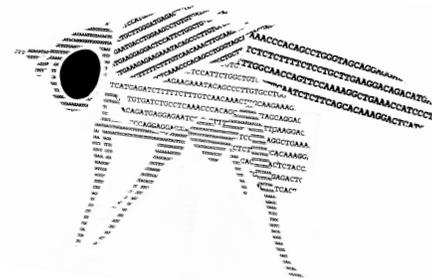


BISC 2207 - GENETICS Fall 2017 SYLLABUS



When and where

Tuesday/Thursday 2:20-3:35 pm, Elliot School of International Affairs B12 (1957 E St. NW)

What this course is about

Why are calico cats usually female? Are GMO foods risky? Why is it so difficult to cure cancer? You have already been introduced to Genetics through BISC 1111, BISC 1112, and/or AP Biology, but perhaps you still don't know the answer to these questions. This course will give you the knowledge base and tools to critically understand, communicate, and even debate these questions and more with your peers, friends, and family.

We will explore how nature is even more complicated and bizarre than introductory biology courses led us to believe. For example, we will learn that the central dogma (DNA --> RNA --> protein) is not necessarily the whole story. We will also explore whether Lamarck was right, through the new and exciting field of epigenetics. Here, phenotypic changes can be inherited from parents to offspring without changing the DNA sequence, suggesting that acquired traits *can* sometimes be inherited. When embarking on our journey, it is important to remember that genetics is a rapidly evolving field, and there is much that remains unknown. Nevertheless, I look forward to leading you into this exciting frontier.

You may have heard that Genetics is the most difficult course in Biology. The rumors are true. My expectations are high, but I will also provide you with many tips and tools for success - if you use them, I am confident you will learn the material. Be sure to review these resources under "Tips and tools".

By the end of the course, you will be able to:

1. Describe genetic and non-genetic contributions to heritable phenotypes.
2. Explain how molecular structure influences cellular function.
3. Present hypotheses for genetic causes of heritable phenotypes and predictions that would support those hypotheses.
4. Predict how mutations will affect phenotypes of organisms and evolutionary dynamics of populations.
5. Identify similarities and differences across diverse genetic principles and processes.
6. Generate hypotheses about causal molecular mechanisms underlying human diseases and their patterns of inheritance.
7. Create an informed opinion about potential risks and benefits of controversial genetic technologies.
8. Identify a challenging concept, outline how to achieve understanding, and effectively communicate that understanding to other students.

About us

Lead Instructor: **Dr. Mollie Manier**

Campus Address: SEH 6000 (mail), SEH 6680 (office)

Phone: 202-994-0126

E-mail: manier@email.gwu.edu

Website: manierlab.com

Office hours: Tues/Thurs 12:30-1:45 (or by appointment), SEH 6680.

I am an Assistant Professor in Biological Sciences, and I have been at GW for four years. I received my BA in 1997 from the University of California at Berkeley in Integrative Biology and my PhD in 2005 from Oregon State University in Zoology. I have also worked as a postdoctoral research scientist and research assistant professor at

Stanford University and Syracuse University. My research uses evolutionary genetics to understand the genetic and non-genetic contributions to natural variation in phenotype. Specifically, I use the fruit fly *Drosophila* as a model organism to address several different questions:

- 1) How does the gut microbiome affect cognition?
- 2) How does climate change influence reproduction?
- 3) What is the genetic basis of female reproductive tract complexity and giant sperm?

GA: Karly Cohen

E-mail: karlyc@gwu.edu

Office hours: Tues 4-5, SEH 6th floor West Research Wing

I am a masters student in the Biology Department as part of the BS/MS program. I graduated with a Bachelors of Science in Biology this past May. I work in the Hernandez lab, where my research focuses on the functional morphology of fishes to better understand how morphology changes in the presence of various physical constraints. Most recently, I have been studying the feeding novelties of silver carp, an incredibly invasive species of Asian carp that threatens the ecosystem of the Great Lakes.

GA: Eric Kenney

E-mail: etkenney2@gwu.edu

Office hours: Thurs 5-6, SEH 5th floor West Research Wing

I am a fourth-year PhD student in Biology at GW. I did my undergraduate work at The University of Maryland, College Park, earned a master's degree in Biology at The University of Maryland, Baltimore County, and worked as a research assistant at The Uniformed Services University in Bethesda where I studied microbial resistance to radiation. I'm now a member of the Eleftherianos lab and use genetic approaches to understand nematode virulence in an insect host, as well as investigate the effects of nematode virulence factors on the functioning of the *Drosophila* immune system.

