INFECTION, IMMUNITY, AND INFLAMMATION — M.S., PH.D.

Program director
Ubaldo Soto

Associate program director
Mark Johnson

The core curriculum provides a broad background in molecular biology, immunology, and medical microbiology and infectious diseases. Advanced courses allow each student to fully develop an area of interest. Research strengths of the program include: signal transduction in bacteria, molecular genetics of virulence in bacteria, mechanisms of oxidative stress resistance, mechanisms of cell death, cellular and tumor immunology, normal and malignant immune cell development, autoimmunity, chaperonins and protein folding, mechanisms of posttranslational modification, and DNA restriction modification.

The thesis or research Master of Science degree provides training for individuals who will become technicians involved in biomedical research in universities or in the biotechnology industry, as well as medical technologists seeking specialized research training. The non-thesis Master of Science degree provides content appropriate for medical technologists preparing for the specialist in microbiology certification; for secondary teachers seeking advanced training in areas such as molecular biology, immunology, or microbiology; and for students seeking admission to professional schools, such as medicine or dentistry.

The Doctor of Philosophy degree is designed to prepare students for careers in independent research as well as teaching in a university, clinical, or biotechnology environment. Doctoral degree students are expected to develop creativity and independence in addition to technical skills.

Program learning outcomes

By the end of the program, the graduate should be able to:

1. Demonstrate a broad knowledge of the biomedical sciences.
2. Demonstrate subject mastery in molecular, cellular, and integrative aspects of microbiology and immunity/inflammation.
3. Interpret the current literature in microbiology and immunity/inflammation.
4. Make original contributions to the body of biomedical knowledge.
5. Exhibit the principles of scientific and professional ethics.
6. Demonstrate the process of applying for external funding.*

*This learning outcome is not applicable to M.S. degree students.

M.S. requirements

A minimum of 45 units is required for the M.S. degree, as detailed in the table below. Two options, a research track and a coursework track, are available. Students must maintain a G.P.A. of at least 3.0. Students must adhere to all University and program policies as published in the *Student Handbook*, University CATALOG, or "Student Guide." Policies and requirements are subject to change.

Basic science core		
IBGS 501	Biomedical Communication and Integrity	2
IBGS 502	Biomedical Information and Statistics	2
IBGS 511	Cellular Mechanisms and Integrated Systems I	6
IBGS 512	Cellular Mechanisms and Integrated Systems II	6
IBGS 522	Cellular Mechanisms and Integrated Systems II Journal Club	2
IBGS 523	Cellular Mechanisms and Integrated Systems III Journal Club	2
Seminars (all required)		
IBGS 604	Introduction to Integrative Biology Presentation Seminar	1
IBGS 605	Integrative Biology Presentation Seminar	1
IBGS 607	Integrated Biomedical Graduate Studies Seminar [1]	1
Religion		
REL_ ____	Graduate-level religion course (RELE, RELR, or RELT)	3
Program specific courses		
Choose from the following:		9
ANAT 548	Introductory Flow Cytometry [3]	
MICR 515	Introduction to Bioinformatics and Genomics	
MICR 521	Medical Microbiology [2]	
MICR 525	Journal Club III	
MICR 530	Basic Immunology [3]	
MICR 536	Virology	
MICR 540	Physiology and Molecular Genetics of Microbes [2]	
MICR 570	Mechanisms of Microbial Pathogenesis [2]	
MICR 624	Special Problems in Microbiology	
MICR 625	Independent Study in Microbiology Literature	
Degree completion options		**11**
Coursework track:		
Electives (Choose 11 additional units from available electives listed below or from program-specific courses above)		
Research track:		
Elective (3)		
MICR 697	Research (5 units)	
IBGS 698	Thesis (1-3 units)	
Total Units		**45**

Available Electives

ANAT 507	Stem Cell Biology and Medicine	4
ANAT 548	Introductory Flow Cytometry	1
BCHM 515	Introduction to Bioinformatics	2
BCHM 544	Advanced Topics in Biochemistry	2-4
IBGS 525	Translational Research Training	2
MICR 536	Virology	3

[1] Registration and attendance required every quarter in residence, but units do not count toward total required for graduation.
[2] Must take at least 3 units of coursework with a clear microbiology focus.
[3] Must take at least 3 units with a clear immunology focus.

