Building a Center of Brain Research Excellence: Wyoming Sensory Biology COBRE

Qian-Quan Sun

Wyoming Sensory Biology Center

Dept. Zoology and Physiology

College of Agriculture, Life Sciences and Natural Resources

Wyoming Sensory Biology Center

Sensory system: a window into the brain

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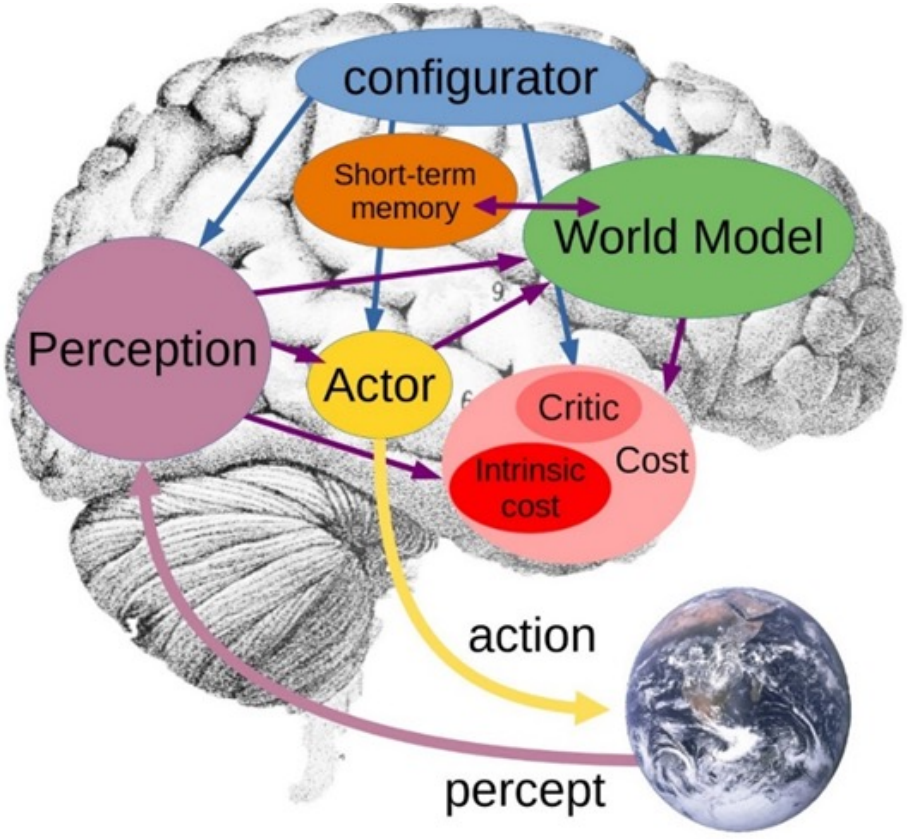
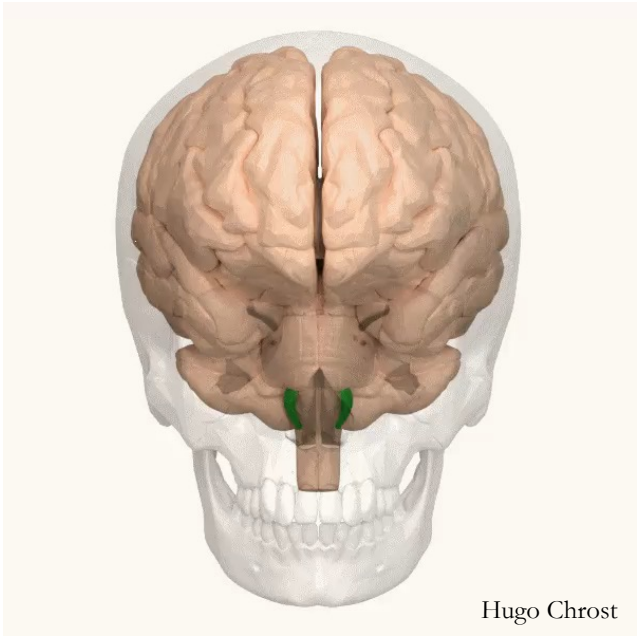
Cognitive activity roots in perceptions.

