Term Information

Effective Term	Spring 2019
Previous Value	*Summer 2012*

Course Change Information

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

Convert the class from an honors class to a regular, non-honors class.

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

To increase student access to an important topic (bioinformatics)

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)?

This is an elective so the proposed change does not affect core programming.

Is approval of the requrest 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	5161
Previous Value	*5161H*
Course Title	Bioinformatics and Molecular Microbiology
Transcript Abbreviation	Microbial Bioinfo
Course Description	Application of computational tools to the analysis of microbial genomes and their gene products.
Semester Credit Hours/Units	Fixed: 3

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	Micrbio 4130 or MolGen 4500, and Biochem 4511; or Graduate standing; or permission of instructor.
Previous Value	*Prereq: Honors standing, and Micrbio 4130 (Micrbiol 581.01) or MolGen 4500 (500), and Biochem 4511 (511); or permission of instructor.*
Exclusions	Not open to students with credit for Micrbiol 5161H
Previous Value	Not open to students with credit for Micrbiol 610H.
Electronically Enforced	Yes
Previous Value	**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

- Knowledgably describe the major developments in computational genomics and bioinformatics
- Knowledgeably describe the key elements of genomic database searches
- Knowledgably describe the basics of protein sequence analysis
- Understand current views on molecular evolution and its driving forces
- Understand common bioinformatics tools
- Understand the impact of genomics on microbiology and medicine
- Critically evaluate research papers on computational genomics and bioinformatics
- Interpret the quality of genomic data in research papers

Previous Value

Content Topic List

- Introduction: bioinformatics, genes, and gene structure
- Databases
- High throughput sequencing methods
- Identifying genes
- Aligning sequences
- Searching databases for sequence matches
- Discovering patterns: proteins and nucleic acids
- Structure predictions: proteins and RNAs
- Phylogenetics
- DNA arrays, metagenomics, and proteomics

Sought Concurrence No

Attachments

- 5161_Coverletter_28June2018.pdf: Coverletter

  (Cover Letter. Owner: Kwiek,Jesse John)

- 5161_program_mapping.pdf: Goal mapping

  (Other Supporting Documentation. Owner: Kwiek,Jesse John)

- MICRO5161_submit.docx: Syllabus

  (Syllabus. Owner: Kwiek,Jesse John)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kwiek,Jesse John	06/28/2018 11:17 AM	Submitted for Approval
Approved	Kwiek,Jesse John	06/28/2018 11:17 AM	Unit Approval
Approved	Haddad,Deborah Moore	06/28/2018 02:33 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Oldroyd,Shelby Quinn Vankeerbergen,Bernadette Chantal Nolen,Dawn	06/28/2018 02:33 PM	ASCCAO Approval

THE OHIO STATE UNIVERSITY

Department of Microbiology

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Columbus, OH 43210

614-292-2301 Phone

microbiology.osu.edu

28 June 2018

RE: Microbiology 5161H conversion to 5161

Dear Colleagues,

We would like to change Microbiology 5161H: Bioinformatics and Molecular Microbiology from an honors course to a regular, non-honors course (i.e. Microbiology 5161: Bioinformatics and Molecular Microbiology). We request this change to increase student access to a topic – bioinformatics – that is increasingly important to (micro)biology research. To facilitate your evaluation of this proposal, I have attached an updated syllabus and a list of the course learning objectives mapped to the Microbiology BS Program Learning Goals.

I thank you for your consideration.
Regards,

Jesse J. Kwiek
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Vice Chair for Teaching & Undergraduate Affairs
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Micro 5161
Bioinformatics and Molecular Microbiology
Spring 2019

Instructor: **Dr. Igor Jouline**
Department of Microbiology
500 Aronoff Laboratory
Email: jouline.1 -at- osu.edu
Office hours: by appointment

Lecture: 3 units
MWF, time and location TBD

Description

In this course, you will learn how the genome sequencing technology has revolutionized biology and provided a foundation for new developments in science and medicine. You will become familiar with computational tools that are necessary to analyze genomic data and you will find out what biological questions can be answered by genomic approaches. We will use prokaryotes as the main material for genomic studies, but the core principles that you will learn are also applicable to eukaryotes including humans.

