2018-2019 ANNUAL REPORT

USC WOMEN IN SCIENCE AND ENGINEERING

wise

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Executive Summary

The USC Women in Science and Engineering Program (WiSE) is USC's premiere diversity initiative. Founded in 2000 by an anonymous donation of $20 million, WiSE is an endowed initiative aimed at increasing the representation of women in tenured and tenure-track faculty positions in the sciences, engineering, and mathematics at USC.

Since the program's inception, WiSE has successfully helped to increase the number of women in these positions in the programs it represents -- the departments of engineering in the USC Viterbi School of Engineering (VSoE) and the departments of mathematics, biological sciences, earth sciences, physics and astronomy, and chemistry in the USC Dana and David Dornsife College of Letter, Arts and Sciences -- from 15 in 2000 to 68 in August 2019 (See Appendix 1). By targeting the recruitment and retention of new women faculty members and by establishing a suite of programs aimed specifically at creating an environment in which women at all stages of their careers may thrive, WiSE serves as a role model for successful diversity efforts at USC, as well as across the country and internationally.

During the 2018-2019 recruitment season, WiSE helped add **five new women to the tenure-track faculty**. VSoE welcomes Assistant Professors **Renyuan Xu** (Industrial and Systems Engineering), **Feifei Qian** (Electrical Engineering), **Ananya Renuka Balakrishna** (Aerospace and Mechanical Engineering), and **Maral Mousavi** (Biomedical Engineering) and the Dornsife College of Letters, Arts and Sciences welcomes Assistant Professor **Vera Glusevic** (Physics and Astronomy).

WiSE continues to play an active role in helping to increase the representation of women faculty candidates by hosting meetings with department chairs and search committees to outline strategies for broadening the scope of searches for outstanding diversity candidates. WiSE leadership also actively meets with women faculty candidates during campus visits. During the 2018-2019 academic year, WiSE leadership participated in meetings with 31 formal candidates during their campus visits (26 in Viterbi and 6 in Dornsife) (See Appendix 2). WiSE Support for Facilitating Diversity in Faculty Searches provided 4 grants totaling $11,637.00 to the departments of Electrical Engineering, Biological Sciences (Molecular and Computational Biology) and Physics and Astronomy.

WiSE Faculty Accomplishments

Current WiSE faculty members continue to distinguish themselves with campus-wide and national-level recognition for their research.

Viterbi School of Engineering:

- **Stacey Finley** (Biomedical Engineering) was promoted to Associate Professor with tenure. She was also appointed as a full member of the NIH Modeling and Analysis of Biological Systems study section, effective July 1, 2019.
- **Amy Childress** (Civil and Environmental Engineering) was selected for a 2019-2020 Fulbright U.S. Scholar award (to Denmark). She was also elected as an AEESP Fellow for advancing the science and technology of membrane-based desalination and wastewater reuse.
- **Kelly Sanders** (Civil and Environmental Engineering) received an NSF CAREER award.
- **Eun Ji Chung** (Biomedical Engineering) was appointed as the inaugural holder of The Dr. Karl Jacob Jr. and Karl Jacob III Early-Career Chair. She was also named a recipient of the NIH Director's New Innovator Award. She also received the Outstanding Young Engineer Award from the Orange County Engineering Council.
- **Mahta Moghaddam** (Electrical Engineering) was elected to the National Academy of Engineering, "For development of physics-based computational algorithms for mapping of subsurface characteristics." She was also elected President of the IEEE Antennas and Propagation Society.
- **Maryam Shanechi** (Electrical Engineering) received the 2019 ONR Young Investigator Award and the 2019 Viterbi Junior Research Award.
- **Maja Mataric** (Computer Science) was appointed as a Distinguished Professor, in recognition of Maja's pioneering work in the field of robotics, as well as her commitment to mentoring generations of women and underrepresented populations in the sciences and engineering.
- **Ellis Meng** (Biomedical Engineering) was named a National Academy of Inventors (NAI) Fellow. She was also appointed as Vice Dean of Technology, Innovation and Entrepreneurship.
- **Michelle Povinelli** (Electrical Engineering) was promoted to Full Professor. She was elected as Fellow of the SPIE and received a USC Stevens Technology Advancement Grant.
- **Yan Liu** (Computer Science) was selected as a new voice of National Academies of Science, Engineering and Medicine.
- **Bistra Dilkina** (Computer Science) received the Okawa Foundation award for her work on "AI for Wildlife Conservation".
- **Leana Golubchik** (Computer Science) receive the John O'Brien Faculty Award for Service from the Viterbi School of Engineering.

Dornsife College of Letters, Arts and Sciences:

- **Sarah Feakins** (Earth Sciences) was selected as an AAAS Leshner Leadership Institute Public Engagement Fellow for long-term perspectives on water and food security.
- **Susan Montgomery** (Mathematics) was the Auslander Distinguished Lecturer at the Algebra Conference at Woods Hole Oceanographic Institution.
- **Irene Chiolo** (Biological Sciences) received the Wilhelm Bernhard Young Investigator's Award.
- **Carly Kenkel** (Biological Sciences) received a Sloan Foundation Fellowship.
- **Sami Assaf** (Mathematics) was promoted to Associate Professor with tenure.
- **Juhi Jang** (Mathematics) was selected as a 2019 Simons Fellowship recipient in Mathematics and Physical Sciences.
- **Smaranda Marinescu** (Chemistry) received the 2019 Sloan Research Fellowship.
- **Elena Pierpaoli** (Physics and Astronomy) received the Simons Fellowship in Theoretical Physics. She was also awarded the 2018 Gruber Foundation Cosmology Prize in recognition of theoretical, analytical, conceptual or observational discoveries leading to fundamental advances in understanding the universe.

WiSE Activities

Programming

During the 2018-2019 academic year, the WiSE Program hosted 60+ events and meetings. In order to further aid in the retention of women faculty and to encourage undergraduate and graduate students to pursue careers in the academe, WiSE administers a monthly programming series of "WiSE Talks," which provide an intimate setting to discuss subjects recommended by the community. The talks are held in the WiSE Suite. This year, notable talks included:

- **"The Ins and Outs of NSF Applications"**
  Dr. Heidi Smith-Parker
  Wednesday, October 10, 2018

- **Coffee Chat: "The Gender/Race Imperative Lecture Series with Anita Hill"**
  Muriel Medard, Professor of Electrical Engineering
  Massachusetts Institute of Technology
  Tuesday, March 5, 2019

WiSE continues to provide professional development and networking opportunities for women. In Fall 2018, the WiSE teaching faculty members organized a Teaching

Symposium on Professional Development and Teaching Innovations. Sessions focused on teaching innovations, as well as mentoring and evaluation. The WiSE Teaching Faculty group plans to host monthly special topics meetings during the 2019-2020 academic year. In Spring 2019, WiSE organized and hosted the *WiSE Research Horizons Symposium* to showcase WiSE junior faculty members as well as provide opportunities for industrial and foundations funding. The event took place on March 22, 2019 in the Hughes Aircraft Electrical Engineering Center (EEB), Room 132, and was co-chaired by Professors Lorraine Turcotte (Biological Sciences) and Michelle Povinelli (Electrical Engineering). At the time, Interim President, Dr. Wanda Austin, and President Elect, Dr. Carol Folt, gave opening remarks to begin the day (See Appendix 4).

