



CELL BIOLOGY, IMMUNOLOGY & MICROBIOLOGY
GRADUATE PROGRAM
HANDBOOK
2016-2017

1. Description of the Cell Biology, Immunology & Microbiology Graduate Program

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Graduate Faculty: Allen; Berg; Borejdo; Cheng; Clark; Fudala; Ghorpade, I. Gryczynski; Z. Gryczynski; He; Hodge; Jones; Krishnamoorthy; Mao; P. Mathew; S. Mathew; McDowell; Millar; Mummert; Park; Simecka; Su; Timani; Zode

Cell biology is the branch of biology that focuses on the study of cells, especially their formation, structure, components, and function. Immunology is the study of the defense mechanisms of the host against infectious diseases, cancers and other diseases. Microbiology is the study of microscopic forms of life, including bacteria, viruses, protozoans, and fungi. The disciplines of cell biology, immunology, and microbiology are uniquely intertwined and rely on cutting-edge techniques to answer questions related to multiple diseases. Gaining a thorough understanding of the molecular and cellular mechanisms used by the body to combat infectious diseases and other pathologies can result in the development of therapeutic approaches to prevent and cure these diseases.

Specific research interests of the cell biology, immunology, and microbiology faculty include neuroinflammation; HIV-1 biology; fluorescence spectroscopy and imaging; regulation of eukaryotic gene expression; T cell and NK cell biology; host response to infections; molecular immunology; tumor immunology; cytokine biology; vision research; and molecular diagnostics for emerging vector borne pathogens. Faculty programs are funded by multiple sources including the federal government, state government, and private foundations.

Students may enter the program with a variety of academic backgrounds, providing that they have fulfilled prerequisite courses. The graduate training program involves core courses that integrate key concepts of biochemistry, cell biology, molecular biology, genetics, physiology, pharmacology, immunology, microbiology, and cell biology, as well as advanced courses in selected topics. Students participate in seminars and discussion of current research and receive extensive training in techniques of contemporary microbiology, molecular biology, cell biology, and immunology. Students perform original, publishable research and present their research findings at national scientific meetings. In addition, students are required to present their research at the annual UNTHSC Research Appreciation Day (RAD) and during the weekly departmental Works in Progress (WIPs) presentations. Approximately two years are required to complete the Master of Science degree, while the Doctor of Philosophy degree is normally completed in approximately five years.

Graduates with advanced degrees typically find employment in higher education, industry and government agencies.

1.2. Graduate Faculty and Specific Research Programs

Michael Allen, Ph.D.

Associate Professor, Institute for Molecular Medicine

Our research focuses on understanding the ecological principles and factors that underlie microbial community dynamics in living and engineered systems, the mechanisms bacteria use for sensing changes in their environment, and the global genetic regulatory systems involved in adaptation. Specific areas of interest include: the microbiomes of ticks and other vectors and how these influence disease transmission, methods to manipulate microbial community composition, genetically engineered microbes as therapeutic treatments, lung microbiomes and disease resistance, and applications of microbial community analysis in forensics.

Rance Berg, Ph.D.

Associate Professor and Graduate Advisor, Institute for Molecular Medicine

My laboratory has a long-standing interest in understanding the cellular and molecular aspects of immune responses against pathogenic microorganisms. Specifically, the gram-positive bacterium, *Listeria monocytogenes*, is utilized to dissect the roles of T cells, NK cells, NK-T cells, dendritic cells, monocytes, neutrophils, and macrophages during the innate and adaptive immune responses to this pathogen. Elucidating the proliferative capacity, cytokine/chemokine secreting potential, localization, and ultimate fate of these and other immune effector cells allows us to understand how the immune system coordinately responds to, and controls, pathogens. We are also actively studying how cytokine/chemokine networks, oxidative stress, and enzymes that regulate the production of reactive oxygen and nitrogen species modulate immune responses and clearance of pathogens.

Julian Borejdo, Ph.D.

