Riverside
Postdoctoral
Association

RPA & IIGB
Early Career Scientist Symposium

June 9th, 2023

Genomics Auditorium, UCR

Riverside Postdoctoral Association

UCR

2023 EARLY CAREER SCIENTIST SYMPOSIUM FULL PROGRAM

June 9th, 2023
Location: Genomics Building Auditorium and Lobby, UCR
Time: 8:30 am – 5:45 pm

8:30 am. Registration

9:00-9:30am. Opening remarks

Chair: Dr. Angela Chen

1) 9:00 am. **Dr. Rodolfo Torres** (Vice Chancellor for Research Economic Development)
2) 9:15 am. **Dr. Katie Dehesh** (Director of IIGB, Distinguished Professor and Molecular Biochemist)

9:30-10:30 am. First keynote speaker

Chair : Dr. Nicole Dennis

Dr. Elia Scudiero (Associate Research Agronomist)
"*Using geospatial sensors to understand agriculture in water-scarce and salt-affected farmland*"

10:30-10:40 am. Coffee break.

10:40-12:00 pm. Oral presentation First Session

Chair: Dr. Rebeca Hernandez-Gutierrez

1) 10:30 am. **Dr. Pari Kaur**, Environmental Sciences
"Application of Bioavailability based Approaches in Understanding the Pesticides degradation in Soil"

2) 10:50 am. **Dr. Kai Shimagaki**, Physics and Astronomy
"*An efficient method for inferring epistasis from temporal genetic data, applied to HIV-1 evolution*"

3) 11:10 am. **Dr. Vanessa Moresco**, School of Medicine
"*In search of non-neutralizing antibody therapeutics for the deadly Crimean-Congo Hemorrhagic Fever Virus*"

4) 11:30 am. **Dr. Shang-Min Tsai**, Earth and Planetary Science
"Strange New Worlds: planets beyond our Solar System"

12:00-1:00 pm. Lunch and informal networking

1:00-2:00 pm. Second keynote speaker

Chair: Dr. Lin Chen

Dr. Maria Elena Zavala (Professor of Biology, California State University Northridge)
"*A Radicle Approach: To Train the Next Generation of Scientists*"

2:00-3:20 pm. Oral presentation Second Session

Chair: Dr. David Fronk

1) 2:00 pm. **Dr. Syed Adeel Zafar**, Botany and Plant Sciences
"Evolution of conserved motifs as plant-manipulating effectors in a galling insect"

2) 2:20 pm. **Dr. Yu-Zen Qin**, Mechanical Engineering
"*Vibrational Control and Deep Brain Stimulation*"

3) 2:40 pm. **Dr. Mitchell Masterson**, Molecular, Cell, and Systems Biology
"*Investigation and functional analysis of human steroid hormone importers*"

4) 3:00 pm. **Dr. Adriana Medina Lomelí**, Molecular, Cell and Systems Biology
"Decoding the taste system of the disease vector Aedes aegypti"

3:20-3:35 pm. Coffee break

3:35-4:30 pm. Panel "Careers and professional development"

Chair: Dr. Angela Chen

1) **Dr. Andrew Gray**, Assistant Professor of Watershed Hydrology, UCR
2) **Dr. Jinzheng Wang**, Plant Scientist at Plantible Foods

4:30-5:30 pm. Poster session and mixer

5:30 pm. Award ceremony and closing remarks

Chair: Dr. Emma H. Wilson, Dr. Angela Chen, Dr. Lin Chen

With remarks from:

Dr. Rodolfo Torres, Vice Chancellor for Research and Economic Development

Dr. Torres is both the Vice Chancellor of RED and a Distinguished Professor of Mathematics here at UCR. His goals as VC-Red include inspiring diverse research and creative activity across campus, as well as coordinating economic development at many levels through partnerships across broad sectors. Dr. Torres' research involves using Fourier analysis for applications in partial dierential equations, signal analysis, and biology. He has many awards and distinctions, including being elected to the 2013 inaugural class of Fellows of the American Mathematical Society, a 2017 feature in the Lathisms Calendar of Latinxs and Hispanics in Mathematical Sciences, and a 2019 Congressional Briefing.

