2025
2026

Faculty Research Abstracts

Biomedical Sciences
Grand Valley State University

October 22, 2025

Biomedical Sciences Department Undergraduate Research 2025-2026

Welcome to the BMS Undergraduate Research portion of our Meet the Faculty Night!

We started this tradition in order to talk with interested students about the opportunities in undergraduate research.

Why does undergraduate research matter?

- Work with faculty/mentors one-on-one. Learn how to work in a professional capacity with someone who wants to teach you their craft.
- Apply what you know. In a lab, you will apply classroom knowledge in a way that is focused on a singular problem.
- Make discoveries! You can develop and design your own experiments and analysis.
- Find out if you like research. Maybe you'll love it, maybe you won't. Either way, your mentors understand that this educational process is important.

How do I start?

- ***Investigate.*** Check out the list of possible topics; peruse the posters and listen to the talks. Check out links to other opportunities at GVSU and outside of GVSU.
- ***Talk.*** Ask the professors about their research. Tell them what interests you. It's OK if you decide you don't like that particular research topic. Just start the discussion. We know you are exploring and we would love to help.
- ***Connect.*** Get the necessary contact information and consult your class schedule to see if you can commit to dedicating time in a lab. Take that first step forward by asking the professor or mentor to see if there are any opportunities, or ask if they have recommendations for other openings.
- ***Commit.*** Expect that this will take some time and effort and will probably extend over the summer. It's work, but it's worth it!

Here are a few topics:

- Ancient Human Anatomy (Ham, Kegley, Laudicina, Miller)
- Cardiovascular Physiology (Kurjiaka, Kwesiga, Liu, Sylvester)
- Developmental Biology (M. Burg, Delano-Taylor, Ramsson)
- Endocrine Toxicology (Fateye)
- Feeding Ecology (Stroik, Thompson)
- Functional Anatomy and Bone Biology (Brandt, Kegley, Laudicina, Miller, Reed, Stroik)
- Immunology (D. Burg, Renkema)
- Infectious Disease Epidemiology, Viruses and Informatics (Cleary, Graham, Thomas)
- Intracellular Signaling (Baxter, M. Burg, Capodilupo, Delano-Taylor, Fateye, Kurjiaka, Pearl, Ramsson, Sylvester)
- Muscle Physiology (Kurjiaka, Sylvester)
- Neurobiology (Bergman, M. Burg, Capodilupo, Delano-Taylor, Ramsson, Shabani)
- Neurophysiology and Behavior (Bergman, Brandt, M. Burg, Ramsson)
- Neurophysiology and Pharmacology (Bergman, Linn, Shabani)
- Parasitology (Graham)
- Physiological Biochemistry (Kipp, Ramsson)
- Reproductive Physiology (Pearl)
- Thermoregulation (Brandt, Thompson)
- Viral, Fungal, and Bacterial Physiology (Baxter, Cleary, Haley, Thomas)

Resources for Finding Research Opportunities and Research Support

Grand Valley State University
Biomedical Sciences Website Faculty Research Interests:
http://www.gvsu.edu/bms/

Office of Undergraduate Research and Scholarship (OURS):
http://www.gvsu.edu/ours/

The Student Summer Scholars Program (S3 and MS3): This program provides funds for a student and faculty mentor to devote up to twelve weeks to a research and/or creative project during the spring/summer semester. Generally, S3 Grants provide a student stipend, faculty stipend, and a small budget for supplies.

OURS Project Supplies Grant: This OURS grant program is designed to encourage collaborative scholarly research and creative work between undergraduate students and faculty. These grants provide students with financial support of up to $500 for supplies and equipment.

Academic Conference Fund (ACF): The ACF is available to students to present at an academic conference related to their professional goals. Support is up to $600 for domestic travel, $800 for international travel.

Academic and Professional Enrichment Fund (APEF): APEF is available to all students to attend (presentation not required) an academic conference that is related to their professional goals, or to engage in a professional experience. Support is up to $500.

McNair Scholars Program:
www.gvsu.edu/mcnair

The McNair Scholars Program is designed to help academically talented students from traditionally underserved backgrounds reach their potential by earning a doctoral degree. We work closely to help students navigate their undergraduate career through academic counseling, financial aid assistance, mentoring, summer research opportunities, seminars, tutoring, and more.

Resources for Finding Research Opportunities and Research Support

Frederik Meijer Office of Fellowships:
http://www.gvsu.edu/fellowships/

The purpose of this office is to advise and support students and alumni to achieve the extraordinary by matching their dreams to prestigious fellowship and scholarship awards and other opportunities. The website has an extensive list of non-GVSU scholarship and fellowship opportunities.

They have a “fellowship finder” which is very useful as well.
https://www.gvsu.edu/fellowships/finding-a-fellowship-216.htm

CLAS Advising:
http://www.gvsu.edu/clasadvising/

Have you talked about your potential career plans with an advisor yet?

Outside Grand Valley State University:
Van Andel Research Institute
http://www.vai.org/research/trainingprograms/studentinternship.aspx

National Science Foundation Research Experience for Undergraduates
http://www.nsf.gov/crssprgm/reu/reu_search.cfm

University of Michigan Pipeline/Profiles for Success, Experience for minority pre-dental students
https://www.dent.umich.edu/education/profile-success

Wayne State University SURE program in biomedical science
http://www.gradprograms.med.wayne.edu/sure.php

Perrigo Undergraduate Research Fellowship
https://perrigo.lsi.umich.edu/

Professor Baxter
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Research Interests:

My research focuses on the pathogenic mechanisms of *Salmonella* and biofilm formation in *Escherichia coli*. In *Salmonella* we are currently working toward finding additional genes necessary for *Salmonella* virulence. Studies have shown that the genes involved in *Salmonella* pathogenesis are found in specific regions of the chromosome known as pathogenicity islands. *Salmonella* Pathogenicity Island 1 (SPI-1) has numerous genes involved in the formation of a type III secretion system and other secreted effector proteins. Activation of this island allows for bacterial invasion of intestinal cells. A second critical island (SPI -2) is needed for survival within macrophage after invasion across the intestinal epithelia is completed. Due to the number of genes required for each of these processes to occur, the bacteria tightly regulate their expression. Our lab's focus is on the regulatory genes that control activation and repression of these islands in response to environmental signals. As part of these studies, I characterized a repressor known as *hilE*, which represses the activation of SPI-1. Studies of the DNA sequence surrounding *hilE* suggest that this repressor lies in a 40 kb region of the chromosome that has all the hallmarks of a pathogenicity island, yet little is known about the function of these genes. We created ten different polar mutations in potential operons within this identified region. Work has started trying to analyze the effects these mutations have on *Salmonella* virulence by using gene reporters, cell invasion, macrophage survival and bacterial adherence assays, etc. all conducted under various virulence inducing and noninducing environmental conditions. Any effects on *Salmonella* invasion could then be further characterized by identifying how each gene affects *Salmonella* pathogenesis in response to an environmental signal.

