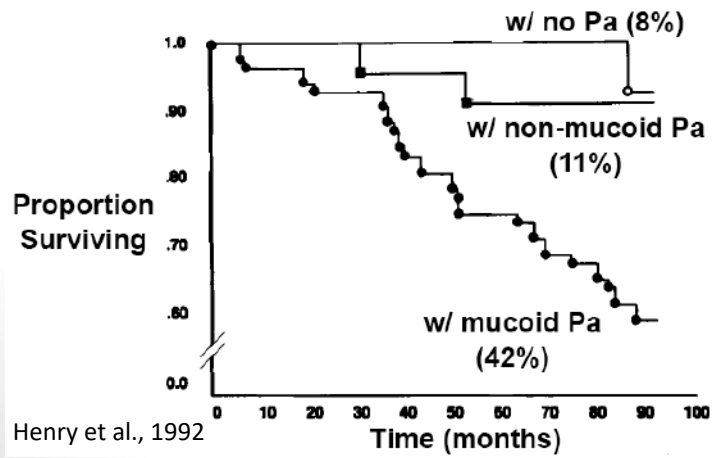


Treated with elastase (green: alive; purple: dead)

Mechanism behind the essentiality of bacterial envelope stress inhibitor

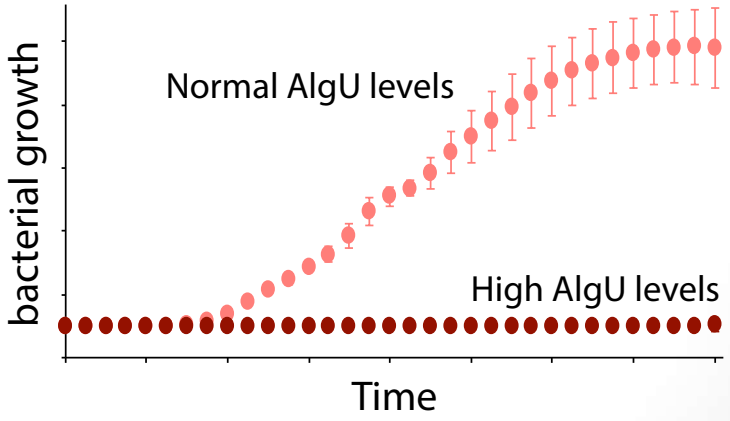


- Exopolysaccharide overproducing (e.g. mucoid) bacteria arise during chronic lung infection
- Associated with poor disease outcomes
- Due to mutation in *mucA* gene, which encodes for inhibitor of envelope stress response via AlgU
- BUT *mucA* required for bacterial viability and overproduction of AlgU inhibits growth



Henry et al., 1992

In children with cystic fibrosis



Question: why is a gene commonly mutated in clinical isolates required for bacterial viability?

School of Life Sciences

Dr. Frank van Breukelen
Professor and Director
School of Life Sciences
Phone: 702-895-3944
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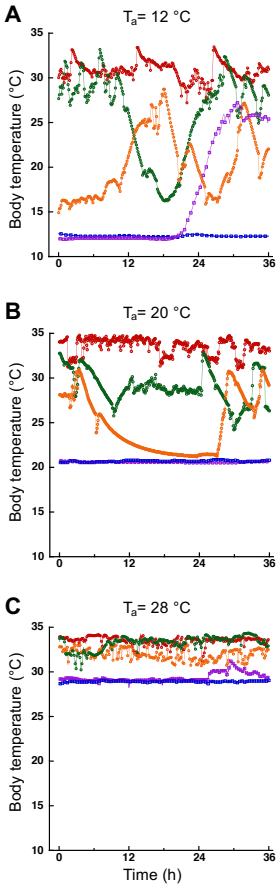
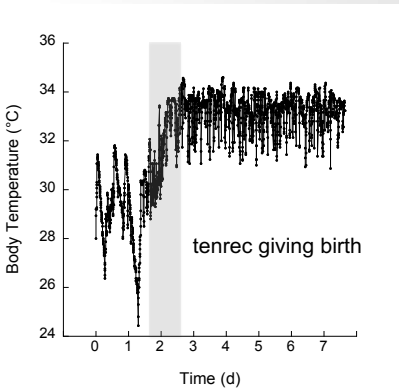
Expertise