Service learning requirement

This requirement may be met by taking IBGS 525 Translational Research Training or a religion course designated as a service learning course.

For more information about this requirement and a list of religion courses that fulfill it, see section on academic service learning (http://llucatalog.llu.edu/about-university/academic-policies-information/degree-completion-requirements/) in this CATALOG.

Noncourse requirements

Coursework track: a comprehensive written examination over the graduate coursework in lieu of preparing a thesis.

Research track: pass an oral examination given by their graduate guidance committee after the thesis has been completed.

Normal time to complete the program

Two (2) years — based on full-time enrollment; part time permitted

Comparison

See the comparison (http://llucatalog.llu.edu/medicine/infection-immunity-and-inflammation/comparison/) of the M.S. and Ph.D. degree programs.

Ph.D. requirements

For the Ph.D. degree, students must complete a minimum of 60 units—as detailed in the table below—and must maintain a G.P.A. of at least 3.0. Students must adhere to all University and program policies as published in the *Student Handbook*, University CATALOG, or "Student Guide." Policies and requirements are subject to change.

Basic science core		
IBGS 501	Biomedical Communication and Integrity	2
IBGS 502	Biomedical Information and Statistics	2
IBGS 503	Biomedical Grant Writing	2
IBGS 511	Cellular Mechanisms and Integrated Systems I	6
IBGS 512	Cellular Mechanisms and Integrated Systems II	6
IBGS 522	Cellular Mechanisms and Integrated Systems II Journal Club	2
IBGS 523	Cellular Mechanisms and Integrated Systems III Journal Club	2
Seminars (all required)		
IBGS 604	Introduction to Integrative Biology Presentation Seminar	1
IBGS 605	Integrative Biology Presentation Seminar [1]	2
IBGS 607	Integrated Biomedical Graduate Studies Seminar [1]	1
Religion		
RELE 5__ Must be numbered 500 or above		3
RELR 5__ Must be numbered 500 or above		3
RELT 5__ Must be numbered 500 or above		3
Program specific courses		
Select from the following area:		12
Infection courses		
MICR 521	Medical Microbiology	
MICR 537	Selected Topics in Molecular Biology	
MICR 540	Physiology and Molecular Genetics of Microbes	
MICR 570	Mechanisms of Microbial Pathogenesis	
MICR 625	Independent Study in Microbiology Literature	
Immunology courses		
ANAT 548	Introductory Flow Cytometry	
MICR 530	Basic Immunology	
MICR 624	Special Problems in Microbiology	
MICR 580	Current topics in Immunology	
Other program specific courses		
MICR/IBGS 515	Introduction to Bioinformatics and Genomics	
MICR 525	Journal Club III	
Research		
IBGS 696	Research Rotations (1)	2
MICR 697	Research (1-7)	12
IBGS 699	Dissertation (2-5)	2-5
Total Units		**62**

Available Electives

ANAT 507	Stem Cell Biology and Medicine	4
BCHM 515	Introduction to Bioinformatics	2
BCHM 544	Advanced Topics in Biochemistry	2-4
IBGS 525	Translational Research Training	2
MICR 537	Selected Topics in Molecular Biology [2, 3]	1-3

1 Registration and attendance required every quarter in residence, but units do not count toward total required for graduation.
2 Must take at least 3 units of coursework with a clear microbiology focus.
3 Must take at least 3 units with a clear immunology focus.

Service learning requirement

This requirement may be met by taking IBGS 525 Translational Research Training or a religion course designated as a service learning course. For more information about this requirement and a list of religion courses that fulfill it, see section on academic service learning (http://llucatalog.llu.edu/about-university/academic-policies-information/degree-completion-requirements/) in this CATALOG.

Noncourse requirements

- Pass both written and oral comprehensive examinations in order to advance to candidacy.
- Successfully defend the dissertation before their guidance committee prior to being awarded the Ph.D. degree.

Normal time to complete the program

Five (5) years — based on full-time enrollment; part time permitted

Comparison

See the comparison (http://llucatalog.llu.edu/medicine/infection-immunity-and-inflammation/comparison/) of the M.S. and Ph.D.degree programs.