BIOLOGY 210

Fall 2008

Dr. Christopher Jones

For the most current BIOL 210 syllabus, please use the following link:

http://home.moravian.edu/users/bio/mecjj01/bio210f08/index.html

Genetics Home Page

Points

As of Sunday, September 14, you can have as much as 167 points in this course: 105 from the two problem sets, 12 from quizzes, 15 from sending me your preferred email address, and 35 for taking the pre-course survey. I suggest you add up your points and talk to me if you're not doing as well as you'd like, particularly regarding the problem sets.

News

August 27, 2008. Researchers have transformed ordinary cells into insulin-producing cells in a living mouse, improving symptoms of diabetes in a major step towards regenerative medicine. (read more)

From a few years ago: "Word that genetic researchers had discovered a cell of rice contains more genes than a human cell caused widespread outrage as people across the globe attempted to prove that humans are easily as smart as a grain of rice." (read more)

Classes

Lectures will be held in Room 116, Priscilla Payne Hurd Academic Complex
Mondays, Wednesdays, and Fridays, 7:50 am to 8:40 am

Lab

Lab meets in Room 301, Collier Hall of Science
Monday, Tuesday, and Wednesday afternoons, 12:45 to 3:45

Text

The text required for this course is the 9th edition of *Introduction to Genetic Analysis*, by Griffiths, Wessler, Lewontin, and Carroll, published by W.H. Freeman, 2008.

Our text has an associated website.

Course Objectives

This is a one-semester course intended to give you a solid grounding in genetics, one of the keys (some would indeed argue **the** key) to understanding all the rest of biology. As Thedosius Dobzhansky famously said, "Nothing makes sense except in the light of evolution." Well, evolution doesn't make sense except in the light of genetics.

By the end of the semester, students should have an understanding of (and appreciation for):

- mitosis and meiosis
- the principles governing inheritance
- genetic linkage and recombination
- chromosomal and molecular mutations
- the basic structures and roles of DNA, RNA, and proteins
- the molecular processes governing genetic function
- quantitative genetics
- population and evolutionary genetics
- the techniques used in modern genetic investigations
- what kinds of questions can be answered using genetics

Students should be able to:

- predict and interpret the outcomes of genetic crosses
- read and understand primary articles in the genetics literature
- articulate current events in genetics research
- describe their research findings in standard format
- use a pooter

Course Policies

Below you will find various course policies, including:

- Reading
- Late Assignments
- Extra Credit

- Food
- Cell Phones
- Lab Conduct
- Group Lab Reports
- Studying Genetics
- Academic Honesty

Attendance

This is an early-morning class, and for many of us (including me), that … isn't our favorite time. Too bad.

It's important that you be in class. As you will discover, there will be no lecture notes for me to give you should you miss a meeting, no little PowerPoint handouts. Classes will be devoted to reviewing the topic(s) for the day, informed by your preparatory reading. Needless to say, that reading is critical to your ability to participate in class, clarify any difficulties you're having, and succeed in learning as much as you can about genetics.

Grading

I do not grade on a curve, so I hope that each of you will do your best to help your fellow students: if they benefit, it does you no harm. In fact, one of the best ways to learn something is to explain it to someone else, so talk to your classmates (see "Studying Genetics" below). Grades for this course will be determined as follows:

I'm going to be using the point system for this course, so you don't have to worry about calculating percentages for individual components. I'll try to keep an up-to-date total here on the website, so you can always determine your grade so far by comparing what you've earned with the max possible. (And don't you just hate Max, that little weenie?) Given my grading scale (see below), you can therefore calculate your own grade in the course at any time.

You want to learn genetics. I want to help you learn genetics. **Quizzes** are a demonstrably valuable tool to help learning. Ergo, I will be giving quizzes throughout the semester. They will be very low-impact individually, but I expect they will cumulatively be worth 100 points or so by the end of the semester. If you're not in class for a quiz, there will be no opportunity to make it up. However, I will be dropping several of the lowest quiz grades, so missing a few quizzes won't do your grade irreparable harm.

