

SYLLABUS
BIO 121 General Biology 1
(Introductory Cell Biology)

Spring 2016

Dr. Patrick Bryan
Office: 209 Wheaton

Office Hours: M	11-1pm
T	11-1pm
F	1-12pm

And By Appointment

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Course Text: One Recommended Text: "BIOLOGY" by *Campbell and Reece (any edition) OR "Essential Cell Biology" by Alberts et al. (any edition), OR "BIOLOGY" by Raven and Johnson (any edition). The campus bookstore stocks the *Campbell Biology* book but you can choose another if you prefer from and on-line vendor. No specific text is required. However, access to the Mastering Biology resource will be used as part of your grade.

*This text is offered by the college bookstore. Other texts can be purchased online.

Contacting Me:

If you need to ask me something about the class you have several ways to get in touch with me. E-mail is probably the easiest and fastest way to get your questions answered. I can access e-mail messages from my office or home, and check my messages often each day. If you need to talk you can ask me whatever you want during the lab period of our course. It is best to not ambush me with questions 5 minutes before class begins, as I am usually organizing materials and time is limited. You can also set up an appointment with me if you need help with the class material. Ask me in person during lab or by e-mail. I will meet with you as often and for as long as you require, but be sure to set up the meeting first.

Course Objectives:

General Biology 1 (BIO 121) is a core biology course designed for students who may major in Biology or a field requiring a solid background in biology. This course will be an introduction to the study of cells, cellular organelles, and an array of processes that take place within the smallest unit of life, the cell. Cell Biology is a broad field of study that covers aspects ranging from modern molecular biology to traditional cellular processes and structures. Therefore, we will focus on the key topics in Cell Biology and add details to

concepts you may have been previously exposed to in other courses. It is important that you understand the dynamics of cell structure and mechanisms occurring within cells. The comprehension and retention of concepts presented in this course are essential to your overall understanding of how biological systems function.

The main objectives of this course are: (see Course Outcomes at end of Syllabus)

- To understand the basic chemistry concepts important to biology
- To provide an introduction to the structure of cellular organelles
- To provide you with a basic understanding of cellular processes including:
(the dynamics of membranes, cellular respiration, the genetic code, expression of genes through protein synthesis, enzyme function and regulation, cell division and the cytoskeleton)
- To reinforce the basic concepts relating to macromolecules and chemical interactions
- To introduce modern techniques used in biological laboratories to study cells and cellular biology

Exams:

There will be four lecture exams plus a cumulative final exam. The lecture exams will be multiple choice, short answer, and essay questions specifically taken from the lecture material and assigned readings. The final exam will cover **cumulative** knowledge of Cellular Biology from each of the previous exams. Make-up exams will only be given under exceptional circumstances and with direct permission obtained **before** the scheduled exam time. The final **must** be taken at the designated time. If you miss an exam and have not previously arranged to take a make-up, you will receive a zero for that exam. Please plan ahead and stay up to date with the exam schedule.

Studying:

This class will be challenging for most students. You can do well in the course provided you are dedicated to learning the material. Exams will assess both your ability to retain facts and your ability to process complex information and use it to solve simple problems. You need to study at least 8h a week if you want to do well. Many students spend over 12h a week studying. Quantity of Time is NOT as important as quality of study time.

Do: study in a quiet place with no distractions, no food, tv, people talking etc.

Do: re-write your notes, but not just verbatim, re-write them in your own words, summarize them. If you can do this you have started to process the information

Do: read the book and your notes OUT LOUD. Hearing yourself increases retention.

Do: re-read and re-write again and again.

Do: form study groups to meet **several** times before and exam, alternatively: utilize the **Discussion** Function of our Vista Course Web Site

Attendance:

It is your responsibility to obtain course information both related to exams and other assignments. All responsibilities and expectations will be explained during lecture and lab sections. If you fail to attend class and miss vital information, it is **by your choice**. Returned assignments, review of assignments, and specific instructions concerning exams and assignments will be given to those attending class. If you choose to miss class you choose to forfeit this information. The instructor will not be providing special private instruction to students who skip classes. If you have valid reasons for missing class, I can help direct you to the appropriate material to study.

Grading:

Grades will be assigned according to the point system below. Do not expect any extra credit assignments to be offered. **Assignments must be submitted on time to receive full credit**. Assignments you turn in **late** will be graded (for reduced points) and returned, but expect them back to you no sooner than the end of the semester. As the only gradebook for the course is the Online gradebook, you have access to all of your grades at any time. Do not expect the instructor to tell you your "Current Grade" as this is something you can calculate for yourself at any time. You add up the total of points that you have received to date, and divide by the total possible points to date. That's it.

Exam 1-4	400	(100 pts each)
Final Cumulative Exam	150	
Quizzes (15)	150	(10 pts each)
Lab report (1)	50	
Lab technique exams (3)	75	(25 pts each)
Lab Notebook	50	
In Class Quizzes	100	
TOTAL =	975 points	

Note that approximately 50% of your grade is the result of lecture exams while the other 40% + results from course assignments. This type of system allows for students to maintain their grades and demonstrate their knowledge in the course outside of traditional exams. However, these assignments can hurt you as readily as they can help you. Complete your assignments on time and do a thorough job on each assignment.

