

BINGHAMTON UNIVERSITY

Beckman Scholars Program



Student Mentor Guide

WELCOME

External Scholarships and Undergraduate Research Center

Program Overview

ABOUT BECKMAN SCHOLARS PROGRAM

The Beckman Scholars Program is a national grant sponsored by the Arnold and Mabel Beckman Foundation. Since 1998, the Beckman Scholars Program has provided financial support to young scientists during their undergraduate career. Selected participants undergo a 15-month (May 2022–Sept. 2023) mentored research experience and receive \$21,000 to support their development and research endeavors. For the next three years, two applicants will be selected annually to participate in the Beckman Scholars Program.

PROGRAM ELIGIBILITY

Applicants must be:

- Full-time Binghamton University student with good academic standing.
- In the first four semesters of college (including transfer credits) and who will not graduate until after the Fall 2023 semester.
- A citizen or permanent resident of the U.S. or its territories and possessions.
- A major in **biochemistry, biological sciences, biomedical engineering, chemistry, integrative neuroscience.**

AWARD BREAKDOWN

Students receive an \$18,200 stipend distributed as follows:

- First summer: \$6,800
- Academic year: \$4,600
- Second summer: \$6,800

Students Scientific Supply and Travel stipend:

- \$2,800 distributed as needed to support current research activities

Total Award Amount: \$21,000

WELCOME

External Scholarships
and Undergraduate Research
Center

Application Process

DEADLINE

Monday, March 20th, 2023

Submit to the following email:
urc@binghamton.edu

Subject Line:
Beckman Scholars Application

APPLICATION REQUIREMENTS

Applicants must provide:

- The names of **3 mentors** ranked in order of most preferred (consult the following pages for more information about eligible mentors)
- A current **resume**
- A copy of their unofficial **transcript**, including the current semester
- Two **letters of recommendation—emailed directly to our office by recommenders**—one from a Binghamton University faculty member familiar with applicant's academic work and one additional letter from a supervisor, faculty member, coach, or other person with knowledge of the applicant's character, work ethic, motivations, or other relevant factors.
- One **essay** (500 - 750 words) in response to the following prompt, "How do the Arnold Beckman 7 Rules for Success resonate with you as a person and as a budding scientist?"

ARNOLD BECKMAN 7 RULES FOR SUCCESS

1. There is no satisfactory substitute for excellence.
2. Absolute integrity in everything.
3. Everything in moderation, including moderation itself.
4. Hire the best people—then get out of their way.
5. Don't be afraid of making mistakes. If you're not making mistakes, then you're probably not doing very much.
6. Acquire new knowledge and always ask why.
7. Don't take yourself too seriously.

QUESTIONS?

Make an appointment by contacting us or coming to walk-in advising. Scan the QR code to learn more about our office!





Dr. Susan Bane

DIRECTOR

BIOCHEMISTRY PROGRAM

PROFESSOR

DEPARTMENT OF CHEMISTRY

Student Engagement

- *Mentored 100+ students in 35 years*
- *6 active undergraduates in the lab as of spring 2021*

Student Accomplishments

Students working with Dr. Bane have accomplished the following:

- *Accumulated time in lab: 19+*
- *Co-authored articles published: 3*
- *External presentations: 3*
- *Internal presentations: 10*

Student Outcomes

Students in this lab continued on to:

- *Stanford University*
- *St. John's University*
- *University of Alabama*
- *University of Denver*

Research Summary

The scientific discipline of our lab is broadly defined as bioorganic chemistry. We use the tools of traditional organic chemistry to understand biological systems and to solve biological problems. In one of our major projects, we are developing new ways to join molecules together (bioorthogonal conjugation) that can be performed in a complicated environment such as the inside of a cell, which has applications in targeted chemotherapy. In a second project, we are designing and developing molecules that can visually distinguish diseased tissues and cells from healthy ones.

Offered Projects

The Beckman Scholar will choose to work on one of the two major projects:

- Design and synthesize new molecules for bioorthogonal conjugations, create targeted drugs such as antibody-drug conjugates using their molecules, and test the effectiveness of their conjugates in selectively killing cancer cells.
- Make molecules that will be designed to react with particular stress-produced substances in diseased cells and produce a detectable fluorescent signal. The student will test that their molecule(s) are specific for diseased cells using models available in the lab, followed by testing for medical applications, such as identifying cancer within biopsy samples.



Dr. Susan Bane



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MENTOR PHILOSOPHY

I spend considerably more time in one-on-one interactions with students, treating them as a hybrid of new researcher and advanced graduate student. I will meet with students very frequently in the beginning—sometimes daily—with fewer meetings as they become more independent. I also interact with students in weekly group meetings where one student presents their research data for discussion with the group. The presenting student also leads a discussion about a research paper from the recent literature. As the Scholar begins independent work on a project, they will have the opportunity to begin presenting to the group in this setting.

RESEARCH PREPARATION

The scientific discipline of our lab is broadly defined as bioorganic chemistry. We use the tools of traditional organic chemistry to understand biological systems and to solve biological problems. In one of our major projects, we are developing new ways to join molecules together (bioorthogonal conjugation) that can be performed in a complicated environment such as the inside of a cell, which has applications in targeted chemotherapy. In a second project, we are designing and developing molecules that can visually distinguish diseased tissues and cells from healthy ones.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Chio TI, Demestichas BR, Brems BN, Bane SL and Tumej LN. Expanding the Versatility of Microbial Transglutaminase Using α -Effect Nucleophiles as Noncanonical Substrates. 2020. Angew. Chem. Int. Ed. Eng., in press (Published online:08 April 2020; <https://doi.org/10.1002/ange.202001830>).
2. Mukherjee K, Chio TI, Gu H, Banerjee A, Sorrentino AM, Sackett DL, Bane SL. Benzocoumarin hydrazine: A large Stokes shift fluorogenic sensor for detecting carbonyls in isolated biomolecules and in live cells." 2017. ACS Sensors 2, 128-134.
3. Dilek O, Sorrentino AM, Bane SL. Intramolecular Catalysis of Hydrazone Formation of Aryl-Aldehydes via ortho-Phosphate Proton Exchange. 2016. Synlett 27, 1335-1338.
4. Blanden AR, Mukherjee K, Dilek O, Loew M, Bane SL. 4-Aminophenylalanine as a biocompatible nucleophilic catalyst for hydrazone ligations at low temperature and neutral pH. 2011. Bioconjugate Chemistry 22, 1954-1961.
5. Sharma S, Poliks B, Chiauzzi C, Ravindra R, Blanden AR, Bane S. Characterization of the colchicine binding site on avian tubulin isotype beta VI. 2010. Biochemistry 49, 2932-2942.
6. Banerjee A, Panosian TD, Mukherjee K, Ravindra R, Gal S, Sackett DL, Bane S. Site-specific orthogonal labeling of the carboxy terminus of alpha-tubulin. 2010. ACS Chemical Biology 5, 777-785.

