The Ohio State University College of Medicine

Biomedical Informatics Education Programs

Wexner Medical Center

College of Medicine

Biomedical Informatics Summer Internship Program (BMI SIP)

The Department of Biomedical Informatics hosts an annual internship program each summer which provides high school, undergraduate, and graduate students opportunities to pursue research projects in the field of biomedical informatics under the guidance of research and operational staff and renowned faculty mentors in the Department of Biomedical Informatics. Participants learn useful tools and technologies used in biomedical and clinical research and attend weekly seminars to learn more about the various fields and interdisciplinary interactions biomedical informatics facilitates. Interns also gain very useful presentation abilities through regular lab and programmatic presentation opportunities, including an end-of-program poster session.

Our website: http://medicine.osu.edu/bmi/careers/students/bmi_internships/pages/index.aspx

All student internship positions within the Department of Biomedical Informatics have the potential to be either paid or unpaid, depending on student experience. Most positions have the ability to transition into projects through the school year, and/or count for course credit, depending on performance. Information about our faculty as well as specific internship projects and preferred student skillsets are listed below. If you are interested in getting more information about a specific internship, please email the faculty member directly using their contact information below.

Faculty Information

Lang Li, Ph.D (Lang.Li@osumc.edu)

Professor and Chair, Department of Biomedical Informatics

Research Interests

Dr. Li's research is focused on translational biomedical informatics research on drug interactions and precision medicine. Using system pharmacology models, statistical methods and informatics approaches, Dr. Li's lab translates molecular mechanisms of drug interactions and pharmacogenetics into clinical trials and pharmaco-epidemiology studies, as well as vice versa.

Potential Projects for Students

Dr. Li is currently looking for 15 students in this summer. The two annotation projects include: 1) annotate cancer drug interactions and toxicity data from clinical trial publications and construct a Clinical Drug Safety database; 2) annotate drugs and drug metabolites from publications and build up a Drug Metabolism database.

Eligibility: Potential students should have biology or pharmacology background.

Ewy Mathé, Ph.D (ewy.mathe@osumc.edu)

Assistant Professor, Department of Biomedical Informatics

Research Interests

Dr. Mathé's primary research interest are to leverage epigenomics, genomics, nucleotide variants and metabolic patterns to 1) understand how the genetic and epigenetic landscape affects disease phenotypes, particularly cancer; 2) define cell-type and disease-type specific molecular characteristics to uncover novel biomarkers and guide the search of novel therapeutic targets.

Potential Projects for Students

Dr. Mathé is currently looking for 1-2 students to assist her with projects this summer. Specific projects include 1) develop and implement improved methodology for pathway enrichment analysis, using an in-house database (https://github.com/Mathelab/RaMP-DB/); and 2) analysis and integration of metabolomics data with gene expression or microbiome data acquired in cancer patients and murine models. These projects involve knowledge of programming and statistics, and students will be expected to read associated literature to understand the underlying biology.

Eligibility: Potential students should be familiar with the R programming language; familiarity

with the Linux environment and bash scripting. Although not required, familiarity with snakemake, biology, and biological terminology is preferred.

James Chen, MD (James.Chen@osumc.edu)

Assistant Professor, Departments of Internal Medicine and Biomedical Informatics

Research Interests
Dr. Chen and his research partner Dr. John Hays, MD, PHD are seeking motivated students to join their exciting and fun translational oncology laboratory. Dr. Hays is an expert in drug development and proteomics and Dr. Chen is an expert in bioinformatics and genomic analysis.
They are both active clinical oncologists and serve as principal investigators on multiple clinical trials. They are seeking students to learn and assist in:
(1) in vitro models, protein and gene analysis
(2) data modeling and algorithm development

Potential Projects for Students
The researchers are currently looking for 1-2 students. Projects may include: 1) developing computational approaches to identify biomarkers of sensitivity to rare tumors; 2) in vitro and potentially in vivo studies to confirm drug sensitivities in cell lines and in mice

Eligibility: Potential students should have at least basic training in programming with R, Python, or other programming languages OR some basic wetlab experience. Self-starters are a must. Term-time positions are also available to exceptional candidates.

Yan Zhang, Ph.D (Yan.Zhang@osumc.edu)
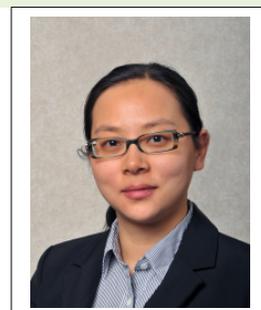
Assistant Professor, Department of Biomedical Informatics

Research Interests
Dr. Zhang's interests span statistical and computational methods and their applications to genomic, proteomic and clinical research, such as (1) integrative analysis of genomic and proteomic data for cancer driver identification; (2) statistical modeling of biological networks.