Dr. Katie Dehesh, Director of IIGB, Distinguished Professor and Molecular Biochemist

Dr. Katie Dehesh is Both Director of Institute of Integrative Genome Biology and Distinguished Professor and Molecular Biochemist at UCR. She hold the Ernst and Helen Leibacher Endowed Chair in Botany and Plant Sciences at UCR. She is a molecular biochemist working in the areas of plant stress responses, with a specific emphasis on the mechanisms regulating interorganellar communication required for cellular homoeostasis in response to prevailing environmental conditions. She was the President of the American Society of Plant Biologists from 2021-2022. She has been selected as a Member of the German National Academy of Sciences Leopoldina in 2017.

Dr. Elia Scudiero, Associate Research Agronomist

Dr. Elia Scudiero is a Research Agronomist at the University of California in Riverside. Elia grew up on a multi-generational family farm in northern Italy. He was awarded a Ph.D. in Crop Science from the University of Padua, Italy, in 2013. Subsequently, he moved to UC Riverside in 2014. Through 2017, Elia was a Postdoc at the Environmental Science Department and at the USDA-ARS US Salinity Lab . During these years, Elia and other UCR postdocs founded the UC RPA. Elia served as RPA President for the 2016-2017 term. Elia remains at UCR, where since 2018 he leads the Digital Agronomy Laboratory. With over 130 scientific contributions, the Digital Agronomy Lab specializes in near-ground and remote sensing measurements to study multi-scale agro-environmental soil-plant processes to support sustainable agriculture and water management practices.

Talk title: Using geospatial sensors to understand agriculture in water-scarce and salt-affected farmland

Summary: Our current understanding of agricultural production systems indicates that Crop Yield is a complex function of Genetics × Environment × Management × Space × Time interactions. Agricultural systems are pressured by the growing global population, increasing water scarcity, and changing climate. In the pursuit of increasing food security, agriculture (especially intensive systems) should also minimize negative and undesired impacts on the environment and rural societies.

This talk will provide an overview of the research carried out by Scudiero and his lab on the use of geospatial data and geographical information systems to study water-scarce and salt-affected agricultural systems.

Dr. MariaElena Zavala, Professor of Biology, CSUN

Dr. Maria Elena Zavala is a Professor of Biology at the CSUN. She was awarded a Ph.D. in Botany/Plant Development from the University of California, Berkeley, in 1978. Her research is focused in two areas: root development and building institutional research capacity through programs that broaden student and faculty participation in science. Her lab has recently developed a robust and rapid method for transforming beans. This method can be used to improve the nutritional qualities of this important crop plant.

Furthermore, she has established programs that develop women and people who are historically underrepresented to gain the skills and cultural competencies to have successful careers in basic biomedical sciences. As the first in her family to earn an undergraduate degree and a Ph.D. and as a Chicana (Mexican American) her lived experiences help her to serve students whose families may have little or no knowledge of the opportunities that are available in science. The programs that she has developed are multifaceted and tailored to the needs of participant as they move from one academic phase to another. These programs have been instrumental in changing the research capacity of CSUN, faculty, and have broadened the participation people in the scientific endeavor. As the Associate Director of the National Research Mentoring Network (NRMN), Mentoring and Networking Core, she was part of the team that developed culturally responsive online mentoring protocol still used by NRMN to promote mentoring for diverse scientists at different stages in their careers.

Talk title: A Radicle Approach: To Train the Next Generation of Scientists

Summary: People are naturally curious about the world around them. However, not all people are encouraged to follow their interests or to satisfy their curiosity by actively engaging in science. Why is that so? What is the genesis of perception that only a chosen few can or should become scientists? How must we prepare the science soil so that students will thrive in an environment that will encourage their curiosity and support their desire to participate in the great adventure of scientific discovery? Using data from programs that I proposed and implemented at CSUN, we will show that these programs not only to prepared students for careers in basic biomedical research but also stimulated changes in the culture of the university to be more inclusive and student focused.

Dr. Andrew Gray, Assistant Professor of Watershed Hydrology, Department of Environmental Sciences

Dr. Andrew Gray is an Assistant Professor of Watershed Hydrology at the University of California, Riverside in the Department of Environmental Sciences. He completed his doctoral work in Hydrologic Sciences at the University of California, Davis where he focused on fluvial sediment dynamics in small mountainous rivers. At UCR Dr. Gray has built a research group to investigate the processes controlling water and sediment transfer, with particular interest in wildfire impacts on sediment dynamics, coastal sedimentology, sediment source investigation, and microplastics pollution. In his spare time he likes to go on adventures with his family, ideally featuring a little rock climbing and/or camping, and collects fig trees.

