University of Colorado Denver College of Liberal Arts and Sciences

**BIOL 4024 – Spring 2016**

**Introduction to Biotechnology**

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**Course Catalog Description:** Introduces aspects of biotechnology within a historical context, including medical, forensic, agricultural and microbial biotechnology. Addresses principles behind state-of-the-field techniques in recombinant DNA technology, bioinformatics, proteomics and genomics. Biotechnology regulations and ethics will also be discussed.

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## Logistics


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|---|---|---|---|
| **Instructor:** | Dr. Gregory Ragland, Ph.D. | **Office:** Science 4113 | |
| **E-Mail:** | gregory.ragland@ucdenver.edu | **Phone:** 303-556-5970 | |
| **Course time:** | Monday, Wednesday 11:00 – 12:15 p.m. | **Canvas:** https://ucdenver.instructure.com/courses/347214 | |
| **Course location:** | North Classroom 1316 | | |
| **Office Hours:** | Mondays 3:00 – 4:00 PM or by appointment | | |


**Prerequisites:** One year of general biology with a grade of "C-" or higher. It is assumed that students have a working understanding of general biology and molecular biology, including, but not limited to, the basic structure of DNA, DNA replication, and the Polymerase Chain Reaction. If you have not had at least one course in Molecular Biology, Genetics, or Microbiology, please meet with the instructor to discuss your preparedness for this course. This prerequisite material will **not** be extensively reviewed in class.

**Course Communication:** I will primarily use Canvas for all communications, so please check the course site and Canvas-related e-mails frequently. Changes in course policy, procedure, or schedule will be communicated on the announcement section of the course Canvas site (and via Canvas notifications), and at the beginning of each lecture.

**Required Materials:**

**Biotechnology, 2nd Edition**
Clark and Pazdernik
Academic Cell Press
ISBN: 9780123850157
This is the newest edition (make sure you get the **2nd edition**). The bookstore should have this book in stock. Please also be aware of rental options, and electronic editions of this book, which may be more economical: www.coursesmart.com, www.amazon.com, www.bn.com, etc.

*Device with internet (or SMS text) access that you can bring to class.*
In the past, we have extensively used "clickers" (also known as audience response systems) in this class to actively gauge and engage learning on-the-fly during lectures. The University's preferred vendor for clickers charges roughly $35 dollars for a clicker, and $20 for an annual license. I don't think this represents good value for students enrolled in this course, so we will be trying a free commercial alternative this semester, polleverywhere.com. This requires you have a web-enabled device, such as a laptop, tablet, or smartphone, in class. You can also text in your answers. Note that you do **not** need an account to participate. Should you choose to create an account with polleverywhere, then you may wish to view their privacy settings (including opt-out) at https://www.polleverywhere.com/privacy-policy. If you have questions about this or don't have such a device, please speak with the instructor right away. Bookmark this page: https://pollev.com/gregoryragla627
**Put simply, active participation in these polls in class leads to better learning and grades.**

**Class Format:** Class will consist of a combination of lectures, guest presentations from industry, discussions, and student presentations. Attendance is crucial, and an important part of how you will be graded (see below).

## Extended Description

Biotechnology applies knowledge gained from biological systems towards solving practical problems facing humanity. This application of knowledge requires fundamental research and advances in technology, commercialization of that research and technology, and careful regulation to ensure the field does not step outside the bounds of what society deems ethical. We will cover all of these aspects of biotechnology in this course, through a series of active learning activities, lectures and readings from the text and from the primary scientific literature. Much of biotechnology is biomedical in nature; we will explore how advances in our understanding of the human genome, bioinformatics, and DNA sequencing are steering research and therapeutics towards personalized genomics. How this genomic knowledge is applied in the context of stem cells and inherited disease is especially interesting. Microbial biotechnology is ancient, but the birth of recombinant DNA technology in the 1970s and 1980s spawned the modern biotechnology era. Both naturally occurring and "synthetic" microbes hold promise for solving many societal problems, including remediation of polluted sites and production of carbon-neutral fuels. In the last few years, almost all aspects of molecular biotechnology have been affected by rapid advances in genome editing. By the end of this course, students should have both broad scientific knowledge of biotechnology important to industry and an understanding of how the application and commercialization of this knowledge affects their day-to-day lives as citizens. Moreover, students will gain practical knowledge of preparing for and pursuing a career in biotechnology.