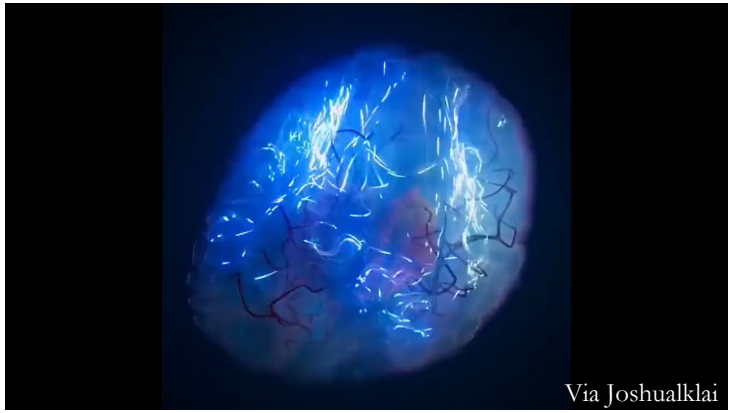


Yann LeCun

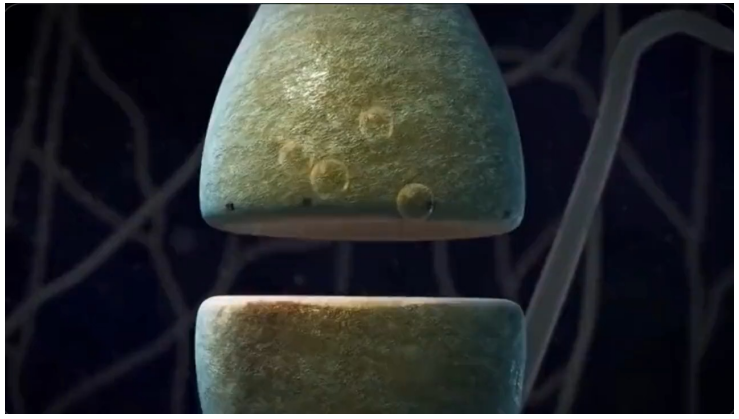
Human Brain Facts: ~100 Billion Neurons, 1,00 trillion connections, travel speed 268 MPH, 23 Watts of Power.



Hugo Chrost



Via Joshualklai



Building the multi-disciplinary team at UW

COBRE Phase I award: 2017-2022 ($11.1Million, total cost); Phase II award: 2022-2027 ($10.5Million, total cost, estimated)

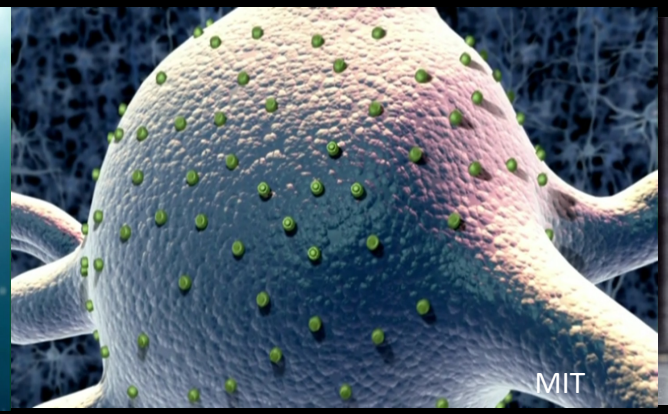
WSBC Phase I Accomplishments: 25 individual grants (2R01, 1 R35, 3NSF Career), over $15 million dollars, were awarded to 15 SBC Project and Pilot leaders (PL). All initial PL achieved independence.

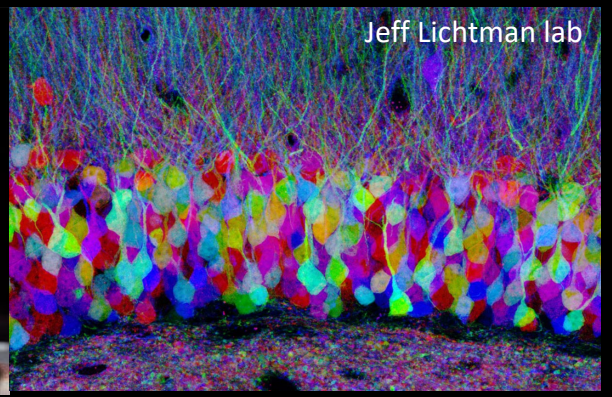
WSBC Phase I Accomplishments: Phase I: SBC PL published 86 publications with 11 in IF10.0+ journals. IMC users published ~320 papers in 5 year period.

