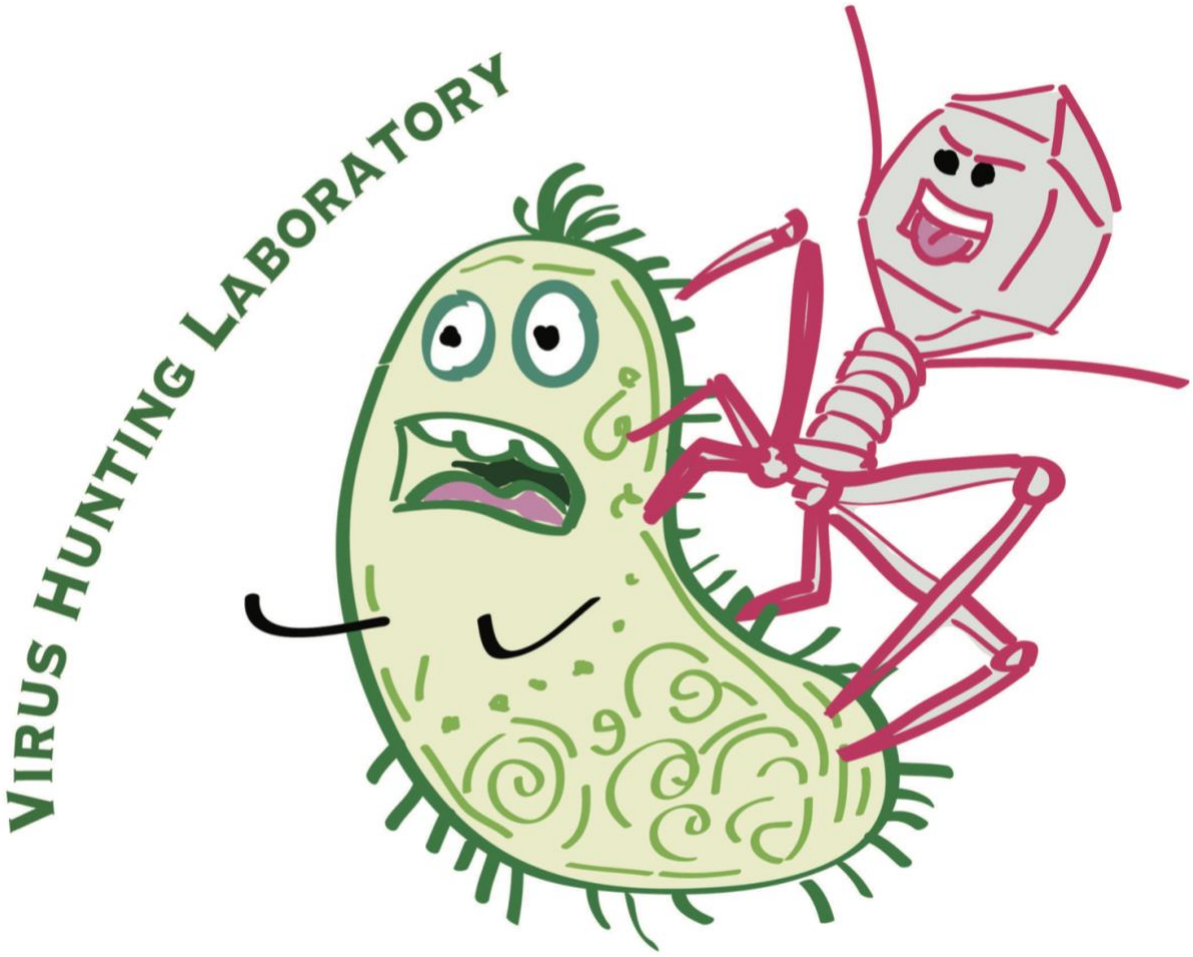


MCB 1201: Virus hunting - Applied Bioinformatics, M/W 1.30 -4.30, TLS411

Join an international science program that seeks to identify new therapies for diseases caused my superbugs (bacteria that are resistant to all or most available antibiotics). Students will annotate one genome of a virus that infects bacteria. There are more of these viruses, known as bacteriophages or phages, than of any other group of organisms on Earth, but only few have been characterized. Phage therapy is a way to treat bacterial infections without antibiotics, thus the work you do in class could have real therapeutic uses.