## Course Goals

Students will participate in all aspects of the course, gaining competencies in the areas outlined in the learning objectives below.

## Course Learning Objectives

At the end of the semester, students should be able to demonstrate mastery of the course material via the following objectives/outcomes. These course objectives are aligned with both the Department of Integrative Biology and CU Denver campus-wide Learning Goals and Outcomes, as noted in the tables below. Our "Core Concepts and Competencies" inform curriculum development throughout the Department, and are guided by a National Science Foundation initiative called "Vision and Change in Undergraduate Biology Education – A View for the 21st Century." Students may find more information here:
http://www.aacu.org/leap/vision.cfm
http://www.ucdenver.edu/academics/colleges/CLAS/Departments/biology/Programs/Pages/Programs.aspx
http://visionandchange.org/

1. Given a specific example of **recombinant DNA or genome editing technology**, students will able to predict and troubleshoot possible hurdles to successful application of the technology by understanding common steps and components of restriction digests, the polymerase chain reaction, vector-based DNA transformations, and CRISPR-Cas9 genome editing in a variety of host systems.
2. Students will be able to compare and contrast the technology and typical outputs of traditional dideoxy DNA **sequencing** with various forms of commercialized high-throughput sequencing, and describe the types of errors common to each technology based on an understanding of the molecular biology and automation underlying each method.
3. Given **DNA forensics** data, students will be able to defend the scientific foundations and limits of DNA fingerprinting, and defend the statistical reliability of finding a database match linking suspect and crime scene.
4. Given a biotechnology goal, students will be able to design steps to perform and evaluate a **directed evolution** experiment whose outcome would be a product meeting that goal. Students should understand the similarities and differences between a directed evolution approach and natural selection in bringing about inherited genetic change.

5. Students will be able to describe the steps necessary to efficiently identify, produce, and purify a **protein product** for biotechnological use, and defend the choice to produce the protein product in one of many potential biological expression systems based on cost-effectiveness and time-to-market goals.
6. For specific examples of disease, students will be able to link specific tissue-level or population-level genetic differences to both phenotype and treatment potential, and utilize biotechnology tools to design a **personalized-medicine** strategy for screening and treatment that exploits these differences.
7. Students will be able to explain the pros and cons of different types of **biomarker** technology, and quantitatively argue for the effectiveness of a given biomarker for classification and outcome prediction.
8. Students will be able to design a strategy for **rational drug design** against a specific molecular target of disease, and predict the likelihood and mechanism of evolution of resistance to rationally designed pharmaceuticals.
9. Students will be able to compare the risks and benefits of various **gene therapy** (e.g. for treatment of Leukemia) and **transgenic delivery** technologies (e.g for GMO crops) via an understanding of the underlying ways that DNA is modified, and the selection pressures that act on vector and target.
10. Students will be able to effectively **communicate**, in written format, the science, regulatory framework, and ethical concerns surrounding a **biotechnology company**, and predict the company's likelihood of future success given these factors and the competitive space the company operates in.
11. Students will be able to **critically read the primary literature** in biotechnology, deduce conclusions from the experiments presented, and decide whether or not the appropriate controls were done to rule out alternative explanations for the data.
12. Students will be able to compare and contrast the technologies employed with traditional **metabolic engineering and synthetic biology**, and argue for appropriate ethical limits of use on either to solve biotechnology problems.

