

# MOLECULAR BIOLOGY SYLLABUS

Biol 320 –Fall 2016

<b>Instructor:</b>	Dr. Diane Caporale	<b>E-mail:</b>	<a href="mailto:dcaporal@uwsp.edu">dcaporal@uwsp.edu</a>
<b>Office:</b>	437 TNR Building	<b>D2L:</b>	Biol 320
<b>Phone:</b>	(715) 346-3922	<b>Office</b>	Tues & Thur: 2 – 3 pm
<b>Website:</b>	<a href="http://www.uwsp.edu/biology/faculty/DCaporal">http://www.uwsp.edu/biology/faculty/DCaporal</a>	<b>Hours:</b>	(or Mon by appointment)

## **Required Text:**

Cox, M.M. et al. 2015. *Molecular Biology: Principles & Practice*, 2<sup>st</sup> ed. For rent in bookstore.

**Required lined paper:** Purchase lined paper for note taking and lab journaling. Another option is to purchase a small lab notebook with lines.

**Lab Manual:** Lab manuals will be provided for you and distributed in lab in the first week. They will be in a 3-ring binder, for the convenience of adding your own notepaper.

**Lecture Meetings:** Tues, Thur, Fri: 10:00-10:50 am; SCI A208

## **Lab Meetings:**

Section 1: Wed 9:00 – 11:50 am, Sci B212;      Section 2: Wed 1:00 – 3:50 pm, Sci B212

**Exam Times:** during lecture time, Check schedule for specific dates

## **Learning Outcomes:**

**University Level:** *Investigation / Understanding the Physical World:* 1) Identify the basic taxonomy and principles of the scientific method as it pertains to the natural, physical world, 2) Infer relationships, make predictions and solving problems based on an analysis of evidence or scientific information, 3) Apply scientific concepts, quantitative techniques and methods to **solving problems** and making decisions, and 4) Describe the relevance of some aspect of the natural science to their lives and society.

**Biology/Biochemistry Program Level:** 1) Apply the scientific method, using appropriate theoretical and practical skills to design research studies, answer biological questions and/or solve problems. 2) Describe the flow of genetic information, the chromosome theory of heredity, and the relationship between genetics and evolutionary theory. 3) Evaluate and discuss contemporary social and ethical issues related to biology. 4) Apply theoretical and practical aspects of biology in a variety of laboratory and/or field experiences.

**Course Level:** 1) Compare the basic principles of inheritance in detail at the molecular, cellular and organismal levels, beyond the scope of Biol 210 (Genetics). 2) Relate DNA structure and manipulation to the function and control of genes. 3) Relate molecular techniques to discoveries in molecular biology. 4) Appraise ethical issues involved with the study of biotechnology and medicine. 5) Conduct basic molecular techniques to answer a variety of biological questions, and 6) Design molecular-based experiments using the scientific method.

**Grading:** The grading scale below is firm. There will be no borderline grades. If you attend and participate in class, keep up with your text reading each week, read lab manual **prior** to lab time, and **ask questions**, then you'll find success in this course. **Late lab reports are subject to 10% off each day late.**

Your final letter grade is calculated as follows: out of 100 pt.

	B+ = 87.5-89.4	C+ = 77.5-79.4	D+ = 67.5-69.4
A = 92.5-100	B = 82.5-87.4	C = 72.5-77.4	D = 60.0-67.4
A- = 89.5-92.4	B- = 79.5-82.4	C- = 69.5-72.4	F = ≤ 60.0

There are four (4) lecture exams, which are in short answer / essay format. **Exams will not cover the lecture before the scheduled time of each exam.** Grades will be posted on D2L, as well as weekly posts, suggested studying assignments, and practice questions to help you succeed in this course. There are also 4 formal lab reports and one in-class lab assignment. Below is a table indicating the percentage point values for each item.

Lecture Exams	60% Total	Lab Reports & Participation	40% Total
1	15%	Gel Electrophoresis	4% / group of 2
2	15%	Sequencing your <i>COMT</i> Gene	8% / individual
3	15%	Detection of 3 Tickborne Pathogens by Multiplex PCR	12% / group of 2
4	15%	Designing Allele-Specific PCR Assay for Genotyping	2% / group of 2
		Identifying SNPs of Interest in your Genome	12% / individual
		Success in Laboratory Technique	2% / individual

**Attendance Policy:** I strongly recommend you attend every lecture. Missing any class will put you at a distinct disadvantage when test taking. Students who must miss an exam due to religious observances or participation in university-sanctioned events should notify me within the first 3 weeks of the beginning of class, so makeup arrangements can be made. The only other valid excuses for missing an exam are: death in the family, violent illness, or accident. In such cases: (1) you must provide evidence of some kind (eg. note from health center), **and** (2) you must reschedule **within 24 hours** after the deadline.