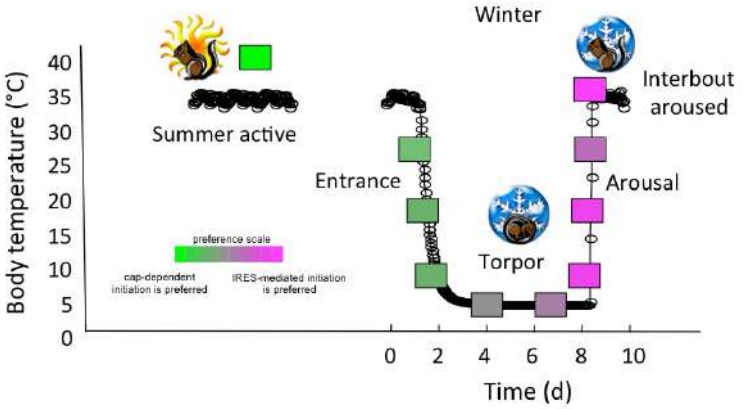
- Metabolic depressions like mammalian hibernation
- Life in extreme environments

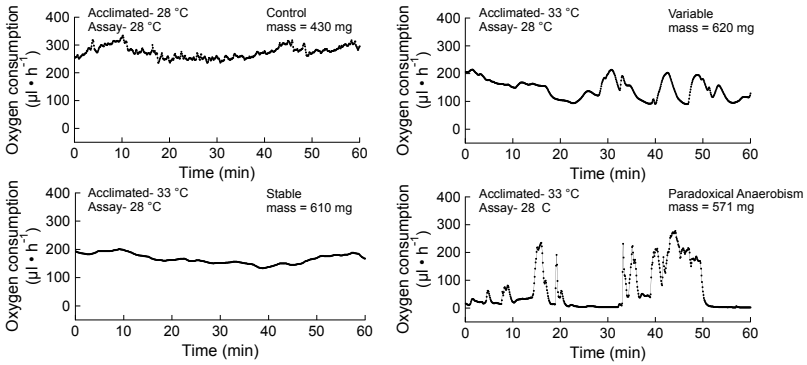
Areas of research

- 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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Understand cancer from an embryonic prospective

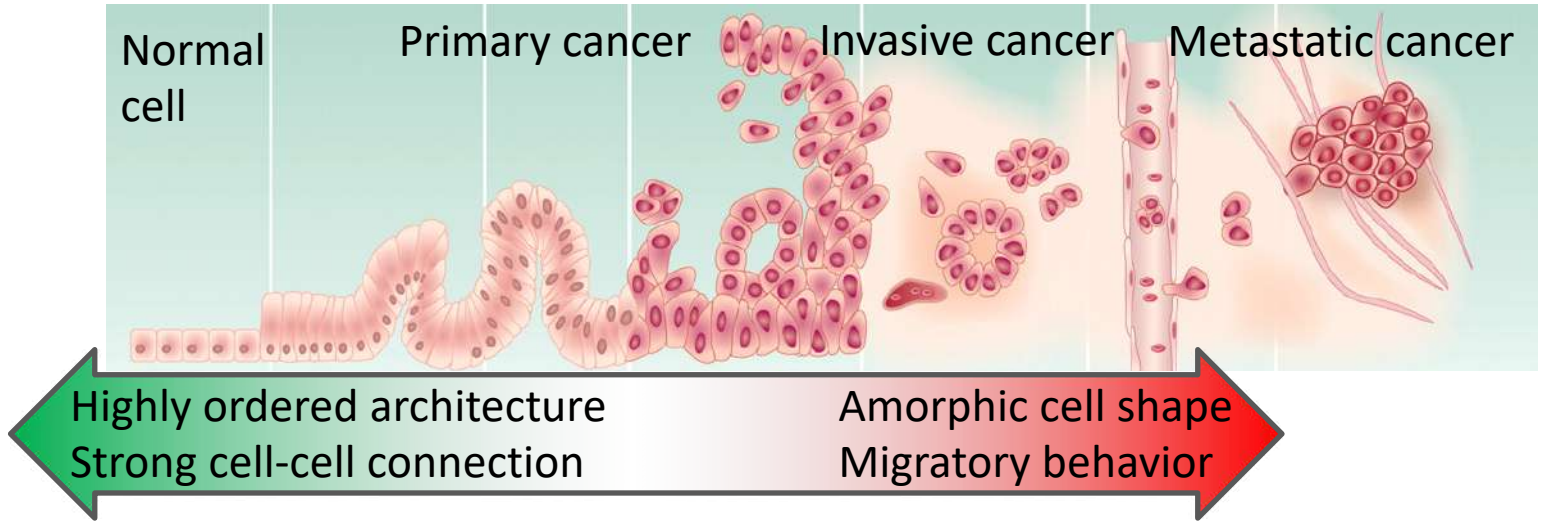
Dr. Mo Weng
Assistant Professor
School of Life Sciences
Phone: 702-895-5704
Email: mo.weng@unlv.edu