***Alignment with relevant CU Denver "Essential Learning Outcomes"***

| Creative Thinking | Critical Thinking | Ethical Reasoning | Information Literacy | Inquiry and Analysis | Integrative Learning | Lifelong Learning | Problem Solving | Quantitative Literacy | Reading | Writing |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,4,5,6,8 | all | 3,4,6,8,9,10,12 | all | esp. 11 | 2,3,5,6,7,8,9,10 | all | 4,5,6,8,9,12 | 2,3,7 | all | esp. 10 |

***Alignment with Department of Integrative Biology "Core Concepts"***

| Evolution | Structure & Function | Information Flow, Exchange, & Storage | Pathways of Energy & Matter | Systems |
|---|---|---|---|---|
| 4,8,12 | 1,2,4,5,7,8 | 1,2,3,4,5,6,7,9,12 | 4,6,8,12 | 6,9,12 |

***Alignment with Department of Integrative Biology "Core Competencies"***

| Inquiry & Analysis | Quantitative Reasoning | Modeling and Simulation | Interdisciplinary Nature of Science | Communicate & Collaborate | Relationship Between Science & Society |
|---|---|---|---|---|---|
| all | 2,3,7 | -- | all | esp. 10 | 3,5,6,7,8,9,10,11,12 |

## Assessment

Grades will be based on the following assessments:

| Assessment | Percentage of Final Grade |
|---|---|
| Exams | 60 |
| Quizzes | 15 |
| In-class participation | 10 |
| Writing Assignment | 15 |

Final grades will be based on the following standard scale:

| | | | | | |
|---|---|---|---|---|---|
| A | 93 – 100 % | Superior/Excellent | D+ | 67 – 69.9 % | Minimum passing |
| A- | 90 – 92.9 % | | D | 63 – 66.9 % | |
| B+ | 87 – 89.9 % | Good/Better than average | D- | 60 – 62.9 % | |
| B | 83 – 86.9 % | | F | < 60 % | Failing |
| B- | 80 – 82.9 % | | | | |
| C+ | 77 – 79.9 % | Competent/Average | | | |
| C | 73 – 76.9 % | | | | |
| C- | 70 – 72.9 % | | | | |

You will have access to your grades via Canvas as we progress through the semester. Please note that there will be no negotiation about changes in final grades. A curve will be implemented, at the instructor's discretion, if the class average falls far below a mean of 70% at the time the final grades are calculated.

**Grade Disputes:** Any disputes with grades reported on the Canvas grade book for any assignment must be reported to the instructor within 1 week of the grade being posted. Problems will be resolved in a timely manner.

**Re-Grade Policy:** Mistakes do occasionally happen while grading. Students will be offered the opportunity to request that specific exam or quiz questions be re-graded. Each requested question will be re-graded in its entirety. The instructor will add *or* subtract points if too few or too many points, respectively, were awarded the first time the question was graded. **All re-grade requests must be submitted via e-mail by one week, or two lecture periods, after exams or assignments are returned in lecture.** All requests must have your name, student number and email address listed. Please state exactly why you think the question or questions were incorrectly graded. For example, you may have simply found that the points were not totaled correctly. Or, you may have found that points were taken off of your answer for something that was, in fact, stated in lecture. In short, please be specific.

## Exams

There will be three examinations during the semester, each covering roughly one third of the course material. Each exam will assess course knowledge using multiple choice and short written questions. Questions will test your command of factual information learned from lecture and the assigned readings, as well as test your ability to synthesize the course content and creatively apply it to new problems. A good long-format answer will cohesively convey information, and not merely be a collection of relevant keywords. Exam question answers will be evaluated using an answer key that will be derived from the lecture notes and readings. Full credit for a question will require a comprehensive answer. The final exam will not be comprehensive, and will cover materials between the 2nd and 3rd exams. However, that material may build on concepts developed earlier in the course.

An effort will be made to return exams in class by the third lecture period after the exam date.

**Missed Examinations:** If you know you will be unable to take an examination at the scheduled time you must contact the instructor **in advance** to get approval for an excused absence and to arrange an alternate time for a make-up examination to be given **before** the regular scheduled class exam time. Excused absences will be granted for good cause, such as illness (certified by a doctor) or family or personal crisis (certified by Dean's Office, Counseling Center, etc.). Excused absences will not be granted for personal convenience -- if you have conflicts at scheduled examination times try to adjust them in advance. If you miss an exam for an emergency beyond your control, contact the instructor within 24 hours after the missed exam to schedule a make-up date. You may be required to take an alternate exam covering the equivalent material but with different questions than the exam that the rest of the students took.