Research Summary



Dr. Christopher Bishop

DIRECTOR

INTEGRATIVE NEUROSCIENCE PROGRAM

PROFESSOR

DEPARTMENT OF PSYCHOLOGY

In my laboratory, we use rodent models of Parkinson's disease to understand how the brain compensates for disease-related cell death and symptoms, thereby identifying novel targets for intervention and treatment. Since I started as a faculty member at Binghamton University 17 years ago, undergraduate students have been involved in almost all aspects of our research from handling rats to presenting findings to the research community. Our translational research is technically and conceptually ideal for training undergraduates, and since many students are interested in the nexus of neurobiology and human disease, they find our work imminently tangible.

Offered Projects

The Beckman Scholar will be expected to work a minimum of 10 hours/week, participate in weekly lab meetings and display progressive mastery of the methods of our discipline. This includes care and handling of rodents, drug preparation and administration, behavioral assays, histological methods, data handling and analysis and finally scientific communication. This final step is expected to include a poster presentation at a local conference and/or national conference like Society for Neuroscience. Throughout the training process, a major goal for the Beckman Scholar will be a transition to independent research. This will be accomplished through the establishment of clear goals, regular feedback, and the advancement of scientific ideas and products.

Student Engagement

- *Mentored 60+ undergraduate students since 2005*
- *10 hours of lab experience per week*
- *40% of undergraduates contribute to a peer-reviewed publication*

Student Accomplishments

Students working with Dr. Bishop have accomplished the following:

- *Accumulated time in lab: 19+*
- *Co-authored articles published: 20*
- *External presentations: 15*
- *Internal presentations: 12*

Student Outcomes

Students involved in this lab are now:

- *Physicians*
- *Scientists*
- *Teachers*
- *Lawyers*
- *Business Leaders*



Dr. Christopher Bishop



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MENTOR PHILOSOPHY

While undergraduate researchers may differ in their preparation and need for oversight, it will be important to interact with the Beckman Scholar, 1-on-1, on a regular basis. This will begin prior to working in the laboratory at which time we will discuss our joint expectations and set goals. I will provide them with seminal readings and training videos that we have created for new students. Thereafter, with immersion in the laboratory, periodic 1-on-1 meetings will happen 3 times/semester or more, depending upon the needs of the student. Part of this process is evaluative from my perspective where I can give the Scholar constructive feedback based on my observations and those of senior lab members; the other is to listen, where I gauge what the Scholar needs to continue their trajectory towards scientific independence.

RESEARCH PREPARATION

Throughout the training process, a major goal for the Beckman Scholar will be a transition to independent research. This will be accomplished through the establishment of clear goals, regular feedback, and the advancement of scientific ideas and products. Having trained 12 doctoral students, it is clear to me that positive feedback and clear achievement milestones not only instantiate confidence but also portend success at the graduate level and beyond. Moreover, students who train in my laboratory are placed in a system where leadership is not only encouraged but expected. Scholars begin as trainees, mentored by more experienced students, but will themselves become mentors as their expertise emerges.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Conti Mazza, M., Ngyuen, V., Beilina, A., Karakoleva, E., Coyle, M., Ding, J., Bishop, C., Cookson, M.R. (2021). Combined knockout of Lrrk2 and Rab29 does not result in behavioral abnormalities in vivo. *Journal of Parkinson's Disease*. *Journal of Parkinsons Disease* 11(2):569-584.
2. Lovejoy, P.C., Foley, K., Conti, M.M., Meadows, S.M., Bishop, C. and Fiumera, A.C. (2021). The genetic basis of susceptibility to low dose paraquat and variation between the sexes in *D. melanogaster*. *Molecular Ecology* May; (30;9):2040-2053.
3. Chambers, N.E., Coyle, M., Sergio, J., Lanza, K., Saito, C., Topping, B., Clark, S.D., Bishop, C. (2021). Pedunculopontine nucleus cholinergic lesion produces gait deficits and decreases dyskinesia in hemiparkinsonian rats. *European Journal of Neuroscience* Apr;53(8):2835-2847.
4. Lanza, K., Centner, A., Coyle, M., Di Priore, I., Manfredsson, F.P., Bishop, C. (2021) Genetic suppression of the dopamine D3 receptor in striatal D1 cells reduces the development of L-DOPA-induced dyskinesia. *Experimental Neurology* Feb; 336:113534.

Research Summary



Dr. Terrence Deak

PROFESSOR

DEPARTMENT OF PSYCHOLOGY

My laboratory of neuroimmunology uses rodent models to better understand how two key experiential events – psychological stress and alcohol exposure – influence overall brain health across the lifespan. Our work is distinctly multi-disciplinary, examining interactions between the endocrine, immune, and central nervous systems. We routinely train six to eight undergraduates each year in this research, with the typical student working in the lab for two years or more. We use a systematic approach to teach the basics of animal handling, followed by gradually more sophisticated procedures including drug administration, behavioral testing, and surgical procedures. At the same time, students are initiated into basic wet-lab biochemistry procedures through a series of simple assays designed to teach sterile technique and micro-pipetting, which forms the basis of many of the cellular and molecular measures we use.

Student Engagement

- *Mentored 90+ undergraduates since 2001*
- *6 currently active undergraduates*

Student Accomplishments

Students working with Dr. Deak have accomplished the following:

- *Accumulated time in lab: 19+*
- *Co-authored articles published: 18*
- *External presentations: 22*
- *Internal presentations: 9*

Student Outcomes

Students involved in this lab continued to:

- *University of California Los Angeles*
- *University of California San Diego*
- *University of North Carolina Chapel Hill*
- *Columbia University*
- *New York University*
- *Albert Einstein School of Medicine*
- *Vanderbilt University*

Offered Projects

Summer will begin with a “deep dive” into mentored readings of the literature, generation of an outline for a review paper on their individualized research project, and target submission of the review paper for peer-review in the Fall semester and will fall in the general rubric of our NIH-funded projects (i.e., the neurobiology of stress, alcohol and aging). Simultaneously, lab skills training will start covering all skills and abilities necessary to conduct independent research, such as animal handling and behavioral testing; surgical training, perfusion and tissue harvest; and basic biochemical assays.



