

BSC 2930
Introduction to Phage Isolation, Genome sequencing and Analysis

Section 1B70

Description

Students will be introduced to the science of genomics through laboratory exercises that require sequencing and analyzing the complete genome of a novel bacterial virus. The course will include discussions of topics ranging from basic genetics, genomes and biotechnology.

Credit Hours

03

Pre-requisites and Co-requisites

None – but AP, first year college biology and/or genetics would be helpful

General Education Requirement

This course meets three credits of the General Education requirement in Biological Sciences. Courses that meet this requirement provide instruction in the basic concepts, theories and terms of the scientific method, and focus on major scientific developments and their impacts on society, science and the environment. In this course, you will formulate empirically-testable hypotheses derived from the study of physical process and living things and you will apply logical reasoning skills through scientific criticism and argument.

Course Overview

The science of genomics is revolutionizing the study of biology and impacting broadly across diverse disciplines from clinical medicine, plant and animal development, genetics, biodiversity and ecology. Genomics technologies have rapidly advanced over the last two decades. This is best illustrated by recent advances in DNA sequences. While completion of the first whole genome draft sequence of human required close to 15 years at a cost of >\$2.7 billion, current methodologies are enabling this to be done with massive reductions in both cost and time. Indeed, technologies are expected to be available this year (2012) that enable a human genome to be sequenced for ~\$1,000 in less than a day. It will be possible to sequence genomes as a routine medical test, giving doctors and other health care workers access to unprecedented amounts of information. It will be critical for all citizens to understand the impact of this technology upon their lives; this course will provide an introduction to this topic.

The costs to sequence organisms with smaller genomes is even less, and this course will immerse non-majors in an exciting effort to sequence and analyze the genomes of bacteriophages (bacterial viruses) that infect non-pathogenic relatives of the bacteria that cause tuberculosis and leprosy. The opportunity to work with viruses that infect safe-to-handle relatives of these fascinating bacteria,

provided in part by funding from the Howard Hughes Medical Institute (HHMI), will provide a unique educational experience.

Efforts to characterize the genomes of novel and uncharacterized organisms, like the bacteriophages that represent the focus for the laboratory portion of this course, are still part of cutting-edge ongoing research efforts. Since this course is supported by HHMI, the students will also have the opportunity to interact online with students engaged in similar inquiry laboratory courses located at Universities and Colleges across the country. This course will give students an opportunity to work on a cutting edge scientific project and be exposed to an exciting picture of 21st century biology.

Course Objectives

By the end of the course, the student will be able to do the following:

- Describe the scientific method and the distinction between discovery-based research and hypothesis-based research.
- Define the research areas of Genomics, Bioinformatics and Computational Biology, and understand the fundamental questions addressed by these research areas.
- Formulate a scientific hypothesis, design an experiment to test that hypothesis, and critically evaluate the results. For this course, the experiments will be computational analyses.
- Explain the basic principles of gene expression, translation, and DNA/RNA replication.
- Understand that information about evolutionary relationships is used to infer gene function; relate the evolutionary analyses used for this project to broader evolutionary theory.
- Understand the mechanisms that bacteriophages and bacteria use to exchange genes and relate those analyses to the underlying molecular basis of infectious diseases.

Instructor Information

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Course Meeting Time(s)

The course meets Tuesdays during periods 4 (10:40AM – 11:35PM) and Thursdays during periods 4-5 (10:40 – 12:35).

Course Meeting Location(s)

The lab will meet in the computer lab in CARR 611.

Course Website

Course materials and related information will be posted on the course E-Learning (Sakai) website at <http://lss.at.ufl.edu>. You are responsible for all announcements made in class and/or posted on the course website for this course.

Fees

NONE

Required Materials

Readings will be provided with the course, including a PDF copy of HHMI SEA NGRI Phage Resource Guide and the guide to DNA master. Students are expected to read these and will use them for the duration of the course. The readings comprise a selected set of papers from peer-reviewed journals, popular science writing, vetted web sites with a science education focus, and science journalism, and will be provided on the course website as necessary. Note that peer-reviewed scientific literature is the means that practicing scientists use to communicate their findings. Reading the peer-reviewed literature can be difficult because the text can be very technical and use a large amount of novel vocabulary. However, it is important to learn how scientists communicate, and reading this literature is a skill you should acquire. Generally these reading materials will be assigned as supplements to material in the Theory lectures that will be discussed the following week. So, for example, I may assign a reading on week 2 that you should read in preparation to discussion during week 3.

Course Outline (topics covered by week – subject to revision throughout the course)

Week	Topic
1 1/3, 1/5	Theory lecture – Fundamentals of genetics
2 1/10, 1/12	Theory lecture - Fundamentals of cellular and molecular biology
3 1/17,1/19	Theory lecture - DNA sequencing, Annotation, Annotation tools
4 1/24,1/26	Theory lecture – DNA sequencing, Annotation, Annotation tools
5 1/31, 2/2	Theory lecture – Introduction to Phage genomes READING – description of the mycobacteriophage L5 genome
6 2/7, 2/9	Theory lecture - Introduction to Phage genomes LAB - Annotation
7 2/21, 2/23	Assignment 1 – in class. READING – description of the insights that have come from phage hunting LAB - Annotation
8 2/28, 3/2	Theory lecture - Comparative genomics and evolution LAB – Continue Annotation Mid-Term Problem Set
9 3/7, 3/9	SPRING BREAK
10 3/14, 3/16	Theory lecture - Comparative genomics and evolution LAB – Continue Annotation
11 3/21, 3/23	LAB – Continue Annotation
12 3/28 ,3/30	LAB – Continue Annotation
13 3/31, 4/2	LAB – Continue Annotation
14 4/4, 4/6	LAB – Continue Annotation
15 4/11, 4/13	LAB – Wrap up annotation efforts
16 4/18	FINAL Take home Exam Due ALL LAB PROGRESS REPORT revisions are due ACTIVITY – Wrap up annotation efforts, send annotated genome for approval