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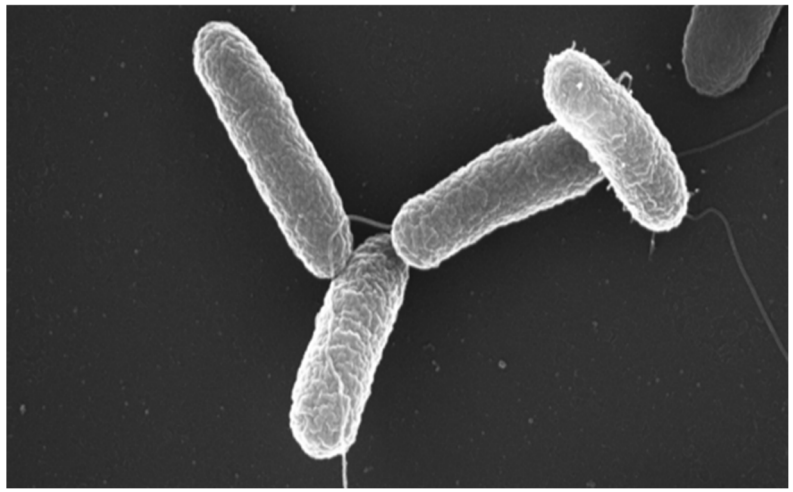
My second project is looking for genes important for *Escherichia coli* biofilm formation under conditions that mirror the intestinal environment. Earlier work has identified many genes needed for the activation and formation of a biofilm when the bacteria are grown under aerobic conditions. As *E. coli* is a commensal bacteria found in the anaerobic conditions of the colon, we are trying to find regulator genes that may be responsible for increasing or decreasing biofilm formation in response to oxygen concentration. We developed a biofilm assay and are using it to screen a library of nonpolar mutants under aerobic, microaerophilic, and anaerobic conditions to determine if there are effects on biofilm formation at varying oxygen levels.



Salmonella typhimurium.

Image: Volker Brinkmann, Max Plank Institute for Infection Biology, Berlin. (April 5, 2005)"A Novel Data-Mining Approach Systematically Links Genes to Traits." PLoS Biol 3(5): e166 doi:10.1371/journal.pbio.0030166

Professor Bergman
bergmand@gvsu.edu

Research Interests:
Dr. Bergman's research lab is a multidisciplinary lab that explores topics in neuroscience, physiology, behavior, ecology, toxicology, histology, and pharmacology. One of the best ways to study the effects of drugs, diseases, and environmental stressors is through animal models. Much of what we know about human medicine today, including vaccines and treatments comes from foundational research in animals. Dr. Bergman uses crayfish as a model system to study how the nervous system responds to injury, drugs/chemicals, and environmental stress. His lab investigates topics like neuropharmacology, sensory system perception, aggression, and how pollutants affect neural and hormonal health. Crayfish are especially useful for this kind of research because they have a relatively simple nervous system that's still surprisingly like ours in keyways, making them ideal for studying neural repair, chemical exposure, and behavior. If you're interested in neuroscience, physiology, or environmental health and you're not afraid of a few claws, this is a great lab to explore.

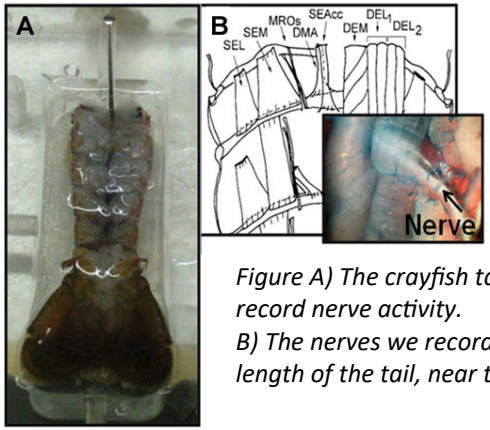


Figure A) The crayfish tail setup used to record nerve activity.
B) The nerves we record from run the length of the tail, near the outer shell.

Professor Brandt
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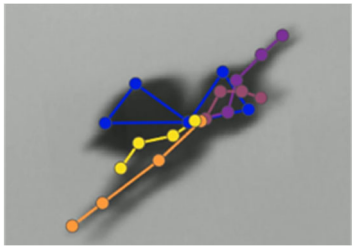
Research Interests:
I am first and foremost an integrative organismal biologist, with a primary interest in the deep understanding of animal communication systems. I believe that the best research approach is multiscale, from the physics of sensory organs, to how species fit into broader ecological and evolutionary patterns. My scholarship is situated in many fields, including physiology, biophysics, behavior, ecology, and evolution. With this background, I leverage a variety of methods to elucidate the proximate *how* of a phenomenon within the important evolutionary context of the *why*.

My lab works primarily in arthropod communication systems, with past projects including the biophysics of cricket hearing, the physics and ecology of cricket sound production, and understanding how temperature influences the physiology and mating behavior of jumping spiders. My lab currently focuses on the jumping spider locomotion system. This unique "semi-hydraulic" system is used both in locomotion (especially jumping) and in flashy sexual display "dances". My lab seeks to understand how both natural and sexual selection interact to influence this unusual locomotion system. I approach this system from a variety of angles, including: (1) behavioral experiments evaluating courtship and mating behavior, (2) morphology studies measuring different aspects of the external morphology and internal locomotion system, and (3) high speed camera studies of jumping and other types of movement. There are many potential approaches to study this topic, and many projects for undergraduates in my lab. I am eager to speak with students and brainstorm potential project ideas.

Jumping spider mid-jump with tracking points measuring its movement



Professor D. Burg
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Research Interests:

My area of expertise encompasses immunology, protein biochemistry and tyrosine kinase-mediated signal transduction. I am not taking any new research students at this time, but I am available for BMS399 (independent study) and HNR499 (honors senior project) projects that are related to my expertise.

Professor M. Burg
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Research Interests:

My lab's research focus is to identify processes that may use the neurotransmitter histamine in the fruit fly Drosophila melanogaster. The gene required for histamine synthesis encodes the enzyme, *Histidine decarboxylase* (*Hdc*). We are currently examining the role of the *Hdc* gene in establishing when and where histamine is synthesized in a variety of tissues. We are also examining the role that histamine metabolism plays in the regulation of histamine (and its metabolites) in the fly. As a result, projects in my lab range from molecular biology projects to behavioral neuroscience projects and utilize advanced microscopy techniques, such as 3-D confocal microscopy.

