

RESEARCH ACTIVITIES

Dr. Bhattacharyya is a bioinformatician with specialized training in processing, managing, and mining ***large-scale biological data*** for pattern recognition using advanced statistical and machine learning approaches. She has a collective 14 years of experience in managing and analyzing big 'omics' datasets, having worked in industry (for 2 years) and government (National Center for Toxicological Research, Food and Drug administration, USA) for 2 years before coming to academia.

Her primary interest is in understanding disease and toxicity related pathophysiology using high throughput systems biology approach, integrating complex data from imaging, genomics, proteomics, epigenetic and metabolomics experiments, building predictive network models to understand underlying perturbations in biochemical pathways.

Dr. Bhattacharyya was recruited to the department of Pediatrics with Arkansas Biosciences Institute Recruitment funds out of which 40% of her time was contracted to work for the Birth defects section and 40% for the Pharmacology and Toxicology section within the department. The rest 20% was dedicated towards developing her own research and other collaborative work. When the contractual terms ended in 2015, she initiated and developed long term collaborations with other sections within and outside the department and is currently fully funded.

Collaborative work within the department of Pediatrics

Pharmacology and Toxicology Division (FTE: 5%)

For the Pharmacology and Toxicology section she has been heavily involved in the analyses of metabolomics and miRNA based research on Acetaminophen toxicity as a Co-Investigator for the **NIH/NIDDK (1R01 DK081406)** project entitled "Identification of new mechanistic biomarkers of adverse responses to acetaminophen in children and adolescents", PI: Dr. Laura James. With Dr. James she has co-authored 9 peer-reviewed journal papers in the last 5 years (3 as first author), including 3 currently under review. She has actively participated in grantsmanship, working on multiple unfunded NIH grants with Dr. Laura James as well as procuring an intramural CUMG grant with Dr. Prit Gill. She still continues to be actively involved in research, presentations at conferences, grantsmanship and manuscript development with Drs. James and Gill under contractual support from the division at **FTE 5%**.

Based on her previous experience in drug-toxicity research in industry and FDA, **she was able to procure Marion B. Lyon Revocable Trust, New Scientist Development Award (\$50,000) as a Principal Investigator. The award was granted to examine *microRNA Expression in Pediatric Acetaminophen Toxicity*.** With this award in collaboration with Drs. James and Gill, she was able to initiate miRNA research at the division.

USDA funded Arkansas Children's Nutrition Center (ACNC); FTE 40%

She initiated collaboration with ACNC in August 2015 and has actively remained funded at **FTE 40%** through the **USDA ARS 6251-51000-007-00D** and **USDA-ARS 6251-51000-006-00D** projects, aimed at

looking at impact of diet and exercise on child development and health. With her expertise and background in high-throughput metabolomics, she was able to assist in establishing a “Metabolomics Core” at ACNC. Recently Dr. Sean Adams, the newly appointed director of ACNC, has formed the informatics team with the aim to build and expand a bigger critical mass in the area of 'Big Data' through strategic collaborations within and beyond ACNC. Dr. Bhattacharyya is a member of the 3-member informatics team at ACNC. So far she has co-authored 3 publications (1 published, 2 in review, 1 as first author) with at least 3 more in the pipeline for this year.

Arkansas Center for Environmental Exposure Research (ACEER): (FTE: 20%)

Since Jan, 2016 she has been working as a Co-Investigator at **FTE 20%** for Drs. Kathleen Gilbert and Sarah Blossom on the **NIH/NIEHS R01ES021484 grant**, titled *Developmental Programming of TCE Induced Autoimmune Disease*, performing bioinformatic processing and statistical analysis of bisulfite sequencing data to examine genome-wide DNA-methylation changes in response to trichloroethylene-induced toxicity in the mouse model. One manuscript is in review. This work has also resulted in submission of a **pending NIH R21** titled *Defining Epigenetic Effects of Trichloroethylene on T cell Differentiation* with Dr. Blossom.

Center for Childhood Obesity (recently funded NIH COBRE): (FTE:TBD)

Dr. Bhattacharyya has just started (since Jan 2017) collaborating as a biostatistician/bioinformatician on the **NIH COBRE 1P20GM109096-01A1 (PI: Dr. Judy Webber)** at a **FTE that is to be decided on a need basis**. She will be performing statistical analysis on several pilot projects funded under the COBRE which aims at reducing childhood obesity through coordinated, community based approaches.