During the 2018-2019 WiSE Undergraduate Research Experience, students had the opportunity to participate in 35 sessions, including:

Introductions and Mentoring Details	8/29/2018
STEM Bytes Seminar	9/5/2018
Graduate Student Lunch	9/11/2018
STEM Bytes Seminar	9/20/2018
Fellowships and Grants	9/26/2018
STEM Bytes Seminar	10/2/2018
Writing a Personal Statement	10/11/2018
STEM Bytes Seminar	10/16/2018
Faculty Guests	10/23/2018
STEM Bytes Seminar	11/1/2018
Impostor Syndrome	11/7/2018
STEM Bytes Seminar	11/13/2018
End of the Semester Celebration/Thank you to PhD Mentors	11/28/2018
What to do on a Graduate School Visit	1/17/2019
STEM Bytes Seminar	1/22/2019
Interview Strategies	1/30/2019
STEM Bytes Seminar	2/7/2019
Negotiation Techniques	2/13/2019
STEM Bytes Seminar	2/22/2019
Graduate Student Lunch	2/27/2019
STEM Bytes Seminar	3/4/2019
Preparing a Research Poster	3/21/2019
STEM Bytes Seminar	3/26/2019
Faculty Guests	4/5/2019
STEM Bytes Seminar	4/10/2019
Mindfulness	4/18/2019
Introductions and Welcome with PhD Mentors	6/3/2019

Writing a CV	6/10/2019
Negotiation Techniques	6/17/2019
How to Write a Personal Statement	7/1/2019
Personal Statement Workshop	7/8/2019
How to Write and Abstract	7/15/2019
Abstract Workshop	7/22/2019
How to Give and Effective Presentation	7/29/2019
Undergraduate Researcher Mini-Conference	8/2/2019

Upon the conclusion of the WiSE Undergraduate Research Experience for WiSE Summer Researchers, WiSE held a mini-conference (8/2/2019) where the participating undergraduate researchers presented short talks on their summer research to an audience comprised of faculty, staff, PhD students and postdoctoral researchers (See Appendix 5).

Undergraduate Summer Researchers, Pictured left to right: Kivilcim Cumbul, Grace Park, Juwon Lee, Helen Salinas, Zihan Sun, Rong Hu

The WiSE Faculty Networking Group continues to meet on the last Thursday of each month and enjoyed WiSE-hosted lunches at the beginning of the fall and spring semesters. This year WiSE celebrated significant faculty distinctions at the spring semester networking lunch. WiSE continues to hold its annual Awards Reception to recognize community achievements (4/23/2019).

WiSE Outreach

WiSE continues to issue regular newsletters. In addition, during this academic year, WiSE began a complete website redesign with Provost IT. The site is expected to be up and running in Fall 2019.

WiSE also continues to support the USC Young Researchers Program (YRP) annually. YRP hosts a summer research experience devised and executed by USC graduate students for USC-area high school students in the sciences.

In March 2019, in collaboration with Dornsife, WiSE hosted a booth at Clippers SCIfest SoCal. The festival included hands-on STEM activities and demonstrations for school-aged children and their parents.

Attendees at the WiSE booth at SCIfest.

Mentoring

In conjunction with WiSE's stated mission to build a supportive environment for women within the University, WiSE faculty mentor women at all levels – ranging from undergraduate to graduate students and postdoctoral scholars to faculty at all levels. Professor Jessica Parr (Chemistry) continued to coordinate the WiSE Undergraduate Research Experience, mentoring 34 undergraduate researchers and fellows; she will continue in her role during the 2019-2020 academic year. In addition, WiSE pairs each undergraduate researcher with a PhD mentor. The mentors meet with the undergraduate students once per month to discuss professional development and other areas of interest.

The WiSE PhD Advisory Board established a mentorship program for PhD students across all WiSE-eligible departments. There are approximately 35 mentor/mentee pairs committed to the initiative. Planning is currently underway for mentorship events throughout the 2019-2020 academic year.

2019 Hanna Reisler Mentorship Award

The 2019 Hanna Reisler Mentorship Award, which recognizes individuals at USC who have advanced the careers of women in science and engineering through generous and committed professional mentorship, was awarded to **Kelly Sanders**, Assistant Professor of Civil and Environmental Engineering, to recognize her exceptional mentoring of graduate students.

Drs. Kelly Sanders and Hanna Reisler along with students from the Sanders Lab.

2019 Leadership Award for Students and Postdoctoral Scholars

The 2019 Leadership Award for Students and Postdoctoral Scholars, which recognizes exceptional students and postdoctoral scholars at USC who are making a positive difference in their scholarly community, was presented to the Women in Chemistry Group for creating a culture of mentorship. WiSE recognized Chemistry PhD students, Amanda Baxter, Arunika Ekanayake and Golnaz Kamalinia for their past and current leadership of the group, as well.

Pictured from left to right: Amanda Baxter, Golnaz Kamalinia, Professor Megan Fieser (WiC Faculty Advisor), and Arunika Ekanayake

WiSE Students and Postdoctoral Scholars Achievements:

Current and past WiSE PhD students and postdoctoral scholars continue to be recognized for their research and accomplishments.

- **Carolina Amador** (Chemistry PhD Student) received a 2018 Biocom Catalyst Award. The award recognizes leaders and innovators in the Los Angeles Biotech Community.
- **Nicolle Gonzalez** (PhD graduate- Mathematics; Mentor- Sami Assaf) won a UC President's Postdoctoral Scholarship to study at UCLA. She also won the Berlekamp endowed Postdoctoral Position for the Mathematical Sciences Research Institute and was honored by USC with the Order of Arete.
- **Taehyun Ryu** (Biological Sciences, PhD Graduate, Mentor-Irene Chiolo) accepted a postdoctoral position at Harvard.
- **Deborah Chin** (Biomedical Engineering, PhD Student, Mentor-Eun Ji Chung) received the American Heart Association Predoctoral Fellowship.
- **Maria Ruggeri** (Biological Sciences, PhD Student, Mentor- Carly Kenkel) received a Wrigley Bakus Fellowship and a Wrigley Summer Fellowship.
- **Erin McParland** (Biological Sciences, PhD Graduate, Mentor- Naomi Levine) accepted a postdoctoral fellowship at Woods Hole Oceanographic Institution.
- **Mahua Roy** (Biomedical Engineering, PhD Graduate, Mentor- Stacey Finley) accepted a position as a Senior Scientist at Pfizer.
- **Jennifer Rohrs** (Biomedical Engineering, PhD Graduate, Mentor-Stacey Finley) accepted a position as a Research Scientist at Applied Biomath after an internship at Genentech.

In addition, current and recent WiSE undergraduates continue to show promise as emerging researchers and leaders.