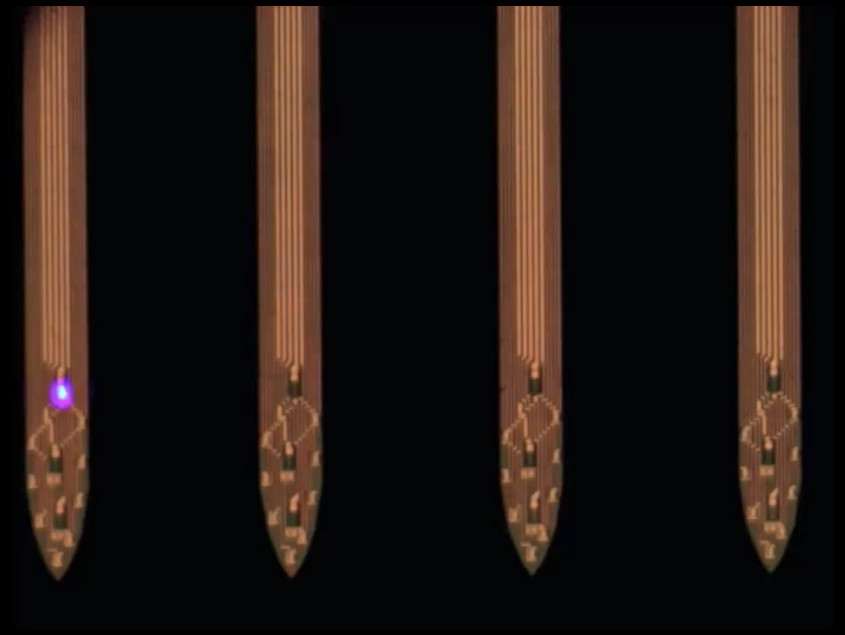
Basic Research (Subject/Approach)	Research Core (Integrated Microscopy Core)	Translational Research (Area)
Santoro* (Olfaction/Molecular)	Integrated Microscopy Core (Approach and technique sharing)	Brown* (Pain and addiction)
Pratt * (Vision/ Cellular and Developmental)		Thygarajan* (Pain and nociception)
Fuzessery (Auditory/Neurophysiological)		Alexander (Reproduction)
Mruk* (Sensorimotor/Cellular and Genetic)	Animal Model, viral tool and Reagents (sharing genetic model, viral tools)	Nair* (Wound healing, itch and pain)
Li* (Multi-sensory system/Cellular and System)		Fox (Huntington's diseases)
Todd* (Circadian system/System and behavior)		Sun* (epilepsy and Alzheimer's)
Nelson* (Social Cognitive/System and Behavior)	Data Publication Grants	Li* (Alzheimer's and dementia)
Bedford*(Social Cognitive/System and Behavior)		Todd* (Alzheimer's disease)
Thygarajan* (Somatosensory/Cellular and Molecular)		Cherrington* (Brain and Pituitary Cancer)
Sun* (Somatosensory/chemosensory/Circuit)		Bobadilla* (Addiction/ Circuit and Behavior)
Gomelsky* (optogenetics/Molecular and genetic)	Training programs	He* (Hypertension and cardiovascular diseases)
Taylor* (optogenetics/Chemical and Molecular)		Gigley* (Immunology)
Prather* (Auditory/Circuit and Neuroanatomical)	**WSBC successfully competed for Phase II award!!**	Schoborg* (Microcephaly)

