

Syllabus

Principles of Genetics/BSC324-201/BSC324-202/BSC-203

4 credit hours

Spring 2018

Times/Location

Lecture BSC324-201/202/203 TR 2:00 PM – 3:15 PM S374

Lab BSC324-201 M 9:00AM-11:50 AM S381
BSC324-202 T 9:00AM-11:50 AM S381
BSC324-203 W 9:00AM-11:50 AM S381

Instructor

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GA

Alexander Murray

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Office hours: M 2:00 – 3:00, T 1:00 – 2:00

University policies

By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to www.marshall.edu/academic-affairs and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802

This link contains university policies for Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

Course Description

This course will provide students with a general introduction to the science of biological inheritance. We will cover the broad areas of transmission or classical genetics, molecular genetics, population genetics and evolutionary genetics in a coordinated lecture and laboratory format. The laboratory will be a venue for hands-on laboratory experiments and other exercises designed to illustrate key principles in genetics. Additionally the laboratory will be a forum for reviewing material covered in lecture and participating in discussions and practice problem solving sessions.

Student Learning Outcomes

Learning outcome	Activities (lecture and laboratory)	Assessment
<i>Fundamental principles of transmission genetics</i>	<ul style="list-style-type: none"> - Lecture, assigned readings and additional media (lecture) - Group problem solving sessions (laboratory) - Group activities on Mendelian inheritance and Drosophila genetics (laboratory) 	<ul style="list-style-type: none"> - Exams (lecture) - Quizzes (lecture and laboratory) - Lab reports (laboratory)
<i>Fundamental principles of molecular genetics</i>	<ul style="list-style-type: none"> - Lecture, assigned readings and additional media (lecture) - Group problem solving sessions (laboratory) - Group activities on DNA barcoding (laboratory) 	<ul style="list-style-type: none"> - Exams (lecture) - Quizzes (lecture and laboratory) - Lab reports (laboratory)
<i>Fundamental principles of population and evolutionary genetics and phylogenetic analysis</i>	<ul style="list-style-type: none"> - Lecture, assigned readings and additional media (lecture) - Group problem solving sessions (laboratory) - Group activities genetic drift and phylogenetic analysis (laboratory) 	<ul style="list-style-type: none"> - Exams (lecture) - Quizzes (lecture and laboratory) - Lab reports (laboratory)
<i>Basic understanding of the history of genetic science</i>	<ul style="list-style-type: none"> - Lecture, assigned readings and additional media (lecture) 	<ul style="list-style-type: none"> - Exams (lecture) - Quizzes (lecture and laboratory) - Lab reports (laboratory)
<i>Appreciation of the broader societal impacts of genetics</i>	<ul style="list-style-type: none"> - Lecture, assigned readings and additional media (lecture) - Assignment of the 1997 film <i>GATTACA</i> to be accompanied by an essay assignment and in class discussion of the broader societal impacts of genetics (lecture) 	<ul style="list-style-type: none"> - In class discussion and essay writing (lecture and laboratory) - Exams (lecture)
<i>Ability to access, analyze and assimilate the scientific literature</i>	<ul style="list-style-type: none"> - In class tutorials on bioinformatics and the scientific literature in general with instructions as to what constitutes valid peer-reviewed source material (laboratory) 	<ul style="list-style-type: none"> - Exams (Lecture) - Quizzes (Lecture and laboratory) - Laboratory reports (Laboratory)
<i>Development of scientific writing and communication skills for both specialized and popular audiences</i>	<ul style="list-style-type: none"> - In class writing sessions (laboratory) - Student peer review assignments for laboratory reports (laboratory) 	<ul style="list-style-type: none"> - Laboratory reports (laboratory) - Peer reviews (laboratory) - Popular audience essay assignment (lecture) - Class presentation (laboratory)
<i>Basic quantitative skills and statistical data analysis</i>	<ul style="list-style-type: none"> - Introduction to basic probability and statistics including classical and Bayesian hypothesis testing (lecture, laboratory) - Statistical problem solving and data analysis activities (lecture, laboratory) 	<ul style="list-style-type: none"> - Exams (lecture) - Quizzes (lecture and laboratory) - Lab reports (laboratory)

Required Text

Hartl, Daniel L. and Ruvolo, Maryellen. 2012. *Genetics: Analysis of Genes and Genomes*, 8th edition. Jones and Bartlett Learning.

