

About the Division of Systems Biology (DSB)

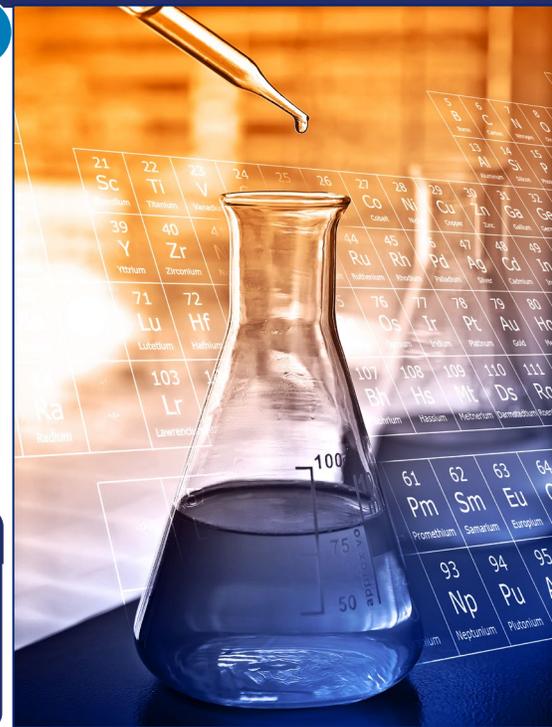
Division Mission

Address regulatory research needs, knowledge gaps, and emerging health threats in regulatory science using systems-biology approaches and innovative technologies of regulatory interests, such as (1) safety and use of medical products (i.e., drugs, biologics, and devices), (2) safety of regulated foods and supplements, (3) safety and detection of components and impurities in regulated products, and (4) develop technological standards and methods used in regulatory science.

Division Organization

DSB is comprised of the immediate office and two branches:

- Omics, Models, Imaging and Chemistry Branch (OMIC)
- Innovative Sciences and Technology (IST)



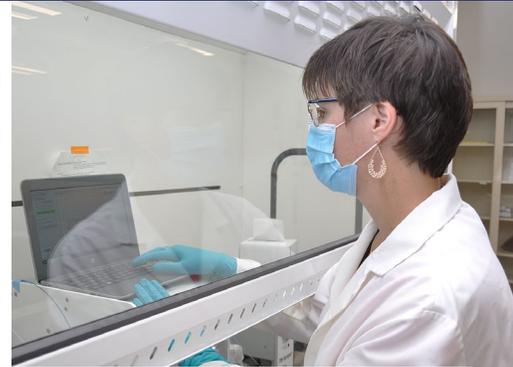
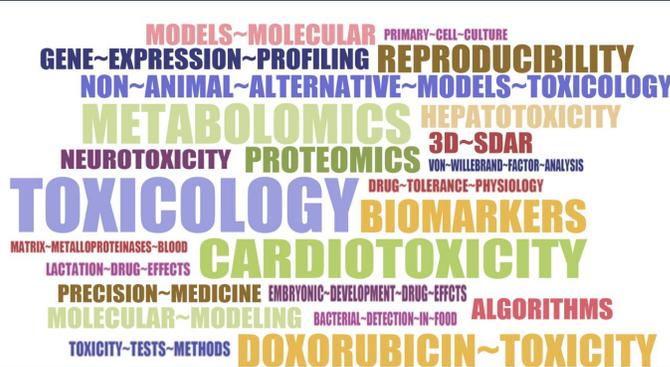
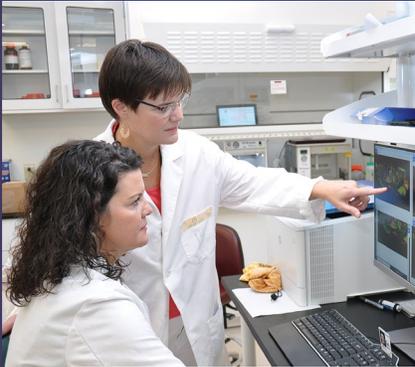
Research Interests

- Mechanisms of Toxicology and Susceptibility to Adverse Effects
- Systems and Organ Toxicological Areas
- Reproduction, Development, and Fertility
- Drug Addiction and Psychoactive Effects
- Methodologies, Diagnostics, and Models for Regulatory Science Applications

Strategies

- Characterize systems biology and toxicology with state-of-the-art tools:
 - Transcriptomics, epigenomics, metabolomics, proteomics, lipidomics, and imaging
 - Human-based new alternative methodologies (NAMs)
 - In vivo disease and pharmacodynamic models
- Utilize pharmacological tools — drug classes with known effects (e.g., anthracyclines, tyrosine kinase inhibitors, opioids, etc.)
- Incorporate innovative computational and instrumental technology
- Integrate data with systems-biology informatics
 - Evaluate differences in risk and toxicology related to species, tissue, sex, and sub-populations





Select DSB Accomplishments in 2021

COVID-19 Response

- Scientists within DSB and NCTR's Division of Bioinformatics and Biostatistics collaborated in using homology modeling computational chemistry to identify key interactions between the SARS-CoV-2 infection co-receptor angiotensin converting enzyme 2 and the full-length spike protein trimer of SARS-CoV-2.
- DSB recruited funding for two Broad Agency Announcement (BAA) contracts that enable NCTR scientists to 1) conduct Biosafety Level 3 studies with SARS-CoV-2 viral strains at the Regional Biocontainment Laboratory at the University of Tennessee Health Science Center (UTHSC), and 2) correlate Matrix-Assisted Laser Desorption-Ionization (MALDI)-imaging mass spectrometry data from COVID-19 infections (human and animal models) with high-powered broadband coherent anti-stokes Raman scattering (BCARS) imaging technologies at Georgia Tech. Research data resulting from these BAA contracts with UTHSC and Georgia Tech are expected to make significant impacts in scientific areas related to:
 - SARS-CoV-2 infection
 - Host-immune responses
 - Therapeutic combinations
 - Perinatal risks
 - Disease pathogenesis
 - Therapeutic risks
 - Variant cross-reactivity of vaccine targets
 - Potential biomarkers

Ongoing DSB Research Projects in 2022

- A Liver-Chip System to Predict Individual Susceptibility and Adaptation to Drug-Induced Liver Injury
- Cannabinoid Neuropharmacology and Pharmacokinetics
- Characterizing the Effects of Viral Load and Immune-Cell Infiltration in COVID-19 Patient Autopsy Tissues
- COVID-19 Effects on Pregnancy and Prenatal and Postnatal Development
- Investigation of Opioid-Induced Neural Tube Defects (NTDs) in a Mouse Model
- Pandemic-Related Research: MIS-C
- Prediction of Adverse Events from *Drug-Endogenous Ligand-Target* Networks Generated Using 3D-Similarity and Machine Learning Methods
- Proteomic and Metabolomic Evaluation of Visible Safe Violet-Blue Light (405nm) Effect on Ex Vivo Stored Human Plasma and Platelets