Professor, Institute for Molecular Medicine

My long-term goal is to understand how muscle works. Since mechanism of contraction of muscles (skeletal, smooth & cardiac) and of movement of non-muscle cells is based on the same principle this work is likely to have an impact on understanding the general principles of cell motility. I measure kinetics of rotations of few molecules of myosin in muscle. Muscle contraction results from interactions of myosin subfragment-1 (S1, cross-bridge) with actin. S1 consists of the N-terminal catalytic domain and the C-terminal regulatory domain. It is believed that the swing of the regulatory domain is caused by a specific event during the ATPase cycle of a cross-bridge. Thus measuring orientation of cross-bridges in muscle is a key to understanding the molecular mechanism of muscle contraction. Ideally, orientation should be measured from a single molecule to avoid averaging signal from large assembly of myosins. The introduction of extremely small observational volumes defined by diffraction-limited laser beams and confocal detection made it possible to limit the number of observed molecules and eliminate much of the background. I have used confocal microscope to measure anisotropy of small number cross-bridges in muscle. Recently, my interest focused mainly on the question of the possible differences between cardiac muscle of the left and right ventricles, and the effect cardiac hypertrophy-causing mutations (such as R21C mutation in Troponin I) on the function of the ventricles.

YiQiang (Eric) Cheng, Ph.D.

Professor, Pharmaceutical Sciences

Dr. Cheng's research interest centers on drug discovery and development based on microbial

natural products. His group applies the knowledge and methodology of microbiology, genetics, biochemistry, natural product chemistry and synthetic biology to discover bioactive natural products from underrepresented microbial species, to decipher the mechanisms by which interested natural products are biosynthesized by microorganisms, and to engineer natural product biosynthetic pathways to produce more abundant and more desirable drugs or drug leads. To these ends, his group has so far decoded five natural product biosynthesis pathways, discovered eight potent histone deacetylase inhibitors and six spliceosome inhibitors. Several of those compounds are at varying stages of in vitro and in vivo studies as anticancer drug candidates. Members of his group gain broad training in microbiology, molecular biology, biochemistry and natural product chemistry, which better prepares them for seeking career opportunity in both academia and pharmaceutical and biotechnology industry.

Abe Clark, Ph.D.

Professor and Institute Director, North Texas Eye Research Institute

Dr. Clark's research interests are focused on understanding the biochemical, cellular and molecular mechanisms involved in the pathobiology of glaucoma and other ocular diseases. His research focuses on the trabecular meshwork, optic nerve head, and retinal ganglion cells. His collaborates with laboratories throughout the US as well as internationally.

Rafal Fudala, Ph.D.

Instructor, Institute for Molecular Medicine

Dr Fudala in his current ongoing studies using fluorescence-based methods such as: laser confocal microscopy, fluorescence resonance energy transfer (FRET), fluorescence lifetime imaging microscopy (FLIM), and cellular imaging as well as polarization-based techniques. Recently, Dr Fudala's interests have expanded to include fluorescence-based methods in biology and cellular imaging, as well as biological/biophysical applications of new nanophotonics processes and single molecule studies in the biomedical and diagnostic fields, especially for early malignant melanoma detection.

Anuja Ghorpade, Ph.D.

Vice President for Research and Professor, Institute for Molecular Medicine

The long-standing interest of our research program is to delineate the role of glial inflammation in neurodegeneration, particularly in the context of HIV/AIDS, stroke and other neurodegenerative disorders. The burden of HIV infection on the world population is astounding. Despite effective antiretroviral therapy, more than half of the HIV+ patients have some sort of neurological manifestation. In the post-antiretroviral therapy era, patients with HIV-1 infection are living longer and have an increased risk for developing neurocognitive decline. The evidence for astrocytes playing an important role in neural health and disease conditions continues to grow. Our laboratory investigates two main themes that pertain to glial responses in disease. One line of investigation is focused on the alterations in protective functions of astrocytes while the other investigates activation of pathways deleterious to neural health. We currently have several individual projects related to these themes. These pertain to regulation of matrix metalloproteinases and their tissue inhibitors, CXCL8 regulation in neuro-AIDS, combined injury of methamphetamine and HIV-1, glutamate imbalance in AIDS brain tissues and function of astrocyte elevated gene-1 in reactive astrogliosis and inflammation. We are also developing novel nanomedicine-based therapeutic approaches in translational research projects for HIV/AIDS and stroke therapy.