The course is designed for first year students. You do not need to be a science student. Non-STEM and STEM students will have a great time in class.

Approved for the GenEd CA3 Science and Technology Lab Course Requirement

SEA PHAGES

MCB 1201 Virus Hunting: Applied Bioinformatics
Semester: Spring
M/W 1:30-4:30 TLS 411 / TLS 409,
open lab times M/W 9-1:30, most Fridays

- Learn about viruses as infectious agents and tools to fight superbugs (antibiotic-resistant bacteria)
- Explore fundamentals of bioinformatics and genomics
- Share your research with an international community of virus hunters (SEA-PHAGES program)
- Approved for Gen. Ed. Content Area 3: Laboratory Course requirement

Instructors:
Dr. Johann Peter Gogarten; Office BPB 404, 486-4061; gogarten@uconn.edu
Danielle Arsenault; Office BPB 427, danielle.arsenault@uconn.edu

Course description and rationale
This course is a unique classroom-based undergraduate research experience that is part of the Howard Hughes Medical Institutes Science Education Alliance Phage Research Program. The course culminates in an online research symposium. Throughout this semester, you will learn about the biology of bacterial viruses by identifying and characterizing a new one from the environment. Your work will be connected to a larger community of undergraduate and graduate level research scientists that are exploring the biology and evolution of bacteriophages. This course is a part of a Phage Hunters Advancing Genomics and Evolutionary Science (PHAGES) educational program sponsored by the Howard Hughes Medical Institute (HHMI) and one of its divisions called the Science Education Alliance (SEA).

Course objectives:
Goal of the course is for every student to characterize a bacteriophage genome. This involves finding genes and annotating them, comparing the gene content of this phage to other known phages, and using sequence analysis to infer evolutionary relationships. The genomic sequences will then be submitted to Dr. Graham Hatful at University of Pittsburgh, and eventually to the National Center for Biotechnology Information (NCBI's) GenBank database for publication. Your phage data will also be entered into the PhagesDB database.

Learning objectives (LOs): By the end of the semester students will be able to
LO 1: Understand the central dogma of molecular biology (DNA, transcription, RNA, translation, protein).
LO 2: Appreciate the different viewpoints on evolution by natural selection.
LO 3. Use annotation software to predict genes from DNA sequence.
LO 4. Refine computer-generated gene predictions using evidence and informed judgment.
LO 5 Show proficiency with PECAAN, Blast, Phamerator, HHPred, Aragorn and other programs used to analyze DNA and protein sequences.
LO 6. Describe the biology of bacteriophage in general, and mycobacteriophage in particular.
LO 7. Design and execute a research project related to mycobacteriophage genomics.
LO 8. Write a scientific abstract and a scientific paper reporting the results of the research project.
LO 9. Construct a poster reporting on the research project.
LO 10. Keep clear and informative electronic records of gene annotations and associated evidence.
LO 11. Present data and findings orally.

Grading: Grades will be based on the following:

• Electronic notebook of gene annotations and evidence	20%
• Midterm Exam	20%
• Research project	20%
• Poster and poster presentation	20%
• In-class presentations of work ("Group meetings")	20%

Oral Presentations
Brief oral presentations will be made by each student on the phage genes and genomes they have characterized.

Poster

At the end of the semester, each MCB 1201 student will present their work in a public poster session. The poster will describe the rationale, experimental design, results, and conclusions from your analysis of a phage genome. This will be your opportunity to share your discoveries with the community of scientists in the MCB Department. One or two students will have the opportunity to present their poster(s) at the 2025 annual SEA Symposium.

Common Curriculum Alignment			
Topic of Inquiry	Common Curriculum objective	Course student learning objective(s)	Course assessment(s)
TOI-6	1. Students will be able to explain and appropriately utilize basic scientific language and concepts.	LO#1, 2, 6, 8, 9, 11.	In-class presentations of work ("Group meetings") Poster and poster presentation Midterm exam
TOI-6	2. Students will be able to design or conduct an experiment or analysis suitable to test a scientific hypothesis and be able to interpret the results.	LO#7, 10:	Research project Electronic notebook of gene annotations and evidence
TOI-6	3. Students will be able to solve problems described verbally, graphically, symbolically, or numerically.	LO#3, 4	In-class presentations of work ("Group meetings") Electronic notebook of gene annotations and evidence
TOI-6L	Through application-based experiences utilizing the scientific method, students will be able to identify problems, make observations, analyze data, interpret data, and develop models or explanations.	LO#5, 4.	Electronic notebook of gene annotations and evidence Research project Poster and poster presentation