## Reading assignments

Reading assignments from either the text book or primary scientific literature will be posted on Canvas and on the course schedule. Every class meeting will include some interactive activities, and the readings will be assigned so that we can focus on critical thinking and problem solving in class rather than learning terminology and simple concepts that appear in the readings. **So, reading assignments must be completed prior to class meetings.**

## Quizzes and Critical Reviews of Primary Literature

There will be a minimum of 9 "quiz" grades during the course of the semester. These assignments will consist either of completing take-home quizzes or in-class quizzes that will test your knowledge of assigned readings. Take-home quizzes will require you to extend your knowledge of topics covered in class to case studies in biotechnology. In-class quizzes will cover assigned readings and ensure that students are properly prepared to discuss readings to be completed prior to class. **Your lowest "quiz" grade will be dropped**.

## Class Participation

Students are expected to participate in class discussions and activities. This requires reading the assigned reading material **prior** to class. Participation will be incorporated into the course grade through in-class polling (https://pollev.com/gregoryragla627), and brief written responses from groups or individuals. Well-controlled studies have shown that **active participation by students leads to better grades, and better understanding of the course material**.

## Writing Assignment

Each student will write a mock cover letter for a job application directed at a Biotechnology job advertisement posted on a science careers database. Students will conceptualize a hypothetical project, and use the letter to show how working on that project demonstrates how they would meet each requirement listed in the job advertisement. There are two primary goals with this assignment: 1) to demonstrate the ability to identify problems and the appropriate methods to solve those problems, and 2) to understand what skillsets and personal qualities are valued by biotechnology laboratories, whether in the public, private, or government sector. Specific details and instructions will be covered in class and posted on Canvas.

If you find that you need help with writing, please consider scheduling an appointment with The Writing Center on campus (North Classroom Room 4014; (303) 556-4845; writing.center@ucdenver.edu). My favorite handbook for clear and effective writing is: Strunk and White, The Elements of Style. This is an excellent and brief guide to writing effectively in any discipline.

**Late writing assignments:** Writing assignments are due at the **beginning** of class (11:00 am) on the due date specified, and **must be submitted via Canvas**. If a writing assignment is turned in after this time but within 24 hours of the due date, the assignment will receive a maximum of 90% of the possible points. Each subsequent 24 hour period that the assignment is late will further reduce the maximum possible points by 10%.

## Email and Canvas for course communication

Email or the Messages system in Canvas are the preferred methods of communication. To ensure that you receive important course announcements, please **make sure your current email address is correct in Canvas, and you have your settings adjusted to receive notifications.** If you want to be sure your email is read and receives a reply, **please place "BIOL 4024" in the subject line** and send e-mails from your university student account. Please communicate in a respectful and professional manner**.** Due to privacy restrictions, specific information about grades cannot be provided by email.

## Canvas course website

This class will use Canvas. The site is located at https://ucdenver.instructure.com/courses/347214. Log in with your university user name and password (it should be the same as you use for your email). If you have any

problems please contact cuonlinehelp@ucdenver.edu the first week of class. The instructor cannot provide IT support. Canvas will be used to post *some* lecture notes, and links to scientific articles and other readings aside from the text book. The site should be checked regularly for course-related announcements and discussions. **You should make sure that you are receiving notifications** (account settings in upper right banner, then click on "Notifications" in the left-hand navigation). If you want it to, Canvas will text you, email you, send you a private tweet, use facebook notifications -- there's no excuse for not knowing what's going on in the course.

## Respect your fellow students

Please remember that the classroom should be an environment conducive to learning. I will treat you with respect; please also treat your fellow students with respect. All electronic devices with an audible signal must be silenced during class. Text messaging not related to class or talking on your phone during class is not acceptable; you will be asked to leave the class. Class begins and ends on time. Adherence to the University of Colorado Denver Student Code of Conduct is expected.

## Academic Dishonesty

Academic dishonesty is a serious offense that diminishes the quality of scholarship and the learning experience for **everyone** on campus.