GA: Tiffini Smith

E-mail: smithts3@gwu.edu

Office hours: Fri 2-3, SEH 6th floor West Research Wing

I am currently a graduate student in the Department of Biological Sciences. I completed my undergraduate degree at Virginia Commonwealth University, after which I took some time off and worked in higher education. I have been at GW for 2 years during which I was a Graduate Teaching Assistant for BISC 1112. My interests are in developmental and reproductive biology, which is why my research focuses on postcopulatory sexual selection in the female reproductive tract and its association with sperm storage organs in the fruit fly *Drosophila*.

LA: Christabel Chan

E-mail: christabelchan@gwmail.gwu.edu

Office hours: Wed 4-5, Milken 7th floor quiet room

My name is Christabel Chan and I am from Toronto, Canada. I am a junior in the Columbian College of Arts and Sciences majoring in Biology and minoring in Applied Ethics. I took Dr. Manier's Genetics lecture during the first semester of my sophomore year and then proceeded to take the laboratory component the following semester. Genetics fascinates me, and that is a big reason why I am so excited for the coming semester. In fact, I conduct genetic medicine research at Children's National Medical Center on pediatric brain tumors. On campus, I'm also involved as a Student Admissions Representative (or tour guide) and on the Eboard of the International Affairs Society amongst other things. Please don't hesitate to reach out to me at any point during the semester if you have any questions or need help!

What you will need - Sapling Learning

Instructions on how to register for Sapling Learning are on Blackboard under Welcome and Overview. Our textbook is *Pierce, Benjamin. Genetics: A Conceptual Approach, 6th ed.* The digital textbook will be available on Sapling Learning. We will also be using iClicker Reef through Sapling Learning. Purchasing access to the course through Sapling Learning will include the digital textbook and iClicker Reef (see instructions under Participation below).

What you will be doing

Pre-course survey

The purpose of this survey is for me to get to know you, your hopes and expectations for this class, and your background. I am also asking about where you currently live - this information will help me organize the class into students that live near each other to facilitate out-of-class study groups. It is also an opportunity for you to communicate any questions or concerns you have before class begins.

The survey is available as a Google form for one week, **from Monday 8/21 at 9 am until Monday 8/28 at 9 am.** *The survey is worth 10 pts toward the Quizzes component of final grade.*

Pre-course quiz

There is a lot to cover in this course, and I want to have time for more in-depth exploration. As a result, **I have assigned sections of the first three chapters to read before class begins.** You should have already been exposed to basic genetics, but you may have forgotten it - the reading should be a refresher and prepare you to build on this knowledge.

The **pre-course reading quiz** will provide extra incentive for you to complete the assigned reading ahead of time. It is also designed to let both me and you know how prepared you are for this course. This exercise will consist of 20 mixed-format questions. It will be available on Sapling Learning **until Monday 8/28 at 9 am.** *The pre-course quiz is worth 10 pts toward the Quizzes component of final grade.*

Participation (3%)

Attendance and participation in lecture will be scored using iClicker Reef. You may use your smartphone, tablet, laptop, or iClicker remote. Download iClicker Reef from your app store, and follow the instructions to create an account, add George Washington University as your institution, and add BISC 2207 Genetics. If you already have an account, log in, and Genetics should show up as one of your courses. If it doesn't, add it. You can also register an account and add the course at <http://www.iclicker.com/>.

To receive free access for the semester, log in to your iClicker Reef account on a **computer** (NOT a smartphone or tablet), click on the Menu icon in the top left of the blue bar. Choose "Subscriptions", click "Polling", and click "Enter an Access Code" (on the right side). Enter the code **CD777BC76140** and click "Submit". You will then see "Access Code is Accepted". You can also view an [instructional video](#) on how to enter the access code. Additional student support can be found [here](#).

Reading

Genetics is a complex field, and it often takes multiple times hearing or reading material before things sink in. Completing assigned textbook readings ahead of time will be imperative for building understanding during the lecture and group activities. I will assign reading that I expect you to have completed before the lecture (see Schedule of Learning on the last pages for specific assignments). I may assign sections of a chapter, sometimes defined by a page range. Read from the section beginning on the first page through the section that ends on the last page. There may be figures or tables referenced within those pages that are not located on those pages. You should read these also.

Reading quizzes (10%)

As a check to make sure you have done the reading *and understand it*, reading quizzes will be administered on Blackboard and will be due before each lecture begins. Questions are recall only and are designed to be easy if you have completed the reading. These quizzes are intended to test foundational knowledge only.