- **Maria Gaines-Richardson** (Biological Sciences, Undergraduate, Mentor- Carly Kenkel) was named a UC Santa Cruz Doris Duke Conservation Scholar.
- Undergraduate mathematics student, **Sabrina Enriquez**, (class of 2018, Mentor-Sami Assaf) won an NSF graduate fellowship and will be attending graduate school at UC Davis.
- **Kayley Cheng** (Biomedical Engineering, Undergraduate, Mentor- Eun Ji Chung) received an Alfred E. Mann Institute Undergraduate Award for Academic Excellence in Biomedical Engineering.
- **Margot Meldefontenay** (Biomedical Engineering, Undergraduate, Mentor- Eun Ji Chung) received a Best Poster Award at the USC Undergraduate Symposium for Scholarly and Creative Work.
- **Kelly (Zhangjingyi) Jiang** (Biomedical Engineering, Undergraduate, Mentor- Eun Ji Chung) received a Bridge Undergraduate Science (BUGS) Program Fellowship.
- **Sarah Milkowski** (Biomedical Engineering, Undergraduate, Mentor- Eun Ji Chung) received an Alfred E. Mann Institute Undergraduate Award for Outstanding Research in Biomedical Engineering.
- **Sydney Prange** (Biological Sciences, Undergraduate, Mentor-Irene Chiolo) received a Rose Hills Foundation Summer Research Fellowship (2019) and a Provost Research Fellowship for Fall 2018 and Spring 2019).

Development

In January 2018, in collaboration with the Department of Chemistry, WiSE submitted a proposal to the Anton Burg Foundation and received $30,000 related to Communication Training for Graduate Students in Science and Engineering. During the 2018-2019 academic year, we began our WiSE Burg Communicating Science pilot program. Events were aimed at PhD students from the departments of Chemistry and Chemical Engineering & Materials Science. Program offerings included: *The Performing Art of Science Presentation half-day workshop, Writing Fellowship Applications, Creating YouTube Content, Effective Communication by Adapting Your Style, and Creatively Communicating Your Message via PowerPoint.* WiSE will expand the program during the 2019-2020 academic year to include PhD students in the Biological Sciences and Biomedical Engineering departments.

WiSE also continued participation on the Work and Family Life Committee this year with explicit focus on facilitating K-12 opportunities at USC, largely in support of faculty recruitment and retention. Substantial progress was made with initial steps including a summer (2019) pilot program, supported by the Provost, that included students from a private school (Mirman) and NAI (Neighborhood Academic Initiative), with faculty participation from multiple USC schools. In addition, WiSE continued work on our industrial partnership model by collaborating with Viterbi, Dornsife and University Corporate & Foundation Relations teams to strategically plan a course of action for

fundraising for 2020. (An initial, two-phase plan has been outlined.) WiSE leadership and development representatives met with several companies and presented the industry partnership vision to the Viterbi Corporate Advisory Board (in April). Weekly meetings surrounding the efforts are ongoing.

WiSE Leadership

A critical aspect of the success of WiSE is the direct involvement of men and women faculty members, at all career levels and from both the USC Dornsife College and the Viterbi School of Engineering, in planning, evaluating, and guiding the Program's development. With the guidance of its diverse committees, WiSE programs have grown and evolved in response to changing needs. Continued evaluation of the success and utility of programs have helped to keep them relevant and effective.

WiSE Program Staff

Leana Golubchik, Stephen and Etta Varra Professor of Computer Science and Electrical Engineering in the Viterbi School of Engineering, serves as Director of the WiSE Program. Golubchik was appointed as Director in September 2010.

Mallory Redel serves as the WiSE Program Manager and administers program development, operations, finance and committee coordination. Mallory joined WiSE in November 2014. She holds a Bachelor of Science in Journalism from Middle Tennessee State University and a Master of Science in Social Entrepreneurship from the University of Southern California.

Jessica Parr, Associate Professor of Chemistry (Teaching) in the Dornsife College of Letters, Arts and Sciences serves as the WiSE Undergraduate Research Experience Program Coordinator. She has been leading the undergraduate program since Fall 2013.

Raffaella Ghittoni, Assistant Professor of Biological Sciences (Teaching) in the Dornsife College of Letters, Arts and Sciences assisted with administrative duties throughout the Program Manager's parental leave during the Fall 2018 semester.

The USC WiSE Program also began a search for a marketing and events assistant during the 2018-2019 academic year, to assist us with our ever growing series of programming and events.

WiSE Advisory Board

The WiSE Advisory Board met twice per semester in 2018-2019 (10/3/2018, 12/5/2018, 2/5/2019, and 4/10/2019) and continues to work with program administration to hone its recruitment and support of programs for maximum impact. The first meeting in the spring semester is joint with the USC Dornsife College and Viterbi School Committees.

During the 2018-2019 academic year, the Board devoted attention to different topics that included recruitment and retention of tenure-track and tenured faculty, childcare, faculty student relationships, additional program support, and raising the profile of WiSE. As always, the Board remains dedicated to mentorship, as it is key to all WiSE endeavors.

WiSE was founded with resources from a single gift from a generous donor who wished to help increase the representation of women in STEM in Viterbi and Dornsife. While we are far from achieving gender equity among faculty, there have been tremendous improvements in the representation of women in most departments. There are also greater numbers of students entering STEM fields at USC. Thus, is stands to reason that WiSE's resources are stretched ever thinner. Consequently, the Board supported efforts to increase WiSE resources through industry partnerships, as well as a proposal submission to the NSF ADVANCE program.

During the 2018-2019 recruitment season, WiSE helped add five new women to the tenure-track faculty, bringing the total number to sixty-eight. Despite recent successes, our numbers remain below the national average in many disciplines. The Board recommended that WiSE continue to work with department chairs in WiSE-eligible departments to help implement policies that promote diversity.

The Board discussed University policy regarding faculty student relationships and was alarmed to realize that sexual relationships between students and the professors who teach them were permissible. The Board was relieved to hear that various administrative branches at the University are strengthening protections of students. Professor Jill McNitt-Gray, Chair of the WiSE Dornsife Committee, has begun a series of informal meetings to discuss how to handle difficult situations in the laboratory as they arise. The

hope is that better communication will lead to healthier and more respectful environments for all genders.

Each year, the topic of childcare emerges during conversations with members of the Board and wider community. This past year was a particularly challenging one for parents. While childcare at USC has always been problematic, the situation deteriorated recently. Members of the WiSE community serve on committees devoted to improving resources for childcare and have raised serious concerns regarding the lack of administrative oversight and the failure to find vendors able to offer consistent and good care. The Board stands behind efforts of the WiSE community and others to help provide this essential resource to families at USC. It is not possible for parents to succeed in their careers if they do not have access to affordable, convenient and high-quality care for their children.

Finally, mentorship is key to the growth and strength of every member of the WiSE community. Hanna Reisler continues to lead our networking group. This year, she has also been part of an initiative to help women in all disciplines by piloting the formation of a Women's Faculty Forum. This entity would not receive WiSE funds, but the hope is that we can share best practices for achieving gender equality across the University via a federation of groups, each tailored to the needs of their specific discipline.