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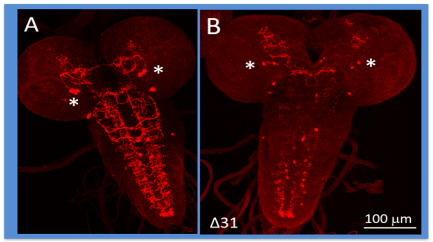
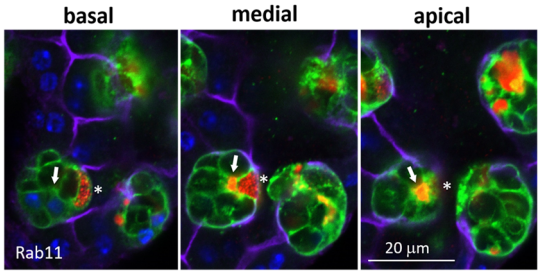
Current research projects for 2025-2026 include (1) identification of developmental and spatial expression of the *AANATL-7* gene, which is responsible for acetylation of histamine in *Drosophila* using a *AANATL-7::mCherry* gene recently made using CRISPR-based gene conversion, (2) investigating the effect of disrupting histamine acetylation on behavior of the fly by studying a variety of behaviors in the *AANATL-7* mutant, and (3) using chemical analysis to further characterize the effect of the *AAANATL-7* mutant on histamine metabolism.

Please contact Dr. Burg (burgm@gvsu.edu) if interested.



C. Louis

Histamine-like immunoreactivity (HLI) in 3rd instar larval brain from a wild-type (A) and fly bearing a partially deleted *Hdc* transgene (B). Confocal image containing all focal planes collected from a scan of ~110 um of tissue. Asterisk indicates 4 pairs of HLI-positive central brain neurons (A), while 3 pair of HLI-positive neurons are present in (B), suggesting that the deletion in (B) disrupts *Hdc* expression in the CNS. There appears to be reduced levels of HA in other areas of the CNS in (B) as well. (C. Louis and M. Burg, 2021)



P. Nalam

Confocal image demonstrating intracellular localization of N-acetylhistamine (red) and the Rab11 protein (green) showing localization differences in specific regions in the secondary cell of an accessory gland from a fruit fly male. (P. Nalam and M. Burg, 2021)

Professor Capodilupo
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Research Interests:

We are examining a molecule called GAP-43 which is a brain protein that is expressed in a wide variety of species including humans and has been shown to become biochemically altered in the process of learning and memory. Specifically, levels of phosphorylated forms of GAP-43 have been shown to increase following a controversial paradigm of learning and memory in several animals including rat, mouse, monkey, and rabbit. We are interested to see if any differences in the profile of GAP-43 are associated with Alzheimer's disease, a human neurodegenerative disorder characterized by profound cognitive impairment. Since human brain tissue is difficult to obtain, we are utilizing primate brain tissue to establish best practice of visualizing GAP-43 isoforms by two dimensional SDS polyacrylamide gel electrophoresis with the goal of eventually testing the hypothesis that the profile of phosphorylated isoforms of GAP-43 are changed in the brains of a human brain affected by severe cognitive impairment (such as Alzheimer's disease). Isoforms of monkey brain GAP-43 will be detected by immunocytochemistry, phosphospecific staining, and, further, quantified by computerized densitometry. We believe the phosphorylated isoform of GAP-43 may serve as an indicator of synaptic efficacy and, compared to normal, an alterations in the relative quantity of phosphorylated isoforms of GAP-43 might be associated with a pathological biochemical processes. GAP-43 might serve as a potential new biomarker testing efficacy of drugs designed to treat Alzheimer's disease.

Professor Cleary
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Research Interests:

My research focuses on the regulation of cell shape and stress responses in *Candida albicans*. This fungus is part of the normal human-associated microbial population, but it is also an opportunistic pathogen and remains the main causative agent of invasive fungal infections. Invasive candidiasis is now the fourth most frequent hospital acquired infection in the U.S and is associated with high morbidity and mortality rates. *C. albicans* lives in varied environments from the skin to the GI tract, and must be able to respond appropriately to these different conditions. Changes in cell morphology and accompanying alterations in surface protein components are important virulence traits and are key factors for the complex interaction between the fungal cells and the host immune system. We are particularly interested in understanding the contributions of different genes to the control of the yeast to hypha morphological transition. Current projects examine different components of this mechanism, from adhesion and sensor proteins on the cell surface, to internal signalling proteins, to transcriptional regulators.

Professor Delano-Taylor
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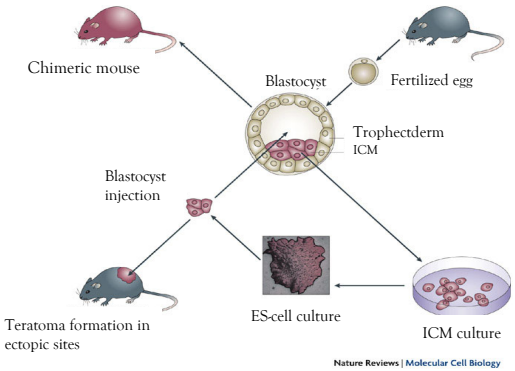
Research Interests:

Neurodevelopment/Genetics/Stem Cell Biology

Our group uses the chicken and mouse embryo as model systems to determine how neural stem cell differentiation is influenced by intrinsic factors (such as gene expression) and extrinsic factors (such as factors secreted by other cells). The accessibility of the chick embryo to experimental manipulation allows us to screen for the effect of experimental manipulation on stem cell differentiation using quantitative PCR and anatomical approaches. With this approach, undergraduate and master's level students have determined that the basic helix loop helix protein Nato3 is sufficient to promote expression of markers for dopamine producing neurons. The clinical significance of this finding is that dopamine neurons are the target of degeneration in the pathophysiology of Parkinson's Disease, so our current studies are focused on understanding the mechanism of this effect with the hope of informing therapeutic strategies towards this disease. Additionally, our lab is using the same model system to analyze the effect of factors outside of the neural stem cell (cell-extrinsic factors) such as polyunsaturated fatty acids. These factors have been shown to be important signaling components in development and can affect stem cell differentiation in culture, but have not been analyzed in the living embryo.



Professor Fateye
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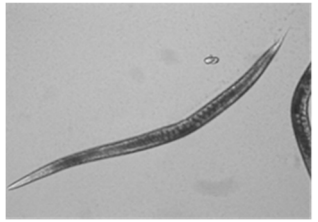
Research Interests:
The research and creativity within the Fateye lab are founded on a core set of values: sustainability, collaboration, and a deep commitment to student-centeredness.

Sustainable Research: My primary interest lies in adopting research methodologies that significantly reduce or replace the use of animal models. Furthermore, I champion the creative repurposing and recycling of resources for both investigative and educational purposes. Current projects within the lab utilize invertebrate models, specifically the nematode Caenorhabditis elegans and the insect Galleria mellonella, as sustainable systems for studying the pharmacology and toxicology of various compounds and environmental agents.

