Molecular Biology & Genetics
BIOL 202
Dr. Alaina Garland
Dr. Kevin Slep

Spring 2020 TTh, 2:00-3:15PM GSB 200 Section 006

Prerequisites

BIOL 101 and CHEM 101, with a grade of C or better

Your instructors

Dr. Alaina Garland
agarland@email.unc.edu
135 Wilson Hall
Office Hours: TBD – See Sign-up tab on Sakai or by appointment.

Dr. Kevin Slep
kslep@bio.unc.edu
402 Fordham Hhall
Office Hours: TBA

Your TAs

Brandon Mourey
Andrew Truong
Carolyn Turcotte

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Main Goals of the course

1. To provide you with the core principles of genetics and molecular biology
2. To gain higher level thinking skills
3. To excite you about basic science and its applications

Copyright Information:

All materials used in this course including notes, tests and assignments are covered by copyrights, which forbid you from sharing class materials with any group.

Expectations

The course is composed of three class meetings and one recitation session each week. **This is NOT a class for passive learners. You are expected to be actively engaged in this course through class discussions, class activities and pre- as well as post-lecture assignments and readings.**
It is expected that you will spend several hours reading/working problems associated with each class. If you stay on top of your reading and homework, there will be no need to cram for an exam. **Practice, practice, and practice more.** Use the internet or other textbooks in the library to find more problems if you run out from your textbook.

You are expected to **VISIT PEER MENTORS** routinely. Don't wait. Check in regularly, maybe with a buddy or small group. Form your own study groups too. Attend **SI sessions** (see below) to review material with your SI leaders

Textbook

Klug et al.: Essentials of Genetics 9th edition

The textbook is available in the bookstore in different formats. This text comes with a web-based software package called **MasteringGenetics** that will be the platform through which **you will be quizzed and receive short pre-lecture assignments.** The package also includes an interactive eBook. There are also other purchase options of the textbook (e.g. you can buy a used textbook and a stand-alone MasteringGenetics package). You also need access to Learning Catalytics (see below). You will receive an email with instructions for purchasing the textbook.

After you enroll in MasteringGenetics, find the course using these codes:

Course name: Biol 202 Spring 2020 Garland Slep

Course ID: garland75873

Recitations

During recitations,Teaching Assistants will lead you through activities or problem-solving practices. This course is a 4 credit hours course, and the recitations are not simply "going over the material that was learned in class", but rather ***a core component of the course.*** Some of the material covered in recitations will be supplemental to the one discussed in class. There will be no make-up opportunities for in-class assignments if you do not attend a recitation in a given week. If you are unable to attend the recitation for which you are registered one week, you may attend another section with prior permission of the TAs if there is room in another section. There is a maximum capacity for each section so please do not assume that you can attend another section if you miss a recitation.

Supplemental Instruction

During the week, we will offer supplemental instruction (SI) sessions (days TBA). The sessions will be led by undergraduate students who excelled in this class in a previous semester. The SI sessions will allow you to process and actively practice material that was taught in the previous week. Students referred to the SI sessions in the past as one of the most significant tools that improved their learning.

Peer-Mentoring

Several of our best students who excelled in this class in the past will serve as peer mentors. They will be present in class and assist during class activities as well as offer weekly one-on-one mentoring sessions.

Class and Recitations Attendance

Students are expected to attend and participate in class meetings and recitations. While the course follows the textbook, some of the material discussed in lecture may not be found in the text. You are responsible **for all material and announcements made in lectures**. You are not responsible for textbook material that was not covered in class, **unless it was specifically assigned (see detailed schedule for assigned readings)**.

Assignments

During the semester you will have **pre-class, in-class, and post-class assignments**.

- The pre-class assignments will be based on **assigned readings from the textbook**. The assignments will be given via the **MasteringGenetics** system (see above).
- In-class assignments will include **Learning Catalyics** and other activities.
- Post-class assignments will include **MasteringGenetics** and occasionally **Peerwise** assignments and possibly written **Homework Assignments** (see below).

All assignments due dates appear on the detailed schedule. Updates will be announced on Sakai. **You are responsible for submitting the assignments on time.** There will be no “second chances”.

Learning Catalytics

Part of your grade (see details below) will come from a program called Learning Catalytics that you use through your laptop or mobile phone. Note - missing just a couple of classes can quickly affect your participation grade! See Sakai for the required registration and troubleshooting information.

PeerWise

One of your assignments during the semester will be to create multiple choice questions that address the material we learn. Asking questions and evaluate your peers’ questions has been shown to be an invaluable tool in developing deep learning. Posting and reviewing questions will be done through an interactive system called PeerWise. Instructions on how to register and how to use PeerWise will be given during the semester.

Homework Assignments

This homework, unlike your regular online assignments via mastering genetics, will be sporadic and at the discretion of the instructor. Problem sets will be posted on Sakai. Written answers are to be handed in at your recitation section the week the assignment is due. Solutions to the problem sets will be posted the subsequent weekend. TAs will grade a selected problem on the homework, and performance on the problem sets will contribute to your recitation grade.

Piazza

We will use an online platform called “Piazza” this semester. You may post any questions that you have about the course to this site at any time and they will be answered by either a fellow student, a mentor, or me. Your questions may be more general and may relate to the course itself or they may be more specific and instead relate directly to content and/or material from class. In any case, Piazza will help you get them answered ASAP. You will receive a welcome e-mail from me granting you access to the course within the first week of the semester and can start using Piazza right away.

