PhD in Systems Medicine - Research Areas

Research area	Description	Sub categories (including but not limited to)
Cancer Biology	Involves the study of the molecular and cellular mechanisms underlying the development and progression of cancer. It focuses on genetic mutations, tumor microenvironment interactions, cell signaling pathways, and how these contribute to uncontrolled cell growth, metastasis, and resistance to treatment. The field aims to uncover and validate targets, mechanisms and pathways with a therapeutic potential for cancer prevention, diagnosis, and treatment.	a) Fundamental Biological Mechanisms b) Translational and Clinical Medicine
Computational Biology	Involve the application of mathematical models, algorithms, and computational techniques to understand biological systems and processes. It involves the analysis of large-scale biological data (such as genomic, transcriptomic, and proteomic data) to identify patterns, predict outcomes, and simulate biological phenomena, aiding in areas like drug discovery, disease modeling, and systems biology.	a) Data science b) Mathematical models c) Artificial Intelligence and Machine Learning d) Bioinformatics
Genomic Medicine	Involves the study of inherited traits, genetic variation, and the molecular mechanisms underlying human biology and disease. It explores the roles of genes and their interactions with environmental factors to understand development, evolution, and disorders, leveraging tools like genomics, bioinformatics, and molecular biology for research and clinical applications. It integrates experimental and computational tools to elucidate pathogenic events.	a) Fundamental Biological Mechanisms b) Translational and Clinical Medicine

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Immunology	Involves the study of the immune system, focusing on its molecular mechanisms, cellular processes, and interactions with the environment that protect the body from infections, diseases, and foreign substances. It explores immune responses, immune-related disorders, and therapeutic strategies to enhance our understanding of health and disease management.	a) Fundamental Biological Mechanisms b) Translational and Clinical Medicine
Medical Humanities	Represents an interdisciplinary field that combines the study of medicine with the humanities, including literature, philosophy, ethics, history, and sociology. It explores the human experience of illness, healthcare, and healing, aiming to enhance the understanding of patients' perspectives, improve doctor-patient relationships, and inform medical practice and policy with broader ethical, cultural, and social insights.	a) Cognitive science b) Biomedicine & society
Molecular and Cellular Biology	Involves the study of fundamental molecular mechanisms and cellular processes that govern the function and regulation of living organisms. It focuses on how molecules like DNA, RNA, proteins, and lipids interact within cells to control growth, division, differentiation, and responses to environmental signals, as well as how cellular dysfunction can lead to diseases.	a) (DNA) Metabolism b) Aging c) Epigenetics/epigenomics d) Cell division e) Signal transduction f) Membranes and organelles g) Intracellular trafficking h) Cell migration i) Mechanobiology j) Tissue formation

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Molecular Therapy	Development of novel strategies for the prevention and treatment of disease. The general objective is to develop new vector systems, test them, and translate the most promising approaches to the clinic.	a) Fundamental Biological Mechanisms b) Translational and Clinical Medicine
Neurobiology	Involves the study of the nervous system's structure, function, and development at cellular, molecular, and systemic levels. It integrates multi-omic approaches, mouse genetics, and organoid models to uncover mechanisms of neural communication, brain function, and behavior, offering insights into neurological disorders and therapeutic strategies through cutting-edge experimental and computational methods.	c) Fundamental Biological Mechanisms d) Translational and Clinical Medicine
Structural Biology	Involves the study of the 3D structures of biomolecules such as proteins, nucleic acids, and complexes to understand their function and interactions. It utilizes techniques like X-ray crystallography, cryo-electron microscopy (cryo-EM), mass-spectrometry and NMR spectroscopy to investigate how molecular structures influence biological processes, including enzyme activity, cellular signaling, and disease mechanisms.	a) Mass spectrometry b) Electron microscopy c) metabolomics d) protein chemistry