Prerequisites

Micro 4130 or MolGen 4500, and Biochem 4511; or Graduate standing; or instructor permission.

Format

Lectures and discussions (including working in small groups). **Graduate students** will also be required to make one in-class presentation and to carry out an individual research project.

Readings

There is no required textbook, but the following book is recommended for those who wish to have additional background and expanded information on some topics:

"Sequence - Evolution - Function: Computational Approaches in Comparative Genomics"
By E.V. Koonin and M.Y. Galperin, 2003. Boston: Kluwer Academic. ISBN-10: 1-40207-274-0

Assignments and grading

Undergraduate students

20%	Exam I
20%	Exam II
20%	Exam III
40%	Final exam

Graduate students

15%	Exam I
15%	Exam II
15%	Exam III
10%	Presentation
25%	Research project
20%	Final exam

Exams
All examinations are scheduled - missed exams will be scored zero. Make-up exams will only be allowed for students with medical emergencies or for those who obtained a prior approval from the instructor. To be eligible to take a make-up exam you must:

1. Email the instructor ***prior*** to the scheduled time of the exam **AND**

2. Provide a valid excuse with written, original documentation for your absence ***prior*** to taking the make-up exam. You may e-mail a digital copy of your excuse, but valid, original documentation will still be required.

If you qualify, you must take the re-scheduled exam within the 24-hour period following the time of the exam or the end of your excused leave. The make-up exam will be different from the regular exam. If you fail to follow these instructions, you will automatically receive a zero as the score for the missed exam. *Documentation that is suspected to be fraudulent will be reported to the Committee on Academic Misconduct (see below).*

Presentation
Graduate students will select, from a pre-approved list, a topic in genomics or bioinformatics and analyze the current literature to reveal significant developments on the subject. Students will share their findings during an in-class presentation (15 minutes plus 5 minutes for discussion and questions). Depending on the number of students enrolled in the class, presentations may be shortened or allocated extra time.

Presentations will be evaluated based on organization/visual appeal and subject knowledge.

Research Project
Each **graduate student** will be required to select a protein sequence for in-depth analysis using the tools and approaches discussed in the class. A written report (a digital copy submitted electronically) is required before the end of the semester. Projects will be evaluated based on the logic of analysis, the tool selection and use, and the interpretation of the results.

Learning Outcomes
Students that successfully complete this course will:

- Knowledgably describe the major developments in computational genomics and bioinformatics
- Knowledgeably describe the key elements of genomic database searches
- Knowledgably describe the basics of protein sequence analysis
- Understand current views on molecular evolution and its driving forces
- Understand common bioinformatics tools
- Understand the impact of genomics on microbiology and medicine
- Critically evaluate research papers on computational genomics and bioinformatics
- Interpret the quality of genomic data in research papers

Attendance policy
Students are expected to attend lectures. Exams will be based on material covered in class. Because

class slides posted in Carmen do not contain much text, *you should attend every lecture and supplement them with your own notes*.

Classroom etiquette
Electronic devices should be silenced during lectures and exams. Computers can be used during lectures as long as they do not distract other students. The use of electronic devices during exams is prohibited and will be reported to the Committee on Academic Misconduct (see below).

E-mail policy
Questions about class material should ***not*** be submitted via e-mail and they will not be answered. Questions are welcome during and right after class.

Academic misconduct
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487).

The Code of Student Conduct **http://studentlife.osu.edu/csc/**

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.

Diversity statement
The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or

veteran status, is prohibited.

Student wellness and counseling services

OSU offers a range of services to assist students experiencing elevated stress levels. **Counseling and Consultation Service** (CCS; ccs.osu.edu) provides a range of confidential mental health services to students. 24-hour emergency help is also available through the National **24/7 Prevention Hotline** at 1-800-273-TALK or at suicidepreventionlifeline.org. **Wellness Coaching** (go.osu.edu/wellnesscoaching) is a free service provided by the Office of Student Life that takes an empowering, strength-based approach to building your capacity to face challenges and navigate transitions in order to create the life you want to live. In addition, the "**Student Advocacy Center** is committed to helping students navigate Ohio State's structure and to resolving issues. that they encounter at the university" (http://advocacy.osu.edu/).

Lecture schedule

This is a tentative schedule and is subject to change. The allotted time for graduate student presentations and the schedule of lecture topics will be adjusted depending on the number of graduate students enrolled in the class.

