UPMC LIFE CHANGING MEDICINE | University of Pittsburgh

UPMC HILLMAN CANCER CENTER ACADEMY

UPMC Hillman Cancer Center Academy Research Sites

The Cancer Biology (CB) Site

Located at The Hillman Cancer Center in Pittsburgh's Shadyside neighborhood, prepares scholars to further their studies in STEM subjects and to consider careers in cancer care and research. Through immersion in laboratories with highly-qualified faculty mentors, CB scholars are introduced to key concepts in cancer biology such as tumor suppressors and oncogenes; cell signaling and growth factors; the role of metabolism and disordered mitochondrial mechanisms; the role of inflammation in cancer; the tumor microenvironment; and tissue invasion/metastasis.

Site Directors:
Deborah L. Galson, PhD Associate Professor of Medicine, Division of Hematology/Oncology; Associate Professor of Microbiology & Molecular Genetics; Member, UPMC Hillman Cancer Center Molecular and Cellular Cancer Biology Program; Member, McGowan Institute for Regenerative Medicine; Co-Director, Pittsburgh Center for Interdisciplinary Bone & Mineral Research
Malabika Sen, PhD Research Associate Professor of Medicine

Project Examples from CB Scholars:

- Novel drug targets for the treatment of small cell lung cancer
- Evaluation of how *SNORD67* promotes distant metastases
- Impact of the COVID-19 pandemic on prostate cancer diagnosis
- The effect of diallyl trisulfide (DATS) on TCA cycle in breast cancer cells
- The microbiome is required for intestinal regeneration after radiation injury

The Computer Science, Biology and Biomedical Informatics (CoSBBI) Site

Hosted by the Department of Biomedical Informatics (DBMI) and the Division of Pathology Informatics, provides a hands-on introduction to the application of software and computational techniques to clinical and research problems. Biomedical informatics covers a wide range of topics including genomic and proteomic data mining, pharmacogenomics, image analysis, interface design, natural language processing, machine learning, and biosurveillance. CoSBBI students will participate in a crash-course in biomedical informatics, a computer programming boot camp, and intensive collaboration with a faculty mentor on an ongoing research project. Scholars will have the opportunity to submit their project

abstracts for inclusion in a published paper describing the summer's activities and to be considered for submission to the high school program at the annual meeting of the American Medical Informatics Association.

Site Director:
David Boone, PhD Assistant Professor of Biomedical Informatics

Project Examples from CoSBBI Scholars:

- Comparison of Query Performance of a Research Data Warehouse Stored in a Relational Star Schema Database vs in a NoSQL Document-Store Database
- Identifying Transcription Factor Binding Motifs: A Convolutional Neural Network Approach
- Using Natural Language Processing to Improve the Prediction of Relevant Data in Electronic Medical Records
- Can Varying the Salutation and Subject Lines of E-Mail Prompts Increase Patient Log-Ins to an Internet Support Group for Mood and Anxiety Disorders?
- Automated Image Analysis for Immunohistochemical Evaluation of Protein Expression Levels to Assess their Use as Biomarkers for Prostate Cancer

Computational Biology (CompBio) Site – Formerly DiSCoBio

The CompBio Site is located on the Oakland campus and hosted by the Department of Computational and Systems Biology and the University of Pittsburgh Drug Discovery Institute. Each CompBio student works first-hand on research projects employing cutting-edge approaches in computational modeling, *in silico* simulations, and/or machine learning techniques to answer questions in cancer biology, drug discovery, and other fast-growing fields while also getting essential training for their college experience and beyond.

Site Directors:
Joseph C. Ayoob, PhD Associate Professor of Computational and Systems Biology
David R. Koes, PhD Associate Professor of Computational and Systems Biology

Example CompBio Projects include:

- Creating a computational model of protein-protein and protein-drug interactions
- Building a generative model of intercellular phenotypic heterogeneity in cultured cancer cells
- Mathematical modeling of cell fate decision pathways of apoptosis and other cell death mechanisms
- Simulating and visualizing the dynamics of proteins and protein complexes
- Knowledge-based ligand conformer generation for virtual drug screening

The Immunology and Cancer Immunotherapy (ICI) Site

Located across multiple buildings, it exposes scholars to immunological research and prepares them for a career in cancer immunology. Scholars will work alongside a mentor to create a research project dealing with data analysis and experimental design. The goal of this immunology program is to explore the exciting biologic basis for novel therapies being developed that may be used in the immunotherapy of cancer.