Control brain cell with light, or sense neuronal activity with light

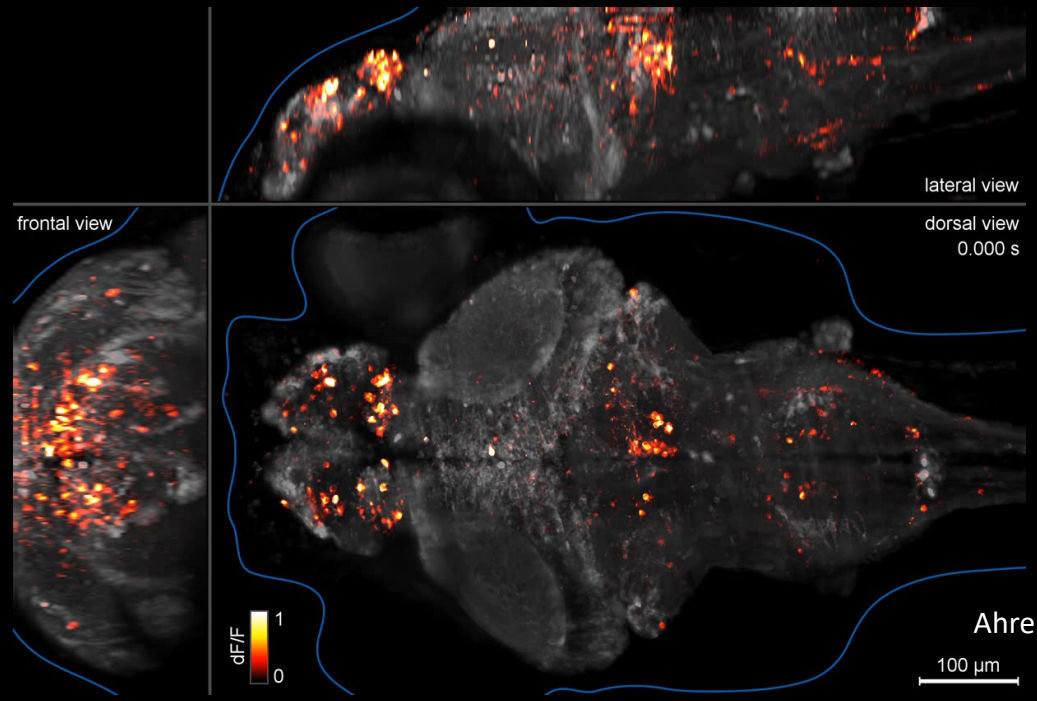
Wyoming Sensory Biology Center







Plexon.



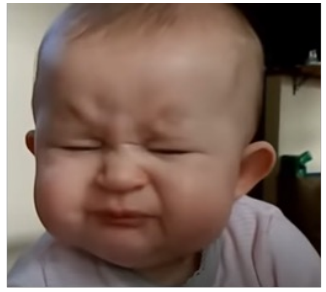
Ahrens, MB

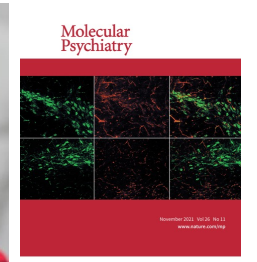
UW Research example: neural basis for learning and memory and emotions, funded by NINDS and NIMH

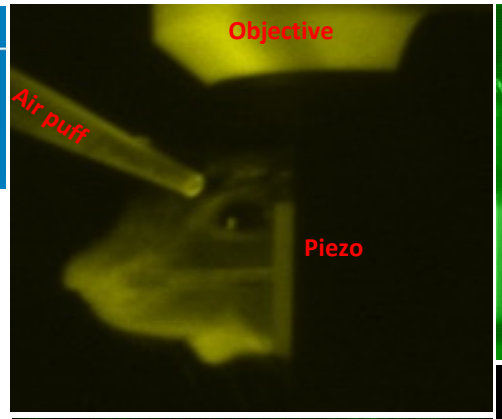
Sun Lab

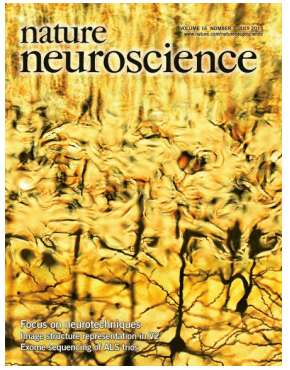
https://www.jove.com/embed/player?id=58037&t=1&s=1&fpv=1