- Complete the assigned reading for a given lecture at least 24 hrs before the lecture.
- Quizzes will be available on Sapling Learning for 24 hrs from 10 am on the day before the lecture until 10 am on the day of the lecture (see example schedule below). **If you have technical difficulties during the quizzes, contact Sapling Tech Support.**
- Quizzes consist of mixed-format questions, and each question is worth 1 point.
- There will be no quiz if there is no reading required for a lecture (see Schedule of Learning on pp. 6-7).

| Suggested schedule for readings and quizzes - this will vary depending on the week (e.g., some weeks will only have one reading). Instructor office hours (OH) are also shown. | | | | | | |
|---|-----------------------|----------------|----------------|-----------------------|----------------|------------------|
| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday |
| 10 am | | | Quiz available | | Quiz available | |
| 12:30-1:45 pm | | Quiz available | Dr. M OH | Quiz available | Dr. M OH | |
| 2:20-3:35 pm | | | LECTURE | | LECTURE | Tiffini OH (2-3) |
| 4-5 pm | Read for next lecture | | Karly OH | Christabel OH | | |
| 5-6 pm | | | | | Eric OH | |
| Evening | | | | Read for next lecture | Quiz available | |

Group work

Social interactions are an integral part of learning, and I hope you will develop connections this semester that will last through graduation and beyond. Your assigned groups of 5 will ideally include other students who live near you to facilitate peer support and study groups outside of class. Your group should also include a range of student abilities (based on past performance in Intro Bio) to enable peer teaching. Thus, if you find something easy to understand, you will be expected to share this understanding with your peers. Peer teaching benefits both the teacher and the learner - as a teacher, explaining concepts to others helps you remember them better, while as a learner, information filtered through a peer is often more accessible.

Making connections

Genetics is a part of our everyday lives, whether we know it or not. Throughout the semester, we will discuss how the genetics that we have learned applies to the real world. These classes will also be an opportunity to review material and make connections among concepts from different parts of the course. These exercises will help you meet Objective 7 (see "By the end of the course, you will be able to" on p. 1).

Worksheets (12%)

Questions that require more application and integration of concepts will be found on the worksheets that will be completed in collaboration with your groups. The worksheets will generally be started in groups during Thursday's lecture and will be due by Tuesday's lecture. Questions on the worksheets will require more in-depth consideration of the material, application of principles to realistic scenarios, and integration of concepts

across multiple subdisciplines of genetics. Questions on the worksheets reflect the types of short-answer problems you will encounter on the exams and will assess your ability to meet Objectives 1-6.

- You will learn how to answer worksheet (and exam) questions through several scaffolding activities in which I will present several types of questions along with examples of good and less good answers. You will have an opportunity to solve a similar problem set and engage in peer evaluation of your answers.
- Worksheets will be assigned on Thursdays and completed in class.
- Each student will complete their own worksheet. One member of the group will be selected at random, and their worksheet will be graded, with the grade assigned to the entire group.

Instructional video (50 pts/15%)

You will work in groups of 2 to write, film, and edit a short 5-10 min instructional video explaining a key concept in genetics that you find challenging. The purpose of this assignment is to guide you through the process of understanding a difficult concept, communicating it, and providing a resource for other students. This assignment will help you meet Objective 8.

- Due 10/26: three possible topics
- Due 11/7: draft script
- Due 11/21: final script
- Due 12/7: final video

Exams (60%)

Exams will consist of both multiple choice and short-answer format questions. All exams (2 midterms and a final) will be open book, open notes, and open laptop. Internet use is allowed. However, don't be fooled into thinking these exams are easy - they are not. Exam questions will require thoughtful synthesis of material beyond basic identification of principles and processes. **Exams are also intentionally long** so that you need to be able to retrieve information quickly and accurately as well as apply it to potentially novel situations in order to do well. However, problems on the worksheets will provide practice and preparation for the exams. The more you take the worksheets seriously, the better you will do on the exams. More advice regarding exams will be found under "Tips and Tools".

Grading

| | |
|---------------------|------|
| Participation | 3% |
| Quizzes | 10% |
| Worksheets | 12% |
| Instructional Video | 15% |
| Midterm 1 | 15% |
| Midterm 2 | 20% |
| Final Exam | 25% |
| Total | 100% |

Letter grades are established from percentages of points earned out of total points possible following **standard GWU guidelines** according to the following scale:

| | | | |
|----|---------|----|--------|
| A | 93-100% | C | 73-76% |
| A- | 90-92% | C- | 70-72% |
| B+ | 87-89% | D+ | 67-69% |
| B | 83-86% | D | 63-66% |
| B- | 80-82% | D- | 60-62% |
| C+ | 77-79% | F | <60% |

Do not contact me about points for participation or quizzes. These are not worth enough of your grade to be worth our time and energy. At the end of the course, people close to a higher letter grade will be rounded up automatically. For example, an 89.4 will receive an A-. If necessary, I will curve the course so that class average is a B- (80%). If the class average is above 80%, the class will not be curved. Check Blackboard for your grades, not Sapling Learning.