Lecture:

Regularly scheduled class periods will be devoted to lectures. The lectures will be conducted in an interactive format, where students are strongly encouraged to **ask questions** and **insert comments**. Lecture information will be a main source of exam questions. It will be very important to attend lectures and obtain a complete set of class notes in order to do your best in the course. No formal attendance record will be kept during class, but past experience indicates that a good grade almost necessitates regular class attendance. Specific reading assignments are listed on the course web site. Students who keep up with the reading can actually use class time to learn and they perform much better on exams than students who do not read the text. However, the lecture and presentations

are the major sources for specific information on the exams. We will follow sequence of topics given on the "Course Outline" (with some flexibility). I will slow down or speed up the topics in relation to how well students are learning the material. So the Schedule for topics is not in stone, but the exam dates will NOT change. (unless snow)

Laboratory:

Cell and molecular biology are large and diverse fields of active research, employing many more techniques and procedures than could be learned by a single individual in a lifetime. However, certain basic techniques are used in a broad range of experiments. In this course we will learn some of these basic techniques while becoming familiar with standard laboratory practices. The exercises presented early in the semester introduce fundamental tools that should be mastered by practically all biologists. Later exercises employ somewhat more sophisticated techniques, and require the use of those learned earlier. Thus the course contents builds in complexity, requiring that students learn the subject matter and procedures as they are introduced in the lectures and laboratory exercises.

The specific details pertaining to each laboratory session will be given to you in a handout prior to the lab period, available on the Class Vista Site (or during a short lecture period preceding the lab). You will be required to read the lab procedures before lab, as our time will be limited.

Lab Goals:

1. Master basic techniques working in a biological laboratory environment
2. Become familiar with a variety of advanced techniques, which will not be mastered but will gain a concept of the skills involved
3. Collect both qualitative and quantitative data
4. Analyze quantitative data and synthesize in the format of a laboratory report
5. Gain an appreciation for working in a laboratory environment

Quizzes:

Every week you will take a quiz from the lecture material that is worth 10 points. There will be 15 of these quizzes. These quizzes will be given to you to perform outside of class time. They are available on the course web site and must be taken on-line. You can view the quiz as many times as you wish and even submit your answers for a grade several times. My gradebook will record your highest grade. However, there will be a limited time period that each quiz is available. Once the date for a Quiz expires it will no longer be available and you will receive a Zero for that assignment. You will have about 5 days to complete each quiz. Aside from a catastrophic crash of the internet or a long term problem with the Vista site, technological problems will NOT be accepted. You can do these Quizzes on campus or from home and if you have problems logging in to the Site Contact me.

Technique Exams:

Throughout the course we will utilize several basic lab techniques during our experiments. You will be responsible for understanding the technique and performing it properly. We will have two Lab Technique Exams throughout the course where you will be given a task and must perform it correctly. Your ability will be graded. There will be two exams (50 points each) and the specific techniques will be announced in lab a week before each exam.

Learning Objectives of Instructional Units: BIO 121

Following completion of the course students should be able to:

Chemistry Overview:

1. Sketch and explain the structure of an atom
2. Explain electronegativity and predict the behavior of individual atoms
3. Identify the types of chemical bonds that would occur between various atoms important to cellular biology
4. Summarize the chemical composition of the cell including inorganic and organic molecules.
5. Describe the structures of the four main classes of biological molecules: proteins, nucleic acids, lipids, carbohydrates.
6. Explain the concept of pH and buffers, calculate pH from given concentrations of H⁺ and OH⁻

Membrane Structure and Function:

1. Compare and contrast the differences and similarities between prokaryote and eukaryote cells.
2. Summarize evolution of eukaryotic cells including the endosymbiotic theory.
3. Sketch and label the structure of a biological membrane
4. Explain the concept of fluidity and the factors (environmental and chemical) that affect it
5. Summarize the fluid mosaic model of the membrane and the various mechanisms (passive diffusion, osmosis, facilitated diffusion and active transport) that materials use to cross this structure.

6. Explain the energetics of active transport and how diffusion and active transport can be energetically coupled.
7. Describe structure and function of membranes in transport of small molecules, receptor mediated endocytosis, cell-cell interaction.
8. Describe the structure and function of cell-cell communication pathways including signaling molecules, cell surface receptors, G-proteins, details of IP3 and cAMP pathways, intracellular signal transduction, and implications for development and differentiation.

