

ZOO 4926 (337E/337L)
Special Topics: Genomics and Biotechnology

Description

Big data and genomics are prominent in the medical and agricultural life-sciences. Students will be introduced to modern next-generation sequence based molecular biology through a combination of lectures and hands-on wet-lab exercises. This course will introduce students to the theory behind basic molecular biology techniques (i.e. nucleic acid biochemistry and isolations, cloning, PCR, DNA/RNA hybridization, traditional and NGS sequencing), basic analysis (basic UNIX and command line familiarity, annotation, sequence alignment, data file formats, variant detection, expression analysis), and supplement these with wet-labs where students will perform RNA and DNA isolations, sample QC, NGS library construction; and, dry-lab sessions where students will learn to perform basic assembly, alignment and expression detection analysis using the NSF iPlant CYVERSE platform.

Instructor

Dr. W. Brad Barbazuk, Department of Biology and the UF Genetics Institute
CGRC room 407 2033 Mowry rd. or by appointment (273-8624)
bbarbazuk@ufl.edu

Course website

UF e-learning

Text

Readings will 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. We will assign readings for student presentation / discussion leading to supplement lectures throughout the semester.

Reading/presentation schedule will be determined during the first week.

A NOTE ON OUR HYFLEX CLASS THIS SEMESTER

This course consists of two sections, an online and a face-to-face, which are *simultaneous*, i.e., they occur at the same meeting days and times. This means that some students in our class, and the

instructor, will be participating from the assigned classroom, while others will be participating remotely (e.g., via Zoom) from their preferred location.

As this is a new format for us, we want to ensure that you are aware of the following:

- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations. Since our rooms hold significantly fewer students than normal, the number of students *in* the classroom will be quite small – in this section, there will be 8 students in person, with the remaining 17 participating online.
- Students who have signed up for the *in-person* section are expected to attend class on every scheduled meeting day and time, as indicated in the course syllabus. Likewise, students who signed up for the *online* section are expected to attend class virtually on every scheduled meeting day and time, as indicated in the course syllabus.
- In-person students (and faculty) are required to wear approved face coverings at all times during class and within buildings, and to maintain physical distancing of at least six feet at all times. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- Face-to-face students and instructors are expected to clean their spaces (desks, chairs, podium) at the end of every class period. Sanitizing supplies are available in the classroom.
- Technology in the classrooms has been updated, but is still insufficient to allow communication between face-to-face and virtual students. The instructor will be the only one able to communicate with both populations, but will have to do so while remaining behind the podium (due to microphone placement). The instructor will have to repeat any questions or comments from face-to-face students for the benefit of the virtual students.
- If face-to-face students wish to join the Zoom call from the classroom, they will have to provide their own computers and, crucially, headsets, in order to avoid interference from the various microphones.
- Instructors will make every effort to incorporate both cohorts of students simultaneously, although this will require a lot of trial and error and a great deal of patience on all our parts.

This will be a different experience for all of us, but we are doing our best to comply with university mandates while still fulfilling the goals and objectives of our courses and providing you with the best possible educational experience. We appreciate your understanding.

Schedule

CLASS LECTURES: M,W & F Period 3,
Location: BARR 0211

Credit Hours

03

Pre-requisites and Co-requisites

BSC2010, PCB3063 (or equivalent) and at least one University level chemistry lab.

Email Policy:

All email correspondence must be from your ufl.edu account, have your full name in the body of the email, and contain your course and section number in the subject line. Emails not meeting these requirements may not be recognized by my email filters, and thus may not be answered.

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.
- Tardiness is disruptive to your peers – please be on time.
- 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.

Software Use

All faculty, staff and students 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

This syllabus is subject to change. While it is very likely that the 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!!

Grading:

20% Active participation,

30% Genome paper analysis

40% Assignments: 2 take home exams (10% each), 1 final analysis (20%)

10% Discussion leading/presentation

- The participation portion of your grade for this class will be calculated on the basis of your attendance and your participation in class activities. Since the pedagogical approach of this course depends heavily on student engagement and interaction, you are required, at a minimum, to participate in class activities through the audio function of Zoom. Your video presence is invited (and encouraged!) as well.

• **No make-up assignments will be given without prior permission or documentation of illness.** In case of illness, a letter from your primary care provider is required. A personal matter requires a note from the Dean of Students (P202 Peabody Hall).

- Attendance in class is mandatory

- Grading will be on a percent scale.

93 – 100%	A
90 – 92.9%	A-
87 - 89.9%	B+
83 – 86.9%	B
80 – 82.9%	B-
77 – 79.9%	C+
73 – 76.9%	C
70 – 72.9%	C-
67 – 69.9%	D+
63 – 66.9%	D
60 – 62.9%	D-
<60	E

Academic Honesty:

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>.

Attendance and make-ups

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

If you are experiencing COVID-19 symptoms ([click here for guidance from the CDC on symptoms of coronavirus](#)), please use the UF Health screening system and follow the instructions on whether you are able to attend class. [Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms](#). Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Refer to the above link for more information on the university's attendance policy.

Accommodations for Students with Disabilities:

Students with disabilities who require accommodations should first seek assistance at the Dean of Students Office of Disability Resources, in Peabody 202 (phone: 352-392-1261). The Dean of Students Office of Disability Resources will work with the instructor to accommodate the student. Please see the University of Florida Disability Resources website for more information at: <http://www.dso.ufl.edu/drp/services/>.