Average minimum amount of independent, out-of-class, learning expected per week:

In a 15-week semester, including exam week, you are expected to spend a minimum of 100 minutes of out-of-class work for every 50 minutes of direct instruction, for a minimum total of 2.5 hours a week. **You should therefore expect to spend at least 5 hours of independent learning per week.**

Tips and Tools

Lectures

- Come to lectures (and participate). You will not get an A if you do not come to class. Guaranteed.
- Ask lots of questions! Questions tell me you are thinking, and thinking is critical to doing well. Especially critical thinking. Ask yourself – does this make sense? If not, say so! Your question can be as simple as “Can you repeat that?” Or “I’m confused about this.” Or “That doesn’t make sense to me.”
- Take good notes during classes. Avoid taking notes on your laptop whenever possible. Physically writing down your observations forces you to synthesize what I’m saying and helps your brain retain and understand more. I will provide detailed notes of the lectures, so you have a backup in case you miss something. However, it is in your best interest to take your own notes as well.

Sapling Learning

- Read book chapters before lecture and review them after lecture.
- Take advantage of Sapling Learning Resources for each chapter, including animations, practice problems, and any additional material.
- Do practice problems at the end of chapters. There are three types of practice problems: Comprehension Questions, Application Questions and Problems, and Challenge Questions. Work through all three. Use the Solutions Manual that accompanies the textbook to check answers that aren't at the back of the textbook.
- Comprehension Questions make sure you know what you need to know. Application Questions ask you to apply what you know. These are especially useful. Challenge Questions ask you to dig deep and apply what you know to new situations. The questions on the exam will be most similar to the Application and Challenge Questions. Take heed.

Other Tips

- Previous students rated this class at over 4 out of 5 for difficulty and generally spent 3-6 hours per week outside of class studying.
- You will be able to work with others to complete the worksheets, so work together. Study together, quiz each other, tutor each other. Create a community, and use your peers as a resource.
- For any assignment or exam questions you get wrong, go over them with any of the teaching team in office hours or another time by appointment.
- Double check our calculations of your grades. Make sure your scores on Blackboard reflect your understanding of how you did. If you think there’s an error, let us know.
- Be organized. A huge part of being good at life is being organized. Organize your notes, organize your time. Set aside a couple hours each week to go back over the lecture slides, notes, worksheet, and book chapter to make sure you understand everything.
- Don’t just read your notes again. Quiz yourself to make sure you actually know it. Try to come up with the “next question” to ask. Ask “what about...” or “what if...” or “how does this relate to...” types of questions.

Nuts and Bolts

Common Courtesy Issues

In order to make the learning environment positive and productive, please show common courtesy to your instructor and classmates. **These include turning off your cell phone when you come into class, arriving on time to minimize disruption, and refraining from e-mailing and websurfing during class.** YOU WILL NOT DO WELL IF YOU DO NOT COME TO CLASS.

Policy on religious holidays

Students should notify me by **Thursday, Sept. 7** of their intention to be absent from class due to religious observance.

Academic Integrity

I personally support the GW Code of Academic Integrity: "Academic dishonesty is defined as cheating of any kind, including but not limited to misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information."

For the remainder of the code, see: <http://www.gwu.edu/~integrity/code.html>

Any student found guilty of violating the rules for academic integrity will, at a minimum, be awarded a grade of "F" for the assignment and/or the course. A report will also be filed with the Administration who will decide if further disciplinary action is warranted.

Support for students outside the classroom

DISABILITY SUPPORT SERVICES (DSS)

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: <http://gwired.gwu.edu/dss/>. Please see me if you have any questions.

UNIVERSITY COUNSELING CENTER (UCC) 202-994-5300

The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:

- Crisis and emergency mental health consultations.
- Confidential assessment, counseling services (individual and small group), and referrals.