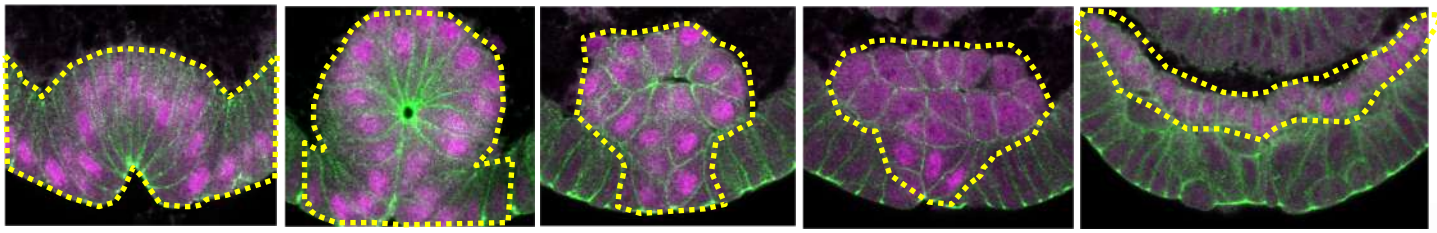
Expertise

- Epithelial-mesenchymal transition
- Developmental genetics
- mechanobiology
- Cancer biology

Understand cancer from an embryonic prospective

- Metastasis, the cause of death for 90% cancer patients, is not a cancer invention but a hijacked natural program essential for generating diverse structures in embryos, called epithelial-mesenchymal transition (EMT).



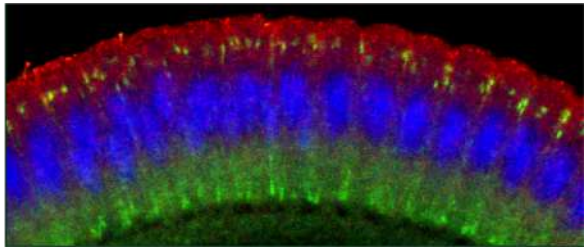


Embryo EMT

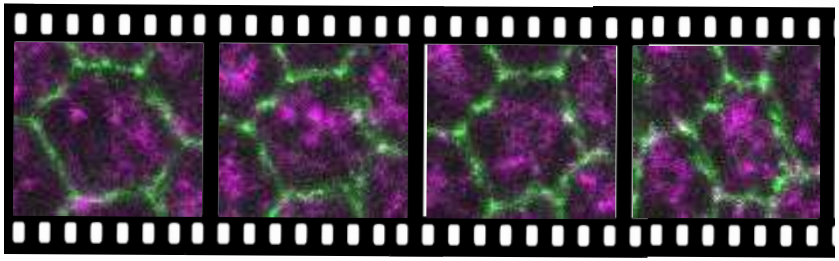
Understand cancer from an embryonic prospective

We use multidisciplinary approaches to study both biochemical and mechanobiological pathways controlling cell polarity and cell fate.