Conduct in Class

- Participate in discussions and ask questions. Be prepared to discuss readings; most readings are assigned the week before they will be covered. Please be courteous to other students during the class, but make sure you engage with both the other students and the instructor.
- We will have discussions focused on issues such as gene patents and genomics and medicine. These discussions will ultimately focus on the intersection of public policy and science. Make sure you have completed readings before the discussions and feel comfortable with the factual claims you will use to back up your opinions. You will be expected to complete a written summary of your points of view before the discussion and then finish it by revising it in light of the discussion before turning it in.
- Tardiness is disruptive for the lecture. Frequent tardiness will not be tolerated. Five points per occurrence will be deducted from the student's overall score after the third occurrence of being late to class.
- Only approved electronic devices may be used in class. Approved electronic devices are laptop computers (when used to participate in classroom activities) and voice recording devices. Unapproved electronic devices include cell phones, video recorders, digital cameras and MP3 players.

Grading

- Mid-Term Problem set: 20% of final grade
- Final Take Home Exam: 35% of final grade
- Laboratory Notebook: 15% of final grade
- Lab Report 30%

Description of Assessment Criteria Used to Assign Grades

- **Tests:** There will be one test, comprised mostly of a series of questions requiring a few sentences to approximately one-paragraph to answer. The focus of these exams will be critical thinking, the synthesis of concepts, and the students' ability to present this information. These questions will be based on material presented in lecture/discussion as well as techniques and theory related to the lab experiments. The exams will be given during the lecture period.
- **Final Exam:** There will be a comprehensive take-home final exam with the same format as the two tests.
- **Laboratory Notebook:** Maintaining an accurate and complete laboratory notebook is critical in the sciences. Notebooks will be examined periodically to ensure accurate record keeping and students will be reminded of the standards for good scientific record keeping throughout the course.
- **Lab Reports:** The lab report will give students a chance to place their laboratory work in the context of broader hypotheses, so these are complementary to the lab notebook. The focus of

these reports will be descriptions of hypotheses and the ways the lab experiments address those hypotheses.

Grading Scale

Point Range (%)	Letter Grade	GPA equivalent
≥ 90.00	A	4.0
86.7 – 89.9	A-	3.67
83.3 – 86.6	B+	3.33
80.0 – 83.2	B	3.0
76.7 – 79.9	B-	2.67
73.3 – 76.6	C+	2.33
70.0 – 73.2	C	2.0
66.7 – 69.9	C-	1.67
63.3 – 66.6	D+	1.33
60.0 – 63.2	D	1.0
56.7 – 59.9	D-	0.67
< 56.7	E	0

Note that a “C-“ will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html>

Grade Curve Policy

Curves will be applied to each individual test when warranted based upon an evaluation of the maximum score and/or mean.

Attendance and Make-Up Work Policy

Class attendance is required. The two lab sections are design to maximize the likelihood of each student completing the project. In addition, theory and/or lab lectures will be provided periodically during each lab session. Please read the assigned chapters before coming to class or logging on, since this will make it easier to comprehend the lecture material.

The policies for allowable absences, make-up work and make-up exams follow the university attendance policies: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>. The student will remain responsible for scheduling any make-up work with the instructor. All excused absences will require appropriate documentation. Make-up work and make-up exams given to accommodate personal matters require a note from the Dean of Students (P202 Peabody Hall). The format of make-up work and make-up exams will be at the instructor’s discretion.

UF Counseling Services

- Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
 - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
 - Career Resource Center, Reitz Union, 392-1601, career and job search services.
- Many students experience test anxiety and other stress related problems. “A Self Help Guide for Students” is available through the Counseling Center (301 Peabody Hall, 392-1575) and at their web site: <http://www.counsel.ufl.edu/>.

Honesty Policy

- All students registered at the University of Florida have agreed to comply with the following statement: “I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.”
- In addition, on all work submitted for credit the following pledge is either required or implied: *“On my honor I have neither given nor received unauthorized aid in doing this assignment.”*
- If you witness any instances of academic dishonesty in this class, please notify the instructor or contact the Student Honor Court (392-1631) or Cheating Hotline (392-6999). For additional information on Academic Honesty, please refer to the University of Florida Academic Honesty Guidelines at: <http://www.dso.ufl.edu/judicial/procedures/academicguide.html>.

Accommodation for Students with Disabilities

- Students who will require a classroom accommodation for a disability must contact the Dean of Students Office of Disability Resources, in Peabody 202 (phone: 352-392-1261). Please see the University of Florida Disability Resources website for more information at: <http://www.dso.ufl.edu/drp/services/>.
- It is the policy of the University of Florida that the student, not the instructor, is responsible for arranging accommodations when needed. Once notification is complete, the Dean of Students Office of Disability Resources will work with the instructor to accommodate the student.

Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

Notice regarding Syllabus lecture and exam schedule

Syllabus is subject to change. While it is very likely that the procedures, lecture, posted exam and presentation dates will be adhered to, these may be subject to change as the semester progresses and should be considered tentative ONLY!!