<http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices>

Schedule of Learning (subject to change)

| Date | Topic | To prepare | Some of what we'll do |
|------|---|---|---|
| 8/29 | What to expect this semester | Ch. 1: Sections 1.1, 1.3 Ch. 2: pp. 18-34 Ch. 3: Genetic terminology (pp. 50-51) <input type="checkbox"/> Complete reading quiz <input type="checkbox"/> Complete pre-course survey | <ul style="list-style-type: none">• Introduction to the course• How to complete worksheets |
| 8/31 | What are the chances, and how do we know? | Ch. 3: Sections 3.2 (skip binomial expansion pp. 58-60), 3.3, 3.4 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none">• Mendelian principles, dihybrid cross• Probability, statistics, χ^2 |
| 9/5 | Why are calico cats usually female? | Ch. 4: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none">• Sex determination, sex linkage• X-inactivation |
| 9/7 | <i>Making connections</i> | | <ul style="list-style-type: none">• Group work |
| 9/12 | What makes black labs black and chocolate labs brown? | Ch. 5: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none">• Types of dominance• Gene interactions, epistasis• Environmental effects |
| 9/14 | <i>Making connections</i> | | <ul style="list-style-type: none">• Group work |

| Date | Topic | To prepare | Some of what we'll do |
|-------|--|--|--|
| 9/19 | What are my chances of inheriting color blindness from my dad? | Ch. 6: pp. 145-158 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Pedigrees • Human genetics |
| 9/21 | How do we know where genes are? | Ch. 7: all sections Ch. 20: Genetic Maps (pp. 607-608), Physical Maps (p. 608), Single-Nucleotide Polymorphisms (pp. 613-615) <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Linkage mapping |
| 9/26 | Why are older women at greater risk of having children with Down Syndrome? | Ch. 8: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Chromosome mutations • Aneuploidy, polyploidy |
| 9/28 | <i>Making connections</i> | | <ul style="list-style-type: none"> • Group work |
| 10/3 | MIDTERM #1 | | |
| 10/5 | How humans actually have two genomes | Ch. 10: Sections 10.3, 10.4 Ch. 11: Sections 11.1, 11.2, 11.4 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • DNA chemistry • Chromosome structure • organellar DNA |
| 10/10 | FALL BREAK | | |
| 10/12 | Why do telomeres get shorter? | Ch. 12: Sections 12.1, 12.2, 12.3, 12.4 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • DNA replication |
| 10/17 | What is a gene? | Ch. 13: Sections 13.1, 13.2, 13.3, 13.4 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Transcription |
| 10/19 | How can the same gene have different functions in the brain and thyroid? | Ch. 14: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Gene structure • RNA processing |
| 10/24 | How the factory of your cell manufactures proteins | Ch. 15: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Translation |
| 10/26 | <i>Making connections</i> | Instructional video topics due | <ul style="list-style-type: none"> • Group work |
| 10/31 | Why bacteria rule the world | Ch. 16: pp. 461-475 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Regulation of gene expression in bacteria • The dreaded <i>lac</i> operon |
| 11/2 | Why eukaryotes do okay too | Ch. 17: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Regulation of gene expression in eukaryotes |
| 11/7 | <i>Making connections</i> | Instructional video draft script due | <ul style="list-style-type: none"> • Group work |
| 11/9 | MIDTERM #2 | | |
| 11/14 | Why X-men is fiction | Ch. 18: Sections 18.1, 18.2, 18.4, 18.5 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Types of mutations, mutagens, and repair mechanisms |
| 11/16 | Genetics in science, genetics as science | Ch. 19: Sections 19.1, 19.2, 19.3, 19.4, 19.6 Ch. 20: Section 20.2 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Biotechnology • Genomics |
| 11/21 | Can acquired traits actually be inherited? | Ch. 21: Sections 21.1., 21.2, 21.3 <input type="checkbox"/> Complete reading quiz Instructional video final script due | <ul style="list-style-type: none"> • Epigenetics |
| 11/23 | EAT TOO MUCH TURKEY | | |
| 11/28 | Why is it so difficult to cure cancer? | Ch. 23: Sections 23.1, 23.3, 23.3, 23.5, 23.6 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Genetics of cancer |
| 11/30 | Why do we often look like our parents, but not always? | Ch. 24: all sections <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Quantitative genetics • Components of phenotypic variance |
| 12/5 | Why do human populations have different phenotypes? | Ch. 25: all sections Ch. 26: Sections 26.1, 26.2, 26.5 <input type="checkbox"/> Complete reading quiz | <ul style="list-style-type: none"> • Population genetics • Evolutionary genetics |

| | | | |
|------|---------------------------|--------------------------------------|--------------|
| 12/7 | <i>Making connections</i> | Final instructional video due | • Group work |
|------|---------------------------|--------------------------------------|--------------|