Dr. Jinzheng (Gene) Wang, Plant Scientist at Plantible Foods

Dr. Jinzheng (Gene) Wang is a plant scientist at Plantible Foods in the San Diego area. He completed his doctoral work in Plant Biology at the Capital Normal University in Beijing, where he studied the mechanism of plants' response to environmental stress. After finishing his PhD, he moved to UC Davis and later UC Riverside to do his postdoctoral work in understanding how plants modify their cellular communication networks in adapting to the changing environment. He used Arabidopsis thaliana as a model for his previous research work and has recently moved from academia to industry to work on plant-based proteins by using aquatic plant, Lemna. He will share his experience in transitioning from academia to industry.

Special thanks to our judges

Dr. Agnieszka Zelerowicz
Assistant professor, Department of Mathematics

Dr. Evelyn Vázquez
Assistant Professional Researcher, Department of Social Medicine, Population and Public Health

Dr. Emma H. Wilson
Associate Dean of Graduate Division
Professor of Biomedical Sciences, School of Medicine

Dr. Fidel Rivas
Student Services Advisor, CNAS Graduate Student Affairs Center
Plant Biology & Environmental Toxicology

Dr. Wei Vivian Li
Assistant Professor, Department of Statistics

Dr. Zhe Fei
Assistant Professor, Department of Statistics

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Symposium Director
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Graphic/Web Designer
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List of Abstracts of Oral Presentations

1) Application of Bioavailability based Approaches in Understanding the Pesticides degradation in Soil
Dr. Pari Kaur, Environmental Sciences
Pesticide degradation or persistence in the soil is one of the most important variables affecting their potential for off-site movement and subsequent environmental safety. Pesticide half-lives (T1/2) in soil are conventionally determined by monitoring the dissipation of the total chemical concentration following exhaustive solvent extraction. Bioavailability, which measures the freely dissolved concentration of a chemical in soil porewater or the rapid desorption fraction from soil aggregates, is closely related to microbial degradation rates and hence pesticide persistence. We have carried out a comprehensive study to derive T1/2 values of a large number of pesticides in different soils using the conventional and bioavailability-based approaches, including two types of passive samplers and Tenax extraction. Physicochemical characteristics of soil and pesticide adsorption coefficients (Kd) were also obtained. The study showed that both passive samplers and Tenax extraction could predict degradation kinetics, and the obtained T1/2 values were consistently significantly shorter than those derived using the conventional solvent extraction. The use of simple bioavailability-based methods may yield more relevant T1/2 data for understanding the environmental safety of pesticides.

2) An efficient method for inferring epistasis from temporal genetic data, applied to HIV-1 evolution
Dr. Kai Shimagaki, Physics and Astronomy
Infectious pathogens surround us, with new influenza strains emerging yearly and widespread viruses like SARS-CoV-2. Viruses adopt unique strategies to coexist with hosts, enabling persistence and proliferation. HIV, in particular, poses a significant challenge to eradication due to its high mutation rate, immune cell targeting, and stealthy integration into our genome. Vaccines provide hope for HIV eradication; identifying beneficial viral genome mutations and fitness landscapes is crucial for development.
Inferring epistasis, the interaction of genetic mutations shaping fitness landscapes, is difficult in real populations. While a few methods have been developed to infer epistasis from data, these are computationally intensive and/or rely on limiting statistical assumptions. We introduce new computational methods that can reduce run time by orders of magnitude without sacrificing accuracy. Our proposed framework considerably accelerates epistasis inference, and real-world data application is now possible. Testing our approach on the HIV-1 envelope protein evolution in a 6-year monitored patient, we found most significant epistatic interactions occurred in variable regions, often involving neutralizing antibody or antibody-binding regions.

