

Term Information

Effective Term Autumn 2018
Previous Value Summer 2012

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Change the course from a 2 credit to a 3 credit offering.

What is the rationale for the proposed change(s)?

- A) Student feedback suggests the course material is dense and they would like more time to understand the content. A change to 3 credit hours gives the instructors an additional 40 minutes to explain complex content. This is reflected in the learning objectives which reflect higher levels of content understanding.
- B) Immunology is a rapidly changing field, and additional time will allow the instructors to spend more time on newly emerging material

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

None

Is approval of the request contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area Microbiology
Fiscal Unit/Academic Org Microbiology - D0350
College/Academic Group Arts and Sciences
Level/Career Graduate, Undergraduate
Course Number/Catalog 5122
Course Title Immunology
Transcript Abbreviation Immunology
Course Description Cellular and molecular properties of the immune system.
Semester Credit Hours/Units Fixed: 3
Previous Value Fixed: 2

Offering Information

Length Of Course 14 Week, 12 Week, 8 Week, 7 Week, 6 Week
Flexibly Scheduled Course Never
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture
Grade Roster Component Lecture
Credit Available by Exam No
Admission Condition Course No
Off Campus Never
Campus of Offering Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites

Prereq: 4000 or 4100.

Previous Value

Prereq: 4000 (509) or 4100 (520).

Exclusions

Previous Value

Not open to students with credit for MicrBiol 522.01.

Electronically Enforced

No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code

26.0502

Subsidy Level

Doctoral Course

Intended Rank

Junior, Senior, Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Appreciate how several seminal immunological concepts were discovered.
- Describe the differences between innate and adaptive immune responses
- Explain how innate immunity recognizes and eliminates microbial pathogens.
- Explain the multiple functions of the complement system.
- Understand how innate immune response initiates and enhances the adaptive immune response.
- Compare the cellular and humoral branches of adaptive immunity.
- Describe the origin, maturation, and function of T-cells.
- Understand and compare antigen processing/presentation to different types of T cells.
- Describe the origin, maturation, and function of B-cells.
- Understand antibody generation and the genetic basis for antibody diversity.
- Describe different types of antibodies and their functions.
- Explain multiple types of vaccines and how they work.
- Understand the basis of allergic reactions.
- Compare and contrast the different types of hypersensitivity reactions.
- Describe the immunological concepts relevant transplantation.
- Communicate how the innate and adaptive immune systems synergize to eliminate bacteria, viruses, or parasites.
- Explain how stress influences immunity.

Previous Value

Content Topic List

- Innate immunity: complement cascade, pathogen recognition, reactive oxygen and nitrogen, antimicrobial peptides, neutrophils, macrophage, and macrophage activation
- Adaptive immunity-humoral response: B lymphocytes, antibody production and antibody diversity, and memory immunity
- Adaptive immunity-cell mediated response: thymus, T lymphocytes, major histocompatibility complex (MHC), T cell receptors, antigen presenting cells, apoptosis, and superantigens
- Signaling: signal transduction cascades, interleukins and interleukin receptors, chemokines and chemokine receptors, interferons and antivirals

Sought Concurrence

No

Attachments

- 5122_current_2cr.pdf: Current (2cr) syllabus
(Syllabus. Owner: Kwiek,Jesse John)
- M5122LO_mappedtoMicroPO.pdf: CourseLO mapped to MicroPO
(Other Supporting Documentation. Owner: Kwiek,Jesse John)
- 3 cr hr syllabus_updated.docx: Proposed Syllabus
(Syllabus. Owner: Kwiek,Jesse John)
- Coverletter_22 March 2018.pdf: Cover letter
(Cover Letter. Owner: Kwiek,Jesse John)
- Future 5122 -2_updated.docx: List of proposed content additions
(Other Supporting Documentation. Owner: Kwiek,Jesse John)

Comments

- Corrected documents have been uploaded. Thank you for your consideration. *(by Kwiek,Jesse John on 03/22/2018 08:56 AM)*
- C Daniels to talk to you about revisions needed following NMS Panel vote. *(by Vankeerbergen,Bernadette Chantal on 11/21/2017 12:58 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kwiek,Jesse John	11/07/2017 09:28 AM	Submitted for Approval
Approved	Kwiek,Jesse John	11/07/2017 11:18 AM	Unit Approval
Approved	Haddad,Deborah Moore	11/07/2017 11:30 AM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	11/21/2017 12:58 PM	ASCCAO Approval
Submitted	Kwiek,Jesse John	03/22/2018 08:56 AM	Submitted for Approval
Approved	Kwiek,Jesse John	03/22/2018 08:57 AM	Unit Approval
Approved	Haddad,Deborah Moore	03/22/2018 11:15 AM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	03/22/2018 11:15 AM	ASCCAO Approval



