

Cardiovascular and Lymphatic Biology Track

(To Replace the Cardiovascular
Science Track)

Cardiovascular and Lymphatic Biology Track Overview and Course Curriculum

I. Overall Philosophy of the Cardiovascular and Lymphatic Biology Graduate Program

A. Overview:

The Cardiovascular and Lymphatic Biology (CLB) Track includes over 40 faculty with diverse expertise related to cardiovascular and lymphatic biology and medicine, ranging from cellular biology at the nanoscale to functional biology and pathobiology, using molecular, cellular, tissue and whole-animal models. This diversity provides the student with excellent exposure to a wide variety of contemporary topics in current biomedical scientific research in the cardiovascular field. Hence, a student working in this environment will be well positioned to successfully network with other basic and clinical scientists in biomedical cardiovascular research. Importantly, an outstanding group of faculty, basic and clinical scientists, and staff will interact with students to provide a professional “family” and community environment, critical for preparing graduate students for a successful future career.

B. Goals of the Cardiovascular Science Track Graduate Program:

In the post-genomic era, two major trends have revolutionized medical research in the cardiovascular field. First, traditional medical disciplines of physiology, anatomy, biochemistry, pharmacology and pathology have become more integrated with other fields, including bioengineering, instrumentation, and computer technology, creating a more holistic approach to complex problems in cardiovascular biology and medicine. Second, remarkable advances in molecular and cell biology have exponentially increased the ability of medical researchers to move knowledge of gene and protein functions from the bench to the clinical bedside. The Cardiovascular and Lymphatic Biology Track provides graduate students with the knowledge and tools to investigate human biology and cardiovascular/lymphatic disease at the leading edge of medical research.

The Cardiovascular and Lymphatic Biology Track is built on the following course sequences: 1) basic cardiovascular science, beginning with the basic structure and function of cardiovascular cells, and progressing to integrated physiology of the heart and vasculature within the intact cardiovascular system; 2) pathophysiological mechanisms underlying cardiovascular and lymphatic disease processes and therapeutic strategies; 3) modern methods and techniques used to probe normal and abnormal cardiovascular and lymphatic function at the molecular, cellular, tissue, organ and whole body levels; and 4) computational systems analyses (e.g., biostatistics) involved in biomedical research. This challenging graduate program prepares trainees to investigate a broad range of problems in modern medical cardiovascular research.

II. Cardiovascular and Lymphatic Biology Track Graduate Curriculum

While the curriculum is presented as a four-year schedule, actual time to completion of the doctoral degree is variable and dependent on other factors, including research progress, selection of electives, and other advisory committee recommendations individualized to address the strengths and weaknesses of each student.

NOTE: “*” Denotes a required CLB track course

FALL YEAR 1

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 601	Current Topics in Advanced Cell Biology I*	5	5
MPHY 601	Experimental Techniques in Cell and Molecular Biology*	4	4
SGSI 601	Responsible Conduct in Research*	1	1
	Lab Rotation I & II		
	Semester Hours	10	10
	Cumulative Hours	10	10

SPRING YEAR 1

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MPHY 631	Cardiovascular Science*	4	4
MSCI 612	Elective (e.g., Current Topics in Cell Signaling)	3-4	3-4
MSCI 691	Research	1-2	0
	Lab Rotation III & IV		
	Semester Hours	9	7-8
	Cumulative Hours	19	17-18

SUMMER YEAR 1

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 681	Seminar*	1	0
MSCI 691	Research	5	0
	Semester Hours	6	0
	Cumulative Hours	25	17-18

FALL YEAR 2

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MPHY 632	Cardiovascular Pathobiology*	4	4
MPHY 624	Biostatistics*	2	2
MSCI or MPHY	Elective (e.g., Advanced Techniques in CV Research) variable		variable
	Semester Hours	9	7-9
	Cumulative Hours	34	24-27

SPRING YEAR 2

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI or MPHY	Elective (e.g., The Lymphatic System)	3	3
MSCI or MPHY	Elective	3	3
MSCI 691	Research	3	0
	Semester Hours	9	6
	Cumulative Hours	43	30-33

SUMMER YEAR 2

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 681	Seminar*	1	0
MSCI 691	Research	5	0
	Semester Hours	6	0
	Cumulative Hours	49	30-33

FALL YEAR 3

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 691	Research	9	0
	Semester Hours	9	0
	Cumulative Hours	58	30-33

SPRING YEAR 3

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 691	Research	9	0
	Semester Hours	9	0
	Cumulative Hours	67	30-33

SUMMER YEAR 3

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 681	Seminar*	1	0
MSCI 691	Research	5	0
	Semester Hours	6	0
	Cumulative Hours	73	30-33

FALL YEAR 4

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 691	Research	9	0
	Semester Hours	9	0
	Cumulative Hours	82	30-33

SPRING YEAR 4

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 691	Research	9	0
	Semester Hours	9	0
	Cumulative Hours	91	30-33

SUMMER YEAR 4

<u>Course #</u>	<u>Course Name</u>	<u>Credit Hours</u>	<u>Graded Hours</u>
MSCI 691	Research	5	
MSCI 681	Seminar	1	0
	Semester Hours	6	0
	Cumulative Hours	97	30-33

