

Term Information

Effective Term Autumn 2025

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 5130
Course Title Biology by the Numbers
Transcript Abbreviation Biology by numbers
Course Description Introduction to quantitative reasoning about biological systems through a survey of the important quantities relevant to a range of biological processes.
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 Biology 1113, 1114; Chemistry 1210, 1220; Statistics 1450, 2450, or 2480; or by permission of instructor.
Exclusions
Electronically Enforced Yes

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

- Introduce students to quantitative reasoning about biological systems through a survey of the important quantities relevant to a range of biological processes, from the central dogma to the Earth's biosphere.

Content Topic List

- Biological numeracy
 - Cell size & geometry
 - Concentrations and absolute numbers
 - Energy & forces
 - Rates & durations
 - Information & errors
 - Ecology by numbers
 - Evolution by numbers

Sought Concurrence

Yes

Attachments

- M5130_Cover letter.pdf: Cover letter
(Cover Letter. Owner: Ruiz,Natividad)
- MICRBIO 5130_syllabus.pdf: Syllabus
(Syllabus. Owner: Ruiz,Natividad)
- Mapping2LG_5130.pdf: Learning goals mapping
(Other Supporting Documentation. Owner: Ruiz,Natividad)
- MICRBIO5130_Concurrence forms.pdf: Concurrence forms
(Concurrence. Owner: Ruiz,Natividad)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Ruiz,Natividad	12/13/2024 02:57 PM	Submitted for Approval
Approved	Ruiz,Natividad	12/13/2024 02:57 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/15/2025 04:39 AM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	01/15/2025 04:39 AM	ASCCAO Approval



December 12, 2024

Dear Colleagues,

The Department of Microbiology would like to propose a new course, **MICRBIOL 5130: Biology by the Numbers**. This 3.0-credit microbiology elective lecture course was developed to introduce undergraduate students to quantitative reasoning through a survey of the important quantities relevant to a range of biological processes, from the central dogma to the Earth's biosphere. We hope this course will fill a gap in OSU's quantitative biology curriculum by offering an accessible course for students in the biological sciences, requiring only an introductory course in statistics (STAT 1450, 2450, or 2480), as well as the general chemistry (CHEM 1210, 1220) and foundational biology (BIOLOGY 1113, 1114) courses required for majors in the biological sciences. This set of requirements contrasts with other quantitative courses in the Department of Mathematics, which emphasize particular modeling approaches requiring a knowledge of differential equations (cf. MATH 3350, 5651). Moreover, it expands the toolkit of quantitative reasoning for biology students beyond statistics (cf. MOLGEN 5650), enabling students to solve new types of quantitative problems. Although this course is primarily intended for undergraduate students, we list it as a 5000-level class to make it accessible to graduate students who desire to learn fundamental concepts in quantitative biology. We expect course enrollees will come from a wide range of undergraduate and graduate programs.

I have attached a syllabus and a list of the course learning objectives mapped to the Microbiology BS Program Learning Goals. We propose it to be a Group 1 elective course for our major.

I requested concurrence from Biology, Math, Molecular Genetics, and Physics on 11/19/2024. I provided them with the proposed course syllabus for MICRBIOL 5130 and the attached OSU Department Course Review Concurrence Form. Having received support concurrence from Biology, Math, and Physics, and no response from Molecular Genetics after two weeks, I am moving forward with this request.

Thank you for your consideration.

Natividad Ruiz

Professor of Microbiology
Vice Chair for Teaching & Undergraduate Affairs

BIOLOGY BY THE NUMBERS

MICRBIO 5130

AUTUMN 2025

Course days/times: TBD

Course location: TBD

Credit hours: 3

Format of instruction: In-person lecture, 3 contact hours/week

Prerequisites: Biology 1113, 1114; Chemistry 1210, 1220; Statistics 1450, 2450, or 2480; or by permission of instructor.

INSTRUCTOR

Instructor: Dr. Karna Gowda

Email: gowda.51@osu.edu

Phone: (614) 688-3830

Office hours: TBD

Office location: Riffe Building R900

COURSE DESCRIPTION

Beneath the surface of every diagram or fundamental concept in a biology textbook is an essential set of numbers: counts, concentrations, rates, sizes, and energies. What are these numbers, and what can we learn from them?