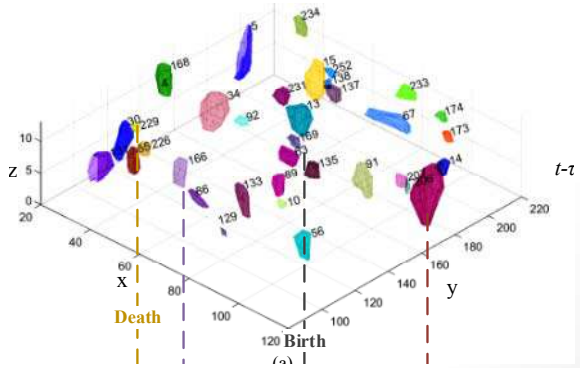
- Seeing is believing: Laser scanning confocal imaging probes micrometer cellular structures in 3D at high resolution and sensitivity



- Live cell imaging records the dynamics of cells and proteins as the living embryo taking on increasingly complex structures.



- Machine-learning approaches extract invisible principles from information-rich images and make predictions



- Genetic approaches such as gene editing test the roles of individual genes and their interaction.

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Microbiology

Dr. Helen J. Wing
Professor,

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Expertise

- Microbiology focusing on agents of Infectious Disease
- Bacterial Gene Regulation
- Bacterial Physiology
- Molecular Biology controlling virulence
- Identification of novel drug targets
- Antibiotics use & Antibiotic resistance

Genetic switches & molecular mechanisms controlling virulence

Central themes of this project

Transcriptional control of bacterial genes

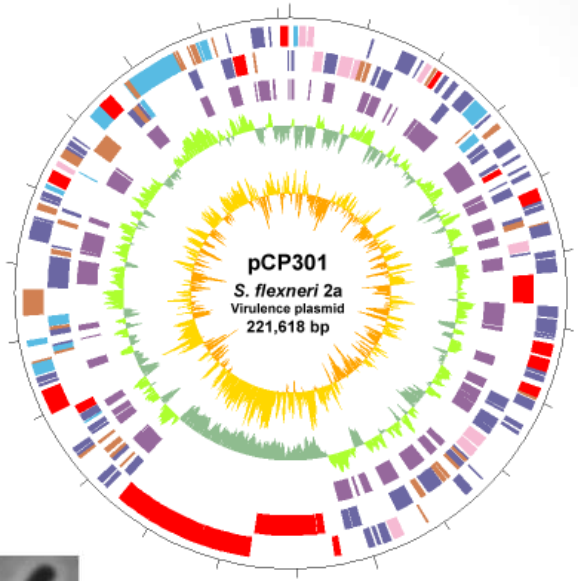
Dynamic nucleoid remodeling

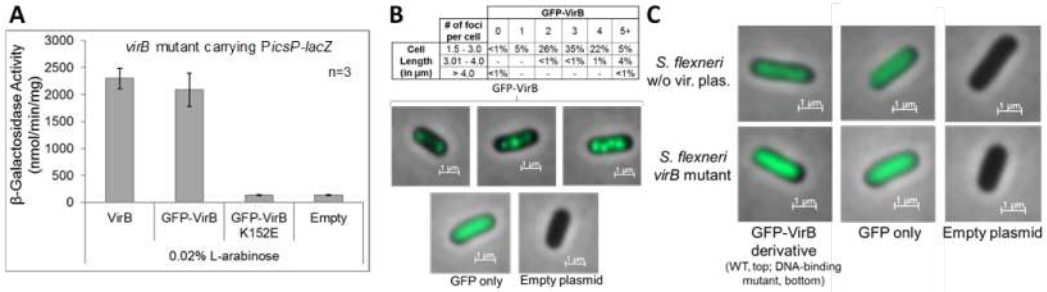
DNA-protein and ligand-protein interactions

