

For the most current version of this syllabus, please use link
<http://home.moravian.edu/users/bio/mecjj01/bio365s08/index.html>.

BIO365 (Molecular Genetics)

Main	Objectives	Components	Policies	Syllabus	Exams	Homework
Labs	Prof. Jones					

Classes

Lectures will be held in Room 102, Priscilla Payne Hurd Academic Complex
Monday, Wednesday, and Friday, 11:30 to 12:20

Lab

Lab meets in Room 301, Collier Hall of Science
Thursday and Friday afternoons, 12:45 to 3:45

Text

The text required for this course is the 3rd edition of *Genetics: From Genes to Genomes*, by Hartwell, Hood, Goldberg, Reynolds, Silver, and Veres, published by McGraw-Hill, 2008.

Our text claims to have an associated website; it does not in fact have any such thing worthy of the name. If the text directs you to material at "www.mhhe.com/hartwell3", don't bother (unless you're really bored or really desperate).



For reasons that are not entirely clear to me, Moravian College considers this to be a personal page. Therefore it is incumbent on me to point out that "The views expressed on this page are the responsibility of the author, Christopher Jones (cjones-at-moravian-dot-edu) and do not necessarily reflect Moravian College or Moravian Theological Seminary policies or official positions."

My goal for Bio365 is to make you comfortable with the terms, concepts, and practices of modern molecular genetics. As this field is built on classical genetics, we'll be spending a little time reviewing the latter (and using some of its techniques in lab) as well.

In addition to the text, we'll be using articles from the primary literature to both hone your skills in analyzing the work of other researchers as well as to see how what we're learning in the classroom relates to what's going on in genetics labs today.

In the laboratory, each of you will be spending time identifying a bacterial unknown using a portion of its genomic DNA sequence, characterizing a novel mutation in *Drosophila melanogaster*, and designing and carrying out an experiment using DNA microarrays. These experiments will not only give you hands-on experience with the techniques, but also the experimental strategies of molecular genetics.

By the end of the semester, you should:

- understand the terms and concepts of molecular and classical genetics
- be able to explain those terms and concepts clearly to others
- be able to solve molecular genetics problems
- be able to carry out most common molecular genetic laboratory procedures
- understand **why** you're carrying them out!
- be able to read a research article *in any area you're at least somewhat familiar with* and be able to confidently analyze its conclusions, strengths, and weaknesses
- be able to devise experimental strategies to answer research questions in molecular genetics

In short, by May I hope that you will feel (and be!) fairly self-sufficient in navigating the ins and outs of a significant part of that area of modern biology called "molecular genetics." More importantly, you'll feel confident in being able to learn what you need on your own — no one course, or even 4 years of them, can prepare you with everything you're going to need to know.

"Give a man a fish, and it will feed him for a day. Teach a man to use the Internet, and he'll leave you alone for weeks." Oops, wrong quote.

A note on 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 Molecular Genetics](#) in the "Policies" section).

Here are the basic (by which I mean "important" (by which I mean "they affect your grade" (of course))) components of this course — in alphabetical order.

- [Attendance](#)
- [Exams](#)
- [Lab Notes](#)
- [Lab Reports](#)
- [Lab Technique](#)
- [Miscellaneous Assignments](#)
- [Paper](#)
- [Participation](#)
- [Presentations](#)
- [Problem Sets](#)

Attendance

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 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 molecular genetics.

To emphasize how important I think attendance is, every day you're in class (and awake) is worth 5 points toward your final grade. Being in lab is worth 10 points. If you're late, I will dock 1 point for every 3 minutes you're late (or fraction thereof).

Exams

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 hour exams will each contribute up to 100 points toward your final grade, and the final exam will contribute up to 200 points (but see my policy on [extra credit](#)).

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.

Lab Notes

Keeping an accurate, legible, and complete 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 examine your notes weekly, give you feedback, and sign off on them; I will collect the copies of your notes (make sure you know how the notebook works!) periodically over the semester. Your lab notes will be worth 200 points.

Lab Reports

I will be asking for formal lab reports for our lab experiments; I anticipate that we will tackle 3 projects this semester:

- identifying an unknown bacterial sample by DNA sequencing
- microarray analysis of *Chlamydomonas* and *Drosophila*, with the specifics yet to be determined
- characterizing an insertion mutant created last semester by BIO210 students

There will be one report for each of these projects, worth a total of 750 points. Each will be in the standard AIMRD format (Abstract, Introduction, Materials & Methods, Results, Discussion).

Lab Technique

Those of you who have had me in previous classes know that "getting the right answer" in lab isn't something that I put a lot of emphasis on. Real science isn't so neat and tidy that coming up with the correct answer (even if you or I know what that is, which often won't be the case in this course) is a reliable measure of how good you are.