PREFERRED CARDIOVASCULAR SCIENCE TRACK ELECTIVE COURSES

<u>Course #</u>	<u>Course Name</u>	<u>Credit/Graded Hours</u>
MPHY 633	Advanced Techniques in Cardiovascular Research	variable (1-2)
MPHY 634	The Lymphatic System	3
MSCI 612	Current Topics in Cell Signaling	3

OTHER POTENTIAL ELECTIVE COURSES

<u>Course #</u>	<u>Course Name</u>	<u>Credit/Graded Hours</u>
ANSC / VTPP 654	Molecular Endocrinology	3
BCD 5306	General Biochemistry	2
BCD 5307	Cellular and Molecular Biology	2
BCD 5222	Applied Biostatistics	2

BCD 5324	Advanced Biostatistics	2
BICH 601	Fundamentals of Biochemistry I	3
BICH 602	Fundamentals of Biochemistry II	3
BICH 603	General Biochemistry I	3
BICH 605	Methods of Biochemical Analysis	3
BICH 624	Enzymes, Proteins, and Nucleic Acids	3
BICH 625	Nucleic Acid-Protein Interactions	1
BICH 628	Computational Biology	3
BICH 631	Biochemical Genetics	3
BICH/BIOL 650	Genomics	3
BICH 654	Structural Biochemistry	3
BICH 655	Crystallography Methods	3
BICH 664	Fluorescence Spectroscopy	1
BICH 672	Biological Membranes	1
BIOL 601	Biological Clocks	3
BIOL 611	Molecular Biology of Differentiation/Development	3
BIOL 634	Comparative Neurobiology	3
BIOL 644	Neural Development	3
BIOL 651	Bioinformatics	3
BIOL 670	The Cell Cycle	1
BIOL 674	Cellular & Molecular Aspects of Development	3
BMEN 601	Foundations of Biomedical Engineering Analysis	3
BMEN 602	Instrumentation and Measurement in Biomedical Systems	4
BMEN 603	Information Processing in Biomedical Engineering	4
BMEN 605	Virtual Instrumentation Design for Medical Systems	3
BMEN 608	Optical Diagnostic and Monitoring Principles	3
BMEN 609	Optical Therapeutic and Interventional Principles	3
BMEN 611	Biomedical Imaging Systems	3
BMEN 614	Modeling of Biomedical Systems	3
BMEN 620	Bio-Optical Imaging	3
BMEN 621	Microscale Bio-Optical Applications	3
BMEN 624	Biomedical Sensing and Imaging at the Nanoscale	3
BMEN 631	Thermodynamics of Biomolecular Systems	3
BMEN 632	Molecular and Cellular Biomechanics	3
BMEN 638	Control Mechanisms in Living Systems	3
BMEN 660	Vascular Mechanics	3
BMEN 661	Cardiac Mechanics	3
BMEN 662	Vascular Fluid Mechanics	3
BMEN 663	Soft Tissue Mechanics and Finite Element Methods	3
BMEN 680	Biomedical Engineering of Tissues	3
BMEN 689	Computational Biomechanics	3
ELEN 601	Linear Network Analysis	3
ELEN 645	Pattern Recognition by Neural Networks	3
ELEN 646	Statistical Communication Theory	3
ELEN 649	Pattern Recognition	3
KINE 627	Exercise Biomechanics	3
KINE 637	Exercise Physiology I	3
KINE 638	Exercise Physiology II	3
MATH 611	Introduction to Ordinary and Partial Differential Equations	3
MATH 614	Dynamical Systems and Chaos	3
MCMD 625	Nucleic Acid / Protein Interactions	1
MCMD 671	Macromolecular Folding / Design	3
MMPA 601	Microbial Pathogenesis of Human Disease	3
MMPA 602	Immunoregulation	3
MMPA 665	Viral Vectors and Gene Therapy	3
MSCI 610	Pathogenesis of Human Disease	1-4
MSCI 612	Current Topics in Cell Signaling	3
NEXT 601	Advanced Neurosciences	2
NEXT 603	Neuropharmacology	4

NEXT 685	Non-Coding RNAs	3
NEXT 685	Stem Cells in Biology	3
NUTR 641	Nutritional Biochemistry I	3
NUTR 642	Nutritional Biochemistry II	3
SRPH 640	Public Health Informatics	3
STAT 601	Statistical Analysis	4
STAT 602	Statistical Methods of Regression Analysis	3
STAT 604	Special Problems in Statistical Computations and Analysis	3
STAT 605	Advanced Topics in Computational Statistics	3
STAT 606	Design of Experiments	3
STAT 607	Sampling	3
STAT 608	Regression Analysis	3
STAT 609	Order Statistics and Non-Parametric Methods	3
STAT 615	Stochastic Processes	3
STAT 615	Application of Stochastic Processes to the Natural Sciences	3
STAT 626	Methods in Time Series Analysis	3
VIBS 606	Neuroanatomical Systems	3
VIBS 640	Neurobiology	1-5
VIBS 670	Basic Environmental Toxicology	3
VTMI 601	Fundamentals of Pathobiology	5
VTMI 649	Immunology	3
VTPP 625	Pharmacology	3