

Current Information:I. A.) COURSE NUMBER, and TITLE: BSC 2930 (Var. Top.) Introduction to GenomicsB.) CREDIT HOURS: 1 C.) PREREQUISITES: None

D.) CURRENT CLASSIFICATION

1. General Education Code: B C D H M N P S None2. Writing Requirement: E2 E4 E6 None3. Math Requirement: M None**Requests:**

II. GENERAL EDUCATION

A.) Requested Classification: B C D H M N P SB.) Effective Date: Fall Spring Summer 2012 (year) 1-time Approval _____ (year)
OrIII. WRITING REQUIREMENT MATH REQUIREMENT A.) Requested Classification E2 E4 E6B.) Effective Date: Fall Spring Summer _____ (year) 1-time Approval _____ (year)
Or

C.) Assessment:

1.) What type of feedback will be provided to the student (in reference to writing skill)?

_____ Grade _____ Corrections _____ Drafts _____ Other

2.) Will a published rubric be used?

IV. ATTACH A DETAILED SYLLABUS

V. SYLLABUS CHECKLIST

Courses that offer students General Education and/or Writing Requirement credit must provide clear and explicit information for the students about the classification and requirements.

A.) For courses with a **General Education** classification, the syllabus should include:

- Statement of the General Education Purpose of the Course with attention to the General Education Classification requested
- List of assigned General Education Student Learning Outcomes
- List of any other relevant Student Learning Outcomes
- List of required and optional texts
- Weekly course schedule with sufficient detail (e.g. topics, assigned readings, other assignments, due dates)

B.) For courses with **Writing Requirement (WR)** classification, the syllabus should include:

- "The Writing Requirement ensures students both maintain their fluency in writing and use writing as a tool to facilitate learning."
- "Course grades now have two components: To receive writing credit, a student must receive a grade of "C" or higher and a satisfactory completion of the writing component of the course."
- A statement or statements indicating that the instructor will evaluate and provide feedback on the student's written assignments with respect to grammar, punctuation, usage of standard written English, clarity, coherence, and organization
- Assignment word counts, page lengths, submission deadlines and feedback dates

Additionally, the syllabus must clearly show that the course meets the WR to

- Evaluate [2,000/4,000/6,000] written words in assignments during the semester
- Provide all feedback on assignments prior to the last class meeting

Important note: The following types of writing assignments **CANNOT** be used to meet the WR: teamwork, exam essay questions, take-home exams, and informal, ungraded writing assignments.

VI. SUBMISSION AND APPROVALS

A.) Submitted by (Signature of Instructor): _____

Print Name Edward Braun Date 23 Nov 2011

B.) Department Approval (Signature): _____

Print Name David Julian Date 23 Nov 2011

C.) College Approval (Signature): _____

Print Name _____ Date 23 Nov 2011

D.) Committee Action: Approved Denied Tabled Date _____

BSC 2930
Introduction to Genomics and Bioinformatics: Learning from Phages
for non-majors – Section 3709

Description

Students will be introduced to the science of genomics by analyzing and annotating the complete genome of a novel bacterial virus. The course will include discussions of topics ranging from genomes and biotechnology to human health and the environment.

Credit Hours

01

Pre-requisites and Co-requisites

None

General Education Requirement

The non-majors course meets one credit 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 identify genes in the genome of a currently uncharacterized bacteriophage, formulate hypotheses regarding the functions of those genes, and use cutting-edge bioinformatic tools test those hypotheses computationally. You will apply logical reasoning skills to evaluate those hypotheses and learn how to place your results in a broader scientific framework.

Course Overview

This is a stand-alone course focused on authentic computational (“dry lab”) research in which students will learn how to analyze genome content. However, it is related to a “wet lab” in which students isolated a novel bacteriophage (bacterial virus). The relationship is simply that the target organism for genome analysis (the bacteriophage) was isolated in the first semester; the goal of this course is to provide an immersion in bioinformatics and it is therefore provides instruction in a completely different set of conceptual and practical skills from the wet lab.

Bioinformatics is central to the science of genomics, and genomics is revolutionizing all aspects of biology. The decrease in costs for genome sequencing have been staggering; whereas the cost of the first human genome sequence was \$2.7 billion (in 1991 dollars) the current cost to sequence a human genome is <\$50,000. 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. However,

understanding genome sequences also requires detailed computational analyses of the sequence data; this course will provide an introduction to those analyses.

