2020

Essential Concepts and Learning Outcomes for Cell and Molecular Biology

Laura L. Newcomb PhD
California State University - San Bernardino, lnewcomb@csusb.edu

Mike Chao PhD
California State University - San Bernardino, mchao@csusb.edu

Dan Nickerson PhD
California State University - San Bernardino, Daniel.Nickerson@csusb.edu

Paul Orwin PhD
California State University - San Bernardino, porwin@csusb.edu

Jeremy Dodsworth PhD
California State University - San Bernardino, jdodsworth@csusb.edu

See next page for additional authors

Authors

Laura L. Newcomb PhD, Mike Chao PhD, Dan Nickerson PhD, Paul Orwin PhD, Jeremy Dodsworth PhD, and David Rhoads PhD

FINAL REFLECTION

Our faculty learning community goal was to ensure that ALL courses within the “Cell and Molecular" core category cover essential concepts and learning outcomes, but yet remain distinct so that students who want to place emphasis on Cell and Molecular Biology can learn from all the courses.

To identify core concepts for the “Cell and Molecular” Category A, we spent time reading materials and discussing the essential concepts in cell and molecular biology. We agreed that the BioGuide was indeed an excellent tool to use as we align and diverge our cell and molecular “category A” courses. The BioCore Guide is a set of general principles that provide a framework to align with the goals of *Vision and Change*, the consensus reports produced with the aim of uniting the undergraduate biology education community under a set of common principles. *Vision and Change* was spearheaded by AAAS with support from the National Science Foundation, Howard Hughes Medical Institute, the National Institutes of Health, and the United States Department of Agriculture. We agreed with the five core concepts: Biological Information Flow, Evolution, Transformation of Energy, Structure and Function, and Systems. As we discussed our courses, we pleasantly found that all courses cover these five core concepts.

To confirm our classes would remain distinct enough we then discussed how each course deals with the core concepts. We found most courses in category A cover these core concepts in distinct ways, although there is some overlap between Cell Biology (3100) and Molecular Biology (3120). We agreed that we should not attempt to make the courses more similar but instead highlight the distinctions, with cell biology focusing more on all cellular organelles while molecular spends most focus on the “brain” of the cell, the nucleus. We are confident all courses in category A will provide the core concepts for students who only take one course (for example a student whose focus is wildlife conservation) but also provide new insight for students who take more than one (for example a student whose focus is biomedical science).

In addition to completing these goals, we also examined free text materials. One of our core courses will use open source materials from MIT (Genetics – 3300). We did examine a free text for Cell Biology (3100) and Molecular Biology (3120) and although the information was accurate, the illustrations were basic. Given we all appreciate good visuals to teach cell/molecular, we decided against this text. We discussed student feedback which indicates many do not read the text. Therefore, we decided to list the text as “highly recommended” or “recommended”, along with reminders that an older edition is acceptable, and information on where to find cheap text. All of the faculty in our FLC design exams based from seminar and do not test on information in the text that was not covered. Further, we all use additional reading materials such as primary manuscripts that are required readings in the courses. Thus we were comfortable listing the texts as recommended for those courses.

We also discussed our laboratory course concepts and learning objectives. One of the reading materials was specifically focused on laboratory education. While seminar time is not altered with the semester schedule, the laboratory is expanded for most courses (shortened for one as Micro 3200 is going from 2 labs per week to 1; all others already have 1 lab per week with more weeks in the semester calendar). The added time allows students to actively participate in hypothesis development and experimental design, priority concepts that were already present in some of the courses, whereas others employed a more "cookie cutter" laboratory. With the added lab time, it was agreed that all Category A courses will involve students in hypothesis development and experimental design. Group work was also emphasized in our materials and while laboratory already provides group work learning, we discussed strategies to ensure cordial working groups.

Lastly, we also read materials that discuss teaching strategies to improve student learning outcomes. Here too we found that many of us already incorporate many of the strategies to improve learning outcomes. For example, most of us already employ Think-Pair-Share activities, require active participation, and encourage questions. One of us implements an artificial intelligence board that rewards open-ended questions and has encouraged the others to incorporate this technology (Packback)– the only downside is the student fee of $25 per course. Yet students have reported enjoying the site and striving to improve "curiosity scores" which improves their question asking skills. Implementing extra credit for overall average high curiosity scores is an additional motivation for students. We shared additional strategies to demand participation from all students, such as using notecards and clickers. We further concluded that making participation worth clear points can ensure everyone takes part.