Dr. Terrence Deak



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MENTOR PHILOSOPHY

A Beckman Scholar will attend weekly lab group meetings in addition to bi-weekly meetings for individualized discussions of their project and regular informal communication as needed. Beckman Scholars will also have extensive interactions with the four doctoral students and two senior (PhD level) research scientists in my lab on a daily basis, offering an unusually rich training environment and the opportunity to learn from individuals at very different stages of their training and scientific career.

RESEARCH PREPARATION

By the start of the Fall semester, the Beckman Scholar will be positioned to form an Honors Thesis Committee as part of my SMP. At this point, they should be well into independent data collection, which will continue throughout the academic year and the summer that follows. To ensure competitive potential at a top-tier graduate program or medical school, the Honors thesis project will form the basis of a peer-reviewed manuscript on which the Beckman Scholar will serve as first author. The intent is to have this article submitted for publication by the end of the 15 month program, which would include authorship on both a conceptual review paper and an empirical manuscript. The combined experiences described as part of this SMP will instill the confidence and early seeds of leadership for Beckman Scholars. Interactions with faculty in the DEARC will also offer excellent role models for success in science (generally) and scientific leadership (specifically).

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Marsland, P.M., Parrella, A., Orlofsky, M., Lovelock, D.F., Vore, A.S., Varlinskaya, E.I. & Deak, T. (2021). Neuroendocrine and neuroimmune responses in male and female rats: evidence for functional immaturity of the neuroimmune system during early adolescence. *European Journal of Neuroscience*, doi: 10.1111/ejn.15118.
2. Perkins, A.E., Piazza, M.K., Vore, A.S., Deak, M.M., Varlinskaya, E.I. & Deak, T. (2021). Assessment of neuroinflammation in the aging hippocampus using large-molecule microdialysis: sex differences and role of purinergic receptors. *Brain, Behavior & Immunity*, 91, 546-555.
3. Hennessy, M.B., Sensenbaugh, J., Molina, A., Schiml, P. & Deak, T. (2020). Presence of mother prompts dissociation of sickness behavior, fever, and hypothalamic gene expression in lipopolysaccharide-injected guinea pig pups. *Developmental Psychobiology*, 62(5), 749-757.
4. Kudinova, A.Y., Gano, A., James, K.M., Lawlor, C., Deak, T. & Gibb, B.E. (2020). Anhedonia and increased evoked immune response. *Brain, Behavior, & Immunity-Health*, (6), 100090.



Dr. Guy German

DIRECTOR

BIOMEDICAL ENGINEERING GRADUATE
PROGRAM

Student Engagement

- *Mentored 37 undergraduates since 2013*
- *7 undergraduates currently in lab*

Student Accomplishments

Students working with Dr. German have accomplished the following:

- *14 senior or co-authored papers*
- *Accumulated 19+ months in lab*
- *Co-authored 14 published articles*
- *10 External presentations*
- *9 Internal presentations*

Student Outcomes

Students involved in this lab continued to:

- *Stryker*
- *Regeneron*
- *Naval Nuclear Laboratories*
- *New York University*
- *Carnegie Mellon*
- *Rensselaer Polytechnic Institute*
- *Stanford University*
- *Rutgers University*

Research Summary

My lab examines the great barrier to the outside world—human skin. We explore all aspects from how it works and how it breaks to what happens to skin when it ages, or becomes infected. My team's research over the years has explored a variety of subjects including the skin microbiome and how it is associated with atopic dermatitis, the effect of cosmetic products on skin mechanics, damage and repair, the development of a noninvasive device to help surgeons plan incisions, and even the creation of sunscreen made of DNA to protect human skin from the sun and minimize the risk of cancer.

Offered Projects

The Beckman Scholar begins by finding out which of the research topics in my lab they are most enthusiastic about, and deciding on an appropriate project. The Beckman Scholar would then be trained on the equipment and protocols required to perform the study, with students always supervised until they are confident in performing the procedures. As the scholar becomes immersed in the laboratory environment, they will be surrounded by graduate and undergraduate researchers performing similar research and listening to weekly presentations. From these interactions, they will learn how to present their work at regional and internationally recognized conferences, and begin to understand how all of the different research projects in the lab integrate together.



Dr. Guy German



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MENTOR PHILOSOPHY

In our lab, I have four requests for all researchers, regardless of their experience level: 1. perform your work safely, 2. help others perform their work safely, 3. meet with me once a week for a 30-minute hypothesis driven conversation, and 4. meet with the whole lab for a 60-minute weekly group meeting. I will regularly meet with them to discuss what the student has done, what they have discovered, what problems they have encountered, and what they are going to do next. I find this template is effective in ensuring that both myself and the researcher know what the next milestones are for evaluating a working hypothesis. This transforms into a more data driven conversation as the student gains experience and begins to work more independently. My goal is to get them to where they can critically examine their own data, and predict what my thoughts and recommendations will be for next steps.

RESEARCH PREPARATION

All students are asked to write technical reports, which help to improve their competence with writing research articles. If the student is interested in staying in academia, I can teach them how to move from an undergraduate, to a graduate student, post-doc, and ultimately then faculty, and give them additional opportunities to write grants as well as research articles and research posters. Students wanting to go into industry will instead be trained more on diversifying their experimental techniques and computational programming portfolio, as well as developing technical writing skills to ensure technical reports are concise and similar to executive summaries favored by industry.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. C H. Maiorana, M. Erbe, T. Blank, Z. W. Lipsky, and G. K. German, 'Fracture guidance in soft solids through embedded topography' Scientific Reports 9: 13493 (2019).
2. D. Lailaona, J. Cohen, K. Coulon, Z. W. Lipsky, C. Maiorana, R. Boltyanskiy, and G. K German, 'Non-invasive in-vivo quantification of human skin tension lines' Acta Biomaterialia 88: 141-148 (2019).
3. A. E. Gasperini, S. Sanchez, A. L. Doiron, M. Lyles and G. K. German, ' Non-ionising UV light increases the optical density of hygroscopic self assembled DNA crystal films', Scientific Reports, 7, 6631 (2017).
4. L. Bromberg, X. Liu, I. Wang, S. Smith, K. Schwicker, Z. Eller, and G. K. German, 'Control of human stratum corneum wettability using the pH of anionic surfactant solution treatments', Colloids and Surfaces B: Biointerfaces, 157, 366-372 (2017).
5. W. J. Doak, D. M. Lailaona, G. K. German and P. R. Chiarot, 'Rebound of Continuous Droplet Streams from and Immiscible Liquid Pool', Physics of Fluids, 28, 057104 (2016).