The Board hopes that WiSE's many efforts will see an acceleration of the rate at which women join the ranks of tenured and tenure-track faculty at USC such that when we celebrate our next milestone anniversary, the goal of WiSE will be to maintain, rather than achieve, gender equality.

2018-2019 WiSE Advisory Board Members

Judith Hirsh (Chair)
Professor of Biological Sciences, Neurobiology
USC Dornsife College of Letters, Arts & Sciences

Linda Duguay
Associate Professor (Research) of Biological Sciences, MEB
USC Dornsife College of Letters, Arts & Sciences

David D'Argenio
Professor of Biomedical Engineering
USC Viterbi School of Engineering

Raffaella Ghittoni
Lecturer, Biological Sciences
USC Dornsife College of Letters, Arts & Sciences

Leana Golubchik (Ex-officio, WiSE Director)
Professor of Computer Science and Electrical Engineering
USC Viterbi School of Engineering

Sandeep Gupta
Professor of Electrical Engineering-Systems
USC Viterbi School of Engineering

Julie Higle
Professor and Chair of Industrial & Systems Engineering
USC Viterbi School of Engineering

Susan Montgomery
Professor of Mathematics
USC Dornsife College of Letters, Arts & Sciences

Michelle Povinelli
Professor of Electrical Engineering-Electrophysics
USC Viterbi School of Engineering

Hanna Reisler
Professor of Chemistry
USC Dornsife College of Letters, Arts & Sciences

Gary Rosen
Professor of Mathematics
USC Dornsife College of Letters, Arts & Sciences

Shang-Hua Teng
Professor of Computer Science
USC Viterbi School of Engineering

WiSE PhD Advisory Board

During the 2017-2018 academic year, WiSE established a PhD Advisory Board to further WiSE efforts in serving the PhD Community. The Board focuses on uncovering topics of interest to the STEM PhD Community at USC, and hosting events based on the findings.

2018-2019 WiSE PhD Advisory Board Members

- **Eun Ji Chung** (Faculty Mentor), Assistant Professor Biomedical Engineering, Viterbi School of Engineering
- **Naomi Levine** (Faculty Mentor), Assistant Professor Biological Sciences (MEB), Dornsife College of LAS
- **Rebecca Peer** (President), PhD Student, Civil and Environmental Engineering, Viterbi School of Engineering
- **Nina Yang** (Vice President), PhD Student, Biological Sciences, Dornsife College of LAS
- **Elizabeth Bondi** (Secretary), PhD Student, Computer Science, Viterbi School of Engineering
- **Emily Reed** (Mentorship Chair), PhD Student, Electrical Engineering, Viterbi School of Engineering
- **Joyce Yager** (Social Chair), PhD Student, Earth Sciences, Dornsife College of LAS
- **Sarah Katz** (Viterbi Liaison/Social Chair), PhD Student, MFD Chemical Engineering & Materials Science, Viterbi School of Engineering

- **Brenda Ontiveros** (Dornsife Liaison), PhD Student, Biomedical Engineering, Viterbi School of Engineering

USC Dornsife WiSE Committee

Committees composed of faculty in each school serve as advisors on grant-making by reviewing and evaluating the applications and making recommendations for funding.

2018-2019 WiSE Dornsife Committee Members

Jill McNitt-Gray (Chair)
Professor of Biological Sciences and Biomedical Engineering
USC Dornsife College of Letters, Arts & Sciences

James Boedicker
Assistant Professor of Physics and Astronomy
USC Dornsife College of Letters, Arts & Sciences

Suzanne Edmands
Professor of Biological Sciences, MEB
USC Dornsife College of Letters, Arts & Sciences

Joshua West
Professor of Earth Sciences
USC Dornsife College of Letters, Arts & Science

A summary of the reviews conducted by the USC Dornsife Committee during the academic year follows:

Program	Deadline	Number of Applicants/ Nominations	Number of Awards
Undergraduate Research, Fall	5/15/18	7	7
Undergraduate Research, Spring	12/3/18	10	10
Graduate Merit	4/8/19	3	2
Graduate Top-Off	3/4/19	6	4 (6 offered)
Undergraduate Research, Summer	4/1/19	5	3 (5 offered)

USC Viterbi WiSE Committee

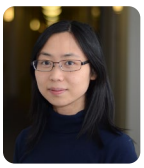
Committees composed of faculty in each school serve as advisors on grant-making by reviewing and evaluating the applications and making recommendations for funding.

2018-2019 WiSE Viterbi Committee Members

Malancha Gupta (Chair)
Associate Professor of Chemical Engineering & Materials Science
USC Viterbi School of Engineering

Felipe de Barros
Associate Professor of Civil & Environmental Engineering
USC Viterbi School of Engineering

Aleksandra Korolova
Assistant Professor of Computer Science
USC Viterbi School of Engineering



Sze-Chuan Suen
Assistant Professor of Industrial and Systems Engineering
USC Viterbi School of Engineering

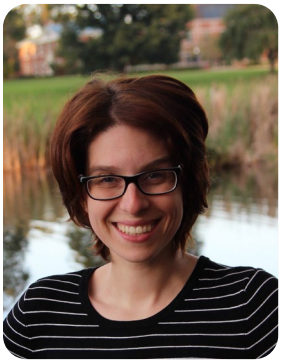
A summary of the reviews conducted by the USC Viterbi Committee during the academic year follows:

Program	Deadline	Number of Applicants/ Nominations	Number of Awards
Undergraduate Research, Fall	5/15/18	10	7
Undergraduate Research, Spring	12/3/18	5	4
Graduate Merit	4/8/19	3	3
Graduate Top-Off	3/4/19	10	3 (8 offered)
Undergraduate Research, Summer	4/1/19	4	3 (4 offered)

New Faculty

Ananya Renuka Balakrishna will join the Department of Aerospace and Mechanical Engineering at USC as an Assistant Professor in 2020. Prior to joining USC, she pursued postdoctoral research as a Lindemann Fellow at MIT (Department of Materials Science), and at the University of Minnesota (Aerospace Engineering and Mechanics). Ananya received her PhD in Solid Mechanics and Materials Engineering from the University of Oxford in 2016. Broadly, her research focuses on developing mathematical models to investigate the links between material microstructures and properties in energy-storage and functional materials.

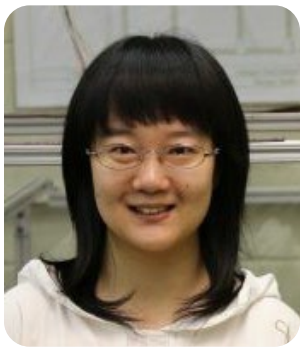
Professor Renuka Balakrishna's research group will use a combination of solid mechanics, materials science, and mathematical modeling to investigate how microstructures evolve in materials, and how we can engineer microstructural patterns to enhance material properties. In this group, members will develop physics-based models and pursue bench-top experiments to solve open problems in a wide range of materials used in batteries, memory devices and energy harvesters. Their theoretical studies will provide insights into fundamental material behavior that guides the development of the next-generation energy-storage and energy-conversion materials.