The goal of this course is to introduce students to quantitative reasoning about biological systems through a survey of the important quantities relevant to a range of biological processes, from the central dogma all the way to the Earth's biosphere. While knowing these numbers at an approximate level (e.g., typical rates of transcription and translation) is an important goal of the course, equally important is learning to quantitatively reason using these numbers (e.g., learning to formulate problems such as: "How do diffusion and active transport rates constrain cell sizes?").

This course is ideal for students who have taken the introductory biology sequence and have mathematical experience through precalculus and/or introductory statistics. Mathematical knowledge required in this course will be mainly simple arithmetic – the emphasis will be placed on learning how to formulate "order-of-magnitude" estimation problems, identify relevant quantities from scientific literature and other resources, and critically assess the quality of these estimates. The course will culminate in an open-ended group project, wherein students will take on an ambitious estimation problem from any area of biology and carry out a rigorous quantitative analysis.

LEARNING GOALS

Successful students will be able to:

1. Identify important scales and quantities in biological systems (e.g., typical concentrations of key biomolecules, time scales of translation, sizes of genomes, etc.)
2. Translate biological processes into quantitative formulations
3. Extract relevant quantities for performing analyses using either quantitative or visual data from literature
4. Analyze data to make order of magnitude estimates of biological quantities and processes
5. Critique the assumptions, generality, potential failures, and margins of error for quantitative analyses
6. Communicate quantitative reasoning, both verbally and visually

COURSE MATERIALS

The textbook for the course will be “Cell biology by the numbers” by Milo and Phillips, 1ed, Garland Science, 2015. An online version of the textbook is freely available: <https://book.bionumbers.org/>. A hard copy of the textbook will also be made available for purchase in the campus bookstore.

The following publications will also supplement the course and will be made available on CarmenCanvas:

1. Bar-On, Y. M., Phillips, R., & Milo, R. (2018). The biomass distribution on Earth. *Proceedings of the National Academy of Sciences of the United States of America*, 115(25), 6506–6511. <https://doi.org/10.1073/pnas.1711842115>
2. Whitman, W. B., Coleman, D. C., & Wiebe, W. J. (1998). Prokaryotes: The unseen majority. *Proceedings of the National Academy of Sciences of the United States of America*, 95(12), 6578–6583. <https://doi.org/10.1073/pnas.95.12.6578>
3. Chure, G., Banks, R. A., Flamholz, A. I., Sarai, N. S., Kamb, M., Lopez-Gomez, I., Bar-On, Y., Milo, R., & Phillips, R. (2023). Anthroponumbers.org: A quantitative database of human impacts on Planet Earth. *Patterns*, 3(9), 100552. <https://doi.org/10.1016/j.patter.2022.100552>

ASSIGNMENT INFORMATION AND GRADING

The breakdown of final grades is as follows:

- Homework – 200 points (20%)
- Midterm exam – 200 points (20%)
- Final exam – 300 points (30%)
- Group project – 300 points (30%)

Homework assignments (40 points each) will be assigned for each major topic in the course. You will need to work through homework problems on your own in a timely manner to perform well in the class. **Late assignments will not be accepted without prior permission from the instructor.**

There will be a midterm (200 points) and a final exam (300 points). The emphasis in exams will be on reasoning and not memorization of quantities. Relevant numbers will be provided. All exams will be administered in-person during the scheduled class time.

Group projects (300 points) will be performed by teams of 2-3 students. Topics for group projects must be approved by me by the date indicated on the course schedule. The final products of these projects will be a 6-page report explaining the topic, formulating a quantitative problem, identifying relevant quantities, performing estimations, and critiquing these estimates.

Letter grades will be assigned based on the [standard letter grades](#) system:

Grade	Percentage
A+	97–100%
A	93–96%
A–	90–92%
B+	87–89%
B	83–86%
B–	80–82%
C+	77–79%
C	73–76%
C–	70–72%
D+	67–69%
D	63–66%
D–	60–62%
F	0–59%

CLASS ATTENDANCE POLICY

In-person attendance for lecture is expected and necessary for success. Students are responsible for any notes, activities, discussions, and announcements given during lecture. Asynchronous materials for excused absences will be available on CarmenCanvas or by request. If you have a situation that might cause you to miss an entire week of lecture, discuss it with me as soon as possible. **Attendance is required** at in-person proctored exams.