22 March 2018

RE: Microbiology 5122

Dear Colleagues,

Thank you for your helpful feedback on our request to change Microbiology 5122: Immunology from a 2-credit course to a 3-credit course. In the updated submission, we have added the correct disability statement, provided further justification for the change, and linked the suggested changes to topics listed in the course syllabus.

To facilitate your evaluation of this proposal, I have attached both the current (2 cr.) and a revised, proposed (3 cr.) Microbiology 5122 syllabi. I also include a map of the course learning objectives to the Microbiology BS Program Learning Goals.

I thank you for your consideration.

Regards,

Jesse J. Kwiek
Associate Professor
Vice Chair for Teaching & Undergraduate Affairs
Department of Microbiology
Ohio State University
476 Biological Sciences Building
484 West 12th Avenue
Columbus, OH 43210
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Fax: 614-292-8120

Microbiology 5122: Immunobiology
The Ohio State University
Autumn 2018
3 credit hours

Lectures:

80 minutes lecture, twice a week
Tuesday and Thursday, 3:00pm to 4:20pm.
Location TBD.

Recommended books

“Immunology” 7th Edition
by Male, Brostoff, Roth and Roitt
Publisher: Mosby/Elsevier
ISBN13: 976-0-323-03399-2

OR

Kuby “Immunology” 7th Edition
By Owen, Punt, Stranford
Publisher: Freeman
ISBN13: 978-14292-1919-8

Extra (free) Resource:

Janeway *et al.*, Immunobiology, 5th Edition (circa 2001)
<http://www.ncbi.nlm.nih.gov/books/NBK10757/>
Many topics outdated, but core concepts are usually correct.

Course instructors: Dr. Abhay Satoskar
Email: Abhay.Satoskar@osumc.edu
Phone: 614-366-3417
Office: 129 Hamilton Hall
Office Hours: By appointment

Dr. Madhura Pradhan
Email: pradhan.2@osu.edu
Phone: 614-292-1196
Office: 372 Biological Sciences Building
Office Hours: Tue, Thurs 2:00-4:00pm. I may also be available after the lecture and by appointment to answer your questions.

Lecture Schedule
Autumn 2018

TR Time, Room, TBD

NOTE: THE FOLLOWING SCHEDULE IS SUBJECT TO CHANGE.

Date	Topic (instructor)	Corresponding Book Chapter (reading not required)	
		Roitt	Kuby
	Introduction to immune system (ARS)	1	1
	Cells and organs of the immune system (ARS)	2	2
	Innate immunity-1 (ARS)	6	5
	Labor Day (No Class)		
	Innate immunity-2 (ARS)	6	5
	Complement (ARS)	4	6
	Introduction to Adaptive Immunity (MP)	3,8	13
	Exam 1		
	Receptors of Adaptive immunity and Signaling (MP)	7	3,4
	Generation of lymphocyte receptor diversity (MP)	5	7
	Generation of Immunoglobulin diversity (MP)	5	7
	MHC structure and genetics (MP)	3,8	8
	Transplantation and rejection reaction (AS)	21	16
	Exam 2		
	Lymphocyte development (MP)	3,8	9,10
	Lymphocyte maturation (MP)	3,8	10,12
	Immunological Tolerance (PB)	19	16
	Autoimmunity (SO)	20	16
	Activation and Effector responses of B cells (MP)	3,8	12,13
	Activation and Effector responses of T cells (MP)	3,8	8,11

	Vaccination (SO)	24, 25	15
Exam 3			
	Regulation of Immune responses (ARS)	11	14
	Immunity to bacteria and fungi (ARS)	14	17
	Immunity to protozoa and viruses (ARS)	15,13	17
	Mucosal Immunology (PB)	various	various
Thanksgiving Break- No Class			
	Hypersensitivity reactions (ARS)	24, 25	15
	Immunity to cancers (ARS)	22	19
	Primary Immunodeficiency (SO)	16	18
	Stress and the Immune Response (MB)	various	various

FINAL EXAM Date/Time/location TBD.

