National Institute of Environmental Health Sciences

Training in Precision Environmental Health Sciences (TPEHS)

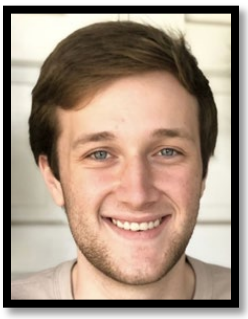
Program Director:
Cheryl Walker, PhD, Director, Center for Precision Environmental Health, Professor, Molecular & Cell Biology, and Medicine, Baylor College of Medicine

Program Co-Directors:
Swathi Arur, PhD, Professor, Genetics, MD Anderson Cancer Center;
Daniel Gorelick, PhD, Associate Professor, Cellular & Molecular Biology, Baylor College of Medicine, and **Craig Hanis**, PhD, Professor, Epidemiology Human Genetics & Environmental Sciences, and Human Genetics Center, School of Public Health, UT Health Science Center at Houston.

http://www.gulfcoastconsortia.org/home/training/training-in-precision-environmental-health-sciences-tpehs/

Meet the TPEHS Trainees

The following trainees are supported by T32ES01781, an NIEHS T32 program:



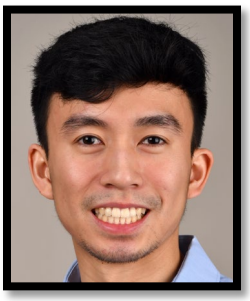
Noah Powell

Appointed: February 1, 2025 – January 31, 2026 (Grant year 06)
Department of Cancer/Cell Biology, Baylor College of Medicine
Primary Mentor: Dr. Jason Lee, Molecular and Cellular Biology, BCM
Secondary Mentor: Dr. Swathi Arur, Genetics, MDA; Dr. Ronald Parchem, Molecular and Cellular Biology, BCM
The Functional Tunability of Membrane-less Organelles in Response to Environmental Stressors
In response to environmental stresses, such as heat or arsenic exposure, cells employ an acute compartmentalization mechanism that changes how mRNAs are organized and utilized within minutes of exposure. This acute compartmentalization of mRNAs is governed by the striking formation of membrane-less organelles, such as mRNA processing(P)-bodies. Extensive research into membrane-less organelles has been conducted over the last decade to uncover their dynamics and composition; however, many of their functions are still unclear. Therefore, the overarching goal of my research is to develop novel assays to uncover the function of membrane-less organelles, specifically when cells are exposed to different environmental stresses.

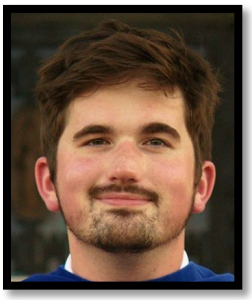
Ellen Thompson

Appointed: February 1, 2025 – January 31, 2026 (Grant year 06)
Department of Development, Disease Models, and Therapeutics, Baylor College of Medicine
Primary Mentor: Dr. Susan Rosenberg, Molecular and Human Genetics, BCM
Secondary Mentor: Dr. Robert Britton, Molecular Virology and Microbiology, BCM
Uncovering the Relationship Between Transcription and Antibiotic-Induced Mutations

In 2019, five million individuals died globally in relation to antimicrobial resistance (AMR), and by 2050 AMR mortality is expected to rise to ten million people. Antimicrobial resistance results from the horizontal transfer of resistance genes or from new mutations that decrease bacterial sensitivity to one or more antibiotics. Adding to this problem, antibiotics can induce increased mutagenesis themselves thus, increasing the probability of bacteria developing new resistant mutations. My project aims to investigate the role of RNA polymerase transcriptional fidelity and its role in E. coli mutagenic DNA break repair of double-strand breaks caused by low-dose exposure to ciprofloxacin (cipro). Cipro-induced double-strand breaks are repaired by homologous recombination which induces the SOS DNA-damage response in all cells causing a cascade of molecular events that lead to increased mutagenesis in a 20-30% subpopulation. We know that RNA polymerase transcription is needed for cipro-induced mutagenesis, so I aim to answer whether the pausing, location, and/or processivity of RNA polymerase has any effect on cipro-induced mutations.