Dr. Puja Goyal

ASSISTANT PROFESSOR

CHEMISTRY

Student Engagement

- *Mentored 10 undergraduates since 2017*
- *3 undergraduates currently in lab*

Student Accomplishments

Students working with Dr. Goyal have accomplished the following:

- *10-18 months of accumulated lab time*
- *5 published, co-authored articles*
- *2 external presentations*
- *3 Internal presentations*
- *American Chemical Society Physical Chemistry Award*
- *Several departmental and university awards*

Student Outcomes

Students involved in this lab continued to:

- *Mount Sinai PREP Program*
- *SUNY Buffalo*
- *Boston University*
- *Max Planck School Matter to Life*

Research Summary

My research group carries out computational modeling of large biological systems. We study how both light modulates structure and functions of naturally occurring photoreceptor proteins. We also investigate how non-light-absorbing proteins can be engineered to make them photoreceptive. In addition, we study the mechanism of coiled coil registry shift in a dynein adaptor protein involved in cellular cargo transport.

Offered Projects

The Beckman Scholar will choose to work on one of the three following projects:

- *photoinduced charge transfer in the CarH photoreceptor protein*
- *photocontrol of calmodulin-peptide binding*
- *coiled coil registry shift and activation of cargo binding in the dynein transport machinery*



Dr. Puja Goyal



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MENTOR PHILOSOPHY

The Beckman Scholar and I will meet at least twice a week. Each meeting will involve troubleshooting any problems that the scholar comes across in the course of training and research. The scholar will be required to write a short report every week to summarize their progress, which will be discussed in meetings, and feedback on report-writing will be provided.

RESEARCH PREPARATION

The ability to think about and carry out scientific research independently is a crucial asset I strive to inculcate in the undergraduate researchers in my lab. The specific ways in which I will work towards inculcating this ability in the Beckman Scholar as part of their SMP are by (1) assigning an independent project to the scholar, (2) encouraging the scholar to take classes related to the specific research topic to solidify fundamental knowledge, (3) involving the scholar in authoring manuscripts for publication, (4) requiring the scholar to present regularly in group meetings and obtain constructive feedback, (5) having the scholar mentor a younger undergraduate student, and (6) helping the scholar obtain exposure to the broader scientific community via presentations at conferences.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Wang J, Zhang K, Goyal P, Grewer C. Mechanism and Potential Sites of Potassium Interaction with Glutamate Transporters. *J Gen Physiol.* 2020 Oct 5;152(10).
2. Cui H, Ali MY, Goyal P, Zhang K, Loh JY, Trybus KM, Solmaz SR. Coiled-Coil Registry Shifts in the F684I Mutant of Bicaudal D Result in Cargo-Independent Activation of Dynein Motility. *Traffic* 2020 May 7; 21(7):463-47.
3. Noell CR, Loh JY, Debler EW, Loftus KM, Cui H, Russ BB, Zhang K, Goyal P, Solmaz SR. Role of Coiled-Coil Registry Shifts in the Activation of Human Bicaudal D2 for Dynein Recruitment upon Cargo Binding. *J Phys Chem Lett.* 2019 Aug 1;10(15):4362- 4367.
4. C. L. Cooper, N. Panitz, T. A. Edwards, P. Goyal, "Role of the CarH Photoreceptor Protein Environment in the Modulation of Cobalamin Photochemistry", *Biophys. J.* 120, 3688-3696 (2021).



Dr. Christof Grewer

UNDERGRADUATE DIRECTOR

DEPARTMENT OF CHEMISTRY

PROFESSOR

DEPARTMENT OF CHEMISTRY

Student Engagement

- *Mentored 23 undergraduates since joining Binghamton University*
- *4 undergraduates currently in lab*

Student Accomplishments

Students working with Dr. Grewer have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 9*
- *Chancellor's Award*
- *Barry Goldwater Fellowship*

Student Outcomes

Students involved in this lab continued to:

- *Mount Sinai*
- *New York University*

Research Summary

My laboratory has long-standing experience in the functional analysis of secondary-active neurotransmitters and amino acid transporters and has been supported by an NIH grant since 2004. We combine experimental analysis of transport function and organic synthesis of active compounds with computational approaches, both on the all-atom level (molecular dynamics simulations) and at lower level (electrostatics calculations). My laboratory works on two general projects: the first project focuses on the molecular mechanism of glutamate transport proteins, and the second project investigates transport proteins as potential targets for anti-cancer agents.

Offered Projects

It would be expected that a student would not only learn electrophysiology, but also get training in other methods used in my laboratory, such as organic synthesis of inhibitors, cell growth assays, and computational methods. Students are trained in literature review, experimental design, supervised experimentation, data analyses, unsupervised research and hypothesis building, as well as troubleshooting and problem solving. Students also learn to present their findings in weekly group meetings, and to prepare short talks, posters, and manuscripts for publication.



Dr. Christof Grewer



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MENTOR PHILOSOPHY

SMP to discuss the newest findings and to establish the future strategy of work. The student will also be assigned to a graduate student for direct supervision and training. In my regular meetings with the Beckman Scholar, we will discuss career goals and opportunities for presentations of research. I will use meetings also as an opportunity to guide participation in writing and editing scientific manuscripts, and fostering a laboratory environment that encourages learning, innovation, continuous literature review, and cutting edge science. When the scholar is ready to apply to graduate school, MD, or MD/PhD programs, or advance to the next stage of their training, I will be available to work with them in writing recommendation letters, cover letters for job applications, resume review, and general preparation for interviews.

RESEARCH PREPARATION

Student leadership in my lab is encouraged by first observing other leaders in the group such as myself and senior graduate students, and later by taking leadership roles in project development and experiment troubleshooting. Senior and advanced undergraduate research students in the lab are often asked to supervise and train new undergraduate students, and assist them with everyday laboratory activities. By the second summer, the Beckman Scholar would have the opportunity to perform this kind of leadership role in the lab.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Wang J, Li P, Yu X, Grewer C. Observing spontaneous, accelerated substrate binding in molecular dynamics simulations of glutamate transporters. PLoS One. 2021 Apr 23;16(4):e0250635.
2. Wang J, Zhang K, Goyal P, Grewer C. Mechanism and potential sites of potassium Interaction with glutamate transporters. J Gen Physiol. 2020 Oct. 5;152(10):e202012577.
3. Ndaru E, Garibsingh RA, Shi Y, Wallace E, Zakrepine P, Wang J, Schlessinger A, Grewer C. Novel alanine serine cysteine transporter 2 (ASCT2) inhibitors based on sulfonamide and sulfonic acid ester scaffolds. J Gen Physiol. 2019 Mar 4;151(3):357-368.
4. Noell CR, Loftus KM, Cui H, Grewer C, Kizer M, Debler EW, Solmaz SR. A Quantitative Model for BicD2/Cargo Interactions. Biochemistry. 2018 Nov 20;57(46):6538-6550.