Birth Defects Center: (FTE: 10%)

For the Birth Defects section she has remained heavily involved, in managing, processing and generating genotype data from approx. 10,000 subjects for the **NIH R01 55R01HD039054-13 grant** (PI: Dr. Charlotte Hobbs) entitled *Genomic and epigenomic factors associated with non-syndromic congenital heart defect risk*. The work on this large scale multicenter study is still ongoing. She is also involved in the preliminary quality assessment of the data prior to passing on to the statistical geneticists for further statistical analysis. She has also generated and processed DNA methylation data from a subset of samples for the same study and is intimately involved in subsequent statistical analyses. Work on this large-scale GWAS grant is still in the replication phase and several manuscripts are in the pipeline for the next few years. Besides this project, she has worked on the **National Children's Study, NIH/NICHD (HHSN275200800026C L013-RT-01-F)** (PI: Dr. Charlotte Hobbs) to determine whether maternal and neonatal samples collected and stored using current methods were robust enough to generate state-of-the-art genomic and epigenomic profiles. Currently she is a Co-Investigator in another study funded by the **Center for Disease Control: CDC 1U01DD001039-01** (PI: Dr. Wendy Nembhard), titled, *the Birth Defects Study to Evaluate Pregnancy exposureS (BD-STEPS)*.

Under BD-STEPS, she has procured intramural CUMG funding (\$40,000) as a Principal-Investigator for a pilot project entitled, *Establishing a link between maternal lipid homeostasis and congenital heart*

defects. This work is in collaboration with the world's leading lipid expert, Dr Bruce Kristal at the Brigham Women's Hospital, Harvard medical school. The work is still ongoing on this project.

Dr. Bhattacharyya is currently funded at **FTE 10%** by the Birth Defects section.

Division of Allergy: (FTE 5%)

Dr. Bhattacharyya has recently (since Feb, 2017) embarked on a long-term collaboration with the division of allergy currently working on two projects: one looking at the impact of viral infections on the microbiome of children with or without asthma (PI: Dr. Joshua Kennedy) and the other looks at changes in gene expressions in children with walnut allergy (PI: Amy Scurlock).

Other:

Dr. Bhattacharyya has also worked with other departmental faculties on department-subsidized projects. One such collaboration with Dr. Laxmi Yeruva has resulted in 1 journal publication and submission of a **pending NIH R01, entitled *Modulation of Chlamydial Pathogenesis by host miRNAs***.

Another collaboration with Dr. Richard Frye on an Autism related project has resulted in a manuscript in preparation (*Title: Modulation of immunological pathways in lymphoblastoid cell lines by the enteric microbiome metabolite propionic acid*), to be submitted in July 2017.

Collaborative work outside the institution (FTE: 20%)

Due to her background in biochemistry and expertise in metabolomics and bioinformatics, **Dr. Bhattacharyya was invited to co-facilitate a think-tank session on the Use of Metabolomics in Population-Based Research at NIH/NCI, Bethesda, MD.** This national-level exposure enabled her to foster collaborations with the Alzheimer's disease Metabolomics Consortium (ADMC: <https://sites.duke.edu/adnimetab/>), headed by Dr. Rima Kaddurah-Daouk at the Duke University (**NIH/NIA (R01AG046171)**). ADMC is a large *international consortium* with 21 participating institutions from all over the world including USA, Germany, Netherlands, Canada and Spain. It is part of ADNI or Alzheimer's Disease Neuroimaging Initiative (<http://adni.loni.usc.edu/>). The main objective of the ADMC consortium is to use MRI and PET images, genetics, cognitive tests and blood based metabolomic biomarkers as predictors for the disease. Data from the North American ADNI's study participants, including Alzheimer's disease patients, mild cognitive impairment subjects and elderly controls are used to detect predictive mechanistic biomarkers of the disease in a systems biology approach.

Currently as a PI, Dr. Bhattacharyya represents UAMS as an integral part of the consortium and is under a subcontract (Directs: \$65,000 from Oct 2016 till May, 2017 and ongoing) with the ADMC to work as a lead bioinformatician for the consortium. Her role is to 1) analyze data from both individual and multiple metabolomics platforms in an integrated fashion, applying sophisticated algorithms like correlation networks, penalized multivariate regression methods and metabolite set enrichment analysis to understand the metabolic pathways that are perturbed in disease state as well as are associated with memory and cognitive functions; 2) to track metabolite changes over time and their association with disease progression and decline in memory and cognitive functions.

Her collaboration with the ADMC has resulted in co-authorship in a manuscript that was submitted to the **New England Journal of Medicine** in May, 2017. The manuscript is currently under review.

She has also just started working on another NIH grant (**NIH/ NIMH (5R01MH108348-02)**) with Dr. Kaddurah-Daouk (Principal Investigator) that aims at detecting *Metabolomic signatures predictive of outcomes to treatments for major depression*. She has also joined the recently formed “**Mood Disorders Precision Medicine Consortium**” constituting of several institutions like Emory, Mayo Clinic, University of Illinois at Urbana-Champaign and Duke University. She represents University of Arkansas for Medical Sciences in the consortium.