Exam policy: When students are forced to miss the midterm of final poster presentation due to illness, accident, death in the family, or other unavoidable reasons they need to contact the Dean of Students Office to receive approval to arrange another exam time. Students should present appropriate documentation to support their request. If you need to reschedule your midterm or cannot participate in the final poster presentation, please let your instructor know ASAP. General policies that apply to Syllabi, including links to the expected workload is at http://provost.uconn.edu/syllabi-references/

Participation

Engagement with instructors and classmates is an integral part of this course. Thus, participating in all class activities will be required. **Class absences** will require make-up labs to complete the necessary laboratory experiments. A failure to make-up the laboratory experiments will result in a grade deduction due to missing entries in the lab notebook and contributions to the in-class discussion.

Classroom Etiquette

Cell Phones: Cell phone use is only permitted during the lab portion of class for data recording (pictures, notes, *etc.*) and is never permitted for texting, calls, apps, or email. If a student is observed using the phone inappropriately, he/she will be asked to turn in their phone and may lose privileges for the remainder of the semester.

Computer Use: While we understand that students will be using computers/tablets for notetaking during the class, if a student is observed using the computer for anything other than lecture materials (email, facebook, youtube, *etc.*) the same policy as outlined for cell phone use will apply.

Our Philosophy

We believe in having a dynamic classroom, open to discussion, participation, and inquiry from all members of the class. We strive to establish a fair and balanced classroom where all students can participate.

Academic Honesty

Academic misconduct is dishonest or unethical academic behavior that includes but is not limited to: misrepresenting mastery in an academic area (e.g., cheating), intentionally or knowingly failing to properly credit information, research or ideas to their rightful originators or representing such information, research or ideas as your own (e.g., plagiarism). Examples of misconduct in this class include, but are not limited to: cheating on exams, plagiarism, turning in questions for fellow students, impersonating another student, falsifying data, copying, fabricating or stealing data. For more details on the University of Connecticut's policy on academic integrity, including the instructor's role and procedures you are referred to the following pages and references therein: https://community.uconn.edu/student-undergraduate-faq/ and https://community.uconn.edu/the-student-code/the-student-code-appendix-a/

Disabilities:

It is the policy of the University of Connecticut that no qualified person be excluded from participating in any University program or activity or otherwise be subjected to discrimination with regard to any University program or activity. This policy derives from the commitment to non-discrimination for all persons in employment, access to facilities, student programs, activities, and services. The Center for Students with Disabilities (CSD) at UConn provides accommodations and services for qualified students with disabilities. If you have a documented disability for which you wish to request academic accommodations and have not contacted the CSD, please do so as soon as possible. The CSD is in Wilbur Cross, Room 204 and can be reached at (860) 486-2020 or at csd@uconn.edu. Detailed information regarding the accommodations process is also available on their website at http://www.csd.uconn.edu/.

Grading Scale:

Letter Grade	If your overall percentage is greater than or equal to this	and your overall percentage is less than this
A	93	—
A-	90	93
B+	87	90
B	83	87
B-	80	83
C+	77	80
C	73	77
C-	70	73
D+	67	70
D	63	67
D-	60	63
F	0	60

Draft Schedule

(lecture topics are in normal font, *exercises and group activities in italics*)