Potential Projects for Students
Dr. Zhang is currently looking for 1~2 students in this summer. The potential projects include: 1) integrate genomic and proteomic data to discover cancer signatures; 2) develop computational models to predict/prioritize noncoding functional elements in gene deserts.

Eligibility: Potential students should have at least basic training in programming with R, Python, or other programming languages.

Lijun Cheng, Ph.D (lijun.cheng@osumc.edu)

Assistant Professor, Department of Biomedical Informatics

Research Interests

Dr. Cheng's primary research interests are to develop system pharmacology models of statistic and machine learning 1) to predict drug response for either single drug or drug combinations in both in vitro and clinical settings (**precision medicine**); and 2) to develop better methodologies to identify the optimal molecular stress points will increase the precision of target and drug selection. Her research application includes cancer genomics, precision medicine, system pharmacology, and drug discovery.

Potential Projects for Students

Dr. Cheng is currently looking for 2~3 students in this summer. The two specific projects include: 1) develop computational approaches to address optimum drug-targeted selection for single patient based on multi-omics data integration, including TCGA, gene pathway-integration, and drug and protein structure; 2) develop drug response prediction models for individual cancer patients based on his/her multi-view omics data, e.g., genetic mutation mRNA, and protein.

Eligibility: Potential students should have at least basic training in programming with R, Python, or other programming languages.

Guy Brock, Ph.D (guy.brock@osumc.edu)

Research Associate Professor, Department of Biomedical Informatics

Research Interests

Dr. Brock's primary methodological research interests are in statistical bioinformatics and clinical biostatistics, with focus areas on missing value imputation, integration of diverse 'omics data, and multistate models of disease progression. Current projects include 1) developing and evaluating methods for missing value imputation in metabolomics data, 2) integrating different types of genomics data and correlating them with patient phenotypes, and 3) modeling disease progression and health services using electronic health record (EHR) data and multistate models.

Potential Projects for Students

Dr. Brock is currently looking for 1-2 students to assist him with projects this summer. Specific projects include 1) model disease progression in diabetes using multistate models and data from the EHR; 2) evaluating different methods for analysis of RNA-seq data using publicly

available data; 3) evaluating different methods for missing value imputation in metabolomics data; and 4) integrating metabolomics data with data types using canonical correlation analysis. These projects involve knowledge of programming and statistics, and students will be expected to read associated literature to understand the underlying biology.

Eligibility: Potential students should be familiar with the R programming language (or another programming language and willing to learn R quickly); familiarity with the Linux environment and bash scripting is preferred.

Fuhai Li, Ph.D (Fuhai.Li@osumc.edu)

Assistant Professor, Department of Biomedical Informatics

Research Interests
Dr. Li's primary research interests are to develop computational, machine learning models 1) to discover risk biomarkers and predict personalized drug and drug combinations (**precision medicine**); and 2) to uncover and inhibit the tumor-stroma crosstalk regulating tumor development, drug response and immune response (**tumor microenvironment**).

Potential Projects for Students
Dr. Li is currently looking for 1~2 students in this summer. The two specific projects include: 1) develop computational approaches to mine and integrate genetic biomarkers regulating cancer development and drug response from multi-data resources, e.g., TCGA, ClinGen, Pubmed abstracts; 2) develop computational models to uncover the activated regulatory signaling network of individual cancer patients by integrating multi-omics data, e.g., gene expression and genetic mutation.

Eligibility: Potential students should have at least basic training in programming with R, Python, or other programming languages.

Kevin Coombes, Ph.D (Coombes.3@osu.edu)

Professor, Department of Biomedical Informatics

Research Interests
Dr. Coombes research interests include applying computational, mathematical, and statistical models to genome-wide data sets in order to understand relationships between genes.

Potential Projects for Students
Dr. Coombes is currently looking for 2~3 students in this summer. The specific projects include: 1). Predicting gene expression from regulatory factors. The goal of the project is to generate a small feature set (from transcription factors,

microRNAs, and methylation sites) that can predict gene expression for the entire human genome. The student will learn skills from computational biology and biostatostics while being mentored on this project. (2) <u>Inferring the order in which mutations occur in cancer cells</u>. The student will read summaries of the literature, track down the associated computer code and data sets, and run the code to compare multiple methods on the same dataset. This project is expected to result in a review article that compares methods. If time permits, we can incorporate new ideas (like mutation allele frequency) into the methods.

Eligibility: Potential students should have at least basic training in some programming language, with R or python most likely to be useful.