**E-mail:** Students are expected to check their University e-mail regularly for information from the university and/or instructor. If you are using an e-mail account other than your campus account to contact me, be sure your full name is included in the message

**Electronic Devices:** Cell phones must be turned **off** and **not** displayed during class, lab or exam. No other communication or musical devices are allowed. Students needing a foreign language dictionary during exams may use one with permission from instructor.

**Academic Conduct:** You are responsible for the honest completion and representation of your work and for the respect of others' academic endeavors. Any act of cheating, plagiarism, or academic misconduct is subject to the penalties outlined in UWS Chapter 14.

For more information: <http://www.uwsp.edu/comm/wdeering/plag.pdf>

**Study Habits:** The best way to grasp the material is to form study groups with your classmates. (Students with a disability requiring accommodations should register with the Disability and Assistive Technology Center in the Learning Resource Center (the Library) and contact me at the beginning of the course.)

## Excellent Studying Strategy Based on the Scientific Method:

*Literature search:* Print off lecture slides posted in D2L. Read the textbook chapter sections (and suggested readings) that pertain to the info in the lecture slides. While reading, take some notes on the side of each slide from lecture to clarify class info.

### *Methods:*

- a) Rewrite your notes! On lined paper, prepare study guide sheets the following way... Take each slide and first write the heading (underline it) then next to it write the info learned. Try to describe the image (or table) in the slide in your own words. Try to do this on one or two sheets of paper per lecture – front side only – without skipping lines if you can, so that the headings are on the left side and the info next to them on the right side. Do this for each lecture BEFORE the next lecture (by Monday you have two lectures to cover already). Then read it over once to see the whole picture or overall theme of that lecture. Try to look for similarities and differences between the information. When appropriate, make a table of info to help compare concepts.
- b) Come up with 1-2 questions of your own from each slide to either quiz yourself later, or anticipate future exam questions. Definitions, functions, comparisons, prok vs euk for all systems, etc.
- c) At the end of each week you will have study guide sheets already made for the upcoming exam. Before all Mondays' lectures, read over your study sheets and highlight only the information you could not remember.
- d) Rewrite notes again! On a blank sheet of lined paper: write down the info you couldn't remember. This will help reinforce those concepts that were more difficult for you.
- e) Before the exam you will have a set of study sheets of all info AND a smaller set of study sheets containing info you needed reinforcing. Use this second set for studying one or two days before the exam. Reread, highlight info that you are having trouble learning or remembering and say it out loud, to yourself or with another person from class, a friend or study group.
- f) At the end of each chapter, try the practice questions before looking at the answers in the back of the book. Write down the ones you do not understand and ask the instructor to go over those problems.
- g) Try to answer your own questions that you accumulated from each slide. Study with someone in class and try to answer each other's questions.

### *Results:*

- a) There will be no need to cram in lots of info right before an exam, so you'll be able to get "good" sleep the night before.
- b) You will feel less stressed, overworked or overwhelmed, and more confident when taking the exam.
- c) Your grade should reflect the amount of cumulative effort you put into your studying – remember – for every hour of lecture, one needs AT LEAST DOUBLE the amount of studying time. In other words, for each exam you should be spending about 12-16 hr of studying! This really isn't possible to do effectively right before an exam.

### *Discussion:*

- a) A good grade results, due to **reading** your notes and the text, **hearing** my lectures, **seeing** the words and images, **writing** and **rewriting** notes from class and the text, **experiencing** by trying to answer questions from the back of each chapter or from a suggested list provided on D2L before each exam, and **discussing** topics with another person (saying it out loud).
- b) If you can teach it to another person, then you know it! **"The best way to learn is to teach!"**

## **Laboratory Reports:**

Genetic researchers generally perform multiple experiments on a daily basis. Therefore, it is very important that researchers keep excellent records of their experimental findings in laboratory notebooks. Lab books are a form of documentation of work that was performed and reported in published manuscripts. Your lab reports will be based on a revised version of a manuscript, whereas all of the detail of the introduction and methods sections will be omitted. However, the discussion and conclusion sections will be greatly emphasized. In order to keep accurate records during each lab investigation, it is critical that you document everything you do in a lab notebook. Although it will not be graded, it will help you to keep organized notes about each lab and collect the data for your reports.

**Lab Reports are to be typed, 12 pt font, 1 inch margins all around, with nothing handwritten.**

They will be graded based on completeness, proper interpretation of data, correctness of answers to questions in discussion, and ideas on optimizing results (improving protocol).

*Use the following format:*

**Title, Group #, and Names** of your partners

**Purpose:** State the reason for doing the experiment (1-2 sentences)

**Hypothesis:** State your hypothesis that you are testing. Place in purpose section in formal lab reports.

**Methods:** In sentence form, ONLY include the general headings of each part of each investigation from your lab manual. You are basically citing your manual. Therefore, there is no need to write the detailed protocols over again. However, include any changes in the methods you may have performed.

**Results:** Summarize your data. Include labeled gel images, tables, graphs, DNA sequences, DNA fingerprints, genetic trees. Describe procedural problems that may have occurred. Include answering any questions from the results section of each investigation. Do not rewrite the questions.