What follows are new syllabi for the Q2S conversion from all Category A – Cell and Molecular course options, BIOL 3100 Cell Physiology, BIOL 3120 Molecular Biology, BIOL 3200 Microbiology, BIOL 3300 Genetics. Students in the major are required to take at least one to learn the core concepts but students can take all and learn novel material.

Biology 3100 – Cell Physiology
Fall 2020 Syllabus

Instructor: Daniel Nickerson, Ph.D.
Office: CS-112 (or research lab, CS-125)
Phone: (909) 537-3671
Email: daniel.nickerson@csusb.edu (email is preferred method of contact)
Office hours: Tue 1:30 to 3 PM, Fri 10:30 AM to noon, or by appointment

Course website: http://blackboard.csusb.edu
Lecture classroom / time: CS-128, MW 9:00-10:15 AM

Lab classroom / time: BI-329, either Mon or Wed 1:00-3:45 PM
Lab support coordinator: Dave Coffey (BI-208; dcoffey@csusb.edu; ext 7-7391)

OSR Peer Lab: Room TBA, Times TBA
Peer Lab Facilitator: Jenna Maddox (jenna.maddox@csusb.edu)

Course description and student learning outcomes

This course focuses on the structure, molecular biology, and physiology of eukaryotic cells. It is designed for biology/biochemistry majors and pre-professional students.

At the completion of this course, students will be able to explain basic molecular processes in eukaryotic cells, with emphases on 1) how molecular and cellular **structures influence function**; 2) the Central Dogma of Molecular Biology and the how **flow of genetic information** is regulated to control cell behavior; 3) metabolism and how **energy** is produced, stored, and expended in the course of building cellular structures and executing functions; 4) how physical and chemical signals perceived at the molecular level can result in changes of levels of **biological systems**, including individual cells, multicellular organisms, populations and ecosystems; and 5) how principles of natural selection explain the **evolution** of the diversity of cell types adapted to succeed in different environments and how specific changes in gene content or expression contribute to successful adaptation and further evolution.

Upon completion of the lab portion of this course, students will be able to demonstrate proper laboratory practice, proper use of laboratory equipment and experimental techniques relevant to modern cell biology research, and the ability to communicate experimental results in formal written reports appropriate to the field.

The class is structured to include lectures with active student participation, problem solving in small group discussions, and guided laboratory instruction. These three elements will achieve parallel objectives: 1) introduce students to *central principles of cell biology*; and 2) train students in *scientific thinking and investigation.*

Writing Intensive (WI): BIOL 3100 is designated a WI class and may be substituted in place of one of the two required GE WI courses required to complete a CSUSB degree. Students should expect multiple writing assignments, workshops emphasizing effective communication of scientific ideas through visual aids and clear prose, and a sustained experimental project in the laboratory in which lab reports completed throughout the term as milestones are revised and compiled into a final, comprehensive lab report in the style of a formal research paper.

Prerequisites and administrative details

To take this course you must have completed either the BIOL 200-201-202 sequence (quarters) or BIOL 2010-2020 sequence (semesters) with grades of C or higher in each class. Students must also complete either CHEM 2300 or 2400 with a grade of C or better. Exceptions may be made only for transfer/visiting students (usually out-of-state or international) under extenuating circumstances and then only with instructor and department consent.

Attention transfer students: transferred credits are not always processed in a timely fashion by the Registrar computer system. Unless your transfer credits have been explicitly acknowledged by the enrollment system, you might officially lack credit for class prerequisites. It is your responsibility to check whether your grades/credits for transferred course prerequisites have been accepted by CSUSB. If any prerequisites are not in the computer, you have until the beginning of the second week to provide the instructor with **hardcopy** documentation (printouts of unofficial transcripts or PAWS reports are OK) that demonstrates you have taken equivalent courses to the prerequisites and earned required. *Failure to provide documentation will result in the student being dropped from the course.*

If any student fulfilled course prerequisites through a combination of credits earned at CSUSB and earned at community colleges, it is especially recommended to check whether the combination of classes fulfills requirements for the BIOL 2010-2020 sequence. Many combinations of CSUSB and community college introductory classes do not offer equivalency to the full BIOL 2010-2020 sequence. Students with concerns in this regard are encouraged to consult the Biology Major Transfer Student Guide on the Biology Dept website:

https://www.csusb.edu/sites/default/files/CC%20transfer%20advising%20v5%20JAD.pdf

BIOL 3100 is an upper-division Biology class. Students are strongly discouraged from repeating upper-division Biology classes and will generally be denied permission to do so unless they failed the class in their original attempt. Biology majors who earn two Fs (total) in attempting to fulfill their upper-division course requirements will be removed from the major.