COURSE SCHEDULE (TENTATIVE)

			Topic/Chapter	Assignment
1	T	Aug 19	Introduction – Biology by the Numbers	
	Th	Aug 21	Biological numeracy 1	
2	T	Aug 26	Biological numeracy 2	
	Th	Aug 28	Biological numeracy 3	HW 1 due
3	T	Sept 2	Biological numeracy 4	
	Th	Sept 4	Biological numeracy 5	
4	T	Sept 9	Size and geometry – Cells and viruses	HW 2 due
	Th	Sept 11	Size and geometry – Organelles	
5	T	Sept 16	Size and geometry – Cellular building blocks 1	
	Th	Sept 18	Size and geometry – Cellular building blocks 2	
6	T	Sept 23	Concentrations and absolute numbers – Making a cell	
	Th	Sept 25	Concentrations and absolute numbers – Cell census 1	HW 3 due
7	T	Sept 30	Concentrations and absolute numbers – Cell census 2	
	Th	Oct 2	Concentrations and absolute numbers – Machines and signals	Project topics due
8	T	Oct 7	Midterm exam	
	Th	Oct 9	Autumn break – no class	
9	T	Oct 14	Energies and forces – Biology meets physics 1	
	Th	Oct 16	Energies and forces – Biology meets physics 2	
10	T	Oct 21	Energies and forces – Energy currencies and budgets	
	Th	Oct 23	Rates and durations – Time scales for small molecules	
11	T	Oct 28	Rates and durations – The central dogma	
	Th	Oct 30	Rates and durations – Cellular dynamics	HW 4 due
12	T	Nov 4	Rates and durations – Life cycle of cells	
	Th	Nov 6	Information and errors – Genome	
13	T	Nov 11	Veteran’s Day – no class	
	Th	Nov 13	Information and errors – Mutations and errors	HW 5 due
14	T	Nov 18	The biosphere by the numbers	
	Th	Nov 20	Prokaryotes by the numbers	
15	T	Nov 25	Ecology by the numbers	
	Th	Nov 27	Thanksgiving – no class	
16	T	Dec 2	Evolution by the numbers	
	Th	Dec 4	Human impacts by the numbers	Projects due
			Final exam	

ACADEMIC MISCONDUCT

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 I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my 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 me.

GENERATIVE AI

GenAI can be a helpful resource for performing quantitative analyses of scientific problems in real world situations. However it is important to recognize that the goal of this course is develop the ability to reason quantitatively and to critique this reasoning. Moreover, you will not be permitted to use GenAI tools in in-person exams, which account for 50% of your final grade. Thus, it is critical for this course that you develop quantitative reasoning skills that do not strictly rely on GenAI tools.

That said, I am supportive of students learning to use GenAI tools for assignments and/or projects **when accompanied by critical thinking**. If you use GenAI, please include the following statement with each assignment:

1. Application used: Specify the GenAI application or tool you used (e.g., Copilot, ChatGPT, Claude AI, Gemini).
2. Intended purpose: Describe the purpose for which you used GenAI.
3. Quality of initial GenAI output: Evaluate the initial output generated by GenAI. For example, was it accurate, biased, coherent, and/or relevant?
4. Iteration and refinement: Explain how you revised prompts or adjusted parameters to refine the GenAI output. Did you experiment with different input prompts to improve the output?
5. Incorporation in completed assignment: Reflect on how you incorporated the GenAI-generated content into your assignment. How did you edit, adapt, or combine it with other ideas?

To give a brief example:

How many Rs are in "strawberry"?



There are **two** "R"s in "strawberry."

Source: ChatGPT-4o. Intended purpose: to illustrate a weakness of GenAI. Quality of the GenAI output: obviously incorrect. Iteration and refinement: I just decided to count the letters myself.

While GenAI can be a valuable tool, remember that academic integrity remains paramount. You are responsible for developing and articulating your own ideas, so addressing how GenAI contributed to those ideas (as you would for any sources you use) is centrally important to your learning. Attribute GenAI-generated content with proper citations and avoid plagiarism. Additionally, consider the accuracy of information incorporated in your assignment and the ethical implications of using GenAI in educational contexts. You are responsible for ensuring that the information you submit based on a GenAI query does not contain misinformation, unethical content, or violate intellectual property laws. Submission of GenAI-generated content as your own work is considered a violation of Ohio State's [Academic Integrity](#) policy and [Code of Student Conduct](#) because the work is not your own. The use of unauthorized GenAI tools will result in referral to the [Committee on Academic Misconduct](#). If I suspect that you have used GenAI inappropriately on an assignment for this course, I will ask you to communicate with me to explain your process for completing the assignment in question.