**Discussion:** In paragraph form, answer the questions addressed in the discussion section of each investigation. Do not answer all of the questions using one long paragraph. Use separate paragraphs when addressing different topics. If you did not get PCR products, then discuss what could have gone wrong with your experiment and give suggestions on how to improve your technique and/or adjust the protocol, etc.

**Conclusion:** Interpret your results according to those expected and why unexpected results may have occurred. State how the exercise addressed the purpose stated above. State how your work relates to broader questions in genetics and any conclusions you can draw relating to your stated hypothesis. If you were to continue this project, what would be the next step? What questions need further explanation?

**References:** Include any that you used besides your lab manual.

## MOLECULAR BIOLOGY LECTURE SCHEDULE

Week	Date	Topic	Chapter
1	Sept 6	Syllabus /Molecular Biology Timeline & Evolution	1
	8	DNA as Genetic Material	2
	9	Chemical Basis of Information	3
2	13	Protein Structure	4
	15	Protein Function	5
	16	Protein Function / DNA Structure	5, 6
3	20	RNA Structure	6
	22	Studying Genes: Molecular Cloning & Screening	7
	23	<b>EXAM I</b>	(1-6)
4	27	Studying Genes: Transgenics	7
	29	Studying Genes: Forms of PCR	7
	30	Studying Genes: DNA Fingerprinting	7
5	Oct 4	Site Directed Mutagenesis VS CRISPR Technology	7
	6	Studying Genes: DNA Sequencing	7
	7	Genomes	8
6	11	Changes in DNA Topology	9
	13	Chromosome Architecture	10
	14	DNA Replication	11
7	18	DNA Replication	11
	20	DNA Mutation	12
	21	DNA Repair	12
8	25	<b>EXAM II</b>	(7-11)
	27	Transposons	14
	28	Immunoglobulin Genes	14
9	Nov 1	Prokaryotic Transcription of RNA	15
	3	Eukaryotic Transcription of RNA	15
	4	RNA Processing	16
10	8	RNA Processing	16
	10	RNA Processing	16
	11	RNA Processing	16
11	15	The Genetic Code	17
	17	Translation of Protein	18
	18	<b>EXAM III</b>	(12, 14-17)
12	22	Translation of Protein	18
	24&25	<b>THANKSGIVING BREAK!!</b>	
13	29	Regulation of Gene Expression	19
	Dec 1	Regulation of Gene Expression	19
	2	Prokaryotic Gene Regulation: Lac Operon	20
14	6	Prokaryotic Gene Regulation: Trp & Ara Operons	20
	8	Genetic Control of Lambda Phage	20
	9	Eukaryotic Transcriptional Regulation	21
15	13	Eukaryotic Post Translational Regulation	22
	15	Catch up	
	16	<b>EXAM IV (8-10am)</b>	(18-22)

## MOLECULAR BIOLOGY LAB SCHEDULE

Date	Topic	Lab#: Pages	Assignment Due
Sept 7	Syllabus, Prepare 1X TAE buffer, Intro to Gel Electrophoresis Lab, Pour Gel	1-3 1: 4-6	
Sept 14	Gel Electrophoresis: run gel & analyze	1: 7-10	
Sept 21	Isolate your DNA & PCR <i>ComT</i> Gene, Pour Gel	(4: 62, 64-65)	
Sept 28	Run Gel, Purify and Cycle-Sequence <i>ComT</i>	4: 66	Gel Electrophoresis Report Due
Oct 5	Flagging for Ticks in Schmeeckle Reserve		
Oct 12	Purify & Prepare <i>ComT</i> for Sequencing	4: 67-68	
Oct 19	<i>ComT</i> Sequencing Analysis	4: 69-72	
Oct 26	Isolate Tick DNA	3a: 22-24	
Nov 2	Quantify Tick DNA, Multiplex-PCR for <i>Borrelia</i> , <i>Anaplasma</i> & <i>Babesia</i> , Pour gel,	3a: 26-27 3b: 28-33	<i>ComT</i> Genotype Report Due
Nov 9	Run & Extract Bands from Multiplex-PCR gel, Purify Positive PCR Products, Cycle-Sequence	3b&c: 34-40 3c: 41-47	
Nov 16	Purify Cycle-Sequence Products, Prepare for Sequencing	3c: 47-48 3d: 49-53	
Nov 23	<b>Enjoy Thanksgiving Break, No Lab!!!!</b>		
Nov 30	Edit Pathogen Sequences, Blast Search to Identify Species, Use Poster to Identify <i>Borrelia burgdorferi</i> Strains	3e: 54-59	
Dec 7	Allele-specific PCR of Two Other Human Genes, pour gel	5: 73-	Tickborne Pathogen Report Due
Dec 14	Run Gel & Identify Your Other Two Genotypes	5:	
Dec 19	Monday of Finals Week, Human Genotypes Lab Report Due by 5:00pm via Email		