Ignacy Gryczynski, Ph.D.

Professor, Institute for Molecular Medicine

Fluorescence spectroscopy and microscopy progressed recently towards a nanotechnology. The technological advances in optics, computers, surface science and engineering made possible single molecule detection and overcome the diffraction limit. Dr. Gryczynski's research focuses on fluorescence enhancements near metallic surfaces and particles. The enhanced fluorescence is being applied to sensing devices and bioassays. He also co-manages the time-resolved fluorescence laboratory. This laboratory carries basic spectroscopy research and is open to the needs of researchers.

Zygmunt Gryczynski, Ph.D.

Professor, Institute for Molecular Medicine

The activities of the Center for Fluorescence Technologies and Nanomedicine (CFTN) are focused on applications of fluorescence spectroscopy and nanotechnology to study various biological systems using time-resolved fluorescence, anisotropy, and FRET. The main areas of CFTN are development of new technological approaches to fluorescence based detection and imaging; development of novel fluorescent probes to study molecular interactions and dynamics on molecular and cellular levels; nanotechnology enabled plasmonic effects induced by light and excited fluorophore in metallic nanostructures; surface plasmons coupled emission (SPCE) phenomena for biomedical and diagnostics application (biophotonics).

Johnny He, Ph.D.

Associate Dean, Graduate School of Biomedical Sciences and Professor, Institute for Molecular Medicine

Dr. He's research focuses on the molecular biology of host-virus interactions. His long-term goal is to understand how human cells interact with HIV/HCV viruses and to develop therapeutic strategies specifically targeted at these interactions. On basic studies, Dr. He is interested in determining what cells are infected by HIV/HCV, how these cells are infected by HIV/HCV, what host factors are needed to support virus replication, and how these infections alone or in combination ultimately lead to diseases. On translational studies, Dr. He is interested in development of therapeutics that is able to attack the viruses and/or prevent the diseases. Dr. He has been collaborating with investigators in countries such as China with limited resources but rapidly increased HIV infected population to determine how viral, host and socio-economical factors affect the nature and prevalence of HIV/HCV-associated diseases and their treatment. He has made several extremely novel observations including identification of the human mannose receptor as the HIV receptor for infection of CD4 negative astrocytes and elucidation of the mechanisms by which HIV-1 Tat protein leads to neurotoxicity. His development of the HIV Tat transgenic mouse model has allowed numerous research laboratories across the world to make advances in HIV neuropathogenesis research. In addition, Dr. He has been a leader in studying the interactions between HIV and Hepatitis C virus and has developed important collaborations in China to study the impact of these diseases on public health.

Lisa Hodge, Ph.D.

Associate Professor, Institute for Cardiovascular and Metabolic Diseases

Our long- range research goal is to evaluate the effectiveness of osteopathic manipulative techniques (OMT) at modulating the immune response against a variety of infectious and inflammatory diseases. Clinical studies support the application of OMT for the treatment of infection, edema, neuromuscular dysfunction, and pain, but experimental support for their use is sparse and the mechanisms involved are not well understood. Currently, we are examining

the mechanisms by which OMT influences lymphatics, inflammation, and lymphocyte migration during pneumonia, cancer and following tissue injury. In addition, we develop animal models to study the mechanisms by which alternative medicine therapies augment the lymphatic and immune systems in both healthy and diseased states.

Harlan Jones, Ph.D.

Assistant Professor, Institute for Molecular Medicine

There is increasing evidence that psychological stress is an important risk factor in the initiation and progression of chronic disease (e.g. cancer, atherosclerosis and chronic infectious disease). My research interest include the investigation of how stress affects host immune mediation of chronic disease states with the intention of facilitating comprehensive therapeutic approaches against stress-induced disease pathogenesis.

Raghu Krishnamoorthy, Ph.D.

Assistant Professor, North Texas Eye Research Institute

The major research emphasis is on understanding biochemical and molecular mechanisms underlying the etiology of glaucoma. Specific research interests are to understand the regulation of expression of the vasoactive active peptides, endothelins, and their receptors, which are thought to contribute to glaucomatous optic neuropathy. The long-term goals are to provide treatment modalities that block inappropriate expression of endothelin receptors in ocular tissues.