There will be three **exams** not including the final. Each will focus primarily on the material covered since the previous exam, but anything covered during the semester up to that point is fair game. The final will be semi-cumulative: about half of the exam will focus on material since the previous hour exam, but the other half will range over material from the entire semester. Barring extenuating circumstances (and it is entirely up to me to decide what is an acceptable circumstance), no make-up exams will be given.

The three hour-exams will each contribute 100 points toward your final grade, and the final exam will contribute 200 points.

There will be no make-up exams except in cases where I had advanced warning of your missing the exam, or you were unable to notify me due to circumstances beyond your control. Note that in **any** case, I may decide not to allow a make-up exam regardless of circumstance.

Homework problem sets will be assigned. I will be selecting them throughout the semester, based on our pace and what I feel will be most helpful to you. I will assign points to these based on how difficult I feel they are. As I don't have them all mapped out, I can't know how much they will contribute to your final grade, but I estimate around 300 points or so.

(I may, at my discretion, drop the lowest grade from the homework assignments. Do not count on this. If you find yourself thinking that you're sunk if I don't drop that score, you'd better come talk to me. *Immediately.*)

I will probably give occasional **miscellaneous assignments** over the course of the semester. These will be worth whatever points I announce at the time. Late assignments **will not be accepted**. I anticipate that there will be a total of 100 to 200 points in this category by the end of the semester.

Class participation will necessarily be somewhat subjective, but will encompass just that: participating in class. Asking questions, answering questions, being prepared to discuss whatever topics arise, doing your share of the work in lab — you're not children, you know what is meant by the term "participation." I assume a certain amount of participation on everyone's part; I will award up to 25 points for participation "above and beyond" at the end of the semester toward your final grade. Conversely, I will also dock up to 25 points for anyone who is not holding up their end in class.

Keeping an accurate, legible, and comprehensible **laboratory notebook** is an ***absolute requirement*** of this course. I've ordered lab notebooks for you to use for this course. We will go over some strategies for keeping notes in lab the first week. I will collect the copies (make sure you know how the notebook works!) throughout the semester; your lab notes will be worth 200 points.

In addition, I will be asking for formal **lab reports** for our lab experiments. I anticipate having 5 reports worth a total of 700 points. **Laboratory technique** will account for another 100 points of your final grade.

In summary, then:

Quizzes	100 points
Hour Exams	300 points total
Problem Sets	300 points

Misc. Assignments	100-200 points
Laboratory Notebook, Reports, and Technique	1000 points
Final Exam	200 points
Anticipated Total	**2000-2100 points**

I reserve the right to tweak these distributions as I see fit: if for example no one appears to be doing the reading, I may institute higher-impact quizzes. These will in all likelihood be given in the first few minutes of class, and no make-ups will be given. In order for them to be taken seriously, I will have to shoehorn them into the grading scheme outlined above.

Here is the grading scale I use in all my classes:

numeric grade	**letter grade**
93.3 - 100	A
90.0 - 93.2	A-
86.7 - 89.9	B+
83.3 - 86.6	B
80.0 - 83.2	B-
76.7 - 79.9	C+
73.3 - 76.6	C
70.0 - 73.2	C-
66.7 - 69.9	D+
63.3 - 66.6	D
60.0 - 63.2	D-

Just to review, this is what the Student Handbook has to say about grades:

A and A-
: These grades are given for achievement of the highest caliber. They reflect independent work, original thinking, and the ability to acquire and effectively use knowledge.

B+, B, and B-
: These grades are given for higher than average achievement. Evidence of independent work and original thinking is expected.

C+, C, and C-
: These grades are given when the student has devoted a reasonable amount of time, effort, and attention to the work of the course and has satisfied the following criteria: familiarity with the content of the course, familiarity with the methods of study of the course, and active participation in the work of the class.

D+, D, and D-
: These grades are given for unsatisfactory work, below the standard expected by the College. They indicate work which in one or more important aspects falls

> below the average expected of students for graduation. The work is, however, sufficient to be credited for graduation, if balanced by superior work in other courses.