Students should familiarize themselves with the Terms of Use for the GenAI service they use, as well as the service's expectations around data privacy and use. Students should not share private or sensitive information about themselves or others with GenAI services. As indicated in Ohio State's February 2024 Security and Privacy Statement on Artificial Intelligence, "[u]niversity community members should not enter any institutional data that is categorized above the S1 (public) level into

generative AI tools, except when using the protected environment of Copilot, meaning that you logged in with your university credentials and see the green 'Protected' button in the upper right-hand corner. Even when using the protected version of Copilot, it is best practice to put only S1 or S2 (internal) institutional data into the tool. S3 (private) and S4 (restricted) data should not be entered into any AI platform.”

Please contact me if you have questions regarding this course policy.

DISABILITY SERVICES

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. 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.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

RELIGIOUS ACCOMODATIONS

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to,

rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the [Office of Institutional Equity](#). (Policy: [Religious Holidays, Holy Days and Observances](#)).

MENTAL HEALTH

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling [614-292-5766](tel:614-292-5766). CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at [614-292-5766](tel:614-292-5766) and 24-hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

CREATING AN ENVIRONMENT FREE FROM HARASSMENT, DISCRIMINATION, AND SEXUAL MISCONDUCT

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity: online reporting form at equity.osu.edu, call 614-247-5838 or TTY 614-688-8605, or Email equity@osu.edu.

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

DIVERSITY

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.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit:

- <https://odi.osu.edu/>
- <https://cbsc.osu.edu>

GRIEVANCES AND SOLVING PROBLEMS

A student who encounters a problem related to his/her educational program has a variety of avenues available to seek resolution. (Note: the procedures for grade grievances are explicitly covered in the faculty rules) Typically, a student is advised to resolve any dispute, disagreement, or grievance as directly as possible, engaging with the person or persons most closely involved. The faculty and staff of the departments and colleges are available to work with students in this regard. If this step does not produce acceptable results, the student should follow a logical stepwise progression to address the academic concerns.

According to University Policies, if you have a problem with this class, you should seek to resolve the grievance concerning a grade or academic practice by speaking first with the instructor or professor. Then, if necessary, take your case to the department chairperson, college dean or associate dean, and to the provost, in that order. Specific procedures are outlined in Faculty Rule 3335-8-23. Grievances against graduate, research, and teaching assistants should be submitted first to the supervising instructor, then to the chairperson of the assistant's department.

LYFT RIDE SMART (PREVIOUSLY SAFE RIDE)

Lyft Ride at Ohio State offers eligible students discounted rides, inside the university-designated service area (opens in new window) and has expanded service to the Short North area along High Street. Service runs from 7 p.m. to 7 a.m. Prices may be impacted by distance, traffic, time of day, special events and prime time surcharges. More information about the service and the Lyft App, and a link to get started using the Lyft Ride Smart services can be found at: <https://ttm.osu.edu/ride-smart>.

WEATHER/SHORT TERM CLOSING

Although Ohio State strives to remain open to ensure continuity of services to students and the public, extreme conditions can warrant the usage of the university's Weather or Other Short-Term Closing Policy. Please visit this webpage to learn more about preparing for potential closings and planning ahead for winter weather.

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	
Total Hrs.			41 - 43					

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 2000		Introduction to Microbiology Research	1.5				B	B
MICRBIOL 2100		Wild Yeast: Isolation to Fermentation	3		B	B	B	B
MICRBIOL 3704		HIV: From Microbiology to Macrohistory	4			I	I	I
MICRBIOL 4145		Introduction to Industrial Microbiology and Bioprocessing Laboratory	3	I	I	I	A	A
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 5130	Biology by Numbers	3	A			A	A
MICRBIOL 5147	Eukaryotic Pathogens	3		A	A	A	
MICRBIOL 5149	Introductory Virology	3		A	A		
MICRBIOL 5155	Environmental Microbiology	3	A	A	A		
MICRBIOL 5161	Bioinformatics and Molecular Microbiology	3	A	A	A		A
MICRBIOL 5270	Antibiotics and Microbial Natural Products	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 6155*	Microbial Ecology & Evolution	3			A	A	A
MICRBIOL 7010*	Cellular and Molecular Immunology	3			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					
MICRBIOL 8149*	Microbiome Informatics	3	A*	A*	A*		
	Total Hrs.	3-9					
Goal: B: Beginning; I, Intermediate; A, Advanced							

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

**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 3798.05	Impact of HIV: Tanzania (study abroad)	4			I	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	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.