Accommodations for disabilities, etc

If a student qualifies for accommodations due to a disability, please provide the instructor documentation from Services to Students with Disabilities at UH-183, (909) 537-5238, to ensure student needs can be appropriately addressed. Schedule conflicts resulting from religious observances should also be brought to the attention of the instructor.

Materials for lecture and lab

1. **Textbooks** (optional): the preferred textbook is *Molecular Biology of the Cell*. *6th ed.* by Alberts et al., Garland Science, publisher (2015). Multiple copies of the 6th ed. are on reserve in Pfau Library, so everyone should have regular access to the text without necessarily having to purchase it. The older 5th ed. textbook (2008) is much more affordable and probably will cover ~85% of the material of the course. If you choose to use the 5th ed., you will be responsible for material that is not in your edition. Students wishing a further free textbook may consider *Basic Cell and Molecular Biology 3e: What We Know and How We Found Out* by Bergtrom, available for download, though we recommend Alberts et al. as a preferred reference.
2. **PowerPoint lecture files**: PowerPoint presentations used during lecture will be made available before and after class for download via Blackboard. Lecture files are living documents, meaning they are subject to revision as needed. While lecture files may change, students may safely assume that lecture files posted in advance of class are always close approximations of lecture narrative and class content, so students are encouraged to preview and 'read ahead' before attending lecture.
3. **Online study quizzes**: study aid questions will be administered regularly via Blackboard.
4. **Lab manual**: this will be provided to students in printed/bound form. It will also be made available for download on Blackboard. Laboratory-appropriate protective clothing is always required.
5. **Zoom resources**: a standing Zoom meeting is established for the class for purposes of office hours and (if needed) synchronous online lectures. The meeting is password protected and permanently linked on the class Blackboard page. Recordings of lecture meetings are stored in the cloud and made available in the Blackboard content folder.

Grading

Classroom and online participation:	120 to 200 points
Midterm exams:	2 x 200 points = 400 points
Final exam:	200 points
Laboratory grade:	200 points (see lab syllabus for details)
Total:	Up to 1000 points

<u>On 1000-point scale:</u>

1000-920 points: A
919-900 points: A-
899-880 points: B+
879-820 points: B
819-800 points: B-
799-780 points: C+
779-720 points: C
719-700 points: C-
699-680 points: D+
620-679 points: D
619-600 points: D-
<600 points: F

Classroom and online participation

Classroom lecture presentations in this course will often incorporate student participation, group exercises, and discussion. Evidence of classroom participation (examples: a completed worksheet, an index card with written response, recorded answers to quiz questions) will often be collected for credit.

Online exercises are provided to offer students more opportunities for understanding and applying concepts presented in class and in readings. Online exercises will commonly emphasize multiple choice- and multiple answer-style questions, which offer the advantage of providing *immediate* feedback. Online quizzes are open book and students will commonly be allowed multiple attempts to take the quiz, so these are essentially credit / no credit exercises. Online exercises are designed to be concise, painless, and focus your attention on key principles or questions that have or will come up in class discussion. Please also remember that quizzes are an opportunity to check and receive feedback about your grasp of key class concepts *before* you sit for examination. From the time a quiz is posted, students will typically have 4 days or longer to complete the quiz. Please have some patience with your instructor regarding the timing of when the quizzes appear online; each quiz takes time to prepare.

Exams

Written examinations consisting mostly of multiple choice and short answer and diagram format questions will be administered. Exams may also provide essay questions that require you to integrate course information and analyze small data sets. Exam questions will emphasize lecture content and discussions.

Exams must be completed in **ink**, or else they will not be eligible for re-grading upon student appeal. When considering an appeal for re-grading, if any part of an exam is found to have been altered from its original state it will be considered a breach of the university Honor Code and grounds for disciplinary action.

No make-up exams will be permitted unless arrangements are made prior to the scheduled exam time or a major emergency has occurred. Appropriate documentation of conflict or emergency circumstances may be required. Make up exams will be of the instructor's choosing and may include an all essay exam or an oral exam.

Personal devices (cell phone, iPod, smart phone, tablet computer, etc) must be switched off during exams and stored out of site (for example, under a student's seat). Calculators should not be needed.

Extra credit

Extra credit may be awarded at the instructor's discretion to those students who attend the Biology Department seminar series and then submit a one paragraph description of the seminar. Please also be sure to sign in when attending seminar to ensure a record of your attendance. The seminar is on every other Friday from 4:00 to 5:00 PM. The schedule, when available, will be posted on the Biology Dept. website (http://biology.csusb.edu). Each seminar is worth 5 points, for a total of 20 possible extra credit points. Extra credit is NOT awarded for attending the Biology Dept. Student Research Colloquium at the end of the quarter, though students are strongly encouraged to attend.