Weiming Mao, Ph.D.

Assistant Professor, North Texas Eye Research Institute

I am interested in Glaucoma, a leading cause of blindness worldwide. I use cell biology, molecular biology, and immunohistochemistry techniques as well as cell culture, eye perfusion culture and mouse models to study the mechanism and potential therapeutic strategy of this disease. My research areas include glucocorticoid responsiveness, cell signaling pathways, as well as cytoskeletal reorganization in the trabecular meshwork.

Porunelloor Mathew, Ph.D.

Associate Professor, Institute for Molecular Medicine

My laboratory focuses on the area of Cancer Immunology, specifically the molecular mechanisms by which Natural Killer (NK) cells recognize and eliminate cancer cells. NK cells are a subpopulation of lymphocytes that play an important role against cancer and various viral and bacterial infections. NK cell functions are controlled by a balance between positive and negative signals through various receptors. In order to understand the molecular basis of tumor cell recognition by NK cells, we identified, cloned and characterized three novel receptors expressed on NK cells. One of the receptors, 2B4 (CD244), is a member of the immunoglobulin superfamily and is involved in killing cancer cells and virus-infected cells by NK cells. By generating 2B4 gene knockout mice, our group explored the *in vivo* role of 2B4 in the immune system. Defective signaling via 2B4 contributes to X-linked lymphoproliferative disease (XLP) in humans. Dr. Mathew also identified two other novel receptors called LLT1 and CS1 (CD319) that play a role in killing of cancer cells by NK cells. Recently it has been reported that CS1 is overexpressed in multiple myeloma and a humanized monoclonal antibody against CS1 (HuLuc63 or Elotuzumab) is in clinical trial for multiple myeloma. Dr. Mathew's research has opened new NK cell based targeted immunotherapy for cancer. We are also investigating the role of 2B4 and CS1 in autoimmune disease. Current research focuses on the role of LLT1 receptor in immune escape by breast cancer and prostate

cancer.

Stephen Mathew, Ph.D.

Assistant Professor, Institute for Molecular Medicine

My research focuses on developing molecular immunological strategies against diseases like cancer with special emphasis on childhood leukemia, HIV-AIDS and lupus. Specifically, our objective is to unravel the molecular basis of tumor cell recognition by NK cells and its multiple receptor ligand interactions and their role in other diseases like lupus and HIV infection. Current research focuses on the role of immune receptors in pediatric acute lymphoblastic leukemia (ALL).

Colleen McDowell, Ph.D.

Research Assistant Professor, North Texas Eye Research Institute

My research focus is aimed at studying the genetic disease primary open-angle glaucoma (POAG). I am using human glaucoma relevant transgene expression (e.g. MYOC, TGF β 2) in the anterior segment of mouse eyes to elevate IOP and cause glaucomatous retinopathy and axonopathy in mice. I am also utilizing human trabecular meshwork cells in culture as well as *in vivo* mouse models, to study the molecular pathways involved in the pathophysiology of ocular hypertension.

Cameron Millar, Ph.D.

Research Assistant Professor, North Texas Eye Research Institute

My major research interests focus around primary open-angle glaucoma (POAG), a heterogeneous group of potentially blinding optic neuropathies that share characteristic pathognomonic changes to the optic disk and visual field of the eye. In recent years I have focused on the mouse as a model for the study of this disease. My current interests include (in the mouse): Measurement of intraocular pressure (IOP). The study of aqueous humor dynamics, and age and strain effects on the same. Creation of induced models of POAG via over-expression of POAG-associated transgenes (for example; sFRP₁, SAA, MYOC.Y437H, Gremlin, hTGF β ₂^{226/228}) using viral vectors based on adenovirus (Ad), adeno-associated virus (AAV), and lentivirus (FIV and HIV). Expression of viral-vector transfected fluorescent reporter genes to assess locus of expression (e.g. GFP, eGFP, copGFP) via fluorescence detection both *in vivo* and in fixed sections of ocular tissue. Creation of induced models of POAG via daily topical treatment with dexamethasone. Creation of transgenic (Tg) models of POAG (for example, TgMYOC.Y437H). Models of retinal ganglion cell (RGC) degeneration achieved via retinal ischemia/reperfusion (I/R) and optic nerve crush (ONC). Imaging of retinal tissues via Spectral Domain-Ocular Coherence Tomography (SD-OCT). Assessment of visual acuity via assessment of the optomotor response. Assessment of the electroretinogram (ERG). Ocular examination (slit lamp examination, direct ophthalmoscopy, gonioscopy).