Interdisciplinary Collaborative Research: The Fateye lab maintains an active commitment to local and global interdisciplinary collaboration, partnering with colleagues across a wide spectrum of fields including earth sciences, engineering, social sciences, and the humanities. A key ongoing international collaboration exemplifies this by seeking to repurpose scrap refrigerators as cost-effective, automated temperature-controlled chambers essential for culturing Galleria larvae.

Student-Centeredness and Equity: A central tenet of the lab is the creation of an equitable and inclusive space that actively welcomes students at all academic levels and abilities. We practice a model of co-created research, where students' interests are integrated with the lab's expertise. Recent student-initiated projects employ both qualitative and quantitative methodologies to investigate the complex social and cultural determinants that influence overall wellness among the college student population.

Micrograph of hermaphrodite Caenorhabditis elegans used in environmental toxicity identification and evaluation.



Professor Graham
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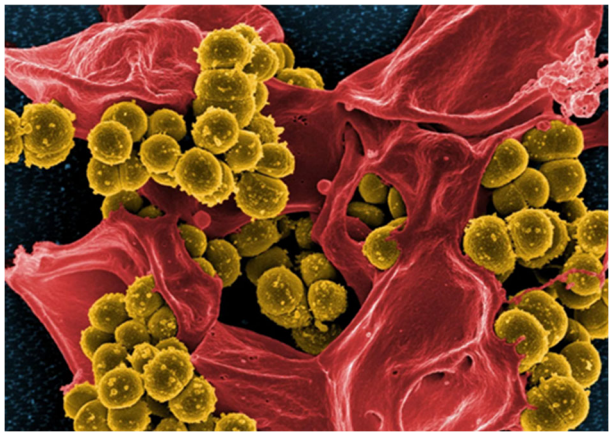
Research Interests:

My research program is somewhat unique in that there isn't really an overarching disciplinary theme that all my work falls neatly under. My tendency is to seize on an interesting question, recruit students to help answer it, then after a year or two move on to something (often completely) different. Most of the projects in my lab, in one way or another, have employed molecular markers to infer past demographic and evolutionary events in populations of parasites and human pathogens. Past projects have looked at intragenic recombination in rotavirus, positive selection in viral hemorrhagic septicemia virus, microevolution of rabies virus in Michigan bat populations, the population dynamics of raccoon roundworm in West Michigan, modeling Ebola diffusion in West Africa, and social evolution in bacteria. Currently, my lab is using the nematode *C. elegans* to investigate how the gut microbiome modulates the severity of viral infection.

Professor Haley
haleykat@gvsu.edu

Research Interests:

During the infectious process, a battle ensues between the human host and the bacterial pathogen over access to nutrients, including metals. The focus of my research is to gain a better understanding of how bacteria acquire nutrients during an infection and how availability of various metals influences disease outcomes. The primary pathogen I study is the skin commensal Staphylococcus lugdunensis which is a coagulase-negative Staphylococcal species that has the potential to cause aggressive and progressive disease. Currently little is known regarding the molecular mechanisms deployed by S. lugdunensis that enable it to transition from a harmless component of the skin flora to a deadly pathogen. I am interested in identifying genes involved in biofilm formation, metal acquisition, and metal detoxification in S. lugdunensis.



Staphylococcal bacteria enmeshed in white blood cells. Credit NIAID

Professor Ham
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Research Interests:

My research focuses on the effects of sex and gender on long-term trends in human health and mortality. Illuminating the biological mechanisms underpinning sex-specific disease patterns across time is vital for interpreting the drivers of past and present sex- and gender-related health disparities. Therefore, my research program includes projects on both historical and contemporary human populations. I have several ongoing projects that are well-suited to provide research experiences to students interested in human microbiomes, sex-specific patterns of oral and systemic disease, and skeletal maturation and growth.

I am currently investigating how hormonal fluctuations in females impact their oral microbiome and downstream health. My aim is to identify how individualized hormonal shifts affect changes in microbial signatures overtime using saliva and urine samples taken over the course of a menstrual cycle. This project will help identify the factors influencing oral microbial dynamics and the mechanisms behind oral disease manifestation.

I am also working to understand how sex-specific patterns of skeletal growth and maturation are affected by environmental and cultural pressures by using computed tomography (CT) scans from a documented postmortem population. This project is working to identify the effects of early life stressors on skeletal maturation and the timing of pubertal events. This project strengthens our knowledge of the interrelationships between skeletal and dental development and soft tissue indicators of human maturation. This is critical to the documentation of variation in patterns of sexual maturation and growth in past human populations.

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Lastly, I am identifying long-term drivers of sex-specific trends in health and mortality using the ancient human oral microbiome, skeletal indicators of disease, and demographic analyses. This project uses ancient DNA sequenced dental calculus taken from medieval and post-medieval Londoners. I use hazards-based statistical modeling to understand how variation in oral microbial diversity across demographic groups in London influenced differential mortality and survival in this context. This project advances our understanding how human-microbial interactions influenced health outcomes in the past.

Preserved dental plaque from an archaeological site.

Professor Kegley
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Research Interests:

I am actively involved in both laboratory and field research. My current lab-based projects include assessing various aspects of hominin (e.g. humans, two species of chimpanzee, their ancestors, and the extinct lineages of their common ancestor) evolutionary anatomy through dissection and non-invasive Magnetic Resonance Imaging (MRI). I have been examining the insertion of the pectoralis minor muscle in the chimpanzee (*Pan troglodytes*), as various interpretations of this attachment have been reported throughout the anatomical literature. Clarity of this issue is fundamental for not only understanding the evolutionary structural and functional pathway(s) of the muscle, but also for producing a better understanding the evolution of the hominin shoulder.

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Another research area that I have focused on is assessing spatio-temporal variation of stress and developmental stability among extant and extinct mammalian taxa through fluctuating asymmetry (FA). The aim of this research area is to continue exploring the utility and advancement of FA to a variety of modern and prehistoric mammalian species. Deviations from symmetry in bilateral characters have achieved some prominence as measures of developmental (in)stability, revealing greater levels of asymmetry under adverse settings and mirrored target phenotypes under optimal extrinsic (environmental) and intrinsic (genetic) conditions. Increased FA has been associated with dietary, thermal, audiogenic and chemical stresses, but has been reported to decrease when genetic heterozygosity is elevated. Identifying the distribution and expression of FA among (paleo)species that have an extensive and well documented biological history (i.e. through time and space) provides *a* context for understanding how evolutionary processes and events potentially impact development.