To ensure your work is received and properly catalogued, 1) please put the extra credit response paragraph in the *main body* of an *email to your instructor* (i.e. no attachments); and 2) please use the subject line 'BIOL 3100 extra credit.'

At the end of the term, additional extra credit (probably 5 to 10 points) could be available for student participation in Biology Department assessment, which is essentially an extra credit exam of core concepts the Department hopes students build and reinforce as you progress through the program. More details will be provided toward the end of the term.

Laboratory

The laboratory manual and syllabus (available on Blackboard, and provided as a hard copy for each student) contain detailed information on lab materials, expectations, and grading.

Any student repeating BIOL 3100 who has previously earned a passing grade in laboratory (72% or higher) does not need to repeat the laboratory experience and is expected to enroll in 'ghost lab.' If this rule applies to you, please see your instructor to learn the administrative details.

Policy on cheating and plagiarism

If a student is found cheating or plagiarizing, penalties will be incurred, up to and including an automatic grade of "F" on the assignment, a grade of "F" for the course, and/or a petition filed to request dismissal of that student from the University. You are responsible to understand and comply with policies described by Academic Regulations and Procedures in the CSUSB Bulletin of Courses, including university policies on course withdrawal, cheating, and plagiarism.

Any students repeating the class must note that previous written work (e.g. group lab reports and pre-labs) *may not be re-submitted* for credit. All work submitted in completion of BIOL3100 must be original.

Copyright and class materials

Never disseminate or post class assignments, exams, answer keys, worksheets, lecture files or lecture recordings on any online media/file repository (e.g. YouTube, Course Hero, Chegg, etc) without the permission of your instructor.

Dropping and adding

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the CSUSB Bulletin (http://catalog.csusb.edu/documents/2012-2014.pdf).

Inclement weather & other disruptions (e.g. pandemic safety restrictions)

Inclement weather can result in campus closure, so students should check local media and university information for announcements. We shall reschedule class activities disrupted by weather.

In the event that COVID-19 guidelines on social distancing require distance learning, all class activities, schedules, assessment and grading policies are subject to revision. Laboratory activities are particularly vulnerable to disruption, but all efforts will be made to ensure that suspension of in-person laboratory meetings will not disrupt fulfillment of Writing Intensive course requirements.

Tips for success

• Arrive in class on time. This is an interactive, discussion-based course, so your timely participation is essential to your success and that of your classmates.

• Ask questions early and often. If something in class or online isn't clear to you, it's almost never the case that you are alone in your confusion. Your classmates and instructors will thank you for asking for clarification.

• Complete out-of-class assignments on time. These exercises are designed to be concise, painless, and focus your attention on key principles or questions that will direct class discussion.

• Try visiting your instructor during office hours. (Highly encouraged!)

• Visit peer lab sessions on [Day/time TBD]. These are excellent opportunities for more than just reviewing course concepts and materials. You will have lots of opportunities to discuss with partners and your Peer Lab Facilitator, practicing how to express what your understand about course concepts (or don't yet understand, but will soon). If you have practiced expressing and illustrating what you understand, you will find it much easier to express your ideas on exams.

• Take frequent handwritten notes and draw your own diagrams by hand. This recommendation applies equally to participation in both online (Zoom) lectures and classroom lectures. The availability of recordings and repeated viewing/listening offers no substitute for the power of crafting your own notes.

• Your lecture notes should be a key source of study material, but it is highly recommended to also read and consult the textbook (MBoC 6th or 5th edition). Lecture exercises and textbook readings are complementary. Many of the diagrams on the provided PowerPoint lectures are from your textbook, which ensures that you will always have access to additional explanation and context as you study and review at your own pace. You are not expected to absorb the entire textbook in an encyclopedic sense! So do not feel overwhelmed by the volume of knowledge the book contains. Rather, you should treat your textbook more as a reference text to help you better understand course material.

In-class conduct and courtesy

• Always treat your classmates with respect and courtesy.

• Laptop computers may be used for taking notes and accessing information to aid in-class discussion. Permission to use laptops and other electronic devices is conditional on their enhancement of the classroom experience. If laptops or personal devices cause any distraction or disruption in class, the instructor reserve the right to remove them.

• Silence your personal devices at the start of class.