Additional supplemental reading of the primary literature will occur in addition to the textbook readings.

No laboratory manual is required. Laboratory activities will be described on handouts to be distributed in class or over Blackboard.

Additional material:

Top Hat

We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message.

You can visit the Top Hat Overview (<https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide>) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.

An email invitation will be sent to you by email, but if don't receive this email, you can register by simply visiting our course website: <https://app.tophat.com/e/804222>

Note: our Course Join Code is 804222

Top Hat will require a paid subscription, and a full breakdown of all subscription options available can be found here: www.tophat.com/pricing.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

GATTACA (1997)

You will be assigned the 1997 film GATTACA to watch outside of class. You will also be expected to write an essay concerning the ethics of genetic testing drawing from the themes in the film and participate in an in-class discussion near the end of the semester on ethics and genetics and society. The film is available from a myriad of sources (iTunes, Amazon Instant Video, Marshall University library, etc.) and I encourage you to arrange a time to watch it with your classmates in small groups.

Student Assessment

Your grade for the entire course will be an equally weighted combination of your lecture and laboratory grades.

Grading Policy

Quizzes – *Lecture* (20 points x 3 = 60 points)

Exams – *Lecture* (100 points x 3 = 300 points)

Final Exam – *Lecture* (100 points)

Essay – *Lecture* (50 points)

Quizzes – *Laboratory* (20 points x 3 = 60 points)

Problem-solving sessions – *Laboratory* (50 points x 3 = 150 points)

Laboratory reports* - *Laboratory* (100 points x 3 = 300 points)

Laboratory report peer reviews* – *Laboratory* (10 points x 3 = 30 points)

Presentation* – *Laboratory* (100 points)

* Denotes a group assignment

Total: 1150 points

A >1035

B 920-1034

C 805-919

D 690-804

F <689

Extra-credit

Pre-test – *Lecture* (1 point extra-credit will be awarded for every 5 correct answers)

Post-test – *Lecture* (1 point extra-credit will be awarded for every 5 correct answers)

Additional extra-credit may be made available at the instructor's discretion.

FAQ regarding exams, quizzes, laboratory reports and other assignments:

What is the exam format?

The exams will be a mix of matching, true-false, multiple choice and short-answer problem solving questions. Quizzes will typically consist of short-answer problem solving challenges.

What is this “pre-test” and “post-test” business?

The goal of the *pre-test* and *post-test* is to assess where your knowledge of genetics is coming into the course (*pre-test*) and where your knowledge is after the course is completed (*post-test*). This allows me to obtain valuable data on student strengths and weaknesses and adjust the course accordingly. Neither the *pre-test* or *post-test* will negatively affect your overall grade but as an incentive to take them seriously you have the potential to accumulate 10 points of extra-credit points for *each* test (20 points possible across both the *pre-test* and *post-test*)

Is the final exam cumulative?

Yes, the final exam will be cumulative and will largely be constructed from versions of questions that have appeared on prior exams. These will not necessarily be exactly the same questions that have appeared on previous exams but studying from your prior exams and understanding why you missed a particular question, or conversely why you got a question correct, will be an excellent study strategy for the final exam.

How long does my laboratory report need to be?

There are no hard page limits for writing assignments or hard time limits for presentations. Your work should be as long as you need it to be to clearly cover the material in a thorough but concise manner. Page limits therefore are to be thought of as a rough guide only. Note that longer is not necessarily better. Laboratory reports should be in the range of 3-5 pages excluding a reference section. Laboratory report peer reviews should be 1-2 pages. You are however expected to adhere more strictly to time limits for presentations. Group presentations should be no more than 15 minutes long and no less than 10 minutes.

Do we just turn in one laboratory report for our lab group?