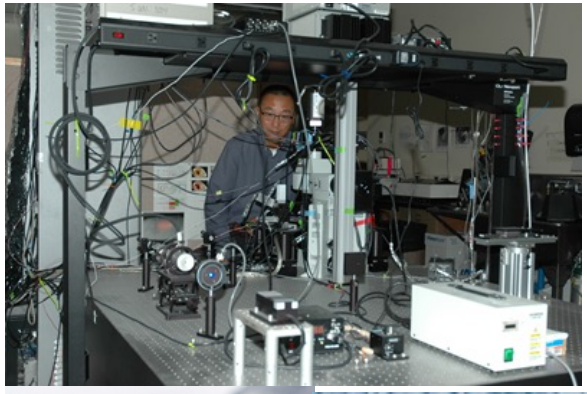


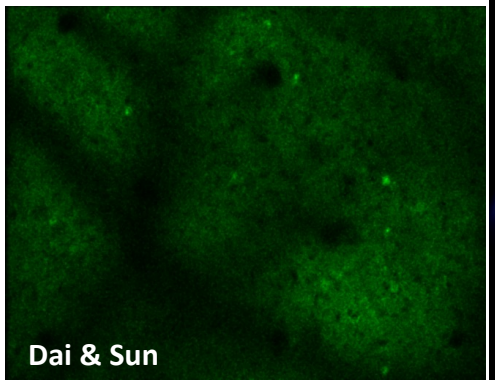



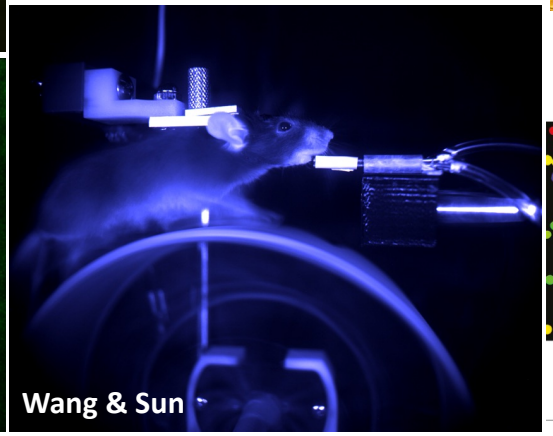



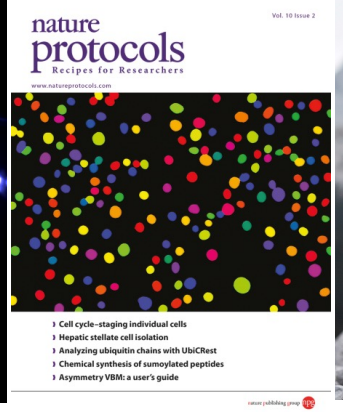


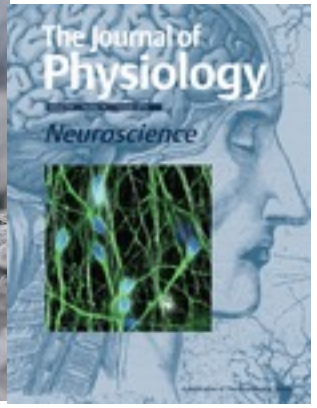








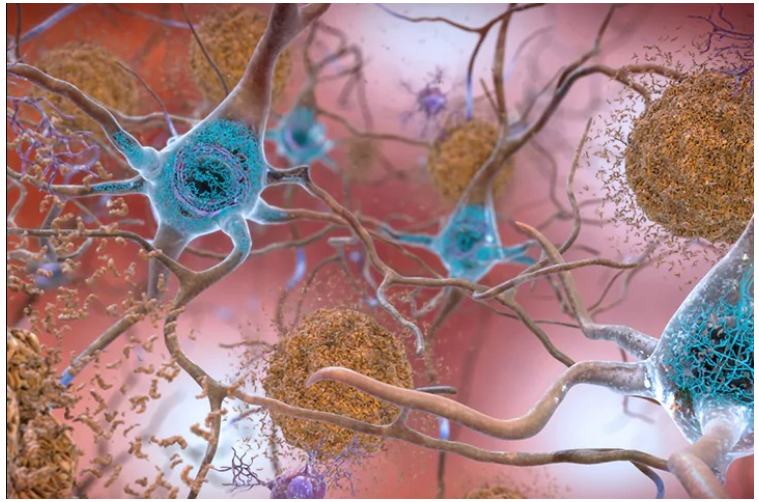




WSBC tackles health issues important for Wyoming: Alzheimer's disease

Wyoming Sensory Biology Center

WY AD patients will Increase to 13,000 by 2025, total annual cost associated with long-term care increase to $142,044 per person.

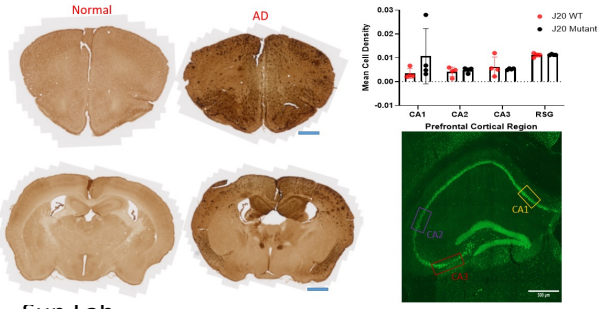


AAIC

Alison Dodds, Laramie, Honors College

ALZHEIMER'S ASSOCIATION AAIC 22 INTERNATIONAL CONFERENCE

Level of beta-amyloid deposition does not correlate with neuronal loss in HF and RSG



Sun Lab

UW Assistant Professor Receives $2M Grant for Alzheimer's Study

October 17, 2022

Yun Li, an assistant professor in the University of Wyoming's Department of Zoology and Physiology, recently received a $2.25 million National Institutes of Health (NIH) RF1 grant to advance her Alzheimer's disease research.