**CLAS Academic Dishonesty Policy**: Students are required to know, understand, and comply with the CU Denver Academic Dishonesty Policy as detailed on the CLAS website. Academic dishonesty consists of plagiarism, cheating, fabrication and falsification, multiple submission of the same work, misuse of academic materials, and complicity in academic dishonesty. If you are not familiar with the definitions of these offenses, or wish to learn more, go to http://www.ucdenver.edu/academics/colleges/CLAS/faculty-staff/policies/Pages/AcademicIntegrity.aspx. This course assumes your knowledge of these policies and definitions. Failure to adhere to them can result in penalties ranging from failure of the assignment or the course to dismissal from the University; be informed and be careful. If this is unclear to you, ask me.

**Plaigerism:** Writing assignments will be checked automatically (via software) and manually (by me) for plagiarism. Papers that plagiarize the work of others will receive no points, and may result in an 'F' grade for the course. Copying and pasting from any source is **not acceptable**. The **only** exception are brief quotes that 1) appear in quotations marks in your paper, and 2) are properly cited.

## Other Administrative Issues

**Access, Disability, Communication:** The University of Colorado at Denver is committed to providing reasonable accommodation and access to programs and services for students with disabilities. To be eligible for accommodations, students must be registered with the UCD Office of Disability Resources and Services (DRS) (North Classroom 2514; 303-556-3450, 303-556-4766 (TTY)). The DRS staff has experience assisting faculty in determining reasonable academic accommodations and coordinating these accommodations. I am happy to provide approved academic accommodations outlined in the DRS letter.

**Students Called for Military Duty:** If you are a student in the military with the potential of being called to military service and /or training during the course of the semester, you are encouraged to contact your school/college Associate Dean or Advising Office immediately.

**Campus Closure:** In the event that the campus is closed for any reason, any scheduled exam, activity or deadline will automatically be rescheduled for the next meeting of the course and the course syllabus will be adjusted if necessary. Closures on Auraria are announced and updated by the campus operator, (303) 556-2401. Students are also encouraged to enroll in the Auraria Campus Emergency Notification System:

http://www.ucdenver.edu/about/departments/UniversityPolice/Emergency_Management/Pages/RAVE.aspx

**Incomplete Grade Policy:** Incomplete grades will not be granted to avoid an undesirable grade in the course. The faculty in the College of Liberal Arts and Sciences have passed the following policy relating to the awarding of Incomplete grades. This CLAS policy is consistent with the UCD campus policy.

Incomplete grades (IW or IF) are not granted for low academic performance. To be eligible for an Incomplete grade, students must (1) successfully complete 75 percent of the course, (2) have special circumstances (verification may be required) that preclude the student from attending class and completing graded assignments, and (3) make arrangements to complete missing assignments with the original instructor. A CLAS Course Completion Agreement is required. Completion of a CLAS Course Completion Agreement is strongly required. Incompletes cannot be awarded that stipulate: (1) a student may repeat the entire course, (2) repeat or replace existing grades, (3) allow the student an indeterminate period of time to complete a course, or (4) allow the student to repeat the course with a different instructor. The CLAS Course Completion Agreement is available from the CLAS Advising Office, North Classroom 4002.

**Biology Department Grievance procedure:** If a student has a grievance with any aspect of a course, the first step is to meet with the instructor during office hours or by appointment to discuss the problem. This discussion should not take place by e-mail. Student and instructor should both maintain a professional, respectful demeanor during this discussion, and make an honest effort to listen carefully and to understand the other's viewpoint. In laboratory courses, the next step in resolving a grievance after meeting with the teaching assistant may involve a discussion with the faculty member in charge of the laboratory course. If the grievance cannot be resolved by an honest and sincere dialogue between student and instructor, the student may then make an appointment to discuss the problem with the department chair. If still not satisfied, the student may appeal to the Associate Dean. No step in this process may be skipped. See also "Procedures for Student Grievances about Courses or Faculty, CLAS."

**Spring 2010 CLAS Academic Policies**

The following policies pertain to all students and are strictly adhered to by the College of Liberal Arts and Sciences (CLAS).