My current paleobiological field research is situated within the *Cradle of Humankind World Heritage Site*, North-West Province, South Africa, at the fossil-bearing site of Luleche and in the adjoining Provence of Gauteng, at the fossil site of Hoogland. Notable excavations within the Cradle of Humankind and several in eastern Africa have produced rich samples of Pliocene and Pleistocene fossil mammals (including hominins), which have been a major source for interpreting our past. Such excavation and analysis of fossil assemblages from prolific sites has led to a wealthy and detailed understanding of a broader African paleolandscape. As important as these excavations are, the exploration of novel deposits, like Luleche and Hoogland, can only increase our understanding of the variability and richness of African (paleo) species, paleoecosystems, depositional processes, and evolutionary factors that existed in the past

Landscape from the Cradle of Humankind, South Africa
flowcomm, CC BY 2.0 <https://creativecommons.org/licenses/by/2.0>, via Wikimedia Commons

Professor Kipp
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Research Interests:

**Professor Kipp's research is on hold during the 2025-2026 school year.*

Fascial release is a popular technique in the strength and performance community. Several methods are reported to increase strength, mobility, and recovery (Body Tempering, roam rolling, Graston©, Reflex Performance Reset, Rolfing). My current interests are in assessing the efficacy of these methods.

The initial investigations will focus on Body Tempering. In Body Tempering, static or shear heavy compressive forces (20-220 lbs.) are applied to tissues to stimulate changes that will stimulate adaptations that render it more resilient to heavier loads. It is proposed that tempering initiates tissue remodeling according to Wolff's Law, Davis Law, and the Specific Adaptations to Imposed Demands (S.A.I.D Principle). Wolff's Law states that mechanical stimulus stimulates bone remodeling (strengthening) and Davis's Law states that soft tissue will adapt and heal in response to a given mechanical stress. The S.A.I.D. principle is applied to explain that all tissue will respond to mechanical stress by increasing strength and resistance. Tissue tempering is initially applied to stimulate tissue to adapt to heavier loads in order to prevent injury. Secondarily it is used to reduce tissue tightness and improve blood flow through local reactive hyperemia. With these purported benefits of tempering, there is a lack of scientific data to back up the claims.

Initial investigations of the range of motion around joints will be used to assess tissue tightness, as well as the measurement through specific exercise movements. This will be accomplished using goniometers and a linear displacement accelerometer (OpenBarbell V3). The effects of tempering on muscular strength will be assessed using a Biodex Balance System SD.

My aim is to understand and learn the methodology of tissue tempering in order to measure its effectiveness for increased mobility and muscular strength. Future research into the other named procedures will be done and their efficacy compared and contrasted, and we will work to explain results we may obtain.

Professor Kurjiaka
kurjiakd@gvsu.edu

Research Interests:

My research evaluates the mechanism whereby capillary density is reduced in those with hypertension. Angiotensin II is an important mediator of that elevated blood pressure and has been shown to play a role in the decreased capillary density. We are interested in the role of angiotensin II in regulating capillary endothelial cell proliferation and apoptosis (both of which would play a role in reduce capillary density: decrease proliferation and increased apoptosis). At the same time, angiotensin 1-7 can also be produced from angiotensin I or II and it has the opposite effect on proliferation/apoptosis. Could increased conversion of angiotensin II to angiotensin 1-7 be a strategy to improve capillary density?

In addition to the specific question above, my broad training in exercise and comparative physiology has provided me with the background to address many other questions. I would be happy to talk with a student this semester about research questions that they might be interested in addressing in the lab in the winter semester and beyond. I have mentored many student projects (both research and writing) for the Honors College.

Micrograph of a capillary network from skeletal muscle (with the muscle tissue removed). Note the density of the capillaries in the image. With hypertension, there would be fewer.

Professor Kwesiga
kwesigam@gvsu.edu

Research Interests:

My research focuses on understanding body cell response to novel therapeutics in physiological and pathological states. Biomaterials for clinical applications are often tested under well-established standard conditions. Although these research studies have provided key insights to foreign body response, the outcomes do not often translate to the *bedside*. Crucial factors that are underestimated are the morbidities of patients that can alter the host response to implanted materials resulting in detrimental consequences. In my lab, we emphasize the need to assess the biocompatibility of these biomaterials in clinically relevant *in vitro* cell culture models using an interdisciplinary approach that integrates Biomedical sciences, Medicine, and Biomedical Engineering. The success of any implanted biomaterial is going to depend on the initiation of an appropriate and well-orchestrated immune response. Therefore, our current work is based on analyzing metabolic changes that occur in macrophages when cultured in diabetic and atherosclerotic conditions and its correlation with biomaterial performance. Students working in the lab will have a better understanding of pathophysiological mechanisms using clinically oriented research models and they will develop transferable skills to promote excellence in their future career interests.

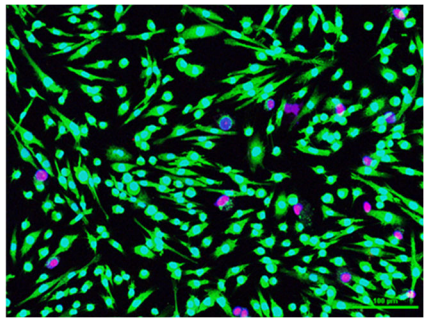
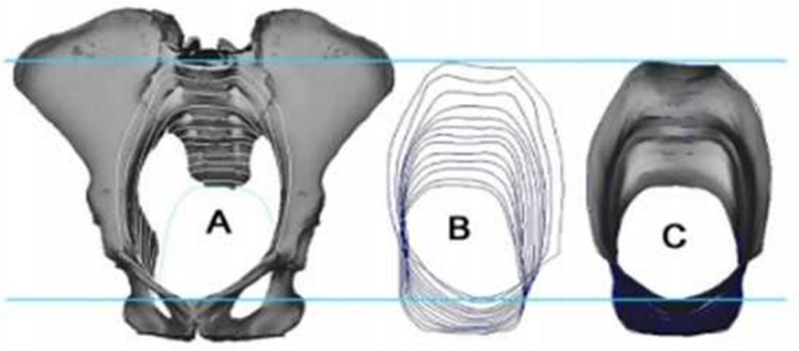


Figure 1. Representative image of inflammatory murine macrophage cells (RAW 264.7) treated with Molybdenum solution to assess the effect of metal degradation products on the viability of immune cells. Scale bar 100 µm. Green: live cells, Red: dead cells, Blue: cell nuclei. Photo credit, Janina Mayers.

Professor Laudicina
laudicin@gvsu.edu

Research Interests:

My research focuses on how bony morphology can inform us about behavior. Using 3D animation modeling, I reconstruct birth mechanisms in human, fossil, and extant primate species in order to better understand how and why human childbirth can be difficult. Students working with me can learn these virtual reconstruction processes while working on pelvic morphology projects.



