

“Fundamentals of Microbial Genomics”

Course Numbers 11:115:423; 16:682:534; 16:215:604

COURSE SCHEDULE

In-person and virtual, Monday and Wednesday, 5th Period (3:55pm – 5:15pm); Virtual until Monday, January 31, 2022: in-person classes are in Foran Hall Room 124

CONTACT INFORMATION:

Instructor: Debashish Bhattacharya

Office Location: Foran Hall 102

Phone: 848-932-6218; Email: dbhattac@rutgers.edu

Office Hours: Monday and Wednesday, for 45 min after class

COURSE WEBSITE, RESOURCES AND MATERIALS:

- <https://rutgers.instructure.com/courses/112980>

COURSE DESCRIPTION:

This course will be taught synchronously (virtually using Zoom) and then in-person on January 31, 2022, onwards. The lectures and discussions for the virtual classes will be recorded and uploaded to the Canvas course website. The in-person classes will not be recorded, but the lecture notes will be uploaded on Canvas. The course material will focus on the foundations of modern genomics: from experimental design to data acquisition, analysis, and interpretation. The course will be of an introductory nature and is intended to provide both undergraduate and graduate students the tools and understanding to take part in the on-going genomics (and -omics) revolution. Areas to be covered include de novo genome sequencing and assembly, gene prediction and annotation, functional genomics (RNA-seq), metagenomics, single cell genomics, and metabolomics. Applications of these tools in the environmental, medical, and evolutionary microbiology fields will be covered with each of these broad areas being looked at in detail through lectures, paper-readings, and discussions. Students in this semester-long theory course are expected to enter with basic training in biology and an interest in bioinformatics and evolution.

LEARNING GOALS:

Goal 1: Explain basic genomic, bioinformatic, and evolutionary genomic concepts.

Goal 2: Describe the evolutionary origins, processes, and patterns of cells over geologic time.

Goal 3: Develop a comprehensive understanding of basic analytic tools in the genomics field such as DNA sequencing technologies, BLAST, phylogeny inference, gene prediction, and data interpretation.

Goal 4: Demonstrate the ability to explain and defend genomics principles in class debates.

Goal 5: Communicate effectively orally in class, and through written text and graphics.

ASSIGNMENTS/RESPONSIBILITIES & ASSESSMENT:

Evaluation and Grading of Undergraduate Students: Midterm: 20%, Debates: 10%, Pre-proposal: 5%, Final exam: 20%, Presentation: 20%, Final Essay: 25%

Evaluation and Grading of Graduate Students: Midterm: 20%, Debates: 10%, Pre-proposal: 5%, Final exam: 20%, Presentation: 20%, Final Essay: 10%, Research proposal: 15%

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

COURSE SCHEDULE:

1. Wednesday, January 19, 2022: Course Introduction and big picture of evolution
2. Monday, January 24, 2022: Genome structure in prokaryotes and eukaryotes
3. Wednesday, January 26, 2022: Endosymbiosis and the chimeric origin of cells and their genomes
4. Monday, January 31, 2022: A brief history of sequencing and applications of current technology
5. Wednesday, February 2, 2022: Bioinformatics and databases I
6. Monday, February 7, 2022: Bioinformatics and databases II
7. Wednesday, February 9, 2022: Genome assembly and gene prediction methods I
8. Monday, February 14, 2022: Genome assembly and gene prediction methods II
9. Wednesday, February 16, 2022: Phylogenetics and Network analysis
10. Monday, February 21, 2022: Phylogenomics
11. Wednesday, February 23, 2022: Functional genomics I (theory) Tim Stephens
12. Monday, February 28, 2022: Functional genomics II (applications) Tim Stephens
13. Wednesday, March 2, 2022: In-class review of lectures and sample take-home exam: *Pre-proposals due by 5pm using email to dbhattac@rutgers.edu*
14. Monday, *March 7, 2022: Take-home midterm exam (no class)*
15. Wednesday, *March 9, 2022: Debate 1 – What can genetics and genomics do for conservation biology?*

March 12-20: Spring Recess

16. Monday, March 21, 2022: Horizontal gene transfer
 17. Wednesday, March 23, 2022: Genome reduction
 18. Monday, March 28, 2022: Metagenomics (biomes, amplicons, and assembly)
 19. Wednesday, *March 30, 2022: Debate 2 – TBA*
 20. Monday, April 4, 2022: Virus genomics and evolution, Felipe Benites
 21. Wednesday, April 6, 2022: Coral metabolomics, Amanda Williams
 22. Monday, April 11, 2022: Presentations 1-5
 23. Wednesday, April 13, 2022: Presentations 6-10
 24. Monday, April 18, 2022: Presentations 11-15
 25. Wednesday, *April 20: Final exam*
 26. Monday, April 25, 2022: Presentations 16-19
 27. Wednesday April 27, 2022: Presentations 20-21
- Monday, May 2, 2022: Classes end**

FINAL ESSAY/REPORT DATE AND TIME

Essay (all students): Thursday, May 5, 2022, 5pm

Graduate student report: Monday, May 9, 2022, 5pm

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- all student work is fairly evaluated and no student has an inappropriate advantage over others.
- the academic and ethical development of all students is fostered.
- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

In this course, we will take cheating very seriously. All suspected cases of cheating and plagiarism will be automatically referred to the student conduct office (<http://academicintegrity.rutgers.edu>), and we will recommend penalties appropriate to the gravity of the infraction.

STUDENT WELLNESS SERVICES

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.