The costs to sequence organisms with smaller genomes is even less than it is for the human genome, and this course will immerse non-majors in an exciting effort to analyze the genome of a bacteriophage previously isolated by UF students. This bacteriophage infects a non-pathogenic relative of the bacteria that cause tuberculosis and leprosy. The opportunity to analyze this bacteriophage genome, provided in part by funding from the Howard Hughes Medical Institute (HHMI), will provide a unique educational experience since the bacteriophage is currently uncharacterized. Thus, the students will be immersed in authentic research.

This course is a laboratory course that will focus on the effort to characterize the genomes of this novel and uncharacterized bacteriophage. These types of research efforts 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.

Note that since this is a laboratory course focused on authentic research, we may deviate from the schedule slightly if our findings demand changes. At this point we simply do not know which genes are present in the genome of the bacteriophage we are analyzing at this point. Thus, we may adjust lectures to cover novel findings of interest. Under the guidance of the instructors, students will be responsible for formulating hypotheses about the identity of potential genes and testing those hypotheses using computational methods. Readings will be added as necessary to help this effort.

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 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.
- Understand that information about evolutionary relationships is used to infer gene function; relate the evolutionary analyses used for this project to broader evolutionary theory.
- Explain the basic principles of gene expression, translation, and DNA/RNA replication in microorganisms.
- Understand the mechanisms that bacteriophages and bacteria use to exchange genes and relate those analyses to the underlying molecular basis of infectious diseases.
- Critically evaluate the factual basis of claims when discussing the ethical, legal, and social implications of biotechnology and genomics.

Instructor Information

Name: Edward L. Braun
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Teaching Assistant Information:

Name: Jessica Sabo
Office location: TBA
Telephone: TBA
E-mail address: jsabo@ufl.edu
Office hours: TBA

Course Meeting Time(s)

This lab will meet once per week for three (3) hours.

Course Meeting Location(s)

The lab will meet in 611 Carr during periods 5 through 7

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 the HHMI SEA NGRI Phage Resource Guide. 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. The readings selected for this semester are listed below (pages 5 and 6).

Bound hardcover laboratory notebook

Course Outline (topics covered by week – readings are assigned during each week for the next week)

Week	Topic (subject to revision)
1	Review of last semester's accomplishments, goals for the coming semester READING – gene ontology (using controlled vocabularies to describe genes) OPTIONAL READING – contamination in genome sequences LAB – Course overview and lecture on computer use.
2	What are genes? How can they be identified in unannotated genome sequences? READING – description of the mycobacteriophage L5 genome LAB – Begin gene calling LAB PROGRESS REPORT I due
3	What is in a phage proteome? READING – description of the insights that have come from phage hunting LAB – Continue gene calling
4	Metagenomics of phage and the phage proteome READING – introduction to genes and homology LAB – Continue gene calling
5	Homology searches and gene identification READING – sensitive homology searches using hidden Markov models LAB – Begin homology searches, learn annotation methods
6	More sensitive homology searches READING – phage evolution and horizontal gene transfer LAB – Continue homology searches
7	Comparative genomics and evolution READING – none (prepare for test) LAB – Compare sequences to other available mycobacteriophages LAB PROGRESS REPORT II due
8	MIDTERM TEST
9	Comparative genomics and evolution READING – comparative genomics of phages (putting it all together) READING PLAN FOR NEXT WEEK – vote on genes to explore in detail LAB – Compare sequences to other available mycobacteriophages
10	Comparative genomics and evolution, continued READING – selected by students based upon gene calls; vote on second reading LAB – Class presentations (students will begin comparing their annotations in detail)
11	Detailed discussion of selected gene function (selected reading #1) READING – selected by students based upon gene calls LAB – Class presentations continue
12	Detailed discussion of selected gene function (selected reading #2) LAB – Class presentations continue LAB PROGRESS REPORT III due
13	Panel discussion: What is in the genome of our bacteriophage? LAB – Wrap up annotation efforts LAB PROGRESS REPORT III due
14	Panel discussion: What is in the genome of our bacteriophage? (continued) LAB – Wrap up annotation efforts, send annotated genome for approval
15	FINAL ALL LAB PROGRESS REPORT revisions are due

Readings

Your readings will come from the peer-reviewed scientific literature (journals like *Nature Genetics*, *PLoS Genetics*, and *Cell* – indicated below using italics). 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. Read my “guide to reading the peer-reviewed literature” for an approach that will help you do this.