Vera Gluscevic joined the USC Department of Physics and Astronomy as a Gabilan Assistant Professor in June of 2019. Coming from the University of Belgrade in Serbia, she earned her Ph.D. in Astrophysics at Caltech, designing and applying novel analysis frameworks to test physical nature of dark energy. Before joining USC, she was a postdoctoral member at the Institute for Advanced Study in Princeton and a Visiting Research Scholar at Princeton University, where she studied complementarities between laboratory experiments and cosmological probes to improve the sensitivity of searches for dark matter particles. She now leads analysis groups for several collaborations preparing to build the next-generation observatories of the cosmic microwave background radiation. Her work involves a broad range of topics in astrophysics, using the entire Universe as a testing ground for fundamental physical theories and seeking to answer major open questions of modern cosmology.

Maral Mousavi joined the department of biomedical engineering at USC in 2019 as an assistant professor. Maral's research focuses on developing engineered tools for improving healthcare and patient outcomes. She is motivated to develop affordable point-of-care diagnostics to make healthcare accessible to all, and to develop new bioanalytical tools to help unravel the pathophysiology of diseases. Maral was a postdoctoral fellow in the research group of Prof. George Whitesides at Harvard University, and Wyss Institute for Biologically Inspired Engineering. She received her doctorate degree in 2016, at the University of Minnesota,

under advisement of Prof. Philippe Buhlmann, who is one of the world leaders in supramolecular electrochemical ion sensing. Maral was the recipient of the University of Minnesota Doctoral Dissertation Fellowship and Graham N. Gleysteen Fellowship for academic excellence, and two Graduate Student Research Awards from Eastern Analytical Symposium, and Society for Electroanalytical Chemistry. She was also the recipient of the runner-up 2018 Young Chemist Award by Metrohm Inc., in recognition of her invention of multiplexed thread-based point-of-care ion sensors. Maral is committed to excellence in both research and graduate education. She is the founder of a YouTube channel called "Surviving and Thriving in Higher Education", dedicated to training students on soft skills, technical skills, and the strategies for maintaining well-being in graduate education. This channel currently has more than 17,000 subscribers, and 650,000 views.



Feifei Qian will join the USC Ming Hsieh Department of Electrical Engineering as an Assistant Professor in January 2020. She received her PhD in Electrical Engineering and M.S. in Physics from Georgia Institute of Technology, in 2015 and 2011, respectively. Prior to her appointment at USC, she worked in the GRASP lab at University of Pennsylvania as a postdoctoral fellow. Her expertise is in analyzing and modeling the complex interactions between robots and environments, and developing innovative control and sensing strategies to improve robot mobility on challenging terrains. In current research she is creating robots that can exploit obstacle disturbances to navigate cluttered environment, and robots that can use their leg as soil strength sensors to generate erodibility map in desert environments. Qian's work has been covered by BBC News and R&D Magazine, and was awarded the best student paper in top robotics conference (Robotics: Science & Systems 2012).

Renyuan Xu is currently a Hooke Research Fellow in the Mathematical Institute at the University of Oxford. Prior to that, she obtained her Ph.D. degree in the IEOR Department at UC Berkeley in 2019 and the Bachelor's degree in Mathematics from the University of Science and Technology of China in 2014. In Fall 2020, she will join the Epstein Department of Industrial & Systems Engineering at the University of Southern California as a Gabilan Assistant Professor.

WiSE Financial Awards

The WiSE Program has adhered closely to the original structure of funds allocation outlined by the 2000 WiSE Task Force. Actual distribution of funds may vary slightly each year depending on the return of investment income on the WiSE endowment and on the number of candidates who accept WiSE awards.

WiSE Gabilan Assistant Professorships

During the 2018-2019 recruitment season WiSE awarded WiSE Gabilan Assistant Professorships to four new faculty hires.

Renyuan Xu	Industrial & Systems Engineering	Viterbi
Feifei Qian	Electrical Engineering	Viterbi
Ananya Renuka Balakrishna	Aerospace & Mechanical Engineering	Viterbi
Vera Gluscevic	Physics & Astronomy	Dornsife

Formal Program Awards

Program	**# Awards**
Faculty Recruitment / Faculty Retention	18
Major Support for Current Faculty	2
WiSE Gabilan Jr. Chair	4
WiSE Gabilan Distinguished Professorship	2
Lloyd Armstrong, Jr. Chair	1
Support for Facilitating Diversity in Faculty Searches	4
Faculty Bridge Funding	1
Supplemental Faculty Support	39
Merit Award for Excellence in Postdoctoral Research	0
Graduate Top-Off Awards	8
Merit Fellowships for Current PhD.	12
Travel Grants	82
Undergraduate Research Grants	37
Child Care Subsidies	4
Support for Faculty Pregnancy, Childbirth, and Adoption	0
Support for PhD. and Postdoc Pregnancy, Childbirth, and Adoption	1
WiSE Leadership Award for Students and Postdoctoral Scholars	4

Discretionary Awards

In addition to its formal suite of programs, costs were incurred in support of program activities (such as receptions, supporting a cohort of new assistant professors, lecturers, website maintenance, etc.) and administrative expenses, WiSE also awarded several discretionary grants to support activities that work toward the goal of increasing the representation of women in science and engineering. In 2018-2019, these awards included:

Group	Purpose
USC Department of Computer Science	To support travel of USC undergraduate and PhD. students to the Grace Hopper Celebration of Women in Computing.
Women in Chemistry	To support the annual activities for women postdocs and PhD students in the Department of Chemistry.
Young Researchers Program	To support a summer research experience devised and executed by USC graduate students for USC-area high school students in the sciences.
Charlotte's Web (Women in Math)	To support the annual activities of the networking and professional development group among women students in the Department of Mathematics.

APPENDIX 1:

Current WiSE Faculty, Tenured and Tenure-Track (Including New Hires)

USC Dornsife College

Life Sciences

Sarah Bottjer	Professor	Biological Sciences (Neuro)
Suzanne Edmands	Professor	Biological Sciences (MEB)
Carol Folt	Professor & President	Biological Sciences
Susan Forsburg	Professor	Biological Sciences (MCB)
Judith Hirsch	Professor	Biological Sciences (Neuro)
Emily Liman	Professor	Biological Sciences (Neuro)
Jill McNitt-Gray	Professor	Biological Sciences (HEB)
Lorraine Turcotte	Professor	Biological Sciences (HEB)
Liang Chen	Associate Professor	Biological Sciences (MCB)
Wiebke Ziebis	Associate Professor	Biological Sciences (MEB)
Irene Chiolo	Assistant Professor	Biological Sciences (MCB)
Carly Kenkel	Assistant Professor	Biological Sciences (MEB)
Naomi Levine	Assistant Professor	Biological Sciences (MEB)
Carolyn Phillips	Assistant Professor	Biological Sciences (MCB)
Lindsey Schier	Assistant Professor	Biological Sciences (HEB)