Dr. Gretchen Mahler

INTERIM DEAN

GRADUATE SCHOOL

ASSOCIATE PROFESSOR

DEPARTMENT OF BIOMEDICAL ENGINEERING

Student Engagement

- *Mentored 22 undergraduates from 2015-2020*
- *3 undergraduates currently in lab*

Student Accomplishments

Undergraduates working with Dr. Mahler have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 8*
- *External Presentations: 12*
- *Internal Presentations: 5*
- *NSF GRFP Awards*
- *Gaann Fellowship & Whitaker Fellowship*

Student Outcomes

Students involved in this lab continued to:

- *Rensselaer Polytechnic Institute*
- *Boston University*
- *Duke University*
- *Cornell University*
- *University of Pennsylvania*

Research Summary

My expertise lies in the development of dynamic, microfluidic, 3D models of the gastrointestinal (GI) tract, lung, vascular endothelium, and valvular endothelium for mechanobiological and toxicity testing. My current research focus includes the development of dynamic, microfluidic, 3D models of the gastrointestinal (GI) tract, lung, vascular endothelium, and valvular endothelium for mechanobiological and toxicity testing.

Offered Projects

A Beckman Scholar will work on determining how common food additives affect microflora populations and nutrient absorption in the gastrointestinal tract. They will also learn sterile technique, human cell culture, bacterial cell culture, microscopy, and microfluidic device design, fabrication, characterization, and operation. The scholar will receive training in Laboratory Safety, Hazardous Waste Management, and Blood Borne Pathogen Safety and Responsible Conduct of Research.



Dr. Gretchen Mahler



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MENTOR PHILOSOPHY

The specific goals of the mentorship plan are to: (1) train the scholar in experimental techniques, experimental design, and data analysis; (2) promote critical thinking, creativity, scientific integrity, and research ethics; (3) teach effective communication skills, including manuscript writing and scientific presentation development; (4) initiate and manage collaborative relationships; and (5) demonstrate and provide opportunities for mentoring. I will personally train the Beckman Scholar with a relatively well developed training program over six weeks.

RESEARCH PREPARATION

The scholar will be expected to give two presentations per semester at lab meetings and monthly presentations to the co-PIs of our NIH grant. As with all students in my lab, the Scholar will be encouraged to submit abstracts to national meetings such as the Biomedical Engineering Society Annual meeting and other national, regional, and local conferences. We will work together on abstract and manuscript writing, and as their research progresses; I will continue to provide critical feedback on presenting and writing skills. I make every effort to secure funding so students can attend these

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Pereira M, Malik M, Nostro J, Mahler GJ. Effect of dietary additives on intestinal permeability in both *Drosophila* and a human cell co-culture. *Disease Models & Mechanisms*. 2018; 11 (12), dmm034520.
2. Dahal S, Bramsen J, Alber B, Murray BT, Huang P, Chen M, Mahler GJ. Chondroitin sulfate promotes interstitial cell activation and calcification in an in vitro model of the aortic valve. *Cardiovasc Eng Technol*. 2021 Nov 4. doi: 10.1007/s13239-021-00586-z.
3. Pereira MT, Malik M, Nostro JA, Mahler GJ, and Musselman LP. Effect of dietary additives on intestinal permeability in vivo in *Drosophila* and in vitro in a human cell co-culture. *Disease Models & Mechanisms*; 2018; 11: 12. doi:10.1242/dmm.034520.
4. Guo Z, Martucci NJ, Liu Y, Yoo E, Tako E, Mahler GJ. Silicon dioxide nanoparticle exposure affects small intestine function in an in vitro model. *Nanotoxicology*. 2018; 12(5): 485-508. doi: 10.1080/17435390.2018.1463407.
5. Richter JW, Shull GM, Fountain JH, Guo Z, Musselman LP, Fiumera AC, Mahler GJ. Titanium dioxide nanoparticle exposure alters metabolic homeostasis in a cell culture model of the intestinal epithelium and *Drosophila melanogaster*. *Nanotoxicology*. 2018; (5):390-406. doi: 10.1080/17435390.2018.1457189.



Dr. Laura Musselman

ASSOCIATE PROFESSOR

DEPARTMENT OF BIOLOGICAL
SCIENCES

Student Engagement

- *Mentored 21 undergraduates between 2015-2020*
- *5 undergraduates currently in lab*

Student Accomplishments

Undergraduates working with Dr. Musselman have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 7*
- *External Presentations: 4*
- *Internal Presentations: 14*

Student Outcomes

Students involved in this lab continued to:

- *University of Michigan*
- *University of Rochester*
- *Rutgers*
- *Columbia*
- *SUNY Upstate*
- *Case Western*

Research Summary

My expertise includes *Drosophila* husbandry, genetics, dietary manipulation, cloning, transgenesis, infection, fine dissection, metabolic assays, microscopy, and cardiac physiology. My lab group works on the biochemistry of obesity using *Drosophila melanogaster* (the fruit fly) as a model. Flies exhibit reduced fitness and lifespan when fed high-calorie diets, and our goal is to understand how biochemistry changes to produce pathophysiology during caloric overload in this simple model system.

Offered Projects

A Beckman Scholar's scientific development would begin in my lab by immersion in a related project studying the genes that control fitness when animals are faced with caloric overload. When they are able to do reproducible and quantitative experiments, they would move on to test hypotheses based on preliminary data. The Beckman Scholar will train at the lab bench and also work to develop reading and thinking skills in small group discussions within and outside the lab. They will join workshops every Friday, which include in-house experts and invited speakers who cover topics like reading the literature, presenting your research, statistics, research ethics, and career paths.



Dr. Laura Musselman



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MENTOR PHILOSOPHY

Developing critical thinking and leadership skills can best be done when immersed in a “village” rather than with a single mentor. In our village, the Scholar would work side-by-side with senior undergraduate and graduate researchers in the lab, who will be role models and help the student understand the rigor and challenges of research. By working in a small group, trainees often learn vicariously how to troubleshoot or revise a hypothesis when an experiment doesn’t turn out as planned. The faculty in our department are no different and lead by example, with a true culture of respect and admiration for our students.