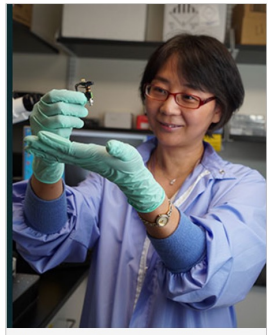
The RF1 grant provides the initial three years of support for her research titled "Loss of TDP-43 disrupts the prefrontal neural activity and circuitry: relevance for TDP-43 linked ADRD." NIH's National Institute of Neurological Disorders and Stroke funds Li's research.

The project will determine the earliest changes to neural activity and the brain network of Alzheimer's disease (AD) and Alzheimer's-related dementias (ADRD) associated with TDP-43 pathology. TDP-43 -- TAR DNA-binding protein 43, a DNA-/RNA-binding protein with a molecular weight of 43 kDa (kilodalton) -- is a multifunctional nucleic acid-binding protein linked to AD/ADRD.

In 2006, TDP-43 was identified as the major pathogenic component in most common subtypes of frontotemporal dementia and amyotrophic lateral sclerosis (ALS), also known as motor neuron disease. Later, TDP-43 pathology also was found in 30 percent to 57 percent of Alzheimer's patients who usually displayed exacerbated cognitive declines and worse brain atrophy.

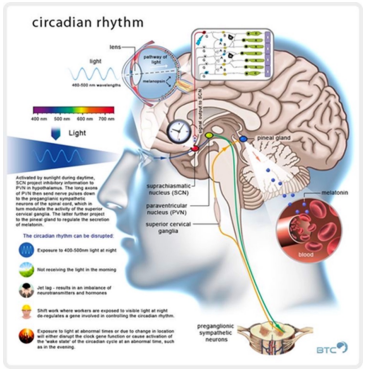
"Successful completion of this project will likely identify novel therapeutic targets and effective therapeutic strategy to attenuate these devastating disorders of the elderly," Li says.

Alzheimer's and ADRD are the most common forms of dementia. They impair memory, thought process and functioning in afflicted individuals, primarily older people.

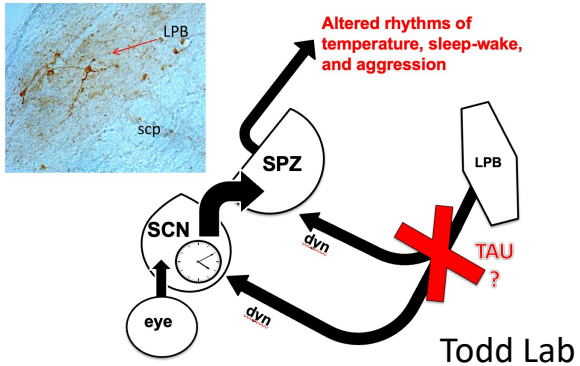


Yun Li, an assistant professor in the University of Wyoming's Department of Zoology and Physiology, holds a custom-

SBC project leader Trey Todd's group investigate neural circuits leading to 'sun downing syndrome'.



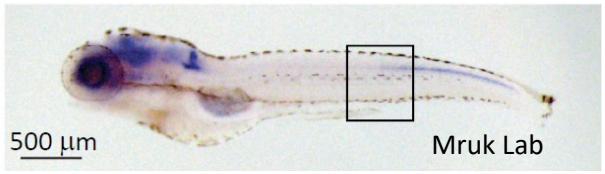
Hugo Chrost

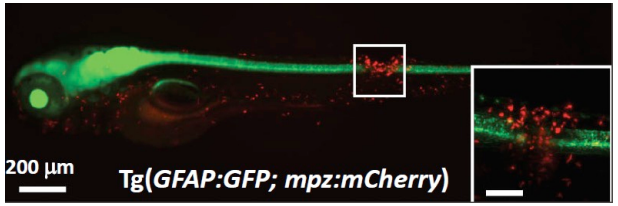


Todd Lab

WSBC tackles health issues important for Wyoming: Spinal Cord Injuries (SCI)