Mark Mummert, Ph.D.

Associate Professor, Institute for Molecular Medicine

The major goal of our laboratory is to understand the biological functions of hyaluronan in innate and adaptive immune responses. Hyaluronan, a glycosaminoglycan composed of glucuronic acid and N-acetylglucosamine subunits is expressed in pericellular and extracellular matrices. We have found that hyaluronan plays an import role in the migration of epidermal dendritic cells to the lymph nodes in models of contact hypersensitivity. We have also shown that hyaluronan plays a key role in the proliferation of T cells in antigen restricted dendritic cell presentation, allogeneic stimulation and mitogenic stimulation. Our current research is

aimed at determining the hyaluronan receptors involved in these processes and the hyaluronan mediated pathways regulating cell proliferation.

In-Woo Park, Ph.D.

Associate Professor, Institute for Molecular Medicine

Dr. Park's research focuses on two main topics. The first is HIV-1-mediated aggravation of liver disease in HCV virus coinfectees. While this basic phenomenon is well documented, the laboratory now wishes to unravel the specific mechanisms by which HIV-1 augments HCV replication in accelerating hepatic malady. The second topic, which is critical to AIDS pathobiology, is the HIV-1-triggered virus/cell protein degradation that occurs at all phases, from virus entry to progeny virion release. The laboratory is currently applying a range of molecular studies to identify and evaluate the coordinate viral/host determinants that orchestrate protein fates.

Jerry Simecka, Ph.D.

Professor, Pharmaceutical Sciences

The major goal of our laboratory is to understand the immune mechanisms involved in respiratory diseases. Immune responses along the respiratory tract have both beneficial and detrimental effects. Immune responses can protect against infectious disease by preventing infection or by eliminating disease causing bacteria or viruses. However, in some cases, the immune response can contribute to the problem. This is the case for infectious diseases and asthma. We are taking advantage of a murine model of respiratory pneumonia caused by mycoplasma to study the generation of immunity that leads to either protection or more severe disease. Mycoplasmas are major causes of pneumonia in man and animals. The immune response against a mycoplasma infection has both beneficial and detrimental effects. We have shown that immune responses, through the activity of T cells, clearly promote the development of inflammatory reactions leading to severe mycoplasma lung disease. However, immune responses can also prevent disease and ensures that the infection remains localized to the lung. Our work is focusing on the role of T cell populations, antigen presenting cell populations and cytokine networks in determining the impact of immunity in mycoplasma disease.

Dong-Ming Su, Ph.D.

Professor, Institute for Molecular Medicine

The goal of Dr. Su's research is to provide mechanistic insights into rejuvenating aged poor and harmful T-cell immunity, focusing on establishment and maintenance of thymic microenvironment, using cellular and molecular approaches. The lab particular strengths include using and generating genetically engineered mouse models in understanding genetic and epigenetic regulation of T cells, thymic epithelial cells, and immune system microenvironment development-associated immunodeficiency and aging-associated chronic inflammation. The lab has several well-designed research projects with unique animal models, reagents, and knowledge necessary. In addition, with on-campus and interuniversity collaboration, Dr. Su's research is also involved in studies on utility of bone marrow mesenchymal stem cells in rejuvenation of neurodegeneration, as well as tumor dormancy in the thymus as a tumor cell reservoir.

Khalid Timani, Ph.D.