You should not post anything unrelated to the class. No personal attacks or usage of offensive language will be allowed. No posts that directly give the answers to assignments are allowed - for instance, "The answer to #5 is C". That being said, you are allowed to ask questions concerning the assignments, and your classmates are allowed to respond, as long as the conceptual framework is being discussed.

Grading

Your grade for this course will be determined as follows:

3 midterm exams = (18% each = 54%)
1 cumulative final exam (18%)
MasteringGenetics assignments (8%)
Recitations (10%)
Peerwise, HW Assignments, and Learning Catalytics (10%)

Grades will not be assigned for individual exams, only points. Final semester letter grades will be assigned on the total number of points for the entire semester: A 93-100; A- 90-92; B+ 87-89; B 83-86; B- 80-82; C+ 77-79; C 73-76; C- 70-72; D+ 66-69; D 60-65; F <60

A curve will be used ONLY if the OVERALL class grade average is <75. Exam questions will be based on class meetings and assigned readings. **Grades will not round up**. B= 83, NOT 82.96. Exams must be taken on the dates indicated; no makeup exams except in special circumstances, i.e. medical or family emergency documented in writing.

THE PROFESSORS RESERVE THE RIGHT TO MAKE CHANGES TO THE SYLLABUS, INCLUDING LECTURE TOPICS, PROJECT DUE DATES AND TEST DATES. THESE CHANGES WILL BE ANNOUNCED AS EARLY AS POSSIBLE

See General Schedule on the next page. For a detailed schedule, including recitations, assigned readings, assignments, and objectives, check the *Sakai- Resources folder.*

Course Learning Outcomes

Upon completion of the 202 course in Biology, a student should be able to:
(Skills):

- Build hypotheses to answer a specific scientific question, design an experiment using an appropriate technique/assay to answer the question, and predict results of their experiment.
- Give examples of how advances in genetics and molecular biology, from the discovery of DNA's structure to sequencing individual genomes, have changed the world (examples include recombinant insulin, personalized medicine, transgenic crops)

(Concepts):

- Explain the term “allele” for a single gene at a population, organismal, cellular, and molecular level; explain how dominance and recessiveness are expressed at these levels.
- Explain ~~how~~ where genetic variation comes from in a population (e.g. from meiosis, mutation, and epigenetic changes).
- Predict genotypic and phenotypic ratios of offspring in defined genetic crosses and work these problems in reverse (when given data about offspring, determine the genotypes and phenotypes of the parents).
- Deduce modes of inheritance (example: autosomal dominance, x-linked recessive) from genetic pedigrees and explain how incomplete penetrance and variable expressivity complicate these analyses.
- Distinguish single gene traits from polygenic traits and the influence of the environment on traits.
- Explain how DNA is replicated normally and abnormally and how these concepts are utilized in the polymerase chain reaction (PCR).
- Compare and contrast the consequences of germline errors during meiosis (such as non-disjunction, and translocations) and somatic errors during abnormal mitosis (such as non-disjunction and cancer)
- Explain the flow of genetic information, based on the central dogma- from DNA to proteins and how mutations are carried through this flow of information.
- Describe the nature of the genetic code
- Describe the general organization of prokaryotic and eukaryotic genomes, including the identification and significance of the different parts of a gene (e.g. regulatory/non-regulatory, exons/introns; transcription start site; translation start site; UTRs)
- Explain how a gene can be regulated transcriptionally and post-transcriptionally and how this leads to limited expression under different conditions (such as in different environments, during the course of development, or disease conditions)
- Predict the outcome of experimental manipulations in genes (e.g. GFP-tagging to investigate gene expression)
- Describe the basic steps in gene cloning (restriction, ligation, etc.)
- Design a transgenic animal/bacteria, where a protein of interest is specifically produced
- Explain the significance of research in genetic model organisms to understand fundamental biological phenomena.

Th Jan 9: 1 Introduction to BIOL202

T Jan 14: 2 How genetic information is organized in the genome/3 How genetic information flows from DNA to RNA to protein

Th Jan 16: 4 Variation in genetic information – from genotype to phenotype

T Jan 21: 5: Process of Science: Discovery of the structure and function of DNA

Th Jan 23: 6 Process of Science: Discovery of DNA Replication/7 How genetic information is copied *in vivo* and *in vitro*

T Jan 28: 8 How genetic variation arises by gene mutation

Th Jan 30: 9 How genetic variation arises by errors during recombination

T Feb 4: 10 How errors in meiosis lead to genetic variation

Th Feb 6: EXAM 1

T Feb 11: 11 Dosage compensation

Th Feb 13: 12 The flow of genetic information- Transcription

T Feb 18: 13 The flow of genetic information- Translation I

Th Feb 20: 14 The flow of genetic information- Translation II

T Feb 25: 15 Revisiting mutations and alleles

Th Feb 27: Revisiting mutations and alleles continued

T Mar 3: EXAM 2

Th Mar 5: Regulation of gene expression in prokaryotes I
T Mar 10: Spring Break
Th Mar 12: Spring Break
T Mar 17: Regulation of gene expression in prokaryotes II
Th Mar 19: Regulation of gene expression in eukaryotes I
T Mar 24: Regulation of gene expression in eukaryotes II
Th Mar 26: Epigenetics
T Mar 31: Recombinant DNA technology I
Th Apr 2: Recombinant DNA technology II
T Apr 7: EXAM III
Th Apr 9: Transmission of independently assorting traits
T Apr 14: Pedigrees and human disease
Th Apr 16: Modifications of Mendel's ratios
T Apr 21: Gene Interactions
Th Apr 24: Complementation and transmission of linked traits
Monday May 4: - FINAL EXAM (Cumulative) at noon in G200