• Email is fine for asking for clarification and communicating with the instructors, but instructors cannot be plugged-in continuously and at all hours. Please allow for email responses within 24 hours from Monday through Friday.

Class topics & schedule (tentative, subject to revision)

Week	Dates	Lecture Topics	Lab Topics	Text
1	8/24- 8/26	Course intro; life at small scale	Pipeting/sterile tech	Ch 1, 2, 3
2	8/31- 9/2	Life at small scale (cont'd) Tree of Life, evolution of eukaryotes Fundamental cell concepts & chemistry	Workshops: How to write a report How to present data	Ch 1, 2, 3
3	9/10	Cell building blocks & bioenergetics *Monday OFF (Labor Day)	OFF (Holiday)	Ch 1, 2, 3
4	9/14- 9/16	Building blocks & bioenergetics (cont'd) Proteins, protein structure, enzymes	Cell culture techniques	Ch 4, 5, 6
5	9/21- 9/23	DNA & chromatin structure Central Dogma/gene expression (workshop)	Microscopy/cell lysates	Ch 4, 5, 6
6	9/28- 9/30	Gene structure, mRNA processing Protein translation, folding, etc	Fluorescence micro	Ch 4, 5, 6
7	10/5- 10/7	Protein translation, folding, etc (cont'd) (1st midterm cutoff) FIRST MIDTERM (10/7)	Protein concentration	Ch 6
8	10/12- 10/14	Membrane structure, dynamics ER transport, ion channels, transporters	Protein electrophoresis & staining	Ch 10, 11
9	10/19- 10/21	Ion channels, transporters (cont'd) ER transport, secretion	Western blot Pt 1	Ch 12, 13
10	10/26- 10/28	Nuclear transport, molecular switches	Western blot Pt 2	Ch 12, 13
11	11/2- 11/4	Endocytosis and lysosomes Vesicle formation, targeting, fusion	Microbial culture tech & microscopy	Ch 13
12	11/9	Mitochondria Protein targeting: signals (workshop) (2nd midterm cutoff) *Wednesday OFF (Veterans Day)	OFF (Holiday)	parts of Ch 12 & 14
13	11/16- 11/18	Cell signaling SECOND MIDTERM (11/16)	Cargo transport assays (colorimetric/plate)	Ch 15
14	11/23- 11/25	Cell signaling (cont'd) *No interruption for Thanksgiving Break	Final paper draft consultations, revision	Ch 15 parts of Ch 7
15	11/30- 12/2	Cytoskeleton Cellular health & cell death	Final papers due	Ch 16 parts of Ch 18 & 20
	12/9	FINAL EXAM (not comprehensive) Day/time TBA		

MOLECULAR BIOLOGY 3120 (4 Units) - Fall 2020
Laura L. Newcomb, Ph.D. Website:
http://biology.csusb.edu/faculty/newcomb/
Office: BI 310/Lab: BI 308 Office Hours: TBD and by appointment.
Email: lnewcomb@csusb.edu Phone: 909 537 5542
Laboratory Preparation: Tom Benson
Peer Research Consultant:
Course Schedule: Seminar: T/R 9:00AM - 10:30AM **CGI 207**
Lab: T or R 1:00PM -3:50PM BI-207

Course Concepts and Student Learning Outcomes: The aim of this course is for each student to gain a better picture of the cellular environment with greater understanding of how cellular processes are regulated at the molecular level. Students will learn the mechanisms and regulation of genome maintenance and gene expression, emphasizing how molecular **structure influences function**, explaining the **energy** required, and highlighting the multiple layers of regulation involved in the **flow of genetic information**. This information will culminate with insight into the role of these molecular mechanisms during organism **development** and the **evolution** of new species.

Through a required laboratory component, students will gain hands on training in proper laboratory practice and scientific inquiry. A **question** will be presented and students will develop a testable **hypothesis** and that will involve molecular biology techniques, such as the **design** and construction of a recombinant DNA plasmid, and expression of recombinant plasmid with appropriate **controls** to observe the experimental **results**. Students will work in **groups** to **communicate** their group project through a written final lab report including figures in the format of a scientific journal, in addition to a brief group oral presentation to their class peers. Course completion will help prepare students for advanced degrees in graduate or professional schools, or careers in biology, specifically molecular biology. Prerequisites: BIOL 2020

Student Expectations: It is expected that students will **attend** all seminars and laboratories. Some assignments are in-class only and information discussed during seminar may not be found in the reading materials but may be included on exams. It is to your benefit to attend all seminars. In class and laboratory **participation** is a portion of your grade. You are expected to come to both lab and seminar **prepared**. This means reading assigned chapters and additional materials PRIOR to class.