Research Assistant Professor, Institute for Molecular Medicine

Dr. Timani's research focuses on elucidation of the role of Tip110/SART3 in regulation of cancer progression. Function of Tip110 is multifarious, ranging from modulation of tumor

antigenicity, regulation of gene transcription, splicing of pre-mRNA, to development of embryo. We demonstrated that Tip110/SART3 protein interacts with and/or regulates several transcription factors such as p53, c-Myc and YB-1, which are important for regulation of cancer progression. We also reported that USP15, an oncogenic protein, regulates UPS-mediated Tip110 protein degradation. Based on these findings, we employ multifaceted experimental approaches, using animal models, to investigate molecular mechanisms and biological significance of Tip110-mediated regulation of oncogenic proteins with respect to cancer development.

Gulab Zode, Ph.D.

Assistant Professor, North Texas Eye Research Institute

My research focus is to understand the pathological molecular mechanisms of glaucoma, a leading cause of irreversible blindness worldwide and to develop therapeutic targets based on the understanding of these mechanisms. Recently, we have demonstrated the pathological role of protein misfolding and endoplasmic reticulum (ER) stress in glaucomatous trabecular meshwork and elevation of intraocular pressure (Zode et al., 2011 and 2014). Main current projects in my laboratory are: 1) Gene therapy: Using shRNA or CRISPR mediated knock down of mutant myocilin or ER stress pathway genes to rescue glaucoma in our mouse models. 2) Protein misfolding and ER stress in glaucoma: Further studying how mutant myocilin causes ER stress and manipulation of these pathways for treatment. 3) Studying the pathological role of ER-stress induced pro-apoptotic transcriptional factor Chop in TM cell death and IOP elevation and 4) Studying the role of autophagy and phagocytosis of trabecular meshwork cells.

2. Course Offerings

2.1. Core Courses

Cell Biology, Immunology & Microbiology students are required to take the following BMSC core courses and CBIM core courses:

BMSC 5160 – Biomedical Ethics

BMSC 5315 – Principles of Scientific Communication

BMSC 6100 – Scientific Communication Competencies

BMSC 6200 – Experimental Design and Biostatistics

BMSC 6201 – Fundamentals of Biomedical Science 1

BMSC 6202 – Fundamentals of Biomedical Science 2

BMSC 6203 – Fundamentals of Biomedical Science 3

BMSC 6204 – Fundamentals of Biomedical Science 4

CBIM 6204 – Fundamentals of Immunology

CBIM 6206 – Fundamentals of Microbiology

CBIM 6203 – Advanced Cell Biology

A student who receives a “C” or “F” in one of the discipline-specific required courses (CBIM 6203, CBIM 6204, or CBIM 6206) will be allowed to self-remediate the course and still take the oral qualifying exam in the summer of year 1 or the fall of year 2. A student who receives two or more “C’s” or “F’s” in the discipline-specific required courses must retake those courses in their entirety the following year. If they receive “A’s” and/or “B’s” upon retaking the courses, they will be allowed to take the oral qualifying exam.

2.2. Advanced Courses and Technique Courses (4-6 SCH for M.S. students and 8-10 SCH for Ph.D. students) from the following:

CBIM 5150 Introduction to Flow Cytometry (1 SCH)

Offered every summer

CBIM 5201 Bioimaging (2 SCH)

Offered every fall and spring

CBIM 5202 Introduction to Confocal Microscopy (2 SCH)

Offered every fall and spring

NTER 5400 Histology (2 SCH)

Offered every fall

CBIM 6101 Principles of Super Resolution Microscopy (2 SCH)

Offered every fall

CBIM 6201 Immune Responses Against Pathogenic Microorganisms (2 SCH)

Offered every other fall (even years)

CBIM 6202 Advanced Molecular Biology: Techniques and Principles (2 SCH)

Offered every other fall (odd years)

CBIM 6205 Fundamentals of Virology (2 SCH)

Offered every fall (odd years)

CBIM 6207 Animal Models of Immunological Diseases (2 SCH)

Offered every spring

CBIM 6210 Practical Fluorescence for Biomedical Science (2 SCH)

Offered every fall

CBIM 6220 Cellular and Molecular Fluorescence (2 SCH)