Site Directors:
Greg Delgoffe, PhD Assistant Professor of Immunology Member, Tumor Microenvironment Center
Tullia Bruno, PhD Assistant Professor of Immunology Member, Tumor Microenvironment Center Member, Cancer Immunology and Tumor Immunotherapy Program.

Project Examples from ICI Scholars:

- Effects of Overexpression of T-bet on Murine Tumor Cell Lines *In Vitro*
- Immune Checkpoint Blockade for Immunotherapy of Breast Cancer
- The Effect of Nitrosylation on Cysteine-based Caspase-1 Activity
- Identification of HSP90i-Sensitive Client Proteins for Conditional T Cell Targeting of Melanomas
- Regulation of Dendritic Cell Activation by NK Cells in the Presence of HSPs

The Ophthalmology (OPT) Site

The OPT site is located on the Oakland campus in the Eye and Ear Institute and the Biomedical Science Tower 3. The OPT site provide unique opportunities to observe ophthalmology clinic activities as well as research projects to study visual biology and blinding diseases. OPT Scholars will be introduced to biology of the eye, cells in the front and back of the eye and their functions, basic biochemistry of the retina, visual perception, and eye diseases. OPT mentors include experienced clinician scientists and basic research scientists who will provide insights and guidance to stimulate the students' professional interests in STEM subjects and biomedical professions.

Site Director:
Yuanyuan Chen, Ph.D. Assistant Professor of Department of Ophthalmology

Example OPT Projects include but not limited to:

- Development of recombinant VZV in which the latency associated transcript is mutated.
- Exploration of pharmaceutical and stem cell strategies for glaucoma and optic neuropathy.
- Pharmacological studies of misfolded proteins in the retina.

The Surgical Oncology Site

The Department of Surgery provides opportunities for research across multiple surgical specialties and campuses (Shadyside, Children's, and Oakland). Students will participate in the full spectrum of clinical, basic, and translation science with faculty and trainees at Pitt. All students will participate in a 1-on-1 research project, various group activities, have the opportunity shadow in the OR, visit research labs, and engage with surgeon scientists. Many of the project will be performed primarily with computers rather than in the lab at the bench and some activities may be run jointly with the CoSBBI site.

Site Director:
Steven Evans, MD Clinical Professor of Surgery; Director; Division of Community Engagement

Project Examples from Surgery Scholars:

- Investigating Novel Biomarkers
- Outcome measures regarding procedural approaches for ruptured abdominal aorticaneurysms
- Predicting postoperative lung cancer recurrence and survival using Cox proportional hazards regression and machine learning
- Determining the Optimal Chemotherapy To Be Used in TACE Therapy by Analyzing Patient Data

Tech Drive X (TDX) Site – Formerly CEBIG

Located along Technology Drive, Tech Drive-X features laboratories selected from the Departments of Bioengineering, Orthopaedics, Microbiology and Molecular Genetics, the McGowan Institute for Regenerative Medicine, and the Aging Institute. Scientific mentors will collaborate to introduce scholars to interdisciplinary research that addresses emerging challenges to our understanding of the complex roles of the cellular and organismal environment (both internal and external), microbes, aging, and genetics on cancer risk, including the onset and progression of cancer.

Site Directors:
Andy Duncan, PhD Associate Professor of Pathology Member, UPMC Hillman Cancer Center Molecular and Cellular Cancer Biology Program
Serafina Lanna Program Manager, Aging Institute

Project Examples from TDX Scholars:

- Analysis of Six2+ Cells During Mouse Kidney Development and their Contribution to Ectopic Kidney Organogenesis
- Role of ECM and Macrophages in Glioblastoma Progression
- Evaluating the Phenotype of Macrophages in the Pathology of Endometriosis

The Women's Cancer Research Center (WCRC) Site

Located along Technology Drive, Tech Drive-X features laboratories selected from the Departments of Bioengineering, Orthopaedics, Microbiology and Molecular Genetics, the McGowan Institute for Regenerative Medicine, and the Aging Institute. Scientific mentors will collaborate to introduce scholars to interdisciplinary research that addresses emerging challenges to our understanding of the complex roles of the cellular and organismal environment (both internal and external), microbes, aging, and genetics on cancer risk, including the onset and progression of cancer.

Site Directors:
Andy Duncan, PhD Associate Professor of Pathology Member, UPMC Hillman Cancer Center Molecular and Cellular Cancer Biology Program
Serafina Lanna Program Manager, Aging Institute

Project Examples from TDX Scholars:

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- Role of ECM and Macrophages in Glioblastoma Progression
- Evaluating the Phenotype of Macrophages in the Pathology of Endometriosis