Note that there isn't a whole lot of emphasis on *knowledge* here (as traditionally defined). Which is odd, but in any event, these descriptions are guidelines, not absolute criteria for a given grade. If you work independently, think originally, and are able to acquire and effectively use knowledge, but don't know squat about genetics at the end of the course, that's simply not "A" work. Context is important, people.

Reading

In this course, the reading is critically important. Classtime will be spent discussing the reading for that day; I will not be lecturing. If you don't keep up with the reading — and by that I mean **active** reading, not just using a highlighter — you won't be able to keep up in class, you won't fully understand what's being taught, the class will rapidly become a waste of time for you.

Late Assignments

Assignments turned in late will not be accepted. Period.

Extra Credit

On a 100-point hour exam, I will give you 110 points-worth of questions. Thus, you can miss (nearly) 10% of the questions on any hour exam and still get the full 100 points. With the exception of these additional points on exams, there will be no opportunity for extra credit in this course. Spend your energy learning the course material; "extra credit" in a college course is almost always a sham and a cheat.

Food

No eating in class, unless you can convince me it's medically necessary. *I* don't eat in class!

Cell Phones

Cell phones are tools of Satan. They are without significant positive value in my world and while I don't expect you to share my view of them, I expect you to spare me from being rudely reminded of their existence. If you are expecting an ***urgent*** phone call while in class or lab, alert me to that fact ahead of time. Otherwise, if your cell phone goes off in class or lab, you can expect me to penalize you some number of points, based entirely on my whim. Some day this will be looked on as one of my loveable eccentricities, but until then you'll just have to put up with my sociopathy.

Lab Conduct

There is to be ***NO*** food or drink in the lab at ***ANY*** time. Rules have gotten stricter, fines have gotten much higher, and our loveable Republican "smaller government" is coming after undergraduate institutions like never before. If I see any comestibles or potables in lab you will be docked points in accordance with my mood; if I see you put anything into your mouth, I may well dock you several hundred (yes, *hundred*) points. This is a serious infraction of laboratory protocols.

The only thing worse is endangering other students or their data, whether through carelessness or malice. If I find anyone doing something which might result in harm to another student or compromise their experimental results, I will fail the perpetrator for the course. I am by and large a fairly easy-going guy, but there are some things which are simply beyond the pale; this is one of them.

Group Lab Reports

For certain labs I will require group (rather than individual) lab reports. When submitting group reports, please be sure to:

- Use "we," not "I" — this is to be a *group* effort.
- Include the title, date, and the names of your group members.
- Every member of the group must initial the report, indicating that they are satisfied with it and agree to its contents.

If you have any questions about this format, please don't hesitate to ask me.

Studying Genetics

Science is a collaborative venture. I urge you to get together with your fellow students as much as possible to study the material for this course in groups. Discussing problems, studying for exams with other students, and asking each other questions on the reading assignments are all examples of activities which will benefit you and which I encourage. Obviously you cannot consult with others during exams or quizzes, but the homework may be something of a grey area for many of you. For my courses, you must prepare your own answers to assigned problems, but I feel that getting together with other students in the course to discuss and think through problems together is not only perfectly acceptable, it is a very good idea. If you have arrived at what you believe to be the correct answer, put it aside for fifteen minutes before writing it down; this way you can be more confident that you really know what it is you're saying, and your answers won't be identical to your partners'.

Note that the idea of collaborative learning in this way does not mean that you should ask for answers from others who have already taken this or a similar course, nor should you just accept an answer from a classmate whom you think is likely to be right. Everybody is mistaken sometimes, and if you don't understand **why** his or her answer is the right one, well, then you don't understand it. And that is not where you want to be. Conversely, if you're sure you've got the right answer, don't just tell your study group and be done with

it. Try to help them arrive at the same conclusion you did step by step; someone else may come up with a very different view of the problem which forces you to rethink your approach. And rethinking your approach, even if it doesn't turn out to change your mind about your answer, is critical to your success as a scientist.