3) In search of non-neutralizing antibody therapeutics for the deadly Crimean-Congo Hemorrhagic Fever Virus

Dr. Vanessa Moresco, School of Medicine

Crimean-Congo Hemorrhagic Fever Virus (CCHFV) is a tick-borne virus widespread in Africa, parts of Asia and Europe with no currently approved vaccine or treatments available. CCHFV mortality rate varies according to different factors such as viral strain and access to emergency health care and could reach 30%r. CCHFV structural glycoproteins (Gn and Gc), induce the formation of neutralizing antibodies, however efforts in developing a treatment for CCHFV have proven challenging. Interestingly, non-structural glycoprotein GP38 was recently highlighted as a target for the development of non-neutralizing antibodies-based therapeutics. Another non-neutralizing antibody candidate is directed at the nucleoprotein (NP). We employed biolayer interferometry (BLI) and structural biology to evaluate human anti-GP38 and mouse anti-NP monoclonal antibodies (mAbs) binding against several CCHFV strains of GP38 and NP proteins respectively. This ongoing study already showed that anti-GP38 mAbs have affinity for different GP38 binding sites and varies among CCHFV strains. Elucidating the molecular mechanisms and specific binding sites will help the development of antibody-based treatments, capable of counteracting the severity and possible spread of this often-fatal virus.

4) Strange New Worlds: planets beyond our Solar System

Dr. Shang-Min Tsai, Earth and Planetary Science

Extrasolar planets (exoplanets) exhibit great diversity and offer insights into the formation of our Solar System. It is an golden age of exoplanet science as the field has transitioned from the stage of detection to detailed characterization. The James Webb Space Telescope (JWST) launched last year is the most powerful space telescope every built and rapidly transforming our understanding of exoplanet atmospheres. In this talk, I will discuss how we study exoplanet atmospheres with numerical models, focusing on simulating the atmospheric composition and climate dynamics. I will highlight our recent discovery with JWST of the first observational evidence of photochemistry on an exoplanet, which is the same process that produces ozone on Earth. Finally, I will conclude with future prospects of observing and modeling exoplanet atmospheres.

5) Evolution of conserved motifs as plant-manipulating effectors in a galling insect
Dr. Syed Adeel Zafar, Botany and Plant Sciences
Ankyrin-repeats are unique structural motifs that mediate protein-protein interactions in a variety of organisms. Ankyrin-repeat containing proteins (ARPs) are most abundant in eukaryotes where these are involved in fundamental biological processes including cell cycle regulation, immune response, and transcriptional regulation. ARPs are also present in a few prokaryotes where these are secreted into host cells to manipulate host defense system, thereby acting as effectors. Though ARPs are also present in some insects, one of the major pests to agricultural plants, we asked if these ARPs also function as effectors in insects. Using DNA sequencing, we have identified 149 ARPs in a galling insect "grape phylloxera", that is a major pest of grapevines. Using RNA sequencing and protein-protein interaction assays, we found that ARPs function as effectors in grape phylloxera. Interestingly, phylloxera genome contains the ARPs with the highest number of ankyrin repeats known across all the organisms, suggesting that phylloxera tend to evolve more ankyrin repeats to increase its chances to interact with lot more host proteins. We further show that Phylloxera ARPs induce a strong defense response in the tobacco (non-host) while a weaker and selective response in grapevine host plants.

6) Vibrational Control and Deep Brain Stimulation
Dr. Yu-Zen Qin, Mechanical Engineering
Cluster synchronization underlies various functions in the brain. Abnormal patterns of cluster synchronization are often associated with neurological disorders. Deep brain stimulation (DBS) is a neurosurgical technique used to treat several brain diseases, which has been observed to regulate neuronal synchrony patterns. Despite its widespread use, the mechanisms of DBS remain largely unknown. In this paper, we hypothesize that DBS plays a role similar to vibrational control since they both highly rely on high-frequency excitation to function. Under the framework of Kuramoto-oscillator networks, we study how vibrations introduced to network connections can stabilize cluster synchronization.

7) Investigation and functional analysis of human steroid hormone importers
Dr. Mitchell Masterson, Molecular, Cell, and Systems Biology
Steroid hormones control development and homeostasis in a wide variety of animals by interacting with intracellular nuclear receptors. Recent discoveries in the fruit fly Drosophila melanogaster revealed that insect steroid hormones, or ecdysteroids, are incorporated into cells through a membrane transporter that belongs to the solute carrier organic anion (SLCO) superfamily. We hypothesized a similar role of the mammalian SLCO genes. Using NanoLuc Binary Technology (NanoBiT), we developed an assay to detect ligand-dependent homodimerization of the steroid receptors in human embryonic kidney (HEK) 293T cells. To investigate the role of SLCOs, HEK239T cell lines were created with modifications of the SLCO genes 4A1 and 3A1 to knockout expression. These two genes were selected due to being the two highest expressed SLCOs in HEK293T cells. Using these cell lines, we were able to investigate steroid entry into the cells and how this is affected by modified SLCO expression. Our investigation showed that SLCOs do contribute to cellular steroid hormone entry. Interestingly, we also saw evidence of some differing substrate specificity of the investigated SLCOs between the different steroid hormones.