That said, being right is hella better than being wrong. And having good lab technique is invaluable for getting the right answer. Consequently I will be evaluating your skills in lab. Being prepared (by doing the necessary background reading), following instructions, paying attention, and being careful with your manipulations are all important parts of this. As you'll learn, some of the reagents we'll be using are expensive and/or irreplaceable, and I abhor waste, so just being awake and aware of what's going on will serve you in very good stead. (Actually, being awake and aware is excellent advice in life in general, not just this lab.) I will give you up to 100 points for technique.

Miscellaneous Assignments

I will 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.

Paper

You will have a paper due at the end of the semester which reviews some aspect of molecular genetics and incorporates findings from at least 3 articles from the primary research literature. It must be a minimum of 1000 words long and should show evidence not only of simply understanding the material you present, but also something deeper: how these results fit into the larger picture, how they might be most profitably extended, or ways in which they are flawed, for example. It should be written in the style of a Perspectives article from *Science*; more on this later. This assignment will be worth up to 100 points toward your final grade.

Participation

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 100 points for participation "above and beyond" at the end of the semester toward your final grade. Conversely, I will also dock up to 100 points for anyone who is not holding up their end in class.

Presentations

On each day of class beginning March 31st, two of you will each give brief presentation on a journal article of your choice which involves some aspect of molecular genetics; I recommend (but do not require) that it be one of the articles you will use for your paper (see above). Plan for 10 minutes with a few minutes for questions; 15 minutes total at most. It will be evaluated by your classmates and myself based on criteria which we will mutually establish.

I'll be giving more specifics about this assignment later in the semester; it will be worth up to 100 points toward your final grade.

Problem Sets

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 500 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 those scores, you'd better come talk to me. *Immediately.*)

Below you will find various course policies, including:

- [Attendance](#)
- [Reading](#)
- [Late Assignments](#)
- [Extra Credit](#)
- [Cell Phones](#)
- [Lab Conduct](#)
- [Studying Molecular Genetics](#)
- [Academic Honesty](#)

Grading

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](#), you can therefore calculate your own grade in the course at any time.

I've laid out the [course components](#) and their point values separately, but to summarize:

Lecture Attendance	190 points
Hour Exams	3 @ 100 points = 300 points total
Problem Sets	ca. 500 points
Paper	100 points
Presentation	100 points
Misc. Assignments	100-200 points
Final Exam	200 points
Laboratory Attendance	120 points

Laboratory Notebooks	200 points
Laboratory Technique	100 points
Laboratory Reports	750 points
Anticipated Total	2960-3060 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 short, sporadic 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.)

Those of you paying attention may have noticed that the individual assignments above only add up to 2660–2760 points. You may assign the remaining 300 points to exams, the presentation, the paper, and/or the lab reports, depending on your own strengths. Within one week after I've returned your first exams, you should email me with instructions on how you'd like those points distributed.

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.

Attendance

If you are going to be absent from class or (Heavens forbid!) lab, please do me the courtesy of letting me know in advance if at all possible. Don't forget that it is *your* responsibility to notify me if you will be away for a field trip, sporting event, or other school-related function. It is not my responsibility to keep up with all the myriad activities which you might be involved in, according to the student handbook.

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" activities are a sham and a cheat.

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 might as well pack up your things and go home, because I won't give you any credit

for being there. 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 entire 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.

Studying Molecular 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 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 necessarily 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" molecular 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 molecular genetics, not happiness, not power, nothing - and I conduct myself and all of my classes in that spirit. If you're not familiar with College policy, you should be.

Meeting number	Date	In-Class	Background Reading
1	Mon., Jan. 14	organizational meeting	
2	Wed., Jan. 16	DNA mechanics: structure, replication, recombination	text sections 6.2–6.5
3	Fri., Jan. 18	DNA mechanics: structure, replication, recombination	text sections 6.2–6.5
	Mon., Jan. 21	No Class (Martin Luther King Day)	
4	Wed., Jan. 23	transcription, translation & the genetic code	text sections 8.1–8.3
5	Fri., Jan. 25	transcription, translation & the genetic code	text sections 8.1–8.3
6	Mon., Jan. 28	restriction enzymes & gel electrophoresis	text section 9.1
7	Wed., Jan. 30	cloning & libraries	text section 9.2
8	Fri., Feb. 1	hybridization & sequencing	text sections 9.3 & 9.5
9	Mon., Feb. 4	genomics	text sections 10.1 & 10.3
10	Wed., Feb. 6	"Eukaryotic operon-like transcription of functionally related genes in <i>Drosophila</i> "	Ben-Shahar <i>et al.</i> <i>PNAS</i> 104 (1): 222–227 (2007).
11	Fri., Feb. 8	"Eukaryotic operon-like transcription of functionally related genes in <i>Drosophila</i> "	Ben-Shahar <i>et al.</i> <i>PNAS</i> 104 (1): 222–227 (2007).