NOTE – The week for readings the readings is the week they are assigned. They will be discussed in the following week. I reserve the right to change readings as the course progresses.

Week 1 – Controlled vocabularies to describe gene functions

Nature Genetics – “Gene ontology: tool for the unification of biology”

Reading for new students (optional reminder for previous students):

PLoS ONE – “Abundant Human DNA Contamination Identified in Non-Primate Genome Databases”

Week 2 – What is in a phage genome?

Molecular Microbiology – “DNA sequence, structure and gene expression of mycobacteriophage L5”

Week 3 – Natural selection and the direction of evolution

PLoS Genetics – “Exploring the mycobacteriophage metaproteome”

Week 4 – Emerging pathogens

Current Biology – “Genes and homology”

Week 4 – Emerging pathogens

Nature Biotechnology – “What is a hidden Markov model?”

Week 6 – Microbial evolution; horizontal gene transfer

Cell – “Origins of highly mosaic mycobacteriophage genomes”

Week 8 – Selected reading

Research in Microbiology – “Comparative genomics of the mycobacteriophages”

Week 9 and 10 – Selected reading

The readings will be selected based upon genes identified in the bacteriophage, by student vote. The vote will select the focal gene(s); the instructors will choose the reading to focus on the gene(s)

Attendance Policy

Class attendance is required. Students are expected to attend lectures unless other arrangements are made. Please read the assigned chapters before coming to class or logging on, since this will make it easier to comprehend the lecture material.

Conduct in Class

- Participate in discussions and ask questions. Be prepared to discuss readings before the class meets; 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 the both the other students and the instructor.

- We will hold panel 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. Computers with appropriate software installed will be provided in the classroom, but students are also welcome to use their own laptop computers for specific tasks.

Grading

- Midterm: 15% of final grade
- Quizzes: 10 quizzes (10% of final grade)
- Final Exam: 15% of final grade
- Laboratory Notebook: 15% of final grade
- Lab Progress Reports: 10% of final grade
- Lab Presentations: 2 presentations (20% of final grade)
- Class Participation: 10% of final grade
- Participation in panel discussion: 5% of final grade
- **Bonus Points:** Students have the opportunity to receive bonus points by participating in the HHMI SEA NGRI Question of the week online. Each week a new question is posted and all students have the opportunity to respond by the deadline posted. Students participating in the question of the week will earn one bonus point for each question they answer online. Only 1 bonus point can be earned each week. HHMI also rewards the first correct answer from each university with a prize, so there is an extra incentive to participate in the Question of the Week!

Description of Assessment Criteria Used to Assign Grades

- **Tests:** There will be a single midterm test, comprised mostly of a series of questions with approximately one-paragraph answers expected. The focus of these exams will be critical thinking, the synthesis of concepts, and the students' ability to present this information. The exams will be given during the lecture period.
- **Quizzes:** There will be 10 short quizzes that will be given online using a multiple choice and short answer format. The purpose of the quizzes is to ensure continued engagement with readings and lecture/laboratory materials.

- **Final Exam:** There will be a comprehensive final exam with the same format as the two tests.
- **Laboratory Notebook:** Maintaining an accurate and complete laboratory notebook is critical in the sciences. This can be especially challenging in a “dry lab” setting because you may not think of the computer work as experiments. But the computational analyses you will do are every bit as important as doing work in a “wet lab”. Thus, good record keeping is critical. 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 Progress Reports:** Progress reports 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.
- **Lab Presentations:** Students will be responsible for two presentations of readings from the scientific literature (typically news features from journals like *Science* and *Nature*). The presentations will be 10 minutes in duration with approximately five minutes of questions afterward.

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.

Make-up Policy

Students who miss class due to an excused absence will be allowed a reasonable time to make-up missed work in accordance with university policies as defined in the current undergraduate catalog. The format of 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.