	Offered every fall
CBIM 6230	Practical Laser Capture Microdissection (1 SCH)
	Offered every fall
CBIM 6355	Clinical Immunology (3 SCH)
	Offered every spring
CBIM 6360	Advanced Biophysical and Biochemical Methods (3 SCH)
	Offered every other spring (odd years)
MOMG 5500	Emerging Role of the Microbiome in Health and Disease (2 SCH)
	Offered every other spring (even years)
MOMG 6250	Molecular and Cell Biology of Cancer (2 SCH)
	Offered every spring
MOMG 6435	Molecular Aspects of Cell Signaling (4 SCH)
	Offered every other fall (odd years)
NTER 5200	Introduction to Bioinformatics (2 SCH)
	Offered every summer
NTER 6440	Methods in Molecular Biology (4 SCH)
	Offered every summer

2.3. Journal Clubs

- CBIM 5122 Current Topics in Immunology
- CBIM 6141 Current Topics in Cell Biology
- CBIM 5121 Seminar in Cell Motility

2.4. Seminar in Current Topics (CBIM 5140)

Department of Cell Biology & Immunology Thursday seminar series and discussion of seminar.

2.5. Degree Plan

M.S. Degree Plan for Cell Biology, Immunology & Microbiology

Year 1: Fall

BMSC 6200 Experimental Design and Biostatistics	2 SCH
BMSC 6201 Fundamentals of Biomedical Science 1	2 SCH
BMSC 6202 Fundamentals of Biomedical Science 2	2 SCH
BMSC 6203 Fundamentals of Biomedical Science 3	2 SCH
BMSC 6204 Fundamentals of Biomedical Science 4	2 SCH
BMSC 5150 Lab Rotations (2)	<u>2 SCH</u>
	12 SCH

Year 1: Spring

CBIM 6204 Fundamentals of Immunology	2 SCH
CBIM 6206 Fundamentals of Microbiology	2 SCH
CBIM 6203 Advanced Cell Biology	2 SCH
BMSC 5160 Biomedical Ethics	1 SCH
CBIM 5140 Seminar in Current Topics	1 SCH
BMSC 5315 Principles of Scientific Communications	2 SCH
BMSC 5998 Individual Research (or 1 additional lab rotation) Journal Club Course	1 SCH <u>1 SCH</u>
	12 SCH

Year 1: Summer

BMSC 6100 Scientific Communication Competencies	1 SCH
BMSC 5998 Individual Research	0-5 SCH
Advanced and/or Technique Courses	<u>0-5 SCH</u>
	6 SCH

Year 2: Fall

BMSC 5998 Individual Research	4-8 SCH
CBIM 5140 Seminar in Current Topics	1 SCH
Advanced and/or Technique Courses	2-6 SCH
Journal Club Course	<u>1 SCH</u>
	12 SCH

Year 2: Spring

BMSC 5395 Thesis	6-7 SCH
Advanced and/or Technique Courses	<u>2-3 SCH</u>
	9 SCH

TOTAL

51 SCH

Ph.D. Degree Plan for Cell Biology, Immunology & Microbiology

Year 1: Fall

BMSC 6200	Experimental Design and Biostatistics	2 SCH
BMSC 6201	Fundamentals of Biomedical Science 1	2 SCH
BMSC 6202	Fundamentals of Biomedical Science 2	2 SCH
BMSC 6203	Fundamentals of Biomedical Science 3	2 SCH
BMSC 6204	Fundamentals of Biomedical Science 4	2 SCH
BMSC 5150	Lab Rotations (2)	<u>2 SCH</u>
		12 SCH

Year 1: Spring

CBIM 6204	Fundamentals of Immunology	2 SCH
CBIM 6206	Fundamentals of Microbiology	2 SCH
CBIM 6203	Advanced Cell Biology	2 SCH
BMSC 5160	Biomedical Ethics	1 SCH
CBIM 5140	Seminar in Current Topics	1 SCH
BMSC 5315	Principles of Scientific Communications	2 SCH
BMSC 6998	Individual Research (or 1 additional lab rotation) Journal Club Course	1 SCH <u>1 SCH</u>
		12 SCH

Year 1: Summer

BMSC 6100	Scientific Communication Competencies	1 SCH
BMSC 6998	Individual Research	0-4 SCH
Advanced and/or Technique Courses		0-4 SCH
Qualifying exam		<u>0 SCH</u>
		6 SCH