Date	Day	Week	Topic	Module
Jan 7	M	1	Introduction to Genomics & Bioinformatics	1. Databases & protein sequence analysis
Jan 9	W			
Jan 11	F			
Jan 14	M	2	DNA repositories & comprehensive genomics resources	
Jan 16	W			
Jan 18	F		Secondary & specialized databases	
Jan 21	M	3	No classes (MLK day)	
Jan 23	W		Computational gene finding	
Jan 25	F			
Jan 28	M	4	Proteins from the genomics point of view	
Jan 30	W		Domains, regions, and motifs	
Feb 1	F		Membrane topology analysis	
Feb 4	M	5	SUMMARY: Module 1	
Feb 6	**W**		**Exam 1**	
Feb 8	F		What is [sequence] similarity?	2. Basic sequence similarity search & multiple sequence alignment
Feb 11	M	6	BLAST, part I	
Feb 13	W		BLAST, part II	
Feb 15	F		Multiple sequence analysis (MSA) - Intro	
Feb 18	M	7	MSA building software	
Feb 20	W		MSA editing	
Feb 22	F		MSA interpretation	
Feb 25	M	8	SUMMARY: Module 2	3. Advanced sequence similarity search
Feb 27	W		Sequence profiles: HMMs and PSSMs	
Mar 1	F		Domain databases: Pfam and SMART	
Mar 4	M	9	Conserved Domain Database (CDD)	
Mar 6	W		Building dynamic profiles: PSI-BLAST	
Mar 8	F		Profile-profile search: HHpred	
Mar 11	M	11	No classes (Spring Break)	
Mar 13	W		No classes (Spring Break)	
Mar 15	F		No classes (Spring Break)	
Mar 18	M	12	SUMMARY: Module 3	
Mar 20	**W**		**Exam 2**	
Mar 22	F		Protein folds and their evolution Fold recognition: PHYRE	4. Protein structure
Mar 25	M	13	Evolutionary concepts in genomics	5. Evolutionary genomics & phylogenetics
Mar 27	W		Phylogenetic trees I	
Mar 29	F		Phylogenetic trees II	

April 1	M	14	Whole genome analysis and metabolic reconstruction	6. Whole genome analysis
April 3	W		Genomics in medicine	
April 5	F		SUMMARY: Modules 3 to 6	
April 8	**M**	15	**Exam 3**	
April 10	W		Graduate student presentations	
April 12	F		Graduate student presentations	
April 15	M	16	Graduate student presentations	
April 17	W		Graduate student presentations	
April 19	F		Graduate student presentations	

	TBD		**Final Exam**	

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 Req. #1	MATH 1151	Calculus 1 (5 Hrs)	5	B				
	or							
	MATH 1156	Calculus for Biol. Sciences (5 Hrs)						
MATH Req. #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		
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	2			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 5161		Bioinformatics and Molecular Microbiology	3		A	A	A	A
MICRBIOL 5169		Microbial Evolution	3			A		
MICRBIOL 5170		Microbes and Evolution	3			A		
MICRBIOL 5270		Microbial Natural Products: Discovery, Biosynthesis, and Antibiotic Activity	3		A	A	A	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;

Electives: Total Required 9 hrs Group 2: 0-6 hrs				Learning Goals				
Semester Course Number		**Course Title**	**Semester Hrs.**	**1**	**2**	**3**	**4**	**5**
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		Phytobacteriology	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.

Micrbiology 5161 learning Goals (Mapped to Program Learning Goals)

1. Knowledgably describe the major developments in computational genomics and bioinformatics **(PLG4 Advanced)**
2. Knowledgeably describe the key elements of genomic database searches **(PLG4 Advanced)**
3. Knowledgably describe the basics of protein sequence analysis **(PLG2 Advanced)**
4. Understand current views on molecular evolution and its driving forces **(PLG3 Advanced)**
5. Understand common bioinformatics tools **(PLG4 Advanced)**
6. Understand the impact of genomics on microbiology and medicine **(PLG3 Advanced)**
7. Critically evaluate research papers on computational genomics and bioinformatics **(PLG4Advanced)**
8. Interpret the quality of genomic data in research papers **(PLG5 Advanced)**