It is expected that all students will work cordially with their peers. Please be respectful during seminars by silencing phones and asking questions to the class, not to your neighbor. I am happy – I actually enjoy – taking questions during seminar, so please do not talk to your neighbor, instead, raise your hand and ask the question. If you have a question, so do others. Laboratory groups

will need to work closely together throughout the semester. **Please select your laboratory group wisely.** We will solidify laboratory groups the second week of lab. It is important that you can communicate efficiently with your laboratory partners. **Collaboration is integral for science progression.** If conflicts arise they need to be addressed and resolved sooner rather than later. Please try to work conflicts out on your own, but myself or the PRC can serve as a neutral third-party mediator.

Course Materials:

Seminar: *Recommended*: Molecular Biology of the Gene; Watson, et. al., 7th ed. A copy of Molecular Biology of the Gene 7th edition is on reserve at Pfau Library. We directly cover chapters from this text in lecture. Chapters covered are listed in the course schedule. Please refer to Ch. 7 "Techniques in Molecular Biology" and Appendix 1 "Model Organisms" as reference chapters for research methods discussed. These chapters are not directly covered in the course but they will be a useful reference for you.
$ saving tip – older editions will suffice;pdf versions on google for as little as $10!

In addition to the recommended text, students will be given additional **required** reading material, including commentaries, review articles, and research papers to supplement the seminar and provide both historical and current perspective of biological information. Materials will be posted to Blackboard.

Seminar will include out of class assignments (100pts) along with 2 midterms (150 each) and a final exam (150 pts). There are no make-up exams; if you have a legitimate reason for missing an exam you must discuss this with the instructor PRIOR to the exam. There will be at least 10 in class think-pair-share activities randomly during seminar. ***Think-Pair-Share*** *involves a proposed question, individual reflection and written answer, discussion with neighboring student, sharing with class, then a final reflection time to add additional written discussion to turn in. 10 pts each (100pts)*
Seminar constitutes 65% or 650 points in the course.

Online Discussion Board: *Required:* We will utilize the Artificial Intelligence driven and human guided discussion board Packback. A link regarding this new technology. https://www.forbes.com/sites/amitchowdhry/2017/11/20/packback-is-building-a-i-to-enhance-university-learning/#746cd5ad2921
Website: https://www.packback.co

Packback is an online discussion platform powered by artificial intelligence. This platform is specifically designed to encourage curiosity and increase critical thinking & writing skills. On Packback, you will be encouraged & rewarded for asking **complex and open-ended** questions about how what we study relates to the world. My goals for using Packback are to spur more detailed discussion

than we can achieve in class. I hope we discover additional information and details about the topics we consider in class and learn more about how molecular biology influences many fields including medicine, agriculture, biotechnology, and others. We all receive "Sparks" to highlight questions or comments we liked, make sure to use them 😊. To increase your curiosity score be sure to complete all of the Packback prompts, such as including references. You will receive an email with instructions on how to enroll. Fee is $25.00. Additional information is posted on blackboard.

Each student will post ONE QUESTIONS and TWO COMMENTS each week for the full 10pts each week. This is **THREE** total posts. Deadline to post is Sunday of each week at 11:59 PM. I will also be posting and participating as well.

Packback discussion participation will be 150 in this course or 15% of the grade. Students with high average curiosity scores at the end of points the course will earn bonus points.

Laboratory: *Required***:** Laboratory Coat, laboratory notebook, pen/pencil. Blackboard will be used to post **all required** laboratory materials which will include research articles, scientific product information, and protocols.

Laboratory is graded for participation (5pts per week - 75pts), upkeep of your laboratory notebook (25pts), various laboratory assignments (40pts), group written project (30pts), and group oral presentation (30pts). Laboratory constitutes 20% or 200 points in the course.

Course Grading Policy: Grades are based on the following **1000-point** scale:

100-93% (1000- 930) A	90-92% (929 – 900) A-	87-89% (899 – 870) B+
83-86% (869– 830) B	80-82% (829 – 800) B-	77-79% (799 – 770) C+
73-76% (769 – 730) C	70-72% (739 – 700) C-	67-70% (699 – 670) D+
63-66% (669 – 630) D	60-62% (629 – 600) D-	below 60% <599 F