Counseling Center:

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 website: <http://www.counsel.ufl.edu/>

Resources Available to Students

- **Health and Wellness**
 - *U Matter, We Care:* umatter@ufl.edu; 392-1575
 - *Counseling and Wellness Center:* <http://www.counseling.ufl.edu/cwc/Default.aspx>; 392-1575
 - *Sexual Assault Recovery Services (SARS):* Student Health Care Center; 392-1161
 - *University Police Department:* <http://www.police.ufl.edu/>; 392-1111 (911 for emergencies)
-

- **Academic Resources**

- *E-learning technical support:* Learningsupport@ufl.edu; <https://lss.at.ufl.edu/help.shtml>; 352-392-4357 (opt. 2)
- *Career Resource Center:* Reitz Union; <http://www.crc.ufl.edu/>; 392-1601
- *Library Support:* <http://cms.uflib.ufl.edu/ask>
- *Teaching Center:* Broward Hall; 392-2010 or 392-6420
- *Writing Studio:* 302 Tigert Hall; <http://writing.ufl.edu/writing-studio/>; 846-1138

Procedure for Conflict Resolution

Any classroom issues, disagreements or grade disputes should be discussed first between the instructor and the student. If the problem cannot be resolved, please contact the (Under)Graduate Coordinator or the Department Chair. Be prepared to provide documentation of the problem, as well as all graded materials for the semester. Issues that cannot be resolved departmentally will be referred to the University Ombuds Office (<http://www.ombuds.ufl.edu>; 392-1308) or the Dean of Students Office (<http://www.dso.ufl.edu>; 392-1261). For further information refer to https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf (for residential classes) or <http://www.distance.ufl.edu/student-complaintprocess> (for online classes).

Other Information:

Please do not request individual special treatment at the end of the semester; we do not adjust grades for individuals for any reason. Plan to do well on all assignments from the beginning of the semester.

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

Week	Topic
1 1/11 1/13 1/15	Course Overview, Intro to Cyverse – get accounts; Lecture – Fundamentals (Nucleic Acids, structure, chromosomes and plasmids, Review of replication/transcription and Translation.
2 1/18, 1/20, 1/22	Lecture – Fundamentals (Nucleic Acids, structure, chromosomes and plasmids, Review of replication/transcription and Translation. Lecture – Properties that influence isolation, purification, quantification and detection (hybridization)). Lecture - Introduction to cloning: Vectors and their properties, Restriction Enzymes and fragment manipulation, Gel electrophoresis and fragment sizing.
3 1/25,	Lecture - Introduction to cloning: Vectors and their properties, Restriction Enzymes and fragment manipulation, Gel electrophoresis and fragment sizing (Cont.)

1/27, 1/29	Lecture – DNA library construction, cDNA library construction library screening (hybridization), Microarrays
4 2/01, 2/03, 2/05	Lecture – PCR, it's derivatives and uses. Lecture – Genomics and Transcriptomics – Legacy to NGS (Genome Mapping strategies, DNA Sequencing, clone sequencing, genome assembly. Take Home Assignment I – cloning, libraries
5 2/08, 2/10, 2/12	Lecture – Genomics and Transcriptomics – Legacy to NGS (Genome Mapping strategies, DNA Sequencing, clone sequencing, genome assembly (Cont.) Lecture – What is a gene, BLAST, Annotation techniques, Gene finders and how they work.
6 2/15, 2/17, 2/19	Lecture – What is a gene, BLAST, Annotation techniques, Gene finders and how they work (Cont.) Lecture - Genome annotation, Annotation files and Public genomics resources, Genome Browsers. Lecture - Introduction to genome projects Take Home Assignment II – sequence alignment and annotation
7 2/22, 2/24, 2/26	Class Presentations
8 3/01, 3/03, 3/05	Class presentations Lecture - Intro to NGS Sequencing technology - Genomic sequencing, assembly issues and Resequencing, alignment and Sequence file formats.
9 3/08, 3/10,	Lecture – Sequence file formats NGS analysis techniques: exome sequencing and Variant detection

3/12	Lecture – Long read sequencing, solving the Mapping problem.
10 3/15, 3/17, 3/19	Lecture – RNA-Seq; transcript characterization/isoform detection Lecture - isoform detection/epigenetics; DNA/RNA binding protein motif detection
11 3/22, 3/24, 3/26	Lecture - isoform detection/epigenetics; DNA/RNA binding protein motif detection (Continued) Lecture – single cell gene expression Lecture/Workshop – NGS Data analysis: Intro to Cyverse - NGS data analysis: sequence assessment, and alignment,
12 3/29, 3/31, 4/02	Lecture/Workshop – NGS Data analysis: Intro to Cyverse - NGS data analysis: sequence assessment, and alignment (Cont.) Lecture - Genome annotation, Annotation files and Public genomics resources (Revisited), gene browsers
13 4/05, 4/07 4/09	Lecture/Workshop - NGS data analysis techniques: RNA sequencing and transcript assembly; Gene expression analysis.
14 4/12, 4/14, 4/16	Lecture – Contemporary Analysis example Lecture – Contemporary Analysis example Lecture – Contemporary Analysis example
15 4/19, 4/21	Lecture (TBD)/Workshop – Project assistance
4/21	Data analysis continued. ANALYSIS projects due 4/26