Wyoming Sensory Biology Center





Andrew, Emily, Kristen and Whitney

UW's Mruk Receives NIH R21 Grant to Study Spinal Cord Regeneration

September 1, 2021

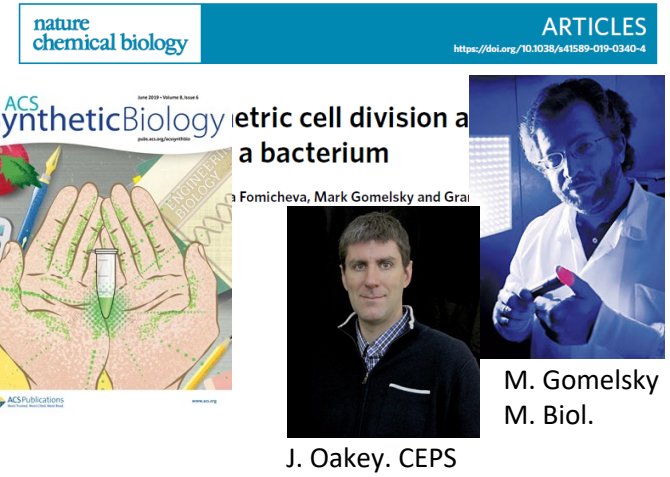
Karen Mruk

Karen Mruk is focused on spinal cord regeneration and is studying how a zebrafish regenerates to learn more about how that information can apply to humans.

To help her conduct this research, the University of Wyoming assistant professor of pharmaceutical science recently received a two-year, $362,494 grant from the National Institutes of Health (NIH).

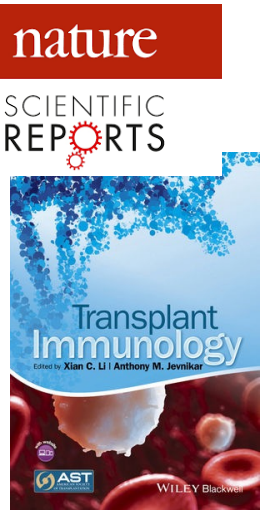
The NIH Exploratory/Development Research Grant (R21) was awarded for Mruk's project, titled "RNA-Based Tools for Developmental and Regenerative Biology." The grant begins today (Sept. 1) and runs through Aug. 31, 2023. The R21 grant mechanism encourages exploratory/development research by providing support for the early and conceptual stages of project development.

"Regeneration is one of the 'holy grails' of biology. Our lab specifically works on spinal cord regeneration," Mruk says. "One limitation in studying regeneration is that the genetic tools that scientists use to study regeneration are often global, meaning there's a lack of control in space and time; slow, so that they miss early events that happen



SBC project leader Jared Bushman's group investigate mechanisms promoting recovery from SCI

J. Bushman



Bushman Lab

The State-Of-The-Art Integrated Microscopy Core (IMC) is a platform for campus-wide research and innovations.

Integrated Microscopy Core

IMCore, directed by Dr. Zhaojie Zhang serves over 60 UW labs, supported by over 48 Federal grants (~ $56Million).