Year 2: Fall

BMSC 6998	Individual Research	4-8 SCH
CBIM 5140	Seminar in Current Topics	1 SCH
	Advanced and/or Technique Courses	2-6 SCH
	Journal Club Course	1 SCH
	Research Proposal	<u>0 SCH</u>
		12 SCH

Year 2: Spring

BMSC 6998	Individual Research	1-5 SCH
CBIM 5140	Seminar in Current Topics	1 SCH
	Advanced and/or Technique Courses	2-6 SCH
	Journal Club Course	<u>1 SCH</u>
		9 SCH

Year 2: Summer

BMSC 6998	Individual Research	5 SCH
BMSC 6100	Scientific Communication Competencies	<u>1 SCH</u>
		6 SCH

Year 3: Fall

CBIM 5140	Seminar in Current Topics	1 SCH
BMSC 6998	Individual Research	4-5 SCH
	Advanced and/or Technique Courses	2-3 SCH
	Journal Club Course	<u>1 SCH</u>
		9 SCH

<u>Year 3: Spring</u>		
BMSC 6998 Individual Research	5-6 SCH	
Advanced and/or Technique Courses	2-3 SCH	
Journal Club Course	<u>1 SCH</u>	
	9 SCH	
<u>Year 3: Summer</u>		
BMSC 6998 Individual Research	5 SCH	
BMSC 6100 Scientific Communication Competencies	<u>1 SCH</u>	
	6 SCH	
<u>Year 4: Fall</u>		
BMSC 6998 Individual Research	5-6 SCH	
Advanced and/or Technique Courses	2-3 SCH	
Journal Club Course	<u>1 SCH</u>	
	9 SCH	
<u>Year 4: Spring</u>		
BMSC 6998 Individual Research	8 SCH	
Journal Club Course	<u>1 SCH</u>	
	9 SCH	
<u>Year 4: Summer</u>		
BMSC 6395 Doctoral Dissertation	5 SCH	
BMSC 6100 Scientific Communication Competencies	<u>1 SCH</u>	
	6 SCH	
<u>Year 5: Fall</u>		
BMSC 6395 Doctoral Dissertation	<u>9 SCH</u>	
	9 SCH	
TOTAL		114 SCH

3. Advancement to Doctoral Candidacy

3.1. Qualifying Examination

The qualifying examination ensures that the doctoral student has mastered information needed to succeed as a Ph.D. in the fields of Cell Biology, Immunology, and Microbiology. A list of key topics, compiled by the Cell Biology, Immunology & Microbiology faculty, will be distributed to the student prior to the qualifying examination. The student is expected to become knowledgeable in each of these topics through their previous course work, reading of textbooks and scientific literature, and discussion with faculty members.

The qualifying examination is administered by a committee comprised of members of the Cell Biology, Immunology & Microbiology graduate faculty and the student's university member. The student's major professor may attend the qualifying examination, may ask questions, but may not be present during the voting or cast a vote. The qualifying examination will be administered in the summer of year 1 or the Fall of year 2. Two attempts to successfully pass the qualifying examination are allowed. Failure of the student to pass the qualifying examination results in dismissal of the student from the doctoral program. A doctoral student who does not pass may be allowed to complete the requirements for a Master of Science degree. It is the responsibility of the student to obtain signatures from the examination committee chair, graduate advisor, university member, and department chairman upon completion of the exam. The appropriate form may be obtained from the Graduate School website.

Research Proposal

The research proposal is an outline of the dissertation project. It must include a summary of the proposed project, the hypothesis to be investigated, significance of the project, research design and methodology to be used, and a review of the salient literature that supports or opposes the hypothesis and potential limitations. To take advantage of the advisory committee's expertise and advice, and to clearly define the project and the committee's expectations, it is imperative that the student meets with his/her advisory committee before preparing the research proposal. The research proposal must be approved by the advisory committee and the dean prior to registering in Dissertation (BMSC 6395). Research Proposal Guidelines and the Research Proposal approval forms are available on the [GSBS Forms and Guidelines website](#).

Upon completion of the qualifying exam and the research proposal, a Ph.D. student will be advanced to candidacy.

4. Contact Information

Graduate Advisor:

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