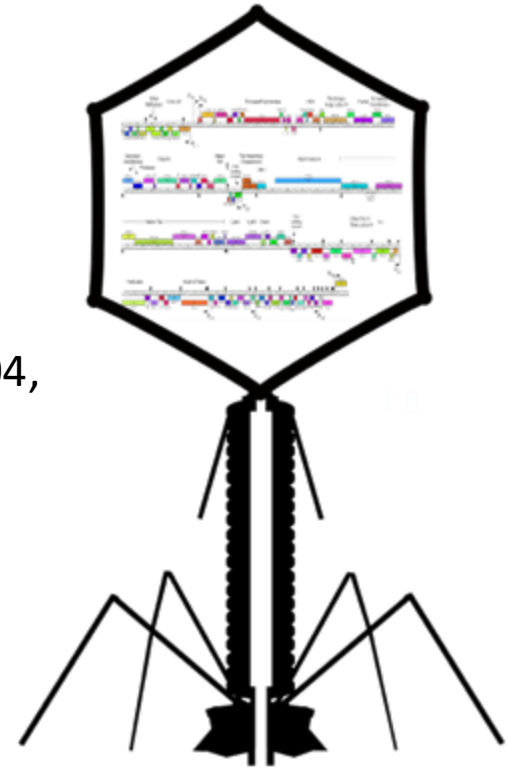
Week	Class Day	Topic
1	1	Introduction to course. Introduction to viruses
2	1	Presentations on viruses Introduction to Phage Biology and genes in bacteriophage Introduction to the genomic analysis workflow
2	2	Sequencing and assembly, multiplexing using barcoding primers *Introduction to annotation software*
3	1	Molecular biology basics Gene structure and regulation in bacteria and viruses *Annotation: Phamerator exercises*
3	2	Genome annotation *Annotation: introduction to DNAMaster, genemark/glimmer*
4	1	BLAST and database searches *Annotation: BLAST exercises*

4	2	Error types in databank searches *Exercises illustrating factors impacting expectation (significance) values*
5	1	Proteins structure data banks and Position Specific Iterated blast searches *Identifying protein domains*
5	2	Lecture *Annotation*
6	1	Lecture *Annotation*
6	2	Lecture *Annotation*
7	1	Discussion of post annotation analyses *Students discuss finish annotations.*
7	2	**Midterm Exam**
8	1	Intro to phylogenetic reconstruction *Introduction to R.* *Phylogenetic comparisons of genes & genomes of interest*
8	2	Phylogenetic reconstruction part 2 and horizontal gene transfer *Introduction to Data visualization*
9	1	Levels of selection and Gene Transfer Agents *Introduction to Poster Design* *Post-annotation analyses*
9	2	Phages as a second adaptive immune system / phage therapy *Post-annotation analyses*
10	1	How many phages are there? How do we know? *Post-annotation analyses*
10	2	Lecture *Post-annotation analyses*
11	1	The role of phages in the global carbon cycle *Students discuss and plan group presentations and refine post-annotation experimentation*
11	2	*Intro to protein visualization software (chimera)*
12	1	*Microbiome symposium 2pm-* *Attend lecture by Forest Rohwer 4:30pm.*
12	2	*Group presentations*
13	1	*Writing abstracts / prepare posters*
13	2	*Critique and edit poster drafts*
14	1	*Student-annotated files are merged, finalized, and reviewed by the Hatfull Laboratory for submission to GenBank. Complete Posters*
14	2	*Poster presentations and class wrap-up*

Course materials including textbook-like information on phage biology and guides to the programs used in the exercises is available at https://seaphagesbioinformatics.helpdocsonline.com/home)
Specialized software used in the course will be available on the computers in the computer lab.
In addition, we will frequently use HuskyCT/Blackboard, Google Apps, and Microsoft 365 (free to UConn students – install the apps on your computers, these work much better than the web versions see the UConn Knowledge base).

Class meeting will be on M/W 1:30-4:30. These include lectures, demonstrations, group discussions, and computer-lab exercises. Most exercises during the class periods will use examples provided by the instructors to familiarize students with concepts, analyses, and programs. The open lab times (M/W 9-1:30, most Fridays) are for students to apply the learned approaches and programs to the phage genome assigned to each student, and to explore additional comparative analyses on their genomes.
The open lab times are an integral part of the course during which students pursue their own research projects. At least one instructor will be presents during the open lab times.

MCB 1201
Virus Hunting: Applied Bioinformatics



Spring Semester 2025, 4 credits
M/W 1:30-4:30, TLS411
open lab times M/W 9-1:30, and
most Fridays

Instructors:

Dr. Johann Peter Gogarten; Office BPB 404,
gogarten@uconn.edu
Danielle Arsenault, BPB 427
danielle.arsenault@uconn.edu

Recommended for freshmen and sophomores;

Science and non-science students welcome!

Approved for the
GenEd CA3 Science and Technology Lab Course Requirement