Microbiology 5122 Learning Outcomes

Successful students will be able to...

1. Appreciate how several seminal immunological concepts were discovered.
2. Describe the differences between innate and adaptive immune responses.

3. Explain how innate immunity recognizes and eliminates microbial pathogens.
4. Explain the multiple functions of the complement system.
5. Understand how innate immune response initiates and enhances the adaptive immune response.
6. Compare the cellular and humoral branches of adaptive immunity.
7. Describe the origin, maturation, and function of T-cells.
8. Understand and compare antigen processing/presentation to different types of T cells.
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10. Understand antibody generation and the genetic basis for antibody diversity.
11. Describe different types of antibodies and their functions.
12. Explain multiple types of vaccines and how they work.
13. Understand the basis of allergic reactions.
14. Compare and contrast the different types of hypersensitivity reactions.
15. Describe the immunological concepts relevant transplantation.
16. Communicate how the innate and adaptive immune systems synergize to eliminate bacteria, viruses, or parasites.
17. Explain how stress influences immunity.

Guidelines for Final Grade

Points Available:

Lecture Exam I	70 points
Lecture Exam II	70 points
Lecture Exam III	80 points
Final Exam	80 points
TOTAL POINTS	300 points

*Please see Attendance Policy in this syllabus

Below is additional information concerning the point categories above. Please read the information carefully and ask if you have questions.

Exam Policy: All exams are as scheduled. Students with excusable conflicts need to contact Dr. Satoskar or Dr. Pradhan at least one week ahead of the regularly scheduled exams. Should you miss an exam and have a valid excuse, you must contact Dr. Satoskar or Dr. Pradhan and provide a written documentation for your absence in order to be eligible to take a make-up exam. *Also note that the format of the make-up exam may be different than the regular exams. **All make up exams must be completed within one week of the regularly scheduled exams.***

Lecture attendance

Attendance in lecture is highly recommended. You are responsible for all the material covered in lecture.

Disability Services

The University strives to make all learning experiences as accessible as possible. If

you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Academic Misconduct Statement

- Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute "Academic Misconduct."
- The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct, so we recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.
- If we suspect that a student has committed academic misconduct in this course, we are obligated by University Rules to report our suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact Drs. Pradhan or Satoskar.

Microbiology 5122: Immunobiology
The Ohio State University
Autumn 2017

Lectures:

Monday and Wednesday, 4:10pm to 5:05pm.
Jennings Hall Rm 40

Recommended books

"Immunology" 7th Edition
by Male, Brostoff, Roth and Roitt
Publisher: Mosby/Elsevier
ISBN13: 976-0-323-03399-2

OR

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Office: 372 Biological Sciences Building
Office Hours: Tue, Thurs 2:00-4:00pm. I may also be available after the lecture and by appointment to answer your questions.

**Lecture Schedule
Autumn 2017
MW 4:10-5:05 pm, Jennings Hall Rm 040**

NOTE: THE FOLLOWING SCHEDULE IS SUBJECT TO CHANGE.

Date	Topic (instructor)	Corresponding Book Chapter (reading not required)	
		Roitt	Kuby
08-23 (W)	Introduction to immune system (ARS)	1	1
08-28 (M)	Cells and organs of the immune system (ARS)	2	2
08-30 (W)	Innate immunity-1 (ARS)	6	5
09-04 (M)	Labor Day (No Class)		
09-06 (W)	Innate immunity-2 (ARS)	6	5
09-11 (M)	Complement (ARS)	4	6
09-13 (W)	Introduction to Adaptive Immunity (MP)	3,8	13
09-18 (M)	Exam 1		
09-20 (W)	Receptors of Adaptive immunity and Signaling (MP)	7	3,4
09-25 (M)	Generation of lymphocyte receptor diversity (MP)	5	7
09-27 (W)	Generation of Immunoglobulin diversity (MP)	5	7
10-02 (M)	MHC structure and genetics (MP)	3,8	8
10-04 (W)	Transplantation and rejection reaction (AS)	21	16
10-9 (M)	Exam 2		
10-11 (W)	Lymphocyte development (MP)	3,8	9,10
10-16(M)	Lymphocyte maturation (MP)	3,8	10,12
10-18 (W)	Immunological Tolerance (PB)	19	16
10-23 (M)	Autoimmunity (SO)	20	16
10-25 (W)	Activation and Effector responses of B cells (MP)	3,8	12,13