Evolutionary relationship of bacterial proteins

Bacterial management of large plasmids

Novel targets for antibiotics and therapeutics



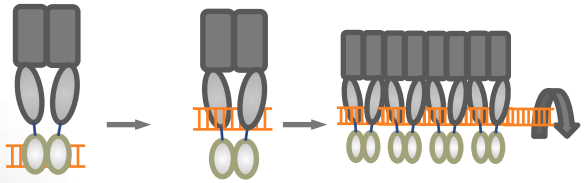


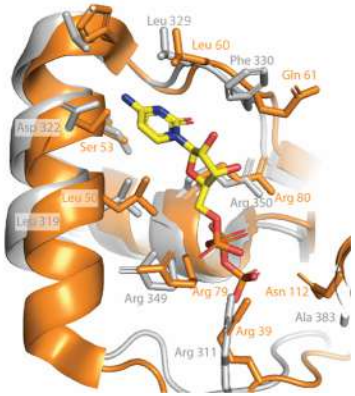
A: Current model

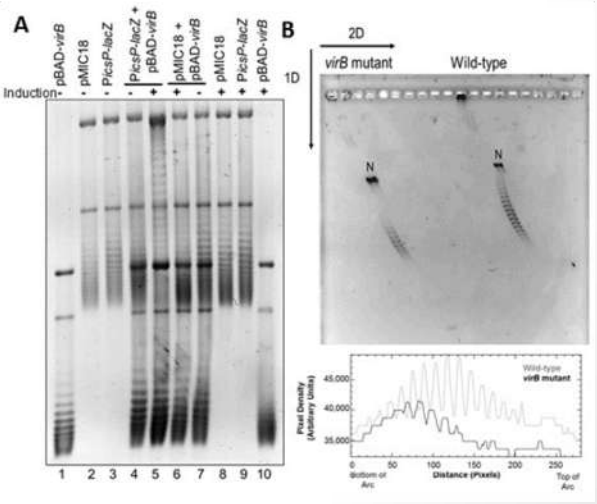
Step 1: Non-specific interactions with DNA (in vitro only)

Step 2: Binding to its recognition site is a prereq. for Δlk, focus formation & anti-silencing

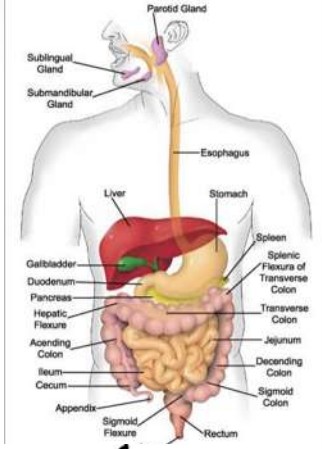
Step 3: Spreading along DNA causing torsion in the DNA helix. The triggered change in DNA supercoiling is sufficient to relieve gene silencing.







Shigella pathogenesis



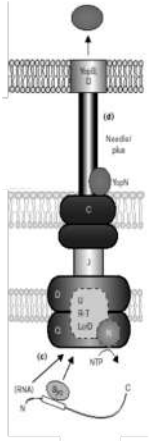
Fast Facts

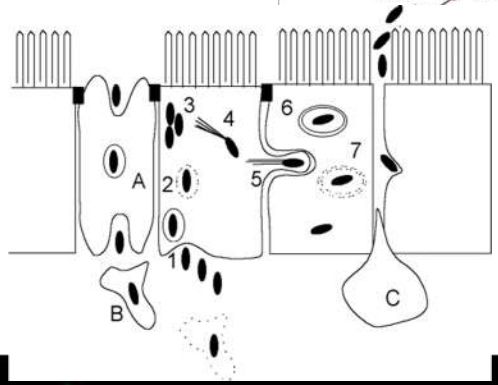
Shigella species - causal agents of bacillary dysentery

Cause an estimated 80-165 million cases per year and 600,000 deaths, mostly in children under 5 years.