Lecture Schedule

DATE (Watson)	day	TOPIC	CHAPTERS
08/25/20	T	Introduction and Course Concept Map	
Molecules of Life			
08/27/20	R	Historical View	1
09/01/20	T	Nucleic Acids as Genetic Info	2
09/03/20	R	Importance of Weak & Strong Chemical Bonds	3
09/08/20	T	DNA and RNA structure	4 & 5
		Nucleic acid schematic – **10pts due 9/17*	
09/10/20	R	RNA World Hypothesis	17
		Centrality of RNA and RNA World	posted articles
		review article for discussion	
09/15/20	T	Protein structure and Molecular interactions	6
Maintenance of the Genome			
09/17/20	R	Genome Characteristics and Storage	8
09/22/20	T	DNA polymerase	9
09/24/20	R	DNA Replication	9
		research article for historical perspective	
		DNA replication schematic – **20pts due 10/13*	
09/29/20	T	DNA Mutation, DNA Repair	10
10/01/20	R	DNA transposition	12
10/06/20	T	DNA Recombination	11,12
10/08/20	R	Review – Questions for Exam I due- **10pts**	
10/13/20	**T**	**EXAM I – 100pts.** **DNA replication schematic due*	

Lecture Schedule

DATE	day	TOPIC	CHAPTERS (Watson)
Expression of the Genome			
Part 1			
10/15/20	R	Transcription: Prokaryotes	13 & 18
10/20/20	T	Transcription: Eukaryotes	13 & 19
		begin gene expression schematic – 40pts** due 11/19**	
10/27/20	T	Splicing and Export	14
10/29/20	R	Splicing and Disease	posted review
		review article for discussion	
Expression of the Genome			
Part 2			
11/03/20	T	Genetic Code and tRNA adaptors	16
11/05/20	R	Translation: Basic Mechanisms	15
11/10/20	T	Translation: Regulation	
11/12/20	R	Regulatory RNAs	20
11/17/20	T	Review - Questions for Exam II due- ***10pts****	
11/19/20	**R**	**Exam II – 100pts.** **gene expression schematic due**	
Genome Expression during Development and Evolution			
11/24/20	T	Gene Regulation During Development	21
11/16/20	R	THANKSGIVING	
12/01/20	T	Gene Regulation and Evolution	
12/03/20	R	FINAL Review – Game **review questions due – **10pts****	
12/08/20	**T**	**Cumulative FINAL – Scantron – Lecture 150pts. CGI 207 10:00 AM – 11:50 AM**	

Laboratory Schedule

DATE	*TOPIC* and Protocol
Week 1	*LAB 1 – Introduction, Safety, and Practice Lab*
08/25	NIH Guidelines for Recombinant DNA
08/27	in class **worksheet** 10**pts (conversions, lab knowledge, safety)**
Week 2	*LAB 2 - Develop Hypothesis*
09/01	posted research articles
09/03	
Week 3	*LAB 3 – Plasmid Construction Lab*
09/08	Introduction to plasmid construction
09/10	in class **worksheet 10pts (design primers)**
Week 4	*LAB 4 – Polymerase Chain Reaction*
09/15	
09/17	
Week 5	*LAB 5 – Gel electrophoresis to check PCR*
09/22	in class - **worksheet 10pts**
09/24	
Week 6	*LAB 6 – Restriction Enzyme Digest*
09/29	Phosphatase Vector (only)
10/01	Gel electrophoresis to check Restriction Enzyme Digest
Week 7	*LAB 7 – DNA clean-up, Optical Density, and Ligate*
10/06	
10/08	
Week 8	*LAB 8– Transformation*
10/13	Gel electrophoresis to Check Ligation
10/15	**assignment** – **10pts**
Week 9	*LAB 9 – Transformation Efficiency and Colony PCR*
10/20	Determine transformation efficiency
10/22	Screen 10 candidates via ‘colony PCR’
Week 10	*LAB 10 – Miniprep*
10/27	Analyze PCR on gel
10/29	Isolate 4 candidate plasmid via ‘miniprep’

Week 11	*LAB 11 – Diagnostic Digest*
11/03	Screen 4 candidates with restriction digest and Gel electrophoresis
11/05	
Week 12	*LAB 12 – Test and sequence plasmid*
11/10	transfect mammalian cells
11/12	set up sequencing reactions
Week 13	*LAB 13 - Observe test and analyze sequences*
11/17	Absorb and Discuss Results
11/19	Time to work with Group
Week 14	Thanksgiving – no labs
11/24	
11/26	
Week 15	**Group Results** –
12/01	Final Oral Presentation (**30pts**)
12/03	Lab Report (**30pts**)

Laboratory Apparel and Behavior:

In laboratory you must follow all **safety** procedures, including wearing a laboratory coat and closed toed shoes for all laboratory sessions. Personal protective equipment such as gloves and goggles will need to be worn for certain laboratories. There is no food, drink, or cosmetics allowed in the laboratory. If you have these items they must be stored either in your bag or in the cubbies in the laboratory.