Yes, your laboratory group will be responsible for turning in both a single laboratory report for your group and a single peer review for the report for another group in your laboratory section. You will work in groups of 2-3 in the laboratory and turn in laboratory reports, laboratory report peer reviews and presentations as a group. All individuals within a group will receive the same grade for each of these group assignments. If certain individuals in your group are not pulling their weight then you need to discuss this with me and your laboratory graduate assistant (GA).

I thought this was genetics class? If so why are we talking about statistics?

Probability and statistical analysis are *absolutely essential* for understanding genetic inheritance. Probability theory lies at the heart of virtually every fundamental concept in genetics and as such you cannot truly understand genetics without some understanding of probability. We will cover the basics of probability and some statistical tools including both classical and Bayesian hypothesis testing during the course.

Course Schedule – Lecture (*schedule subject to change as needed*)

January 9 – First day of lecture
Week of January 8 – Labs start

Transmission Genetics and DNA

January 8 – February 5

Hartl and Ruvolo Chapters 1-5 (*we will cover these chapters a little out of order starting with chapters 3-5 followed by chapters 1-2*)

February 1 Quiz I (20 points)

Week of February 5 Group problem-solving session I (50 points)

February 8 Exam I (100 points)

Chromosomes, replication, gene expression and regulation

February 12 – March 12

Hartl and Ruvolo Chapters 6-8, 10-11

March 8 Quiz II (20 points)

Week of March 12 Group problem-solving session II (50 points)

March 15 Exam II (100 points)

Spring Break

Week of March 19

Mutation, extranuclear inheritance, quantitative genetics, phylogenetics and population genetics

March 26 – April 16

Hartl and Ruvolo Chapters 14, 16-18

April 12 Quiz III (20 points)

Week of April 16 Group problem-solving session III (50 points)

April 19 Exam III (100 points)

Additional lecture deadlines, due dates and general holidays

January 15

Martin Luther King Jr. Holiday **NO LAB this week**

March 19 – March 24

Spring Break **NO CLASS**

April 5

Essay due

Week of April 23

Review and catch up on additional material if needed.

May 3

Final Exam 12:45 – 2:45 PM

Academic calendar for the 2018 spring semester with holidays, withdraw deadlines, etc. is available here.

<https://www.marshall.edu/academic-calendar/academic/spring2018/>

Course Schedule – Laboratory (*schedule subject to change as needed*)

Laboratory activities are listed by the week they occur. Section 201 activities will occur on Monday of that week, section 202 will occur on Tuesday and section 203 on Wednesday. Lab activities may not take up the entire class period for the laboratory. Remaining time in lab will be reserved for review questions, sample problems, discussion and questions on the material from lecture. All problem-solving sessions to prepare for exams in lecture will take place in your laboratory session prior to the exam date. **Dates for lab quizzes TBA**

Topic and lab activity	Lab week of ...
<u>Introduction</u>	
Introduction to the lab section, organization into groups, and discussion of presentation topics	January 8
Martin Luther King holiday	January 15 NO LABS THIS WEEK
Scientific writing and citation workshop	January 22
<u>Transmission Genetics</u>	
Mendelian inheritance simulation and statistical analysis	January 29
<i>Drosophila</i> genetics (Lab report due week of March 5) Group problem-solving session	February 5 and February 12 February 5
<u>DNA, Molecular Genetics and Bioinformatics</u>	
PCR, DNA barcoding and bioinformatics (Lab report due week of March 26)	February 19, February 26, March 5
Group problem-solving review session	March 12
<u>Population Genetics and Genetic Drift</u>	
Genetic Drift Simulation (Lab report due week of April 16)	March 26
<u>Phylogenetic analyses</u>	
Primate family tree analysis (Lab report optional, due week of April 23)	April 2
Group Presentation (submit topic by week of February 8)	April 9 and April 16
Group problem-solving review session	April 16
Review (for final exam)	April 23

Due dates for lab reports (subject to change if needed)

Drosophila genetics **Week of March 5**

PCR and DNA barcoding **Week of March 26**

Genetic drift simulation **Week of April 16**

Phylogenetics **Week of April 23** (*optional lab report, may be submitted to replace the lowest scoring previously submitted report*)