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.

Microbiology 5130 Learning Goals (Mapped to Program Learning Goals)

1. Identify important scales and quantities in biological systems (e.g., typical concentrations of key biomolecules, time scales of translation, sizes of genomes, etc.). **(PLG 1 Advanced)**
2. Translate biological processes into quantitative formulations. **(PLG 1 & 4 Advanced)**
3. Extract relevant quantities for performing analyses using either quantitative or visual data from literature. **(PLG 4 Advanced)**
4. Analyze data to make order of magnitude estimates of biological quantities and processes. **(PLG 4 Advanced)**
5. Critique the assumptions, generality, potential failures, and margins of error for quantitative analyses. **(PLG 4 & 5 Advanced)**
6. Communicate quantitative reasoning, both verbally and visually. **(PLG 4 Advanced)**

Ohio State Department Course Review Concurrence Form

The purpose of this form is to provide a simple system of obtaining departmental reactions to proposed new courses, group studies, study tours, workshop requests, and course changes. A letter may be substituted for this form.

Academic units initiating a request which requires such a reaction should complete Section A of this form and send a copy of the form, course request, and syllabus to each of the academic units that might have related interests in the course. Initiating units should allow at least two weeks for responses.

Academic units receiving this form should response to Section B and return the form to the initiating unit. Overlap of course content and other problems should be resolved by the academic units before forwarding this form and all other accompanying documentation to the Office of Academic Affairs.

A. Information from academic unit *initiating* the request:

Initiating Academic Unit: Microbiology Date: 11/19/24

Registrar's Listing: MICRBIO 4130

Course Number: 5130 Level: U P G Credit Hours: 3

Course Title: Biology by the numbers

Type of Request: New Course Group Studies Workshop Study Tour Course Change

Academic Unit with related interests asked to review the request (use a separate form for each unit while requesting concurrences from multiple units):

Date responses are needed: 12/04/2024

B. Information from academic units *reviewing* the request:

- The academic unit **supports** the proposal
 The academic unit **does not support** the proposal.

Please explain:

The academic unit suggests:

 - Assistant Director for Curriculum & Instruction

Signature of Department Chair

Signature of Graduate Studies Chair (if applicable)

Ohio State Department Course Review Concurrence Form

The purpose of this form is to provide a simple system of obtaining departmental reactions to proposed new courses, group studies, study tours, workshop requests, and course changes. A letter may be substituted for this form.

Academic units initiating a request which requires such a reaction should complete Section A of this form and send a copy of the form, course request, and syllabus to each of the academic units that might have related interests in the course. Initiating units should allow at least two weeks for responses.

Academic units receiving this form should respond to Section B and return the form to the initiating unit. Overlap of course content and other problems should be resolved by the academic units before forwarding this form and all other accompanying documentation to the Office of Academic Affairs.

A. Information from academic unit *initiating* the request:

Initiating Academic Unit: Microbiology Date: 11/19/24

Registrar's Listing: MICRBIO 4130

Course Number: 5130 Level: U P G Credit Hours: 3

Course Title: Biology by the numbers

Type of Request: New Course Group Studies Workshop Study Tour Course Change

Academic Unit with related interests asked to review the request (use a separate form for each unit while requesting concurrences from multiple units):

Date responses are needed: 12/04/2024

B. Information from academic units *reviewing* the request:

- The academic unit **supports** the proposal
 The academic unit **does not support** the proposal.

Please explain: Although the course involves mathematical concepts and methods, its focus appears to be on applying these tools to biological phenomena rather than developing mathematical tools. This distinction aligns well with the intended audience of microbiology students and does not overlap significantly with the offerings of our mathematics department. We fully support the introduction of this course within microbiology and believe it will provide valuable interdisciplinary skills to students.

- The academic unit suggests:

Signature of Department Chair


Signature of Graduate Studies Chair (if applicable)
Undergraduate Studies Vice Chair

Ruiz, Natividad

From: Ruiz, Natividad
Sent: Tuesday, November 19, 2024 7:00 AM
To: Cole, Susan
Subject: Concurrence request for new Microbiology course
Attachments: MICRBIO 5130_syllabus.pdf; MICRBIO5130_Concurrence form.pdf

Dear Susan,

I would like to request concurrence from your unit for a new course that the Department of Microbiology would like to submit for approval. The course, *Biology by the numbers* (MICRBIO 5130), has been developed by one of our junior faculty, [Dr. Karna Gowda](#). We hope to offer this course in AU 25.