Highly infectious (low infectious dose)

Increasingly resistant to commonly used antibiotics



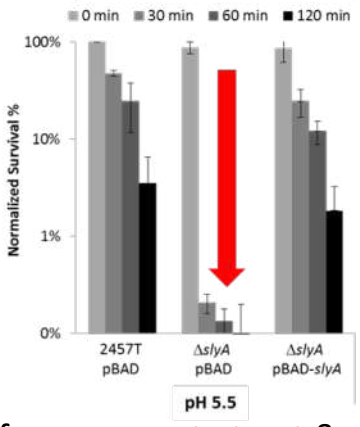


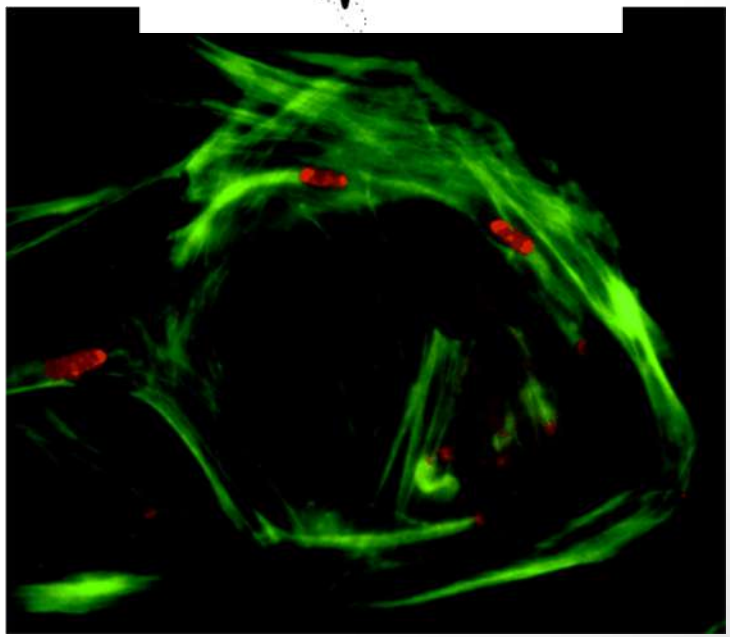
Central themes of this project

Why are these pathogens so infectious?
- we explore their acid resistance (stomach acid)

How do they enter host cells?
- we study regulation of the Type III secretion system (a bacterial conduit that delivers proteins into host cells).

How do these bacteria cause disease in humans?
-one way is to hijack the host's actin cytoskeleton. The bacteria use the actin to move through the host cell cytoplasm!





Through these studies we hope to identify new ways to treat & prevent Shigellosis

Management & Leadership of UNLV VTM production for SNPHL

Through April 2020 and into the Fall, Dr. Wing led a team of volunteers in making VTM(S) media for Southern Nevada Public Health Labs.

Volunteers came from the School of Life Sciences, Department of Chemistry and the UNLV School of Medicine (listed below).

By the end of the project 50,000 vial of medium had been made, which were used by SNPHL Strike teams to test for SARS-Cov-2 (the agent of COVID-19 disease)

UNLV Volunteers:

UNLV SoLS: Monika Karney (Wing Lab Manager and co-lead), Holly Martin (Grad), Tatiana Ermi (Grad), Shrikant Bhute (Post-doc), Isis Roman (Undergrad), Boo Shan Tseng (Asst Prof.) & Cody Cris (Undergrad/Grad).

UNLV Chemistry: Ernesto Abel-Santos (Prof and co-lead), Naomi Okada (Grad), Jacqueline Phan (Grad), Chandler Hassan (Grad), Lara Turello (Grad) & McKensie Washington (Undergrad),

UNLV SoM: James Clark, Michael Briones, Liz Groesbeck & Anita Albanese (all Med students)

Stem Cells, Genetic and Epigenetic Inheritance, Cancer

Dr. Hui Zhang
Associate Professor
Department of Chemistry and Biochemistry
Phone: (702)774-1489
Email: hui.zhang@unlv.edu

Expertise:

- Biochemistry and developmental regulation of pluripotent embryonic stem cells, adult stem cells, and related diseases

- Regulation of chromatin structure, epigenetics, and transcription by protein methylation and ubiquitin enzymes

- DNA replication, DNA repair, cell cycle, genome instability, and cancer

- Targeting the vulnerability of human cancers

Current research areas in Zhang Laboratory:

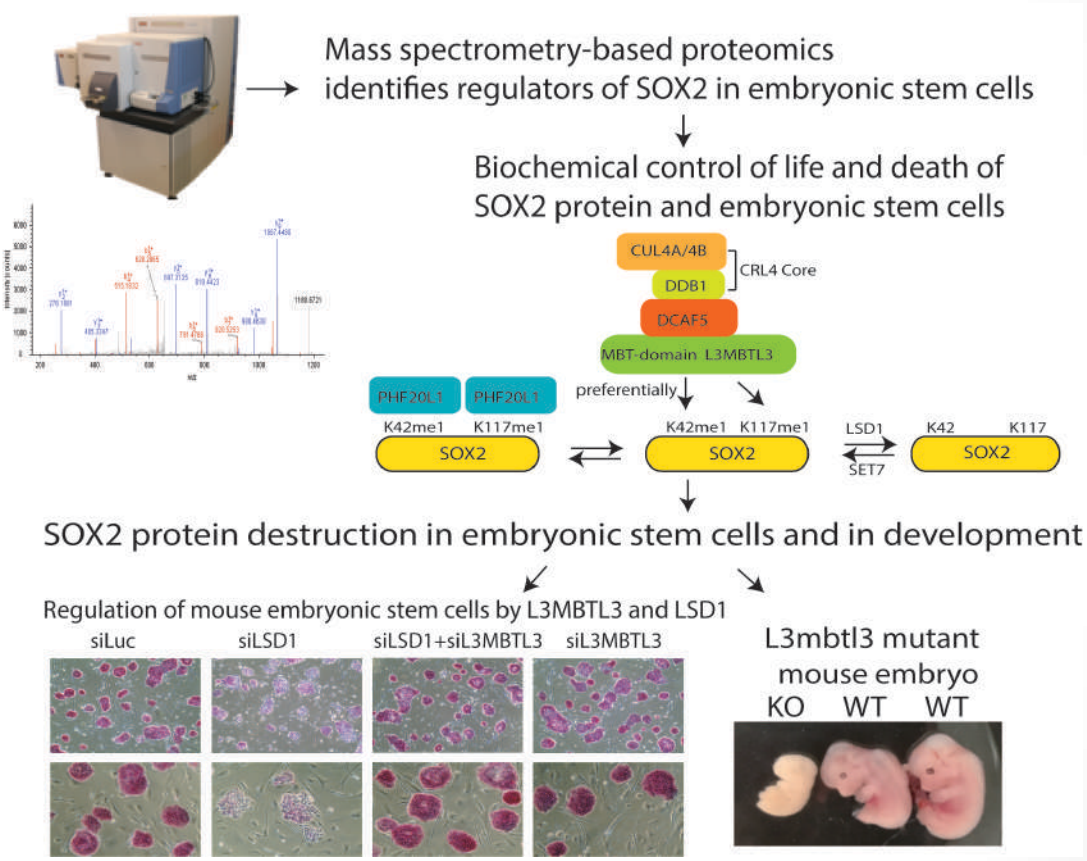
• Discover novel proteins essential for stem cell regulation, examples:

How SOX2 is regulated in embryonic stem cells and many other stem cells in development?

- Sox2 is a master stem cell protein that controls the self-renewal and pluripotency of embryonic stem cells that can develop into any tissue types of cells in development.

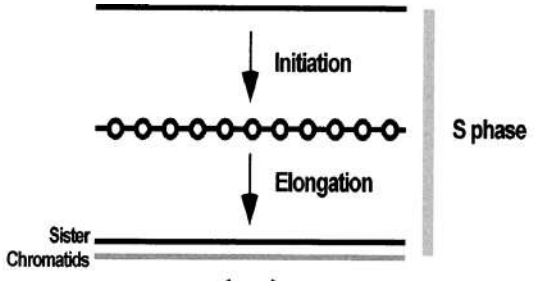
- SOX2 is also a master regulator of many adult stem cells including the stem/progenitor cells for brain, lung, colon, breast, liver, cochlea/ear, skin, retina, ovary, bladder, esophagus, and testes for tissue repair/regeneration.