Cellular Physiology:

1. Identify the differences between endothermic and exothermic reactions
2. Explain the 1st and 2nd Laws of Thermodynamics
3. Apply the laws of thermodynamics to predict if the outcome of reactions are spontaneous or non-spontaneous
4. Summarize the role of enzymes as chemical catalysts.
5. Sketch and label a typical enzyme and its binding sites
6. Explain how enzymes activity is regulated and the basics of enzyme kinetics
7. Describe how energy flows through the cell including the formation of ATP.
8. Sketch an overview of the catabolic reaction of cellular respiration including: Glycolysis, Pyruvate Oxidation, and Citric Acid Cycle.
9. Explain the key Redox events during cell respiration and the energetic input and products of each reaction pathway
10. Thoroughly explain oxidative phosphorylation and the structure of the mitochondria
11. Sketch mitochondria structure and identify where reactions during aerobic respiration take place.
12. Sketch and explain the mitochondrial electron transport chain and its significance
13. Sketch, Label and Explain the FoF1ATPase of the mitochondria
14. Demonstrate the process of photosynthesis including: photosystems, photoexcitation, light dependent reactions and Calvin cycle, and light energy

15. Explain and sketch the chloroplast structure and label the components of the light dependent reactions

Genes and Gene Expression:

1. Describe the structure of the nucleus.
2. Describe the structure and function of nuclear envelope including nuclear pores.
3. Relate the internal organization of the nucleus to function (e.g. chromatin structure, functional domains, nucleolus, and nuclear matrix).
4. Explain and sketch the general structure for DNA and RNA
5. Diagram the process of DNA replication and identify all the proteins involved in the process
6. Explain 3 prime and 5 prime ends and leading and lagging strands
7. Describe how genes are expressed in general and in detail
8. Explain RNA transcription and the processing of each type of RNA
9. Summarize Translation and incorporate all the types of RNA and their roles
10. Compare and contrast the organization of eukaryotic nuclear, chloroplast and mitochondrial genomes.
11. Describe how protein and RNA molecules are transported across the nuclear envelope.
12. Describe changes in the nucleus during mitosis.
13. Describe the structure and function of the endoplasmic reticulum (ER) in protein synthesis, protein sorting, protein targeting, and lipid synthesis.
14. Describe the structure and function of the Golgi apparatus in protein glycosylation, lipid and polysaccharide metabolism, protein sorting and export.
15. Describe the mechanism of vesicular transport.
16. Describe the structure and function of lysosomes including acid hydrolases, endocytosis, phagocytosis, and autophagy.

Cell Cycle

1. Explain an overview of the cell cycle

2. Describe the phases of Mitosis and activity of the chromosomes
3. Sketch the phases of mitosis and identify key characteristics of each phase
4. Explain the structure and function of actin, myosin microfilaments, intermediate filaments, and microtubules
5. Describe the role of cytoskeletal proteins in each phase of Mitosis

BIO 121 Laboratory Outcomes:

A student successfully completing the laboratory course should be able to demonstrate the following skills:

1. Properly focus a light microscope and/or dissecting microscope to view specimens
2. Identify cell structure on slides using a light microscope
3. Prepare and view wet mount slides
4. Demonstrate proper laboratory safety procedures for handling chemicals and other laboratory materials
5. Properly measure liquid chemicals using a graduated cylinder and/or pipette
6. Accurately record volume measurements using a graduated cylinder and/or pipette
7. Accurately determine the pH of a solution
8. Conduct experiments involving chemical and biological principles such as diffusion and osmosis, pH, and enzyme activity
9. Safely and Properly mix chemicals(ie acids and bases into water)
10. Perform scientifically sound and safe experiments
11. Successfully follow laboratory procedures, record observations and report their findings using the scientific method
12. Use standard laboratory equipment correctly and record data to reflect the accuracy of the instrument
13. Select and use appropriate personal protective equipment
14. Prepare and use a standard curve to determine unknown concentration
15. Prepare a molar solution based on their own calculations from given information
16. Prepare serial dilutions
17. Use a hemocytometer to count cells/organelles (chloroplasts) and calculate concentration of a suspension based on these numbers
18. Identify stages of cell division under a light microscope

IMPORTANT COLLEGE POLICIES!! PLEASE READ CAREFULLY!

For information about the college's policies and procedures regarding academic honesty, accessibility/disability services, attendance, audio-recording in the classroom, grade appeals, plagiarism, religious accommodations, weather and emergency closings, and more, please go to the following website: www.mxcc.edu/catalog/syllabus-policies/ or scan the QR code with your smart phone. Also, please become familiar with the policies regarding nondiscrimination, sexual misconduct, and general student conduct at the following website: www.mxcc.edu/nondiscrimination/.



NON-DISCRIMINATION STATEMENT

Middlesex Community College does not discriminate on the basis of race, color, religious creed, age, sex, national origin, marital status, ancestry, present or past history of mental disorder, learning disability or physical disability, sexual orientation, gender identity and expression or genetic information in its programs and activities. In addition, the College does not discriminate in employment on the additional basis of veteran status or criminal record.

The following people have been designated to handle inquiries or complaints regarding non-discrimination policies and practices:

- *Primary Title IX Coordinator*
Dr. Adrienne Maslin
Dean of Students/Title IX and Section 504/ADA Coordinator
amaslin@mxcc.edu; 860-343-5759; Founders Hall Room 123
- *Secondary Title IX Coordinator*
Ms. Mary Lou Phillips
Director of Human Resources, Middlesex Community College
mphillips@mxcc.edu; 860-343-5751; Founders Hall Room 115
- *Secondary Title IX Coordinator*
Ms. Queen Fordham
Coordinator of the Meriden Center Welcome Desk
qfordham@mxcc.edu; 203-608-3011