Professor Linn
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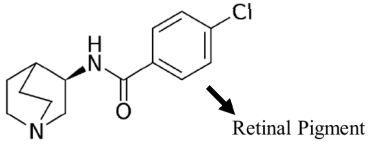
Research Interests:

My research at GVSU has largely been an extension of my previous work at Pharmacia/Upjohn/Pfizer. We have been exploring the possible therapeutic benefits of nicotine-like compounds in the treatment of visual diseases, like glaucoma. Acetylcholine (ACh) can activate several subtypes of nicotinic ACh receptors (nAChR) and we have been interested in the alpha7 subtype. Our previous studies have shown that selective activation of the alpha7 nAChR can provide protection to the cells that die during glaucoma. More recently, we have shown that activation of the alpha7 nAChR can also lead to the generation of new cells to possibly replace those lost during disease or injury. We have been examining this mechanism with a multi-step cell culture approach. After obtaining pig eyes from a local slaughterhouse, we culture retinal pigment epithelium (RPE). Then, after exposing (or not) the RPE with the compound we transfer it to a different culture dish of cells from the pig retina. Finally, after a defined time, we count if the stimulated RPE can induce more retinal cells vs. non-simulated RPE. We are attempting to characterize this generation of new cells with markers for cell division, specific types of neurons, etc.

Exploration of the generation of new retinal cells in a multi-step pig cell culture.

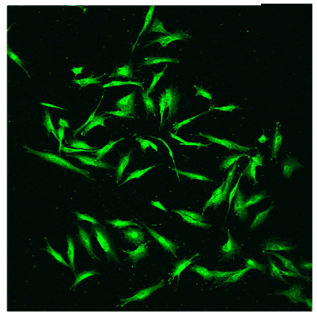
Pig cell culture studies examining proliferative effects of PNU-282987



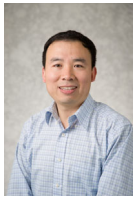
Retinal Pigment Epithelium Culture

Retinal Culture

'New' Retinal Cells



Ki67-positive cells after exposure to 'activated' RPE



Professor Liu
liuruiji@gvsu.edu

Research Interests:

Cells detect and respond to external signals (such as an increase in temperature or nutrients) by activating certain intracellular proteins. When the environmental cues are gone, these proteins must be inactivated to avoid overreaction of the cells. Inactivation of proteins is in part through their degradation. Research in my laboratory focuses on the function of one protein named dual-specificity phosphatase 8(DUSP8) in the heart. My prior research has demonstrated that if DUSP8 level is abnormally high in the experimental mice, it will lead to heart failure. This data suggests that DUSP8 protein level must be tightly controlled. Preliminary study performed here at GVSU showed that half of the total DUSP8 proteins was lost after 6 hours (Fig. 1). One explanation for the loss of DUSP8 protein is its degradation over time. *The overall goal of this study is to investigate the cellular mechanism controlling the degradation of DUSP8.* Specifically, this study will determine whether PEST amino acids within DUSP8 protein serve as the destruction signal to recruit other proteins for DUSP8 degradation.

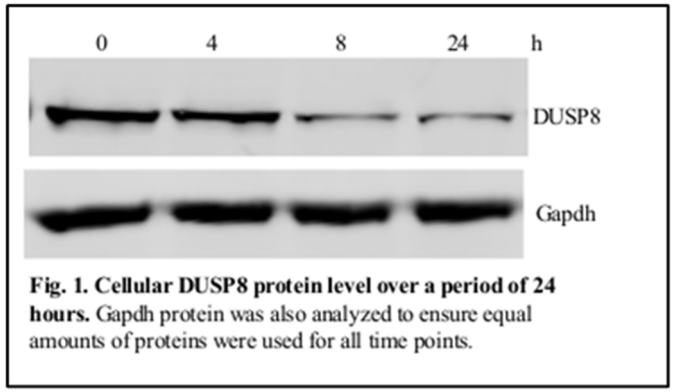


Fig. 1. Cellular DUSP8 protein level over a period of 24 hours. Gapdh protein was also analyzed to ensure equal amounts of proteins were used for all time points.

Professor Miller
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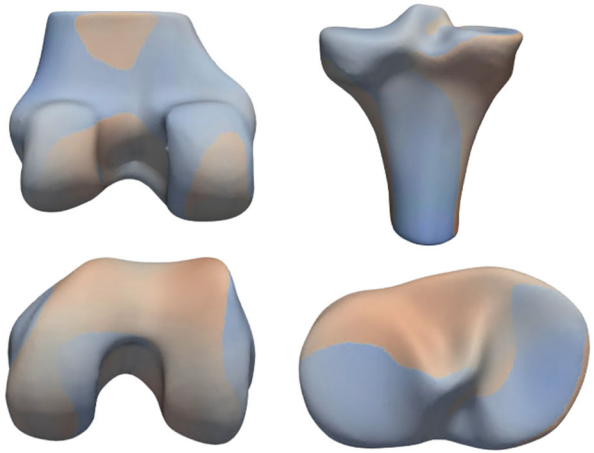
Research Interests:

My research is in paleoanthropology where I investigate questions about human evolution. I am specifically interested in the evolution of upright walking, or bipedalism. I study how bipedalism evolved by combining modern human and primate biomechanics of the knee joint with 3D shape analysis of the bones to interpret the fossil record.
I am also actively involved in field research at the site of Kromdraai Cave in The Cradle of Humankind in South Africa. This site preserves fossil hominin remains from approximately 2 million years ago.



Professor Pearl
pearlch@gvsu.edu

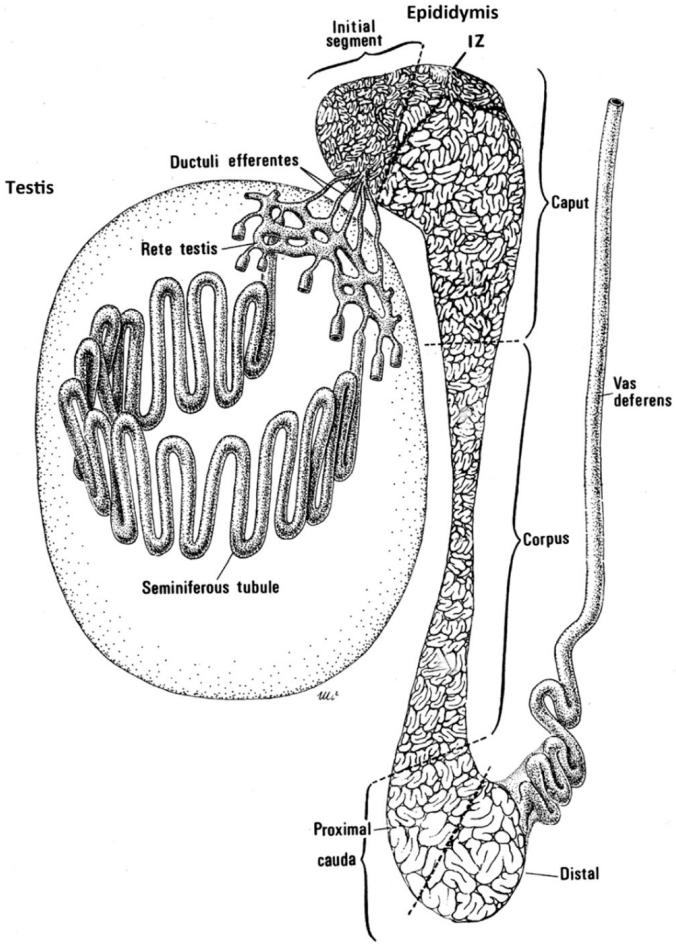
Research Interests:

The overall focus of my research is to investigate the role of hormone signaling in the male reproductive tract with the goal of better understanding male fertility and infertility. Control of spermatogenesis and sperm production is hormonally regulated through the hypothalamic-pituitary-gonadal axis. Classically, testosterone and other androgens have been associated with the male, while estradiol and other estrogens have been associated with the female. However, the testes produce significant amounts of estradiol in addition to testosterone and males unable to produce estrogens are infertile. Results from my research, and other groups, reveal that estrogen receptors are expressed within the testis and epididymis of multiple species. This indicates that the male reproductive tract in mammals is both a source and target for estrogen regulation.