RESEARCH PREPARATION

Depending on the Scholar’s future leadership ambitions, they might be invited to serve as an undergraduate TA, to be featured as a Department Highlight, tweet writer, outreach speaker or panelist, or to join committees such as the undergraduate committee and/or the diversity, equity, and inclusion committee. The Scholar will have the opportunity to attend weekly seminars as well as monthly Genetics and Drosophila research interest group meetings to interact with other scientists. The Scholar will be invited to present at local, regional, and national conferences.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Tuthill B.F., Quaglia C., O’Hara E., and L.P. Musselman. “Loss of Stearoyl-CoA Desaturase 1 leads to cardiac dysfunction and lipotoxicity” *Journal of Experimental Biology*, in press, June 2021.
2. Pereira M.P., Brock K., and L.P. Musselman. “Meep, a Novel Regulator of Insulin Signaling, Supports Development and Insulin Sensitivity via Maintenance of Protein Homeostasis in *Drosophila melanogaster*” *G3: Genes, Genomes, and Genetics* 2020 Sep 30;g3.401688.2020.
3. Pereira, M.P, Malik M., Nostro J.A., Mahler G.J., and L.P. Musselman. “Effect of dietary additives on intestinal permeability in both *Drosophila* and a human cell coculture” *Disease Models and Mechanisms*. 2018 Nov 28;11(12). pii: dmm034520. PMID: 30504122
4. Richter J.W., Shull G.M., Fountain J.H., Guo Z, Musselman L.P., Fiumera A.C., Mahler G.J. “Titanium dioxide nanoparticle exposure alters metabolic homeostasis in a cell culture model of the intestinal epithelium and *Drosophila melanogaster*.” *Nanotoxicology*. 2018 Jun;12(5):390-406. PMID: 29600885
5. Musselman, L.P., Fink J.L., Maier E.J., Gatto J.A., Brent M.R., and T.J. Baranski. “Seven-Up is a novel regulator of insulin signaling.” *GENETICS* 2018 Apr 208(4):1643-1656. PMID: 29487137.
6. Musselman L.P., Fink J.L., Grant A.R., Gatto J.A., Tuthill B.F., and T.J. Baranski. “A Complex Relationship between Immunity and Metabolism in *Drosophila* Diet-Induced Insulin Resistance.” *Mol Cell Biol*. 2017 Dec 29;38(2) doi: 10.1128/MCB.00259-17. PMID: 29084810

Research Summary



Dr. Kirsten Prior

ASSISTANT PROFESSOR

DEPARTMENT OF BIOLOGICAL
SCIENCES

I am trained as a field ecologist, who works on the effect of anthropogenic change on biodiversity. My ecology lab's research program explores how biodiversity and functionally important species interactions are affected by global change and mitigation efforts. We currently work in two study systems: 1) an insect-host parasitoid system, where we examine how climate change affects networks of interacting species, and 2) an investigation into how global change impacts seed dispersal of understory plants in eastern deciduous forest ecosystems. These projects are funded by the National Science Foundation and the National Geographic Society.

Student Engagement

- *Mentored 25 undergraduates between 2015-2020*
- *9 undergraduates currently in lab*

Student Accomplishments

Undergraduates working with Dr. Prior have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 12*
- *External Presentations: 4*
- *Internal Presentations: 14*

Student Outcomes

Students involved in this lab continued to:

- *Columbia*
- *McGill*
- *University of Florida*
- *Department of Natural Resources*
- *University of Washington*

Offered Projects

The Scholar will develop their own project based on one of the lab's pre-existing studies and learn valuable techniques such as DNA barcoding, field sample collection, and genomics. After deciding on feasible projects that suit the Scholar's interests, we will develop an experimental and data collection plan. The Scholar will perform lab work throughout the school year, and during the summers will have the opportunity to collect data in the field. During the school year, Scholars will also work with me to familiarize themselves with the code-based statistical program R that is used to analyze ecological data. During the final months of the mentorship, the Scholar will analyze data, present their work at conferences and prepare a manuscript to submit to a peer-reviewed journal.



Dr. Kirsten Prior



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MENTOR PHILOSOPHY

I am a hands-on mentor who tailors each mentorship experience to students. I will meet weekly with the Beckman Scholar to discuss details about the research project, read and discuss literature together, work on learning the statistical program R and analyzing data, and work on presentations and writing. Students will also participate in weekly lab meetings, where we discuss science and topics that help in preparation of a research career. Previous lab meeting topics include publishing, presentation skills, diversity equity and inclusion in science, engaging in outreach, practicing elevator talks.

RESEARCH PREPARATION

The Beckman Scholar will engage in a research project that is already at the graduate level. The work is designed to be published in a high-quality peer-reviewed journal. The Scholar will develop leadership roles in several capacities as they progress in the lab. By their second summer, they will have at least one undergraduate assistant helping them with their project to co-mentor. They will be encouraged to present their work and lead discussions at the lab and other department meetings. They will also have opportunities to develop and lead a module in our outreach program, and participate in department communities.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Parker WJ, Buono CM, Prior KM. 2021. Antagonistic and mutualistic interactions alter seed dispersal at forest edges. *Ecosphere* 12:e03397 (<https://doi.org/10.1002/ecs2.3397>).
2. Prior KM, Meadly-Dunphy SA, Frederickson ME. 2020. Interactions between seed dispersing ant species affect plant community composition in field mesocosms. *Journal of Animal Ecology* 89: 2485-2495. (<https://doi.org/10.1111/1365-2656.13310>).
3. Meadly-Dunphy SA, Prior KM, Frederickson ME. 2020. Invasive ants disperse seeds farther than native ants, affecting the spatial pattern of seedling recruitment and survival. *Oecologia* 192:119-132. (<https://doi.org/10.1007/s00442-019-04553-3>).
4. Gordon SC, Meadly-Dunphy SA, Prior KM, Frederickson ME. 2019. Asynchrony between ant seed dispersal activity and fruit dehiscence of myrmecochorous plants. *American Journal of Botany* (106):71-80. (<https://doi.org/10.1002/ajb2.1214>).
5. Milligan P.D., Prior KM, Palmer TM. 2016. An invasive ant reduces diversity but does not disrupt a key ecosystem function in an African savanna. *Ecosphere* 7:e01502. (<https://doi.org/10.1002/ecs2.1502>).



Dr. Karin Sauer

CHAIR

DEPARTMENT OF BIOLOGICAL
SCIENCES

PROFESSOR

DEPARTMENT OF BIOLOGICAL
SCIENCES

Student Engagement

- *Mentored 30 undergraduates between 2015-2020*
- *6 undergraduates currently in lab*

Student Accomplishments

Students working with Dr. Sauer have accomplished the following:

- *Accumulated time in lab: 19+ months*
- *Co-authored articles published: 4*
- *External Presentations: 3*
- *Internal Presentations: 1*

Student Outcomes

Students involved in this lab continued to:

- *PhD programs*
- *MS programs*

Research Summary

My research has focused on microorganisms that form biofilms with the goal of identifying ways to control and manage biofilms and their resistance to antimicrobial agents. Some of my other projects include: 1) The role of the SagS interactome in biofilm antibiotic tolerance, 2) Biofilm antibiotic tolerance and oxidative stress, 3) Effectors and regulators modulating biofilm antibiotic tolerance, 4) Elucidating the mechanism of biofilm dispersion and its effect on antibiotic resistance and virulence, 5) Persistence of the dispersion phenotype.