8) Decoding the taste system of the disease vector Aedes aegypti
Dr. Adriana Medina Lomelí, Molecular, Cell and Systems Biology
Historically, the anthropophilic nature of mosquitoes have posed threats to human public health. Their blood-feeding behaviors are of utmost concern. Yet, effectively carrying out taste-driven behaviors that precede and follow a blood meal, such as nectar feeding, rapid surveying of both human host skin and oviposition sites all contribute to a female mosquito's overall fitness. However, the mosquito gustatory system remains largely unexplored. Here, we provide the first map of the functional organization of taste sensilla of a major taste organ, labellum, of Aedes aegypti. We found that labellar sensilla are organized into four functional groups that exhibit unique response properties that are modulated by the mated and blood-fed state of the female and differ from the male response. In addition to sweet, bitter, water and salt taste, labellar sensilla also exhibit neuronal sensitivity to amino acids and an artificial sweat mixture via neurons of unknown identity. Our results demonstrate that Aedes labellar sensilla exhibit a unique organization compared to that of the phytophagous dipteran, D. melanogaster. Functional maps like ours can be used to expand knowledge of the mosquito taste system and address complex scientific inquiries about taste coding in a major disease vector.

List of Posters

1. Aimee Uyehara, Department of Botany and Plant Sciences, TANGLED1 recruitment to atypical division sites in maize

2. Aklima Khanam Lima, Department of Nematology, ShK Domains from a Parasitic Nematode are Toxic to Drosophila melanogaster

3. Duc Phan, Department of Environmental Sciences, Spread of Antimicrobial Resistance in the Agricultural Environment from Farm to Fork

4. Lei Yang, Department of Chemistry, Low-pressure and nascent yields of stabilized Criegee intermediates produced from ozonolysis of ethene

5. Lida Halilovic, Department of Microbiology and Plant Pathology, Plant defense metabolite trafficking in extracellular vesicles

6. Lina M. Aguirre Rojas, Department of Botany and Plant Sciences, Comparative transcriptomic analyses of Peruvian cassava infested with the whitefly Aleurotrachelus socialis

7. Lynne Xu, Department of Environmental Sciences, Seasonal variability and meteorological drivers affecting California wildland fire emissions transport and human health impacts

8. Parima Udompholkul, Department of Botany and Plant Sciences, Characterization of a potent and orally bioavailable Lys-covalent inhibitor of apoptosis protein (IAP) antagonist

9. Reuben Franklin, Department of Cell, Molecular and Developmental Biology, Histone chaperones SPT6 and CAF-1 cooperate to maintain progenitor cell identity

10. Sarah Maples, Department of Psychology, Effects of global and astrocyte-specific deletion of FMR1 on tonic GABA currents in hippocampus CA1 pyramidal neurons

11. Sarbendu Rakshit, Department of Mechanical Engineering, Notes on the robustness of synchronization

12. Satoshi Ogawa, Department of Botany and Plant Sciences, Identification of biosynthetic genes of a putative plant growth regulator

15. Shiwei Fu, Department of Statistics, scINSIGHT for interpreting single-cell gene expression from biologically heterogeneous data

16. Soroush E. Neyestani, Department of Environmental Science, Investigating the effects of improved fire heat flux input on modeled wildland fire plume height and air quality impacts

17. Stephanie Martinez, Department of Botany and Plant Sciences, KATANIN is required for microtubule severing, growth and division positioning in maize

18. Nanchaphorn Udomsri, Department of Environmental Sciences, Fate and Transport of Atrazine in various agriculture soils: experiment and modeling studies

19. Proma Basu, Department of Molecular, Cell, and Systems Biology, A topically applied hydrogel formulation helps heal diabetic chronic wounds. Bioengineering.

20. Janty Woojuh, Department of Botany and Plant Sciences, Characterization of endogenous natural products as novel aba receptor agonists

21. Shumei Wang, Department of plant pathology and microbiology, Plant mRNAs move into a fungal pathogen via extracellular vesicles to reduce infection

22. Baoye He, Department of Microbiology and Plant Pathology, EVs facilitate cross-kingdom RNA trafficking between plants and fungal pathogens