My concern is not that you "learn" genetics, seeing it as a (very large) pile of facts, but that you **understand** it. Your fellow students and I are resources to help you; it's up to you to do the work necessary to gain that understanding.

You should expect to spend ***at least*** 2 hours studying on your own for every hour in the classroom. At a ***minimum***. That's true for every class, not just mine. If you're content to just slouch through, willing to trade a better grade in the course for whatever you think is more important than your studies, you're welcome to do so. But if you want to excel, not only for the sake of a higher mark on your transcript, but also for the sake of your education, you owe it to yourself to put in enough effort that you can honestly say to yourself at the end of the semester, "I did my best, and I learned as much as I could in that course." If you do, I'll do everything I can to make this a worthwhile experience for you.

Academic Honesty

I adhere to the Academic Honesty policy of the College. There is nothing more important to me than personal integrity — not happiness, not power, not even genetics, nothing — and I conduct myself and all of my classes in that spirit. If you're not familiar with College policy, you should be.

Syllabus

Meeting number	Date	In-Class	Background Reading
1	Mon., Aug. 25	organizational meeting	
2	Wed., Aug. 27	intro to genetics and genomics	chapter 1
3	Fri., Aug. 29	DNA structure & replication	chapter 7 pp. 265–279
	Mon., Sept. 1	No Class (Labor Day)	
4	Wed., Sept. 3	Transcription	chapter 8 pp. 295–309
5	Fri., Sept. 5	Protein structure & the genetic code	chapter 9 pp. 319–330
6	Mon., Sept. 8	Translation	chapter 9 pp. 330–340

7	Wed., Sept. 10	Mutation I	chapter 15 pp. 513–525
8	Fri., Sept. 12	Mutation II	chapter 15 pp. 525–542
9	Mon., Sept. 15	Meiotic crossing over & cancer	chapter 15 pp. 542–49
10	Wed., Sept. 17	Prokaryotic genetics	chapter 5 pp. 181–199
11	Fri., Sept. 19	Bacteriophage genetics	chapter 5 pp. 199–212
12	Mon., Sept. 22	hour exam	chapters 1, 7–9, and 15
13	Wed., Sept. 24	Single-gene inheritance I	chapter 2 pp. 31–46
14	Fri., Sept. 26	Single-gene inheritance II	chapter 2 pp. 46–61
15	Mon., Sept. 29	Sex linkage & pedigree analysis	chapter 2 pp. 61–75
16	Wed., Oct. 1	Independent assortment I	chapter 3 pp. 89–102
17	Fri., Oct. 3	Independent assortment II & organellar inheritance	chapter 3 pp. 102–118
	Mon., Oct. 6	No Class (Fall Break)	
18	Wed., Oct. 8	Linkage & recombination mapping	chapter 4 pp. 129–145
19	Fri., Oct. 10	More mapping	chapter 4 pp. 146–153
20	Mon., Oct. 13	Mapping analysis	chapter 4 pp. 155–164
21	Wed., Oct. 15	paper	TBA
22	Fri., Oct. 17	paper	TBA
23	Mon., Oct. 20	hour exam	chapters 2–5
24	Wed., Oct. 22	Gene interactions I	chapter 6 pp. 221–235
25	Fri., Oct. 24	Gene interactions II	chapter 6 pp. 235–248
26	Mon., Oct. 27	Prokaryotic gene regulation I	chapter 10 pp. 351–363
27	Wed., Oct. 29	Prokaryotic gene regulation II	chapter 10 pp. 364–371
28	Fri., Oct. 31	Eukaryotic gene	chapter 11