12	Mon., Feb. 11	Hour Exam 1	
13	Wed., Feb. 13	mutations	text section 7.1
14	Fri., Feb. 15	mutations & genes	text sections 7.2 & 7.3
15	Mon., Feb. 18	DNA polymorphisms	text sections 11.1 & 11.2
16	Wed., Feb. 20	finding human disease genes	text sections 11.3 & 11.5
17	Fri., Feb. 22	systems biology	text sections 12.1–12.3
18	Mon., Feb. 25	chromosomes	text chapter 13
19	Wed., Feb. 27		paper TBA
20	Fri., Feb. 29		paper TBA
	Mon., Mar. 3	No Class (Spring Break)	
	Wed., Mar. 5	No Class (Spring Break)	
	Fri., Mar. 7	No Class (Spring Break)	
21	Mon., Mar. 10	chromosomal mutations	text section 14.1
22	Wed., Mar. 12	prokaryotic genetics	text section 15.2
23	Fri., Mar. 14	gene regulation in prokaryotes	text sections 17.1 & 17.2
24	Mon., Mar. 17	Hour Exam 2	
25	Wed., Mar. 19	gene regulation in prokaryotes	text sections 17.3 & 17.4
	Fri., Mar. 21	No Class (Easter Break)	

	Mon., Mar. 24	No Class (Easter Break)	
26	Wed., Mar. 26	gene regulation in eukaryotes	text sections 18.1 & 18.2
27	Fri., Mar. 28	gene regulation in eukaryotes	text sections 18.3 & 18.4
28	Mon., Mar. 31	student presentations	
29	Wed., Apr. 2	student presentations molecular evolution	text section 22.1
	Fri., Apr. 4	No class today (<i>Drosophila</i> Research Conference)	
30	Mon., Apr. 7	student presentations molecular evolution	text section 22.2
31	Wed., Apr. 9	student presentations molecular evolution	text section 22.3
32	Fri., Apr. 11	student presentations molecular evolution	text section 22.4
33	Mon., Apr. 14	student presentations paper	
34	Wed., Apr. 16	student presentations paper	
35	Fri., Apr. 18	student presentations paper	
36	Mon., Apr. 21	Hour Exam 3	
37	Wed., Apr. 23	student presentations	
38	Fri., Apr. 25	student presentations	
	some day, at some time	FINAL EXAM	

Life is fluid, so this syllabus is subject to change. I will do my best to adhere to it, but helping you learn as much as you can about molecular genetics trumps any satisfaction I might glean by marching us in lockstep through the semester.

Here we go: here's a link to [problem set #1](#). It's due next Friday (February 1) in class.

Here's a link to [problem set #2](#). It's due next Friday (February 8) in class.

Lab Syllabus

Session	Date	Activity	Background Reading
1	Jan. 17/18	review lab rules discuss microbiological sampling techniques	
2	Jan. 24/25	PCR amplification of 16S rRNA	text section 9.4 this animation on PCR (go to Other>PCR in the menu on the left)
3	Jan. 31/Feb. 1	check amplification (gel electrophoresis) clean up PCR product prep genomic DNA from mutant <i>Drosophila</i>	text figure 9.5
	Jan. 31/Feb. 1	<u>Thursday lab section's PCR gel</u>	
	Jan. 31/Feb. 1	<u>Friday lab section's PCR gel</u>	
4	Feb. 7/8	prepare RNA from <i>Drosophila</i> and <i>Chlamydomonas</i> discuss microarray experiment	
5	Feb. 14/15	evaluate RNA purification (gel electrophoresis) digest genomic DNA	
6	Feb. 21/22	convert RNA into cDNA ligate genomic DNA	
7	Feb. 28/29	hybridize labeled cDNA to DNA chips	
	Mar. 6/7	No Lab (Spring Break)	
8	Mar. 13/14	inverse PCR on ligated genomic DNA transform bacteria	
	Mar. 20/21	No Lab (Easter Break)	
9	Mar. 27/28	assess inverse PCR products purify plasmids from transformed	

bacteria

	Apr. 3/4	No Lab (<i>Drosophila</i> Research Conference)
10	Apr. 10/11	digest and analyze plasmids
11	Apr. 17/18	data analysis
12	Apr. 24/25	data analysis

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.

If you ever have questions that you can't answer yourself, realize that there are a lot of resources available to you: if your classmates can't help you, feel free to ask 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 1 pm to 3 pm Monday and 10 am to noon Tuesday. That said, official hours are all but irrelevant to me. 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). 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.