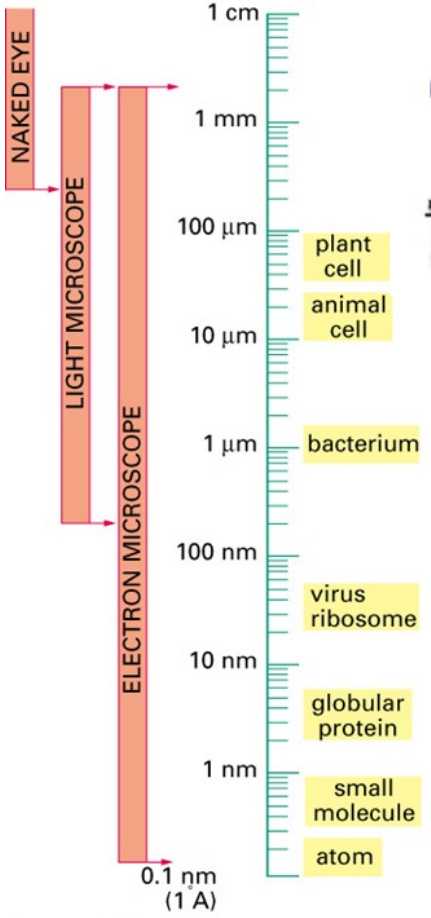
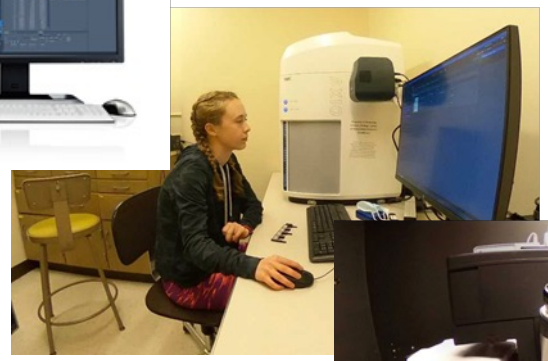
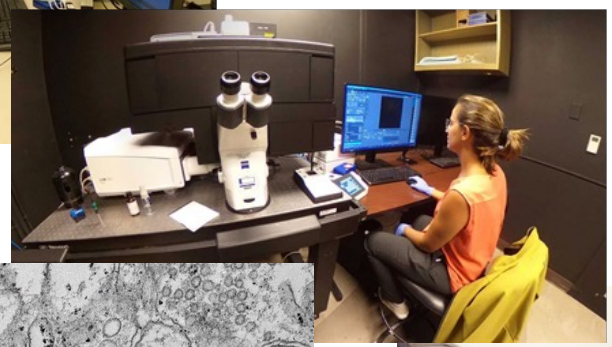
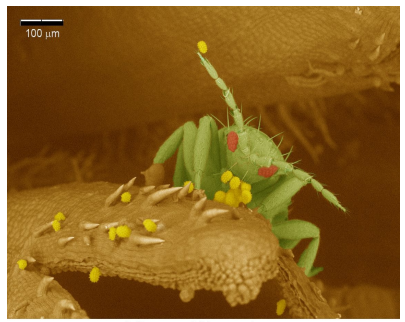


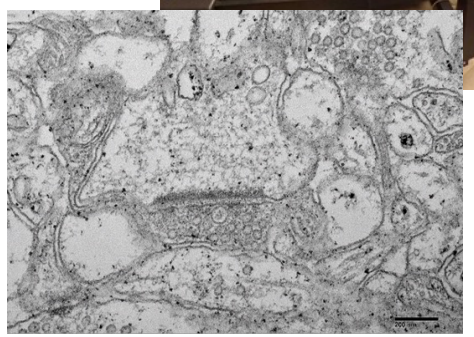
Figure 9–2. Molecular Biology of the Cell, 4th Edition







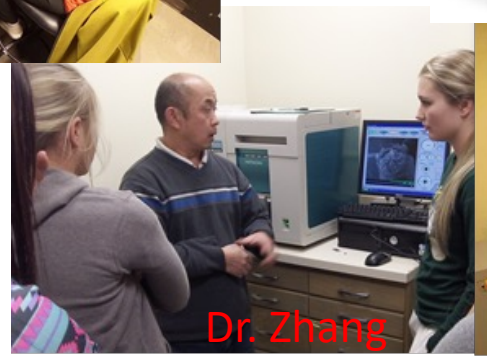
Pollen anyone? It is yummy!
SEM image of Thrips - mini insects of pollen eaters and pollinators

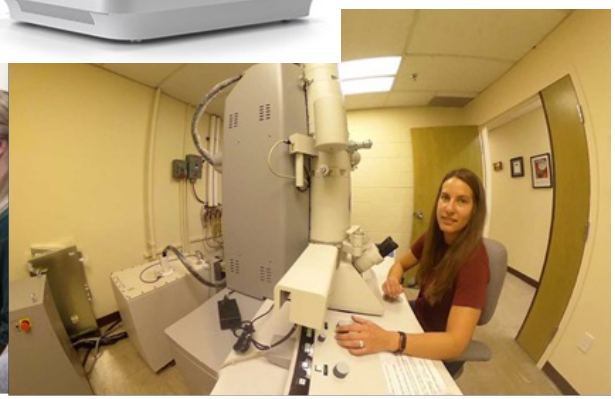


Postsynaptic density (Dr. Li lab)

DNA ⟷ RNA → Protein

Replication Transcription Translation





Acknowledgements

THE WORLD NEEDS MORE COWBOYS.

We thank the AA, RED, and College of A&S, ALSNR, HS, EAS for support!

NIH NIGMS | IDeA Institutional Development Award™

NIH P30GM121310

THE WORLD NEEDS MORE OUTSIDE THINKERS.

THE WORLD NEEDS MORE INSPIRED CREATIVITY.

THE WORLD NEEDS MORE ADVENTUROUS SPIRIT.

THE WORLD NEEDS MORE RELENTLESS CURIOSITY.