		regulation	385–402
29	Mon., Nov. 3	Developmental genetics I	chapter 12 pp. 415–426
30	Wed., Nov. 5	Developmental genetics II	chapter 12 pp. 427–439
31	Fri., Nov. 7	Genomics	chapter 13 pp. 453–468
32	Mon., Nov. 10	Aneuploidy	chapter 16 pp. 555–572
33	Wed., Nov. 12	Chromosome rearrangements & transposons	chapter 16 pp. 572–588 chapter 14 pp. 487–492
34	Fri., Nov. 14	review	
35	Mon., Nov. 17	hour exam	chapters 6, 10–13
36	Wed., Nov. 19	Population genetics I	chapter 17 pp. 603–619
37	Fri., Nov. 21	Population genetics II	chapter 17 pp. 620–633
38	Mon., Nov. 24	Quantitative genetics I	chapter 18 pp. 639–654
	Wed., Nov. 26	No Class (Thanksgiving Break)	
	Fri., Nov. 28	No Class (Thanksgiving Break)	
39	Mon., Dec. 1	Quantitative genetics II	chapter 18 pp. 654–668
40	Wed., Dec. 3	Evolutionary genetics I	chapter 19 pp. 679–697
41	Fri., Dec. 5	Evolutionary genetics II	chapter 19 pp. 697–710
42	Mon., Dec. 8	paper	TBA
43	Wed., Dec. 10	paper	TBA
	Tues., December 16 8:30 am	**FINAL EXAM somewhere in PPHAC (probably)**	

Life is fluid, so this syllabus is subject to change. I may have to change the syllabus to best help you learn about genetics, but this is certainly preferable to rigidly adhering to some timetable in lockstep. So come to class and you'll always know what's going on with the syllabus; changes will of course also be posted here, but you should be in class anyway!

Exams

Here are the ground rules for all of my exams (unless I explicitly tell you otherwise):

- Write your exam in pen, not pencil.
- Don't forget to write your name on the front page!
- Only calculators may be used during exams — no cell phones/PDAs/other electronic gizmos
- There are 110 total points possible on my exams; I will only count questions you get right, which means that you can miss up to 10 points and still get a hundred for the exam. So I recommend doing what you're most sure of first, then struggling with the more difficult questions.
- Guess if you must, but don't b.s. and don't "core-dump" — answer the questions directly and concisely.
- If you feel that a question cannot be answered as it is stated without making an assumption, go ahead and make that assumption, but **note** that you are making it!
- No question should require more than three sentences to answer; if you think you have to write more, go ahead, but it shouldn't be necessary. Feel free to continue on the back of the page, but **note** that you are doing so! It's your responsibility to make clear to me which is your (final) answer in all cases.
- If someone is absent for an exam, don't discuss the exam with **anyone** until I say otherwise.

Homework

Here is problem set 3, which is due at the beginning of class next Friday, September 19.

I've posted my answers to problem set 2; the class mean was 39.4 (72%).

I've posted my answers to problem set 1; the class mean was 40.8 (82%).

Quizzes

September 8

1. True or false: tRNA molecules do not use complementary base pairing in their normal functioning in the cell.

False: the tRNA's anticodon recognizes the matching mRNA codon by complementary base pairing.

2. True or false: ribosomes are the molecular machines that synthesize proteins in the cell.

   True.

3. Which of the following biomolecules are structural components of ribosomes: DNA, RNA, proteins?

   Ribosomes are comprised of several RNA molecules and proteins, but no DNA.

September 5

1. What is the name of the monomer subunits that make up proteins?

   Amino acids are the monomer subunits of proteins.

2. True or false: genes and proteins are colinear.

   True, genes and proteins are colinear.

3. How many nucleotide bases are in a codon?

   Each codon consists of 3 nucleotide bases.

September 3

1. Name one difference between DNA and RNA.

   DNA is double-stranded and uses deoxyribose for its sugar and thymine as one of its bases; RNA is single-stranded, uses ribose for its sugar, and uses uracil in place of thymine.

2. True or false: RNA polymerase can go in either direction when transcribing a DNA strand.

   False: RNA polymerase always travels in one direction, synthesizing RNA from 5' to 3'.

3. True or false: alternative splicing occurs in both prokaryotic and eukaryotic cells.

   False: alternative splicing only occurs in eukaryotic cells (as far as we know now).

August 29

1. What animal did Griffith use in his R/S transformation experiments?

   Griffith used mice in his experiments demonstrating transformation.