10-30 (M)	Activation and Effector responses of T cells (MP)	3,8	8,11
11-01 (W)	Vaccination (SO)	24, 25	15
11-06 (M)	Exam 3		
11-08 (W)	Regulation of Immune responses (ARS)	11	14
11-13 (M)	Immunity to bacteria and fungi (ARS)	14	17
11-15 (W)	Immunity to protozoa and viruses (ARS)	15,13	17
11-20 (M)	Mucosal Immunology (PB)	various	various
11-22 (W)	Thanksgiving Break- No Class		
11-27 (M)	Hypersensitivity reactions (ARS)	24, 25	15
11-29 (W)	Immunity to cancers (ARS)	22	19
12-04 (M)	Primary Immunodeficiency (SO)	16	18
12-06 (W)	Stress and the Immune Response (MB)	various	various

12-14 (Thursday) FINAL EXAM (4PM-5:45PM) in Jennings Rm 40

Microbiology 5122 Learning Outcomes

Successful students will be able to...

1. Appreciate how several seminal immunological concepts were discovered.
2. Describe the differences between innate and adaptive immune responses.
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Guidelines for Final Grade

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Lecture attendance

Attendance in lecture is highly recommended. You are responsible for all the material covered in lecture.

Disability Statement

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Future 5122 (3 credit hours)

The following are a few major challenges that students face in learning immunology:

1. Students, while trying to master the new immunology vocabulary and details, lose the big picture.
2. Students struggle to make connections between different topics/processes taking place in the immune system. Students tend to compartmentalize the processes and fail to see the interconnectedness of different branches of the immune system, such as innate branch influencing the adaptive response.
3. Students fail to visualize the functioning of the immune system. Therefore, introducing dynamics of the immune system in Time and Space is critical.

Rationale for three credit hour conversion:

1. Immunology is a rapidly evolving field with many advances being made in several aspects of the immune system, such as, Pattern Recognition Receptors of the Innate Immune system, Natural Killer cells, subsets of T-Helper cells, Cross-presentation of antigen, and Mucosal immunity, just to name a few. While covering the breadth and depth of the immunology topics, currency is important. Adding more contact time with students will allow us to incorporate current new scientific observations and findings (and scientific literature) that will extend the knowledge and understanding of the immune system.
2. Since it is a 5000-level course, we would like to adopt an advanced approach to deliver important concepts in the experimental context while discussing the excitement of classical research discovery. Additional credit hour will allow the much needed classroom interaction time for small group discussions to connect the field of immunology with both classical research and emerging discoveries. This will not only foster student engagement but will also encourage the application of critical thinking skills.
3. An extra credit hour will allow time to incorporate more clinical connections to content and concepts learned in Immunology instead of memorization-driven approach. It will allow students to see the application of immunology concepts in the development of new cancer vaccines, immunotherapy, potential targets for treatment of autoimmune diseases.

Rationale	Lecture topics expanded
<p>Incorporation of recent new scientific observations and findings (and scientific literature) that will extend the knowledge and understanding of the immune system.</p>	<ol style="list-style-type: none"> 1. Cells and Organs of the Immune system: we will include <ol style="list-style-type: none"> 1) the recent discovery of a second Thymus and its implications, 2) ever-expanding population of helper-T subsets, and 3) Regulatory T cells 2. Innate Immunity: We will include <ol style="list-style-type: none"> 1) newly discovered Toll-like receptors and their significance in pathogen recognition, other types of pattern recognition receptors. 3. Lymphocyte maturation: We will include <ol style="list-style-type: none"> 1) Instructive model, stochastic model and kinetic signaling model to explain Lineage commitment of thymocytes. 2) Two different models (TCR affinity vs Altered peptide models) proposed to explain positive selection of T lymphocytes. 4. Activation of T cells: We will include recent advances made in the field to explain cross-presentation of antigen to CD8+ T cells.
<p>Incorporation of Classical research experiments to deliver important concepts and content</p>	<ol style="list-style-type: none"> 1. Isolation of Hematopoietic stem cells 2. Elucidation of antibody structure 3. Discovery of the T cell receptor 4. Paradigm shifting experiment of Hozumi and Tonegawa to solve the puzzle of Immunoglobulin gene structure 5. Demonstration of self-MHC restriction of CD8+ T cells 6. Rethinking Immunological memory: NK cells 7. Early life exposure to antigens favors Tolerance
<p>Clinical Connections</p>	<ol style="list-style-type: none"> 1. Vaccine controversy 2. New types of vaccines including vaccines for cancers 3. Immunotherapy and engineered lymphocytes 4. Monoclonal antibodies in the treatment of cancer