(Continued on page 29)

(Continued from page 28)

The mechanisms by which estrogen regulates sperm production and maturation remain largely unknown, but this knowledge is essential for further progress in understanding male fertility. Elucidating these mechanisms is the long-term objective of my research program. Projects in my lab investigate the effects of estrogen signaling throughout the lifespan (i.e. development, adulthood, aging) using rodent models.



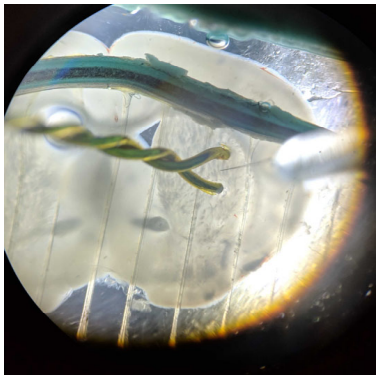
Professor Ramsson
ramssone@gvsu.edu

Research Interests:

My research interests center around a functional, real-time measure of neurotransmission. Neurons send and receive information through chemical means, transducing electrical signals into chemical signals. These transmissions occur on a very fast timescale, in the millisecond timeframe.

One of the best methods for monitoring neurotransmission in real time is called Fast-Scan Cyclic Voltammetry (FSCV). Fast-scan because it is happening fast: every 100 ms; cyclic because it happens repeatedly; and voltammetry because it deals with voltage changes. In brief, when a carbon surface reaches a certain voltage, and a neurotransmitter is next to it, the neurotransmitter will oxidize (like metal rusting). You can measure this reaction and use it to look at changes in neurotransmitter concentration.

The goals of my lab: 1) continue to improve neurotransmitter recording techniques. 2) characterize the effects of various substances on dopamine neurotransmission in the mouse brain, such as melatonin and CBD.



A brain slice is stimulated (metal prongs) to release dopamine, which is measured at the recording electrode (thin line in between stimulating electrode prongs).

Professor Reed
reedjam@gvsu.edu

Research Interests:

My research focuses on human craniofacial growth and development, with specific attention to the closure of cranial sutures. My current project is investigating the structure of non-human primate dura mater. The dura mater has been shown to be a source of genetic regulation of and mechanical influence on the closure of the cranial sutures. Both of the genetic and mechanical effects on suture closure may be related to the density and orientation of the regions of the dura deep to the cranial sutures. For instance, previous research in a rabbit model has indicated that the regions of the dura deep to the coronal suture does indeed contain a denser arrangement of collagen fibers when compared to the rest of the structure, which might provide increased genetic signaling and mechanical force to stimulate suture closure. In order to continue this line of investigation, my research students and I currently are in the nascent stages of a project to evaluate the density and orientation of collagen fibers in the dura mater of non-human primates. The organization of collagen in the dural section associated with the sutures could indicate a significant influence on the closure of cranial sutures. If the primate model yields positive results, we hope to move directly to human dura mater.

Professor Renkema
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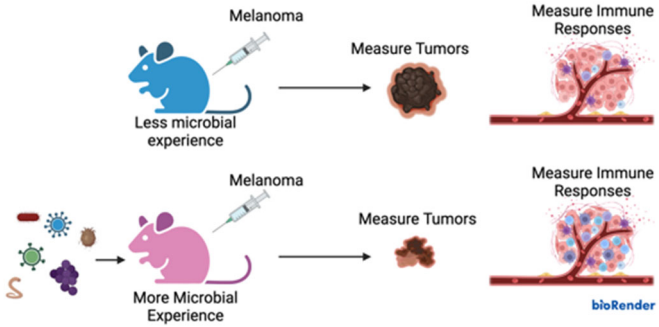
Research Interests:

My research investigates the microbial impact on immune development and function. When immune machinery functions properly, it is a potent weapon. When the machinery fails, the host is at risk for developing immune disorders like allergies and cancer. The prevalence of these immune disorders has drastically increased over the past few decades, particularly in areas with high sanitation standards and therefore decreased exposure to various microbes like viruses, bacteria, fungi, and parasites. Many researchers have developed hypotheses to explain this. One popular hypothesis is the hygiene hypothesis—basically, that the increase in cleanliness can have unintended, harmful consequences to the immune system.

My lab investigates the hypothesis that microbial exposure impacts innate and adaptive immune cell numbers, activation, and function in the context of cancer. We compare the immune systems of mice with little/no microbial experience and mice with extensive microbial experience. Our lab has shown that mice with increased microbial experience have corresponding increased innate and adaptive immune activation. We recently expanded these findings to a mouse model of melanoma. Microbially experienced mice have slower tumor growth, increase time of survival, and increased tumor-infiltrating immune cells. My lab continues to use this model to investigate the immune mechanism(s) resulting in increased anti-tumor immunity.



Dawn Richiert
richierd@gvsu.edu

Research Interests:

I am the current director of the GVSU Plastination Lab. We produce plastinated anatomical specimens (both human and animal) for use in Biomedical Sciences and Biology laboratory courses. Each specimen needs to be meticulously dissected before the process of plastination begins. Most of these dissections are performed by GVSU students. After the specimens have been plastinated, they require positioning to best demonstrate their various structures. Finally, the ‘plastic’ in the specimens needs to be hardened. When all is complete, we have created a marvelous teaching resource that, with gentle handling, can be used for many years.