Physical Sciences / Mathematics

Susan Friedlander	Professor	Mathematics
Anna Krylov	Professor	Chemistry
Jia Grace Lu	Professor	Physics & Astronomy
Amber Miller	Professor & Dean	Physics & Astronomy
Susan Montgomery	Professor	Mathematics
Elena Pierpaoli	Professor	Physics & Astronomy
Hanna Reisler	Professor	Chemistry
Sami Assaf	Associate Professor	Mathematics
Rosa di Felice	Associate Professor	Physics & Astronomy
Sarah Feakins	Associate Professor	Earth Sciences
Juhi Jang	Associate Professor	Mathematics
Greta Panova	Associate Professor	Mathematics
Emily Cooperdock	Assistant Professor	Earth Sciences
Megan Feiser	Assistant Professor	Chemistry
Vera Gluscevic	Assistant Professor	Physics & Astronomy
Smaranda Marinescu	Assistant Professor	Chemistry

The USC Viterbi School of Engineering

Andrea Armani	Professor	Chemical Engineering and Materials Science
Burcin Becerik-Gerber	Professor	Civil and Environmental Engineering
Amy Childress	Professor	Civil and Environmental Engineering
Leana Golubchik	Professor	Computer Science
Julie Higle	Professor	Industrial and Systems Engineering
Andrea Hodge	Professor	Chemical Engineering and Materials Science
Eva Kanso	Professor	Aerospace and Mechanical Engineering
Maja Matarić	Professor	Computer Science
Ellis Meng	Professor	Biomedical Engineering
Urbashi Mitra	Professor	Electrical Engineering
Mahta Moghaddam	Professor	Electrical Engineering
Alice Parker	Professor	Electrical Engineering
Stacey Finley	Associate Professor	Biomedical Engineering
Malancha Gupta	Associate Professor	Chemical Engineering & Materials Science
Mercedeh Khajavikhan	Associate Professor	Electrical Engineering
Yan Liu	Associate Professor	Computer Science
Michelle Povinelli	Associate Professor	Electrical Engineering
Katherine Shing	Associate Professor	Chemical Engineering & Materials Science
Nora Ayanian	Assistant Professor	Computer Science
Ananya Renuka Balakrishna	Assistant Professor	Aerospace and Mechanical Engineering
Heather Culbertson	Assistant Professor	Computer Science
Bistra Dilkina	Assistant Professor	Computer Science
Eun Ji Chung	Assistant Professor	Biomedical Engineering
Dina El-Damak	Assistant Professor	Electrical Engineering
Aleksandra Korolova	Assistant Professor	Computer Science
Megan McCain	Assistant Professor	Biomedical Engineering
Maral Mousavi	Assistant Professor	Biomedical Engineering
Feifei Qian	Assistant Professor	Electrical Engineering
Kelly Sanders	Assistant Professor	Civil and Environmental Engineering
Maryam Shanechi	Assistant Professor	Electrical Engineering
Shaama Sharada	Assistant Professor	Chemical Engineering & Materials Science
Sze-Chuan Suen	Assistant Professor	Industrial and Systems Engineering
Jennifer Treweek	Assistant Professor	Biomedical Engineering
Alejandra Uranga	Assistant Professor	Aerospace and Mechanical Engineering
Phebe Vayanos	Assistant Professor	Industrial and Systems Engineering

Renyuan Xu	Assistant Professor	Industrial and Systems Engineering
Cristina Zavaleta	Assistant Professor	Biomedical Engineering

APPENDIX 2:

Faculty Candidates Interviewed On Campus

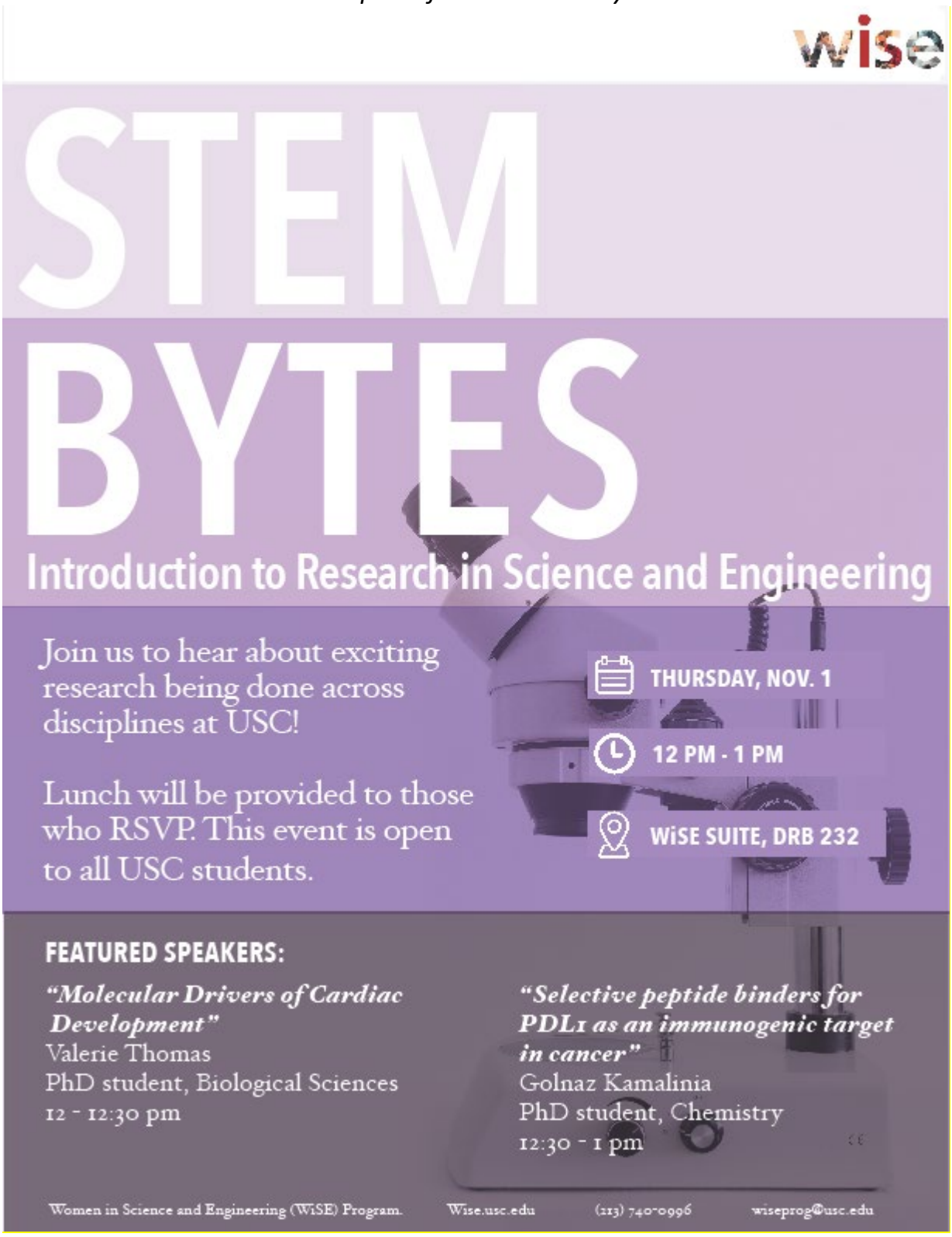
As in previous years, WiSE leadership offered to meet with women faculty candidates during their visits to campus, both to communicate information about the WiSE Program and resources and to provide opportunities for candidates to ask questions about USC and work-family issues that they might not feel comfortable discussing as part of their formal interview process. Departments continued to take advantage of this offer and senior WiSE faculty met with 31 faculty candidates over the course of 2018-2019. The list of candidates is below:

Anne-Sofie Ahm	Earth Sciences	12/3/2018
Ann Dunlea	Earth Sciences	12/5/2018
Elizabeth Brunk	Biological Sciences	1/15/2019
Renyuan Xu	Industrial and Systems Engineering	1/24/2019
Ziyue Gao	Biological Sciences	1/24/2019
Ran Dai	Aerospace and Mechanical Engineering	2/7/2019
Danielle Mai	Chemical Engineering & Materials Science	2/12/2019
Sangeetha Abdu Jyothi	Computer Science	2/12/2019
Jouha Min	Chemical Engineering & Materials Science	2/14/2019
Chiara Mingarelli	Physics and Astronomy	2/14/2019
Clarice Aiello	Electrical Engineering	2/21/2019
Rajalakshmi Nandakumar	Computer Science	2/26/2019
Parinaz Naghizadeh	Electrical Engineering	3/7/2019
Eunsol Choi	Computer Science	3/7/2019
Hye Ji Kim	Electrical Engineering	3/18/2019
Ananya Balakrishna	Aerospace and Mechanical Engineering	3/21/2019
Amy Zhang	Computer Science	3/21/2019
Maral Mousavi	Biomedical Engineering	3/26/2019
Yiying Zhang	Computer Science	3/26/2019
Feifei Qian	Electrical Engineering	3/27/2019
Chunyi Peng	Computer Science	3/28/2019
Mengjia Yan	Electrical Engineering	3/28/2019
Yixin Sun	Computer Science	4/4/2019
Amy Babay	Computer Science	4/4/2019
Nandita Vijaykumar	Electrical Engineering	4/4/2019
Mahsa Shoaran	Electrical Engineering	4/4/2019
Stephanie Coronel	Astronautical Engineering	4/5/2019
Motahhareh Eslmamehdiabad	Computer Science	4/11/2019
Chuchu Fan	Electrical Engineering	4/11/2019
Nicole Hashemi	Aerospace and Mechanical Engineering	4/15/2019

Sara Behdad	Aerospace and Mechanical Engineering	4/17/2019

APPENDIX 3:

Samples of WiSE Events Flyers

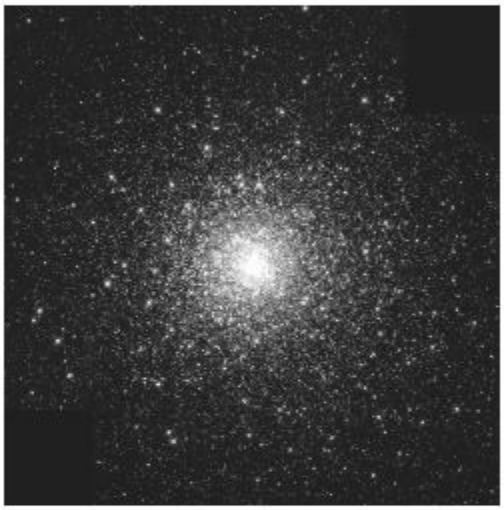


THE USC WOMEN IN SCIENCE AND ENGINEERING PROGRAM PRESENTS:

WISE UNDERGRADUATE RESEARCHER MINI-CONFERENCE

WHEN:
Friday, August 2, 2019
9:45am - 12:45pm

WHERE:
SGM 460, The Mudd Room



Lunch will be provided and will begin directly after the presentations.

PLEASE RSVP HERE.

WISE.USC.EDU

WISE@USC.EDU

APPENDIX 4:

WiSE Research Horizons Symposium

APPENDIX 5:

WiSE Undergraduate Researcher Mini-Conference

WiSE Undergraduate Summer Research Mini-Conference

Friday, August 2nd 2019
9:45 am – 12:30 pm

Schedule

9:45 – 10:00	Coffee
10:00 – 10:05	Introductory Remarks
10:05 – 10:20	Grace Park *Professor Mark Thompson*
10:20 – 10:35	Juwon Lee *Professor Jill McNitt Gray*
10:35 – 10:50	Rong Hu *Professor Gary Rosen*
10:50 – 11:05	**Break**
11:05 – 11:20	Helen Salinas *Professor Cristina Zavaleta*
11:20 – 11:35	Zihan Sun *Professor Dion Dickman*
11:35 – 11:50	Kivilcim Cumbul *Professor Heather Culbertson*
11:50 – 11:55	Closing Remarks
11:55	Lunch

Hole Blocking Material for Blue OLED Applications

Grace Park, Professor Mark Thompson

Organic light-emitting diodes (OLEDs) are an important technology for attractive, high efficiency flat-screen displays and solid-state lighting. Red and green phosphorescent OLEDs have attracted significant attention due to their high efficienciesand long operational stabilities. However, achieving deep blue electrophosphorescence remains a significant challenge because of the need for higher energy materials which are more prominent to molecular degradation in blue OLEDs. One of the crucial components that limits the efficiency and lifetime of OLEDs is the hole blocking material (HBM). This material is required to block diffusion of holes/excitons from the emissive layer (EML) into adjacent layers in the device which lead to molecular decomposition. HBMs for red and green OLEDs have been extensively studied but are unsuitable to use for blueOLEDs because their triplet energies are much lower than that of typical blue emitting materials (2.75 eV). We have found that multisubstituted pyrimidines both theoretically and experimentally display high triplet energies as well as deep HOMO energy levels capable of blocking the migration holes in deveices. These materials also demonstrate high glass transition temperatures (T_g) which are favorable for realizing longer lifetimes since low T_g materials tend to crystallize during device operation. Using a facile and high yielding synthesis, we have shown that these materials can be made at large scales and are highly modular, ensuring their transition into amorphous materials. Herein, we present the rational design of multisubstituted pyrimidines for use as HBMs to achieve satisfactory efficiency and lifetimes for blue OLEDs.

Differences in Upper Extremity and Torso Control After Wheelchair Reconfiguration

Juwon Lee, Professor Jill McNitt Gray

Wheelchair (WC) configuration affects individuals' posture, pressure distribution, and stability during daily activities. A clinician's role is to reconfigure the WC fit to tailor to individual needs and lifestyle. Ongoing clinical research has shown that reconfiguring WC seating affects posture, stability, and upper extremity joint kinetics in individuals with paraplegia. Paraplegia is the paralysis of the legs and lower body, typically caused by a spinal injury. In this study, we conducted an in-depth joint kinetic analysis of upper extremity during wheelchair propulsion uphill before and one-month after WC reconfiguration. Individuals with paraplegia (T2-L3, 13 male, 1 female) using a manual WC for mobility volunteered to participate in accordance with the Institutional Review Board of Rancho Los Amigos National Rehabilitation Center (RLANRC). Individuals with a history of shoulder pain that hindered performance of daily activities or required medical treatment were excluded from the study. We hypothesized that WC reconfiguration will affect control of the upper extremity and trunk during manual WC propulsion uphill in order to maintain stability and generate impulse.