Xing Zhang
Appointed: February 1, 2025 – January 31, 2026 (Grant year 06)
Department of Genetics, MD Anderson Cancer Center
Primary Mentor: Dr. Georgios Karras, Genetics, MDA
Secondary Mentor: Dr. Chad Huff, Epidemiology, MDA
Interrogating Environmental Determinants of HSP90-Buffered Phenotypes
Predicting the clinical pathogenicity of germline mutations is challenging due to gene-environment interactions that contribute to the incomplete penetrance and variable expressivity of phenotypes. The protein-folding chaperone HSP90 may account for much of this phenotypic variation, as it can suppress or “buffer” the deleterious effects of mutations at the cost of rendering phenotypic expression conditional on proteotoxic stressors in the environment. Using the genome instability-associated DNA repair genes FANCA and BRCA1 as models, my project aims to identify common proteotoxic stressors found in the environment that can reveal HSP90-buffered phenotypes. Moreover, it will determine the impact of HSP90-mediated gene-environment interactions on clinical phenotypes, such as cancer, in the general population.



Ty Gadberry, PhD
Appointed: February 1, 2025 – January 31, 2026 (Grant year 06)
Center for Precision Environmental Health, Baylor College of Medicine
Primary Mentor: Dr. Rachel Arey, CPEH, BCM
Secondary Mentor: Dr. Kristina Whitworth, CPEH, BCM
***Understanding Gene-Environment Interactions in PFAS-Induced Neural Toxicity Using* Caenorhabditis Elegans**
Per- and poly-fluoroalkyl substances (PFAS) are a class of persistent and ubiquitous environmental pollutants, with >98% of humans exhibiting detectable levels in circulation. Various legacy and emergent PFAS are associated with adverse health outcomes across species, yet the specific mechanism(s) underlying neurodevelopmental impairments remain poorly understood. C. elegans are soil-dwelling nematodes that serve as a powerful model organism for assessing cellular and multi-omic responses to environmental toxicants thanks in part to their rapid lifecycles, translucence, and invariant nervous systems with highly conserved/orthologous function with humans. Therefore, this project will assess the effects of PFAS exposure in C. Eelgans on neuronal gene expression across critical developmental stages and over time, explore how natural variations across genetically diverse strains can confer selective susceptibility or resilience to discrete compounds, and determine if exogenous supplementation of candidate antioxidants can mitigate toxicity.

The following TPEHS trainees receive financial support from their home institutions:

Udhaya Kumar Siva Kumar, PhD

Appointed: February 1, 2025 – January 31, 2026 (Grant year 06)
Department of Medicine, Baylor College of Medicine
Primary Mentor: Dr. Zheng Sun, Medicine, BCM
Secondary Mentor: Dr. Cristian Coarfa, CPEH, BCM
Intergenerational Effects of Paternal Arsenic Exposure

Extensive air, water, and soil pollution has resulted from urbanization and industrialization. While some progress has been made in reducing pollution, its long-term effects on future generations and their risk for chronic diseases remain unclear. Our study focuses on inorganic arsenic (iAs), a common environmental pollutant in drinking water, to investigate how it impacts health across generations. Male mice exposed to iAs had female offspring with impaired blood sugar regulation and disrupted hypothalamic-pituitary-gonadal (HPG) axis, while male offspring showed lower liver lipid content and triglyceride levels. We found that iAs exposure altered DNA methylation and non-coding RNAs in sperm, which regulate genes linked to hormones and lipid metabolism. We hypothesize that iAs-induced DNA methylation and gene expression changes in the HPG axis can explain the metabolic phenotype in the female offspring. I will use whole genome bisulfite sequencing to analyze DNA methylation in the pituitary. I will use CRISPR-guided epigenome editing to manipulate DNA methylation at specific loci with differential methylation levels in the pituitary. We also will profile RNA modifications in the paternal sperm and early embryos and address their function in epigenetic and phenotypic changes in the offspring. Our study will improve our understanding of how environmental pollutants contribute to chronic diseases like diabetes and fatty liver, helping address the global rise in metabolic disorders.

The TPEHS program is Administered by the:
Gulf Coast Consortia
QUANTITATIVE BIOMEDICAL SCIENCES
www.gulfcoastconsortia.org

The GCC is a collaboration of:
Rice University
Baylor College of Medicine
University of Houston
University of Texas Health Science Center at Houston
University of Texas Medical Branch at Galveston
University of Texas MD Anderson Cancer Center
Institute of Biosciences & Technology at Texas A&M Health Science Center
Houston Methodist Research Institute