Professor Shabani
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Research Interests:

My broad research interests are on genetic risks of drug use disorders and the associated neural substrates that influence specific aspects of drug use such as, drug taking, seeking and relapse. Methamphetamine (MA) use like that of opioids is a widespread problem in US and is highly addictive drug with devastating consequences to the individual and society at large. My research program explores binge MA use, MA withdrawal and relapse using a genetic mouse model for high and low MA intake. The main aim of my research is to identify and explore druggable targets for future development of therapeutic interventions. Extensive work by my collaborator at Oregon Health & Science University, and her group, who developed this mouse model system have identified at least two quantitative trait loci (QTL) associated with MA intake, located in chromosome 10 and X. In particular, two gene candidates located in the chromosome 10 QTL, namely a u-opioid receptor and a g-protein coupled receptor, known as trace-amine associated receptor TAAR1, seem to play an important role in the MA intake, and other correlated traits. Correlated behavioral traits of interest involve: sensitivity to rewarding and aversive effects through procedures such as, conditioned place preference, conditioned place aversion, conditioned taste aversion; drug reinforcement such as the operant self-administration paradigms; drug withdrawal in form of anxiety and depression-like symptoms tests, such as, zero or plus-maze, forced-swim, and tail-suspension. Recent pharmacological manipulations of TAAR1 receptor in a number of these experiments seem to support the hypothesis that TAAR1 receptor plays an important protective role in MA use and therefore is a prime druggable target to explore in the future. In sum my lab pursues neuroscience related questions mostly at the behavioral genetics, physiological, neurochemical, and pharmacological level.

Professor Stroik
stroikl@gvsu.edu

Research Interests:

My primary research interest lies in understanding the ecological mechanisms that drove changes in community composition and structure throughout mammalian evolution. In other words, I am interested in determining “why” and “how” mammalian groups arose, diversified, and went extinct by studying their interactions with their physical environment and with one another. In mammals, one of the most impactful species interaction is competition, and species most likely to compete with one another are those who occupy the same ecological niche or “role” in the community. In the fossil record, ecological niches can only be examined using the anatomical features preserved in fossil specimens, namely teeth and bones. As teeth are the point of contact between a mammal and its food, I use fossil teeth to reconstruct the dietary niches, and ultimately patterns of dietary competition, of mammals living in North America between 65 and 40 million years ago.

Students working in my lab are currently exploring two different aspects of mammalian evolution: (1) dietary reconstruction through the study of dental anatomy and (2) microfossil collection and curation. (1) Students interested in dietary reconstruction will prepare dental molds for casting, cast dental specimens from these molds, curate molds and casts, mount dental casts for micro-CT scanning, process digital micro-CT scans, and collect two- and three-dimensional data using imaging software. (2) Students interested in microfossil collection will process sediment from the Uinta Basin, Utah and identify fossils in that sediment using microscopy. These fossil finds fill in an important gap in the vertebrate fossil record during a period of significant global warming ~40 million years ago. Finally, students working in my lab also have the opportunity to conduct paleontological fieldwork in the Uinta Basin, Utah.

Professor Sylvester
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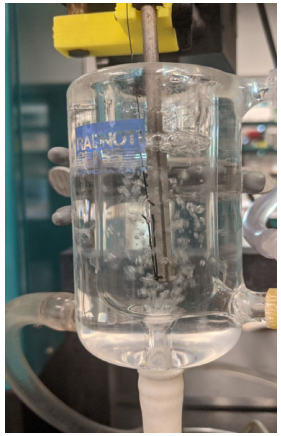
Research Interests:

The cardiovascular system plays an essential role in enabling the body to adequately perform daily activities such as spending time studying for an exam or setting a new personal best on a university athletic field. Pathologic alterations in the function of the cardiovascular system can be catastrophic as impairments in this system are the leading cause of morbidity and mortality in the United States. In humans, the cardiovascular system is a closed system composed of a pump, i.e. the heart, and a lengthy series of tubes that carry blood from the heart to the cells of the body and, ultimately, back to the heart – these tubes (blood vessels) are specifically known as arteries, veins, capillaries, arterioles, and venules. Our lab is interested in the function of the blood vessels, as they are primarily responsible for regulating blood flow to precisely meet the needs of the body's tissues across a wide range of metabolic states. Additionally, blood vessels play a pivotal role in the regulation of blood pressure as changes in blood vessel diameter directly impact this important physiological parameter. Since blood vessels are partially comprised of smooth muscle which is known to be sensitive to a variety of stimuli, our lab studies the responses of blood vessels to numerous physiological/pharmacological stimuli including temperature, drugs, and nutritional supplements. We conduct in vitro and in vivo experiments using animal models (usually pigs or mice) to observe acute or chronic changes in cardiovascular function. Many of our experiments involve the isolation of specific arteries that are studied under controlled conditions in an attempt to observe and measure the response of living arteries to relevant stimuli. It is hoped that insights gained from these studies will increase our understanding of the regulation of the human cardiovascular system.



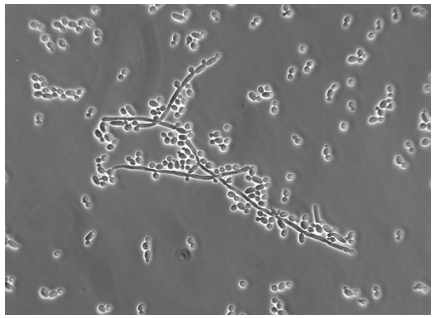
Professor Thomas
thomasde@gvsu.edu

Research Interests:

My research focuses on using *Candida albicans* as a model fungal pathogen. *C. albicans* is a frequently acquired nosocomial infection both within the US and worldwide. It is an increasingly common threat to human health as a consequence of AIDS, steroid therapy, organ and tissue transplantation, cancer therapy, broad spectrum antibiotics and other immune defects. These infections carry unacceptably high morbidity, mortality rates (30-50%) and important economic repercussions (estimated total direct cost of approximately 2 billion dollars in 1998 in US hospitals alone).

The objectives of my research are: (i) the application of state-of-the-art yeast cell biology and genetics to the study of *Candida albicans* pathogenesis and commensalism, (ii) the use of proteomics, genomics, and bioinformatics in the analysis of the lifecycle of *C. albicans*, (iii) studies of *C. albicans* virulence in vivo, and (iv) signal sensing and transduction particularly with reference to disease related and quorum sensing pathways in *C. albicans*.

Currently, we are focused on studying a subset of proteins whose level appears to need to change to allow the shape transition that is associated with disease to occur. We are studying this subset on multiple levels including: Which need to change to allow the transition, how this subset influences the ability to cause disease and how the proteins modulate their effect.



Professor Thompson
thompscy@gvsu.edu

Research Interests:

My research investigates how primates integrate behavioral and physiological adaptations to overcome ecological challenges in their natural environment. I aim to understand how these different facets of animals' biology work together at the organismal level. My lab provides opportunities for students to gain experience in hormone analysis, behavioral observation methods, thermoregulatory research, and international fieldwork.

Within this framework, my current research projects focus on how thermal pressures from climate change impact primate thermoregulation and conservation. This includes how animals utilize behavioral and physiological adaptations to maintain a stable body temperature, as well as cope with the energetic demands of thermoregulation. My research in this area has covered behavioral mechanisms such as microhabitat choice and use of postures, hormonal mechanisms of thermoregulation, and non-invasive assessment of body temperature via infrared thermography.

NOTES

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