- Every student MUST check and verify their schedule prior to the published drop/add deadlines. Failure to verify a schedule is not sufficient reason to justify a late add or drop later in the semester. It is the student's responsibility to make sure that their schedule is correct prior to the appropriate deadlines.
- CLAS students must use their email.ucdenver.edu email address. Email is the official method of communication for all University of Colorado Denver business. All email correspondence will take place using your UCDHSC email address. Go to http://www.ucdenver.edu/student-services/resources/registrar/students/policies/Pages/EmailPolicy.aspx to activate your email address.
- Students **are NOT automatically added** to a course off a wait list after wait lists are dropped. If a student is told by a faculty member that they will be added off the wait list, ***it is the responsibility of the student to complete the proper paperwork to add a course.***
- Students are ***not automatically notified*** if they are added to a class from a wait-list. Again, it is the responsibility of the student to verify their schedule prior to any official dates to drop or add courses.
- Students must complete and submit a drop/add form to make any schedule changes. ***Students are not automatically dropped from a class if they never attended, stopped attending or do not make tuition payments.***
- Late adds will be approved ***only*** when circumstances surrounding the late add are beyond the student's control and can be documented independently. This will require a petition and documentation from the student. Please note that the signature of a faculty member on an add form does not guarantee that a late add petition will be approved. Petitions are available in NC 4011.
- Late drops will be approved ***only*** when circumstances surrounding the late drop have arisen ***after*** the published drop deadlines, are beyond the student's control, and can be documented independently. This will require a petition and documentation from the student. Pre-existing circumstances (circumstances that existed prior to the published drop deadlines) regarding illness, work, family, or other confounding issues will not be considered adequate reason to drop or withdraw from courses after the published University and/or College drop deadlines. Please note that the signature of a faculty member does not guarantee that a late drop petition will be approved. Petitions are available in NC 4011.
- **Undergraduate students wishing to graduate in spring of 2010** must meet with their academic advisor by census date to obtain a graduation application. This application must be completed and submitted by 5 PM on **February 3, 2010**. You can obtain an application ONLY after meeting with your academic advisor. **There are no exceptions to this policy or date.**
- **Graduate students wishing to graduate in spring semester 2010** must complete their Intent to Graduate form and have a Request for Admissions to Candidacy on file with the CLAS Dean's office no later than 5 PM, **February 3, 2010.**
- Students are responsible for completing financial arrangements with financial aid, family, scholarships, etc. to pay their tuition. Students will be responsible for all tuition and fees for courses they do not officially drop using proper drop/add procedures and forms.

Students who drop after the published drop/add period will not be eligible for a refund of the COF hours or tuition.

**Important Dates**

- **January 19, 2010:** First day of Class
- **January 24, 2010:** Last day to add a class or be added to a wait list for a class using the SMART system.
- **January 25, 2010: LAST DAY TO DROP WITHOUT DROP CHARGE – THIS INCLUDES SECTION CHANGES.**
- **January 25, 2010: Wait Lists are dropped.** Any student who was not added to a course automatically from the wait list by this date and time MUST complete a schedule adjustment form to be added to the class. Students are NOT automatically added to the class from the wait list after this date and time. If your name is not on the official student roster, you are not registered for the course.
- **January 26-February 3, 2010:** Students are responsible for verifying an accurate spring 2010 course schedule via the SMART registration system. Students are NOT notified of their wait-list status by the university. All students must check their scheduled prior to February 3, 2010 for accuracy.
- **January 26, 2010:** First day instructor may approve request to add a student to a full course with a Schedule Adjustment Form.
- **February 3, 2010:** Census date.
- **February 3, 2010 at 5 PM:** Last day to add structured courses without a written petition for a late add. ***This is an absolute deadline and is treated as such.*** This deadline does not apply to independent study, internships, project hours, thesis hours, dissertation hours, and late-starting modular courses.
- **February 3, 2010 at 5 PM:** Last day to drop a spring 2010 course **or** completely with draw from all spring 2010 courses **using a schedule adjustment form** with a tuition adjustment **minus the drop charge** and no transcript notation – this includes section changes. Drops after this date will appear on your transcript. ***This is an absolute deadline and is treated as such.***
- **February 3, 2010 at 5 PM:** Last day to request pass/fail or no credit option for a course.
- **February 3, 2010 at 5 PM:** Last day to for a graduate student to register for a Candidate for Degree.
- **February 3, 2010 at 5 PM:** Last day for a Ph.D. student to petition for a reduction in hours.
- **February 3, 2010 at 5 PM:** Last day to apply for spring 2010 graduation. You must make an appointment and see your academic advisor before this date to apply for graduation if you are an undergraduate; you must complete the intent to graduate and candidate for degree form if you are a graduate student.
- **February 15-24, 2010**: Faculty can use the early alert system.
- **March 22-28, 2010**: Spring break (no classes/campus open)
- **April 2, 2010 at 5 PM:** Last day for **non CLAS students** to drop or withdraw from all classes without a petition and special approval from the student's academic Dean. **After this date, a dean's signature is needed.**
- **April 16, 2010 at 5 PM:** Last day for **CLAS students** to drop or withdraw from all classes with signatures from the faculty and Dean without a petition. **This is**