Offered Projects

The Scholar will receive training that will enable them to become proficient with aseptic techniques, biofilm growth conditions, molecular techniques including PCR, real-time PCR, cloning, and gene manipulation, as well as biochemical techniques including protein extraction and immunoblotting. The Biofilms center holds regular training workshops that will also be available to the Beckman Scholar as they begin immersing themselves in the lab. In addition to laboratory techniques, students in my lab are taught quantitative data analysis and statistics, and a Beckman Scholar would be expected to become proficient with these skills as well. The Scholar will eventually start working independently on a small project.



Dr. Karin Sauer



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MENTOR PHILOSOPHY

The Beckman Scholar will be expected to participate in our weekly lab meeting which is a forum for presenting research findings, problems, and discussion of potential pitfalls and solutions. This allows students the opportunity to not only present their own findings, but participate in scientific discussions as well as obtain an overview of the diverse ongoing research projects. In addition to the lab training, I meet with all members of the lab at least once a week in discussion about background, research findings, troubleshooting, and plans for the next step in their project.

RESEARCH PREPARATION

The weekly mentorship discussions with the Beckman Scholar will frequently include career planning, guidance with scientific writing and presentations, and development of hypotheses. I believe that the combination of hands-on training, weekly group meetings, and individual meetings provide a solid intellectual environment for students to flourish and succeed but also to experience up close graduate level research and future leadership roles in scientific research and innovation.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Park, S., J. Dingemans, M. Gowett, and K. Sauer. Glucose-6-phosphate acts as an extracellular signal of SagS to modulate *Pseudomonas aeruginosa* c-di-GMP levels, attachment and biofilm formation. *mSphere* 6:e01231-01220.
2. Tao, T., I.-T. Bae, K.B. Woodruff, K. Sauer, and J. Cho. 2019. Hydrothermally- Grown Nanostructured Anatase TiO₂ Coatings Tailored for Photocatalytic and Antibacterial Properties. *Ceramics International* 45: 23216-23224.
3. Dingemans, J., Al-Feghali, R. E., H. Sondermann, and K. Sauer. 2019. Signal sensing and transduction is conserved between the periplasmic sensory HmsP domains of BifA and SagS. *mSphere* 4: e00442-19.
4. Goodwine, J., J. Gil, A. Doiron, J. Valdes, M. Solis, A. Higa, S. Davis, and K. Sauer. 2019. Pyruvate-depleting conditions induce biofilm dispersion and enhance the efficacy of antibiotics in killing biofilms in vitro and in vivo. *Scientific Reports* 9, 3763.
5. Dingemans, J., Al-Feghali, R. E., Lau, G. W. and K. Sauer. 2019. Controlling chronic *Pseudomonas aeruginosa* infections by strategically interfering with the sensory function of SagS. *Molecular Microbiology* 111, 1211-1228, doi:10.1111/mmi.14215.



Dr. John Swierk

ASSISTANT PROFESSOR

DEPARTMENT OF CHEMISTRY

Student Engagement

- *Mentored 24 undergraduates from 2018-2021*
- *13 undergraduates currently in lab*

Student Accomplishments

Undergraduates working with Dr. Swierk have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 3*
- *External Presentations: 3*
- *Internal Presentations: 6*
- *Received national, university, and departmental awards*

Student Outcomes

Students involved in this lab continued to:

- *NYU*
- *Michigan State*
- *University of North Carolina*
- *SUNY Stony Brook*

Research Summary

Research in my group primarily focuses on photochemistry, the use of light to drive chemical reactions. Photochemistry is central to many of the grand scientific challenges of today, from renewable energy to biological imaging to green chemistry. Undergraduate research and development are also core pillars of the work we do. We use a transdisciplinary approach to teasing apart complex reaction mechanisms of photochemical processes. Common examples of these techniques include, transient laser spectroscopy, electrochemistry, NMR spectroscopy, and steady state photochemical measurements

Offered Projects

The Scholar will receive a breadth of training on multiple instruments and techniques from chemistry, materials science, and biology. The new Scholar in my group will initially join an existing project to learn and contribute to. Students typically focus on learning one or two techniques in detail. After training during the first summer, the Scholar will transition to an independent project that utilizes techniques they have already mastered and requires them to both learn a wider range of techniques and take ownership of the project.



Dr. John Swierk



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MENTOR PHILOSOPHY

Mentorship in my group takes several different forms. As noted above, peer mentorship is a key component of training in my lab. In addition, I schedule one-on-one meetings with students every one to two weeks that complement informal discussions in the lab. We also hold weekly subgroup meetings, where all of the students working in a particular project area present and discuss their results from the week and their plans for the next week. All of these interactions will work to strengthen the Beckman Scholar's scientific understanding of both their project and related work in the lab. Finally, we have a weekly group meeting involving all of the members of the lab.

RESEARCH PREPARATION

The focus of each weekly full group meeting is entirely professional development. We will spend several weeks discussing, for example, how to design an effective presentation or how to improve as a scientific writer. During the summer, we will typically invite guests from a variety of career paths (e.g., industry, publishing, national labs) to talk about their career and the route they took to get there. We also devote at least one group meeting to a discussion of what's involved in applying to graduate school and how to be successful once there. All of these efforts will be incorporated into the SMP for a Beckman Scholar.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. B.G. Stevenson, E.H. Spielvogel, E.A. Loiaconi, V. Wambua, R.V. Nakhamiyayev, J.R. Swierk, "Mechanistic investigations of an α -Amino Arylation Photoredox Reaction," J. Am. Chem. Soc. 2021, in press.



Dr. Florence Varodayan

ASSISTANT PROFESSOR

DEPARTMENT OF PSYCHOLOGY

Student Engagement

- 9 undergraduates currently in lab
- Mentored 1 Bridges to Baccalaureate Program student
- Mentored 2 undergraduates from 2020–2021

Student Accomplishments

Students working with Dr. Varodayan have accomplished the following:

- Accumulated lab time: 9–12 months
- Journal articles in preparation: 3
- External Presentations: 1

Student Outcomes

Students involved in this lab continued to:

- Psychology PhD (SUNY Binghamton)
- Medical School
- PhD Programs

Research Summary

My lab's research program is focused on understanding how alcohol and stress impact brain synapses and circuits to promote alcohol use disorder. We are particularly interested in the medial prefrontal cortex region of the brain as it regulates mood and motivation. We use a mouse model of alcohol dependence and a systems biology approach that includes molecular biology, slice electrophysiology, chemogenetics, and behavioral pharmacology techniques. Our ultimate goal is to provide better treatment for patients suffering from comorbid alcohol- and anxiety/stress-related psychiatric diseases.