	<ul style="list-style-type: none">5. Stem cells: clinical uses and potential6. Gut microbiome and its role in developing tolerance7. Hygiene hypothesis8. Cytokines and obesity9. Complement system as a therapeutic target10. MHC alleles and susceptibility to certain diseases
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Required Prerequisites for the Major

Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
BIOL 1113		Biological Sciences: Energy Transfer and Development	4	B			B	
BIOL 1114		Biological Sciences: Form, Function, Diversity, and Ecology	4	B			B	
MATH Requirement 1	MATH 1151	Calculus 1 (5 Hrs)	5	B				
	or							
	MATH 1156	Calculus for Biol. Sciences (5 Hrs)						
MATH Requirement 2	MATH 1152	Calculus 2 (5 Hrs)	3 - 5	B				
	or							
	MATH 1157	Math. Modeling for Biol. Sciences (5 Hrs)						
	or							
	STATS 1450	Intro. to the Practice of Statistics (3 Hrs)						
	or							
	STATS 2480	Statistics for the Life Sciences (3 Hrs)						
CHEM 1210		General Chemistry 1	5	B				
CHEM 1220		General Chemistry 2	5	B				
CHEM 2510		Organic Chemistry 1	4	B	B			
CHEM 2520		Organic Chemistry 2	4	B	B			
CHEM 2540		Organic Chemistry Lab 1	2	B	B		B	
PHYS 1200		Mechanics, Thermal Physics, Waves	5	B			B	
PHYS 1201		E&M, Optics, Modern Physics	5	B			B	
Total Hrs.			46 - 48					

Goal: B: Beginning; I, Intermediate; A, Advanced

Required Core for the Major

Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
MICRBIOL 4100		General Microbiology	5	I	I	I	I	I
MICRBIOL 4110		Pathogenesis and Immunobiology	3	A	A	A		
MICRBIOL 4120		Microbial Physiology and Diversity	3	A	A	A		
MICRBIOL 4130		Microbial Genetics	3	A	A	I	I	
MICRBIOL 4140		Molecular Microbiology Laboratory	3	I	I	I	A	A
BIOCHEM 4511		Biochemistry	4	I	A			I
Total Hrs.			21					

Goal: B: Beginning; I, Intermediate; A, Advanced

Electives: Total Required 9 hrs

Group 1: 3-9 hrs

Learning Goals

Semester Course Number		Course Title	Semester hrs	1	2	3	4	5
MICRBIOL 4150		Immunobiology Laboratory	3	I	I	A	A	A
MICRBIOL 4193		Individual Studies	1-3					
MICRBIOL 4194		Group Studies	1-3					
MICRBIOL 4591S		DNA Finger Printing Workshops in Columbus PS	1				A	A
MICRBIOL 4797		Study at a Foreign Institution	1-19					
MICRBIOL 4798		Study Tour Domestic	1-19					
MICRBIOL 4998		Undergrad Research in Microbiology	1-5				A	A
MICRBIOL 4998H		Honors Research	1-5				A	A
MICRBIOL 4999		Undergrad Research in Microbiology- Thesis	1-5				A	A
MICRBIOL 4999H		Honors Research-Thesis	1-5				A	A
MICRBIOL 5122		Immunology	3			A		
MICRBIOL 5129		Cellular and Molecular Biology of Pathogenic Eukaryotes	3		A	A		
MICRBIOL 5147		Eukaryotic Pathogens	3		A	A	A	
MICRBIOL 5149		Introductory Virology	3		A	A		
MICRBIOL 5150		Microbial Ecology	3	A	A	A		
MICRBIOL 5155		Environmental Microbiology	3	A	A	A		
MICRBIOL 5161H		Bioinformatics and Molecular Microbiology	3	A	A	A		A
MICRBIOL 5169H		Microbial Evolution	3			A		
MICRBIOL 5170		Microbes and Evolution	3			A		
MICRBIOL 5536		Food Microbiology Lecture	3		A	I		A