The goal of this course is to introduce undergraduate students to quantitative reasoning through a survey of the important quantities relevant to a range of biological processes, from the central dogma to the Earth's biosphere. We hope this course will fill a gap in OSU's quantitative biology curriculum by offering an accessible course for students in the biological sciences, requiring only an introductory course in statistics (STAT 1450, 2450, or 2480), as well as the general chemistry (CHEM 1210, 1220), and foundational biology (BIOLOGY 1113, 1114) courses required for majors in the biological sciences. This is in contrast to other quantitative courses in the Department of Mathematics, which emphasize particular modeling approaches requiring a knowledge of differential equations (cf. MATH 3350, 5651). Moreover, it expands the toolkit of quantitative reasoning for biology students beyond statistics (cf. MOLGEN 5650), enabling students to solve new types of quantitative problems. Please refer to the attached syllabus for additional details.

I would appreciate if you could please respond either by completing the attached Department Course Review Concurrence Form or by replying to this email by December 4th. No response will be interpreted as support for the course proposal.

Please let me know if you have any questions. I appreciate your time and consideration.

Natacha



Natividad Ruiz, PhD

Professor
Vice Chair for Teaching and Undergraduate Affairs
Department of Microbiology
264 Aronoff Lab Bldg
318 W 12th Ave., Columbus OH 43210
614-292-3426 Office | 614-292-4129 Lab | 614-292-8120 Fax

Ruiz, Natividad

From: Heckler, Andrew
Sent: Wednesday, November 20, 2024 9:03 AM
To: Ruiz, Natividad
Cc: Bundschuh, Ralf
Subject: RE: Concurrence request for new Microbiology course

Dear Natacha,

We have looked over the syllabus for the proposed course Micro 5130 "Biology by the Numbers", and we confirm concurrence for this course from the department of physics. Our department does offer a grad-level course 6809 "Topics in Biophysics" that does cover some of this material, but the overlap is not significant, and the target population is different.

Best regards, Andrew

Cc: Ralf Bundschuh

--

Andrew Heckler
Professor
Vice Chair for Administration
Department of Physics
Ohio State University

----- Forwarded Message -----

From: "Ruiz, Natividad" <ruiz.82@osu.edu>
To: "Bundschuh, Ralf" <bundschuh.2@osu.edu>
Subject: Concurrence request for new Microbiology course
Date: Tue, 19 Nov 2024 12:00:00 +0000

Dear Ralf,

I would like to request concurrence from your unit for a new course that the Department of Microbiology would like to submit for approval. The course, *Biology by the numbers* (MICRBIO 5130), has been developed by one of our junior faculty, [Dr. Karna Gowda](#). We hope to offer this course in AU 25.

The goal of this course is to introduce undergraduate students to quantitative reasoning through a survey of the important quantities relevant to a range of biological processes, from the central dogma to the Earth's biosphere. We hope this course will fill a gap in OSU's quantitative biology curriculum by offering an accessible course for students in the biological sciences, requiring only an introductory course in statistics (STAT 1450, 2450, or 2480), as well as the general chemistry (CHEM 1210, 1220), and foundational biology (BIOLOGY 1113, 1114) courses required for majors in the biological sciences. This is in contrast to other quantitative courses in the Department of Mathematics, which emphasize particular modeling approaches requiring a knowledge of differential equations (cf. MATH 3350, 5651). Moreover, it expands the toolkit of quantitative reasoning for biology students beyond statistics (cf. MOLGEN 5650), enabling students to solve new types of quantitative problems. Please refer to the attached syllabus for additional details.

I would appreciate if you could please respond either by completing the attached Department Course Review Concurrence Form or by replying to this email by December 4th. No response will be interpreted as support for the course proposal.

Please let me know if you have any questions. I appreciate your time and consideration.

Natacha



Natividad Ruiz, PhD

Professor

Vice Chair for Teaching and Undergraduate Affairs

Department of Microbiology

264 Aronoff Lab Bldg

318 W 12th Ave., Columbus OH 43210

614-292-3426 Office | 614-292-4129 Lab | 614-292-8120 Fax