Offered Projects

The Beckman Scholar will investigate one of the following questions:

- How does the norepinephrine stress system influence the transition from social drinking to excessive alcohol consumption?
- What role does the neuroimmune system play in normal cognitive function, and how is this impacted by alcohol?
- What are the shared mechanisms that underlie the effects of alcohol and stress in the medial prefrontal cortex?

The Beckman Scholar will play a direct role in the project's experimental design, data collection and analyses, and final data presentation.



Dr. Florence Varodayan



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MENTOR PHILOSOPHY

My mentorship goal is that all students in my lab to understand the overarching question that drives their projects, the limitations of their approaches, and how their findings further the field. In find that this deeper level of knowledge fosters confidence in my mentees to effectively communicate their work to other scientists and the public, and builds their independence towards pursuing future research studies. To achieve these goals, the Beckman scholar will meet with me weekly to discuss their project, as well as their immediate academic plans and their career goals. They will also attend our biweekly lab meetings, where they will have the opportunity to present their research findings and participate in discussions about varied topics such as, "scientific writing", "diversity, equity and inclusion in the sciences", and "what is like to be a professor?". Through this mentoring, I strive to provide all my mentees with a meaningful research experience and to foster diversity and inclusion in the STEM fields.

RESEARCH PREPARATION

Throughout their time in the lab, I will provide the Beckman Scholar with hands-on training to learn the skills they will need to develop and execute their independent project. This training will include learning technical skills, as well as learning how to analyze, graph and present data, how to develop research proposals and award applications, and how to network professionally at scientific conferences. I will also work with the Beckman Scholar to complete an Individual Development Plan to ensure that their research and professional training in my lab aligns with their scientific interests and career goals. By regularly updating the IDP, we will be able to identify specific opportunities that can help the Beckman Scholar develop their own leadership and mentoring skills. Alternatively, they may want to attend a professional development workshop focused on scientific research and innovation, or take a class in Python programming language.

UNDERGRADUATE AUTHORS UNDERLINED

SELECT PUBLICATIONS

1. Warden AS, Wolfe SA, Khom S, Varodayan FP, Patel RR, Steinman MQ, Bajo M, Montgomery SE, Vlkolinsky R, Nadav T, Polis I, Roberts AJ, Mayfield RD, Harris RA, Roberto M. (2020). Microglia Control Escalation of Drinking in Alcohol-Dependent Mice: Genomic and Synaptic Drivers. *Biological Psychiatry*, 88(12):910-921.
2. Varodayan FP, Minning MA, Steinman MQ, Oleata CS, Riley MW, Sabino V, Roberto M. (2020). PACAP regulation of central amygdala GABAergic synapses is altered by restraint stress. *Neuropharmacology*, 168:107752.



Dr. Kaiming Ye

CHAIR

DEPARTMENT OF BIOMEDICAL
ENGINEERING

PROFESSOR

DEPARTMENT OF BIOMEDICAL
ENGINEERING

Student Engagement

- *Mentored over 100 students throughout career*
- *10 undergraduates currently in lab*

Student Accomplishments

Undergraduates working with Dr. Ye have accomplished the following:

- *Accumulated time in lab: 10-18 months*
- *Co-authored articles published: 14*
- *External Presentations: 30*
- *Internal Presentations: 50*

Student Outcomes

Students involved in this lab continued to:

- *Georgia Tech*
- *Johns Hopkins University*
- *Cornell*
- *Columbia*

Research Summary

Using genome editing technology, we developed cancer vaccines for eliminating metastatic cancers. We invented a technology to regenerate pancreatic islets for diabetes treatment. With 3D bioprinting and microfluidic technology, we created pancreatic tumor-on-a-chip for oncology study and drug screening. We invented a nanofluorescent biosensor for continuous glucose monitoring and a molecule probe for continuous monitoring of intracellular glucose in live cells. We invented a yeast surface protein display vector and used it to formulate a yeast vaccine against influenza H5N1. Now we are developing a UV sterilization technology for disinfecting SARS-COV-2 viruses on any surface.

Offered Projects

The Beckman Scholars will be teamed up with graduate students and will learn how to develop a hypothesis, design experiments, collect and analyze data, and write manuscripts for publication. They will be assigned small research projects derived from a large project carried out at the lab and begin to perform research independently by the end of their first summer. The Scholar will be part of the research team assigned to conduct a specific research project that attempts to solve a scientific problem. This teamwork will cultivate the Scholar's communication skills and leadership skills. The scholars will have opportunities to interact with leaders and peers in the field through national advanced biomanufacturing network created by Dr. Ye.



Dr. Kaiming Ye



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MENTOR PHILOSOPHY

As a Beckman Mentor, I will meet with the Scholar to provide orientation in the first week of the program. The orientation includes biosafety, responsible conduct of research, and general experimental skill training. The Scholar will be required to present their research results during weekly lab seminars after their first summer. I will continue meeting with the Scholar weekly to discuss their research progress. The Scholar and I will also interact daily in the lab along with other graduate students.

RESEARCH PREPARATION

The Scholar will eventually be asked to train new undergraduates who join the lab doing research, giving them an opportunity to develop leadership skills. These trainings will expose students to a multidisciplinary research environment and network with other investigators around the world. By the end of the Beckman program, the Scholar will be required to present their research at a national or international conference and publish their research in high impact journals. The Biomedical Engineering department hosts a Distinguished Life Science and Biomedical Engineering Lecture featured by invited speakers who are leaders in the field. The Scholar will be provided an opportunity to interact with these speakers during and after the seminar.

SELECT PUBLICATIONS

UNDERGRADUATE AUTHORS UNDERLINED

1. Jayaraman Rukmini, S., Bi, H., Sen, P., Everhart, B., Jin, S., and Ye, K. (2019). "Genome edited CD47^{-/-} tumor cells as cancer vaccines", *Sci. Rep.* 9, 20057.
2. Hai, N. Shin, D. W., Bi, H., Ye, K., and Jin, S. (2018) "Mechanistic analysis of physicochemical cues in promoting human pluripotent stem cell self-renewal and metabolism", *Int. J. Mol. Sci.* 19, 3459-3463.