Estimating Breath Alcohol Concentration (BrAC) from Transdermal Alcohol Concentration (TAC) Biosensor Data

Rong Hu, Professor Gary Rosen

There are 17.6 million cases of Alcohol Use Disorder (AUD) diagnoses solely in the US. To help people make better drinking decision, to treat people suffering from AUD, to enhance medical and sociological research into the causes, treatment, and potential cures for AUD, and to monitor people convicted of Driving Under the Influence (DUI), portable unobtrusive biosensors like the Self Contained Remote Alcohol Monitoring system (SCRAM, AMS, Inc.) and the WrisTAS (Giner, Inc.) have been developed. These devices are designed to monitor users' real-time Transdermal Alcohol Concentration (TAC) data, which is the amount of ethanol diffusing through the skin. While the physical measurement and the hardware have proven to be reliable, the greatest challenge for this novel technology is a reliable conversion model which converts TAC to either Blood Alcohol Concentration (BAC) or Breath Alcohol Concentration (BrAC). Unlike BrAC, whose

proportionality to Blood Alcohol Concentration (BAC) is clear (via Henry's Law) and which has long been accepted by the justice system, TAC depends on both individual factors, for example skin thickness, tortuosity, porosity, etc. and environmental factors such as ambient temperature and humidity. To approach this problem, we first developed a forward model that simulates the body's processing of ethanol from oral ingestion to absorption in the gut, to metabolism in the liver, to diffusion through the skin, and finally to transdermal excretion and measurement by the TAC biosensor. We then invert the mathematical equations to estimate BrAC (or BAC) from TAC. Due to the complexity of the link between TAC and BrAC, the parameters vary from subject to subject and even drinking episode to drinking episode. The contributory factors are too numerous and complex to capture explicitly with a first principles model. Therefore, instead of being calibrated to each individual and each episode, the model takes parameters as random variables and trains them, or more precisely, their distributions, based on population data gathered in the clinic or laboratory. We have developed Matlab codes that identifies the distribution of these random variables from sample data and reports a 75% credible band for the estimated BrAC (eBrAC). To evaluate the model, eBrAC curves are compared with BrAC data collected from breathalyzers. When we look at the population data from laboratory as sample data, the 75% eBrAC credible band successfully captures most of the BrAC data. The results indicate the population-based model is promising. Our next step is to stratify episodes so that the training samples match readily observable characteristics or covariates of the target individual. In this way, we can shrink the credible bands and make the model more accurate.

An Investigation of the Enhanced Permeability and Retention Effect Using Fluorescent Liposomes

Helen Salinas, Professor Cristina Zavaleta

There is presently a shortage of methods to accurately identify tumor margins which contributes to the 37% mortality rate of the 1.5 million new cases of cancer reported each year. The instance of cancerous cells present on edges of removed tumors (positive margins) is extremely detrimental to a patient's outcome and impacts local recurrence. We are developing a new imaging strategy to help guide surgeons in the operating room that uses fluorescent liposomal contrast agents. These nanoparticles (NPs) have the ability to passively accumulate in solid tumors due to the enhanced permeability and retention effect (EPR). Surgeons can exploit the EPR effect to accurately locate cancer in real-time and decrease positive margin rates. However, their use in vivo in relation to the EPR effect still needs to be investigated. One variable that can enhance liposomal accumulation at tumor sites is the optimization of the size of nanoparticles. This project considers two sizes of nanoparticles (100 nm and 400 nm) to determine which size can best accumulate in tumors while preserving the intensity of the fluorescent dye the liposome encompasses. Both sizes of fluorescent liposomes accumulated in greater quantities in tumors than healthy adjacent tissue. We observed 4.5 times more fluorescent signal in tumors of mice that had been IV injected with 100 nm NPs compared to those administered 400 nm NPs. The commercially available fluorescent dye's properties in conjunction with liposomal ability to passively accumulate in tumors prove that these nanoparticles can aid in visualizing tumor margins in the operating room.

Intellectual disability risk gene leads to deficient receptor trafficking at glutamatergic synapses

Zihan Sun, Xiling Li, Professor Dion Dickman

In the U.S., nearly 3% of children in the general population are diagnosed with intellectual disability (ID), a neurodevelopmental disorder that seriously affects their life quality. However, no effective treatment is developed since the cellular mechanism behind ID is little known. Previous research has shown that synaptic Ras GTPase-activating protein (SynGAP) is an ID risk gene, whose mutation results in deficient receptor trafficking at glutamatergic synapses in the brain. However, the signaling target downstream of SynGAP remains enigmatic. In addition, current SynGAP research is limited by using mammals as the animal model because the labyrinthine neuronal circuits in their brains make it hard to target synapses and further

study the role of SynGAP. Here, we propose a new glutamatergic synapse model using Drosophila neuromuscular junction (NMJ) for the investigation of SynGAP. Furthermore, we identify that Raskol, a Drosophila homolog gene to human SynGAP, also exhibits functional similarities to SynGAP in the nervous system. Using electrophysiology as a method, we discover that Raskol^{EY02873a} mutation leads to a decreased miniture excitatory postsynaptic potential, which implies a reduction in receptor availability at NMJ. Our result from immunofluorescence imaging further confirms that Raskol^{EY02873a} is deficient in receptor trafficking, which corresponds to the phenotype of SynGAP mutation. Our study provides an intriguing *in vivo* model for the study of SynGAP and thus contributes to deciphering the molecular mechanism of intellectual disability.

A Haptic Device for Emotional Freedom Technique to Relieve Anxiety

Kivilcim Cumbul, Professor Heather Culbertson

Public speech anxiety, namely glossophobia, which affects 74% of people, can be treated by an emerging psychological intervention technique known as EFT (Emotional Freedom Tapping). EFT has been shown to treat public speaking anxiety by many researches, yet no research has been conducted on virtual EFT by using haptic feedback. Our aim is to use sound coils to imitate the tapping sense and to use a VR (Virtual Reality) device to create a virtual therapy experience. We created a haptic vest, ring and VR pillow to tap certain EFT points, and developed virtual environments for therapy and testing. Subjects were given a 10 minute tutorial on VR and wearing haptic devices. Our program starts from an environment which has a stage with a static audience, and subjects rate their anxiety levels there. Then, they will were virtually teleported to a calming therapy room where we applied virtual EFT. After the end of the therapy, they were sent back to the first environment and rated their anxiety level after therapy. Throughout all of the processes, we will also track their galvanic skin response and heart rate to see anxiety level difference. The anticipated outcome of the device we created is to demonstrate a significant decrease in anxiety scores. This will indicate a different approach to anxiety treatment and impact the future of EFT therapy by introducing a haptic device.