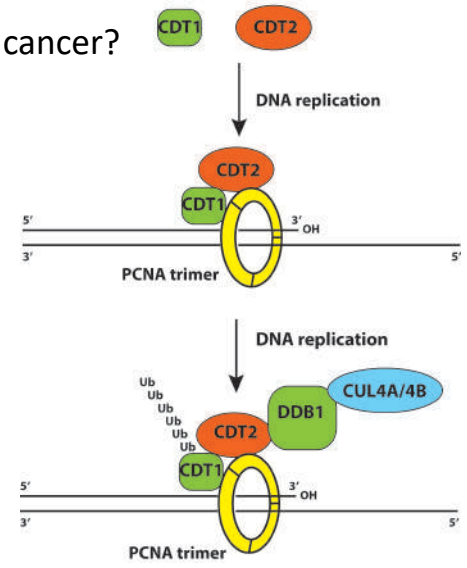
- Artificial Sox2 expression (together with Oct4 and accessary Klf4, and Myc) can virtually convert any differentiated cells, such as skin or blood cells, into induced pluripotent stem cells (iPSCs), the embryonic stem cell-like cells.

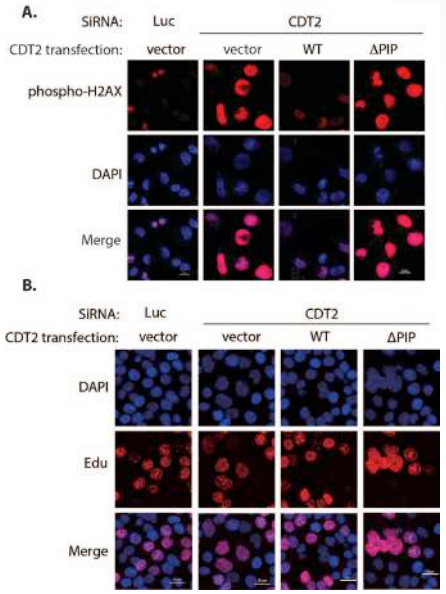


- Discover novel proteins important for epigenetic and cell cycle regulation, examples:
- **Regulation of DNA replication and DNA methylation in normal and cancer cells**

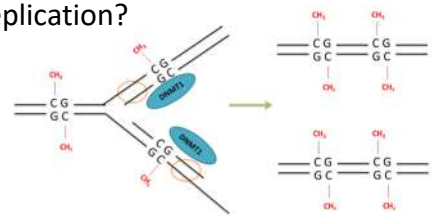
  - How DNA replicates only once in one cell cycle in animal cells? How re-replication is prevented that causes genome instability and cancer?





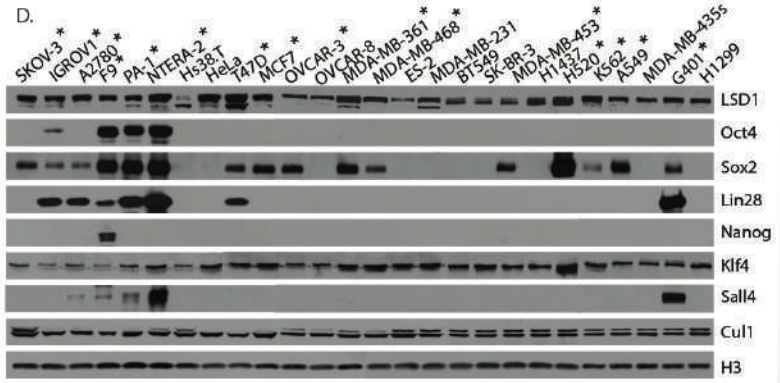


  - How the fidelity of epigenetic DNA methylation is maintained during DNA replication?



- **Cancer Biology and therapy development**

Elevated SOX2 levels cause many cancers including cancers of lung, brain, breast, and ovary. These cancers are hard to treat because they behave like stem cells due to SOX2 expression. We are developing novel LSD1 chemical inhibitors that target the epigenetic vulnerability of these cancer cells.



The presence of SOX2 in different types of cancer cells is responsible for sensitivity towards our LSD1 inhibitors. *: Sensitive to LSD1 Inhibitors

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