**treated as an absolute deadline.**

- After **April 16, 2010** all schedule changes require a full petition. Petitions are available in NC 4011.
- **May 10-15, 2010:** Finals Week
- ***No schedule changes will be granted once finals week has started. There are NO exceptions to this policy.***

## BIOL 4024 Spring 2017 Tentative Lecture Schedule -- check Canvas site for current schedule and assigned readings

| Class | Week | | Date | Lecture Topics (Major Assignments and Exams highlighted) |
|---|---|---|---|---|
| 1 | | W | 18 Jan | Course Introduction; a brief history of biotechnology |
| 2 | 2 | M | 23 Jan | Ethics and Regulation of Biotechnology (readings: Text Ch24) |
| 3 | | W | 25 Jan | DNA, RNA, and Proteins: A review |
| 4 | 3 | M | 30 Jan | DNA: manipulation and synthesis |
| 5 | | W | 1 Feb | DNA: manipulation and synthesis |
| 6 | 4 | M | 6 Feb | DNA sequencing and Genomics |
| 7 | | W | 8 Feb | DNA sequencing and Genomics |
| 8 | 5 | M | 13 Feb | Bioinformatics |
| 9 | | W | 15 Feb | Bioinformatics |
| 10 | 6 | M | 20 Feb | RNA sequencing and gene expression – ch5 OR Guest Lecture: Andrew Hawkins, Gevo |
| 11 | | W | 22 Feb | RNA sequencing and gene expression – part of ch 8 |
| 12 | 7 | M | 27 Feb | **Exam 1** |
| 13 | | W | 1 Mar | Guest Lecture: Rahcel Ostroff + Kirk DeLisle, Somalogic |
| 14 | 8 | M | 6 Mar | Proteomics and protein manipulation Lecture I |
| 15 | | W | 8 Mar | Guest Lecture: Mark Duncan, AMC Prot. Core |
| 16 | 9 | M | 13 Mar | Binjie Xu, Sharklet |
| 17 | | W | 15 Mar | Proteomics and protein manipulation Lecture II |
| | 10 | M | 20 Mar | *Spring Break – no classes or office hours* |
| | | W | 22 Mar | *Spring Break – no classes or office hours* |
| 18 | 11 | M | 27 Mar | Recombinant proteins – **Job Ad Due** |
| 19 | | W | 29 Mar | Transgenesis I |
| 20 | 12 | M | 3 Apr | Guest Lecture: Hide Machado, Dharmacon |
| 21 | | W | 5 Apr | Transgenesis II and Review for Exam II |
| 22 | 13 | M | 10 Apr | **Exam 2** |
| 23 | | W | 12 Apr | Guest Lecture: Matthew Seefeldt, Gates Biomanufacturing |
| 24 | 14 | M | 17 Apr | Guest Lecture: Thale Jarvis, Crestone Pharmaceuticals **– Cover Letter assignment due** |
| 25 | | W | 19 Apr | Stem cells I |
| 26 | 15 | M | 24 Apr | Stem cells II |
| 27 | | W | 26 Apr | Guest Lecture: Mike Lochhead, MBio Diagnostics |
| 28 | 16 | M | 1 May | Applications: Cancer |
| 29 | | W | 3 May | Applications: Aging and Review for Exam III **– Cover Letter Assignment Revisions due** |
| 30 | 17 | | 8-13 May | Finals week – **Exam 3** |