MICRBIOL 5546	Food Microbiology Laboratory	3		A	I	A	A
MICRBIOL 6020*	Microbial Physiology and Biochemistry	3	A	A	A	A	
MICRBIOL 6080*	Advanced Microbial Genetics	3		A		A	
MICRBIOL 7010*	Cellular and Molecular Immunology	3			A	A	
MICRBIOL 7020*	Physiology Meets Pathogenesis	2	A	A	A	A	
MICRBIOL 7023*	Molecular Immunology: Lecture	3			A	A	
MICRBIOL 7050*	Fermentation Biotechnology	3	A			A	A
MICRBIOL 7060*	Advanced Topics in Molecular Microbiology	2		A		A	
MICRBIOL 7536*	Advanced Food Microbiology	3		A	I	A	A
MICRBIOL 7724*	Molecular Pathogenesis	3		A	A	A	
MICRBIOL 7889*	Host-Pathogen Interactions: Research Seminar	1			A	A	
MICRBIOL 7899*	Microbiology Colloquium	1					
	Total Hrs.	3-9					

*Indicated graduate-level course. Requires special permission to enroll.

Goal: B: Beginning; I, Intermediate; A, Advanced

Electives: Total Required 9 hrs
Group 2: 0-6 hrs

Learning Goals

Semester Course Number	Course Title	Semester Hrs.	1	2	3	4	5
MICRBIOL 3300	The Biology of Pollution	2	B				I
BIOCHEM 5621	Intro Biological Chemistry Laboratory	4	I			I	
MOLGEN 4500	General Genetics	3		I			
MOLGEN 4606	Molecular Genetics I	4		I			
MVIMG 5000	Evolution of Emerging Viruses	2			A		
PLPATH 5010	Phylobacteriology	2		I	A		
PLPATH 5020	Introduction to Plant Virology	2		I	A		
PLPATH 5040	Science of Fungi: Mycology Lecture	3	I	I	A		
ANSCI 6090*	Anaerobic Microbiology	3		A			
ENR 5263	Biology of Soil Ecosystems	3	I	A			
ENR 5266	Field Soil Investigations	3	I			A	
	Total Hrs.	0-6					
	Total Hrs. for the Major	30					

*Indicated graduate-level course. Requires special permission to enroll.

Goal: B: Beginning; I, Intermediate; A, Advanced

Program Learning Goals (B, beginning; I, Intermediate; A, Advanced)

1. Students acquire the ability to interrelate and apply the fundamental concepts of chemistry, physics and mathematics to the functions of living cells.
2. Students understand the chemical properties of biological molecules and how these molecules function in the molecular mechanisms underlying physiological processes in microbial cells.
3. Students understand evolutionary processes, the diversity of microorganisms, and how microorganisms impact their environment, including their roles in human health and disease.
4. Students acquire the ability to design experiments to test hypotheses, perform analyses, interpret and analyze data, and present scientific information in written and oral formats.
5. Students acquire the ability to appraise scientific data presented in the popular press for accuracy and scientific merit and understand issues and ethical conflicts associated with applications of biotechnology.

Micrbiol 5122 learning Goals (Mapped to Program Learning Goals)

Successful students will be able to...

- Appreciate how several seminal immunological concepts were discovered. **(PLG3I)**
- Describe the differences between innate and adaptive immune responses. **(PLG3I)**
- Explain how innate immunity recognizes and eliminates microbial pathogens. **(PLG3I)**
- Explain the multiple functions of the complement system. **(PLG3I)**
- Understand how innate immune response initiates and enhances the adaptive immune response. **(PLG3A)**
- Compare the cellular and humoral branches of adaptive immunity. **(PLG3A)**
- Describe the origin, maturation, and function of T-cells. **(PLG3A)**
- Understand and compare antigen processing/presentation to different types of T cells. **(PLG3A)**
- Describe the origin, maturation, and function of B-cells. **(PLG3A)**
- Understand antibody generation and the genetic basis for antibody diversity. **(PLG3A)**
- Describe different types of antibodies and their functions. **(PLG3A)**
- Explain multiple types of vaccines and how they work. **(PLG3A)**
- Understand the basis of allergic reactions. **(PLG3A)**
- Compare and contrast the different types of hypersensitivity reactions. **(PLG3A)**
- Describe the immunological concepts relevant transplantation. **(PLG3A)**
- Communicate how the innate and adaptive immune systems synergize to eliminate bacteria, viruses, or parasites. **(PLG3A)**
- Explain how stress influences immunity. **(PLG3A)**