2. What is "Chargaff's Rule"?

   Chargaff's rule states that in all organisms, the amount of A in its DNA equals the amount of T and the amount of G equals the amount of C

3. What does DNA polymerase do?

   DNA polymerase is the enzyme which replicates DNA, synthesizing the new strands using the old ones as templates.

Lab Syllabus

Week	Date	Activity
1	Aug. 25–27	Lab orientation & overview handling flies examine wild-type flies and begin life-cycle observations collect and plate bacterial sample
2	Sept. 1–3	[no lab — Labor Day]
3	Sept. 8–10	fly genetic nomenclature basics examine and score mutant line for mapping set up mapping cross 1 set up bacterial 16S PCR reactions
4	Sept. 15–17	set up mapping crosses 2 & 3 run gel on PCR reactions ***Drosophila* life cycle lab report due**
5	Sept. 22–24	examine and score F_1 flies from mapping cross 1 flip to fresh vials to generate F_2 analyze bacterial 16S sequences
6	Sept. 29–Oct. 1	examine and score F_1 flies from mapping crosses 2 & 3 set up crosses to generate F_2 review lab report format
7	Oct. 6–8	[no regular lab — Fall Break] examine and score F_2 flies from mapping cross 1
8	Oct. 13–15	examine and score F_2 flies from mapping crosses 2 & 3 decide whether to proceed with mapping cross 4a or 4b

		bacterial identification lab report due
9	Oct. 20–22	set up mapping cross 4 (a or b, as appropriate)
10	Oct. 27–29	**mapping lab report 1 due**
11	Nov. 3–5	examine and score F_1 flies from mapping cross 4 set up cross to generate F_2 for mapping cross 4
12	Nov. 10–12	**mapping lab report 2 due**
13	Nov. 17–19	examine and score F_2 flies from mapping cross 4 PV92 population genetics lab
14	Nov. 24–26	[no lab — Thanksgiving break]
15	Dec. 1–3	evolutionary genetics lab **PV92 lab report due**
16	Dec. 8–10	clean up **evolutionary genetics lab report due**

Life is fluid, so this syllabus is subject to change. I don't anticipate any significant deviations, but remember that it's written in electrons, not stone.

Andrew Mashintonio

Andrew Mashintonio will be serving as my teaching assistant for this class. Andrew is a senior, and took this class two years ago. He did very well in the course, and is very knowledgeable about genetics. If you have a question and your classmates can't help you, don't hesitate to ask him. His email address is stafm02 [at] moravian [dot] edu and his cell phone number is 267-664-2318 (but please don't call after 11 pm). If you're more the IM type, his IM name is "mashtheitalian".

If there is enough interest, Andrew will coordinate one or two study sessions prior to exams.

Prof. Jones

If you ever have questions that you can't answer yourself using the textbook, the Web, or even (gasp!) *thinking*, realize that there are a lot of resources available to you: your classmates, Andrew, and me. This is part of my job, and one which I don't shirk. Depending on what the problem is, the most reliable method is probably email (I

sometimes don't realize I have voicemail for a day or two). My email address is cjones [at] moravian [dot] edu and my office (and lab) phone number is 610-861-1614.

If you need to speak with me sometime when I'm not on campus (a rare event!), call me at home any time between 9 am and 9 pm. Students often tell me they don't feel comfortable calling me at home because they think I mind. Consider the logic here: there's nothing that says I have to give you my home phone number, yet I have done so in class. So ***why*** would I give you that number if I didn't want you to use it? Note that "use" is not the same thing as "abuse:" don't call me at 3 am the day before an assignment is due and expect much sympathy (or pleasant conversation)!

Here's a copy of my current class schedule. My official office hours are from 9 am to 10 am Mondays, Tuesdays, and Wednesdays. If I'm not in my office (Room 310, Collier Hall of Science), try my lab (Room 233, Collier Hall of Science — between the elevator and the loading dock on the main floor). That said, feel free to get hold of me any time; if I can't spare the time to talk then, I'll tell you so, and we can set up an appointment at our mutual convenience.