In laboratory you must work cordially with others. Science is collaborative and your laboratory grade will be based in part on **collaborative work**. You will be asked to evaluate the participation of your group members and yourself. It is imperative that if conflicts arise regarding communication or percentage effort in the group, they are discussed early and resolved. Please begin to **meet as a group early** to discuss your collaborative project.

Policies:
Please note cheating is a violation of the California State University Student Discipline Code and will result in a failing grade for the class. Please refer to the "General Regulations and Procedures" in the CSUSB Bulletin of Courses for the University's policies on course withdrawal, cheating, and plagiarism. Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified.

Commitment to Diversity:
In our commitment to the furthering of knowledge and fulfilling our educational mission, California State University, San Bernardino seeks a campus climate that welcomes, celebrates, and promotes respect for the entire variety of human experience. In our commitment to diversity, we welcome people from all backgrounds and we seek to include knowledge and values from many cultures in the curriculum and extra-curricular life of the campus community. Dimensions of diversity shall include, but are not limited to, the following: race, ethnicity, religious belief, sexual orientation, sex/gender, disability, socioeconomic status, cultural orientation, national origin, and age. (from the CSU San Bernardino University Diversity Committee Statement of Commitment to Diversity, 1995)

Services to Students with Disabilities:
If you are in need of an accommodation for a disability in order to participate in this class, please contact Services to Students with Disabilities at UH-183, (909)537-5238. It is the student's responsibility to seek academic accommodations for a verified disability in a timely manner. If you require assistance in the event of an emergency, you are advised to establish a buddy system with a buddy and an alternate buddy in the class. Individuals with disabilities should prepare for an emergency ahead of time by instructing a classmate and the instructor.

Additional Services to Students:
The DEN serves to assist students who face food insecurity or scarcity on our campus. More information can be found at
https://www.csusb.edu/basic-needs/food-security/obershaw-den

CSUSB CNS/Department of Biology
BIOL3200 – Biology of Microorganisms
Fall 2020 Syllabus – Lecture and Lab sections

General Information:
Instructor: Paul Orwin
Office: BI-115
Office Phone: (909) 537-5405
Email: porwin@csusb.edu
Office hours: T 10:00-12:00, R 1:30-3:30, or by appointment.
Lecture classroom/time: CS-222, M W 10:30-11:45 am
Laboratory classroom/time: BI-213, M W 1:00-3:50 pm
Final exam: TBD (I think)
Class website (accessed through CSUSB blackboard): http://blackboard.csusb.edu/

Prerequisites:
A grade of "C" or higher in BIOL2020 is a prerequisite for all upper division courses offered by the Department of Biology.

Course Description:
This course will cover basic topics in microbiology, including structure, function and metabolism of Bacteria and Archaea, as well as an introduction to virology and eukaryotic microbes. Some topics of particular interest will be (1) **bacterial physiology and metabolism,** (2) **microbial genetics**, (3) **microbial pathogenesis and human-microbe interactions**, (4) **virology**, (5) **eukaryotic microbial cell biology,** and (6) **bacterial cell culture techniques.** Emphasis will be placed on developing an understanding of microbial cell biology, genetics, the interactions of microbes with their environment and eukaryotic hosts. This course includes **lecture** and **laboratory** components**.** Student performance in the lecture section will be evaluated based on homework assignments, student presentations, two exams, and a cumulative final exam. Performance in the laboratory will be assessed in two lab practical exams, two lab reports on unknown culture identification, performance on pop quizzes at the beginning of lab, and notebook quality.

Course materials:
1) Textbook (Recommended): Willey, Sherwood, Woolverton. Prescott's Microbiology, 10th edition. 2016
Hardcover: ISBN-13: 978-1259281594

2) Lab Manual (Required): Harley. Laboratory Exercises in Microbiology, 10th Edition. 2016
Spiral-bound: ISBN-13: 978-1259657573
Note- there are several available packages (soft and hard cover; textbook and lab manual together; ebook for the textbook). The hard and soft cover versions are the same, any combination that includes a textbook (hard copy or electronic book) and hardcopy lab manual is acceptable. Also, there are earlier versions of the textbook and lab manual available, e.g. the 8th and 9th editions. While it is recommended to get the 10th edition (because this is what your instructor will be using), most of the material is the same; if you choose to get earlier editions, you do so at your own risk and are still responsible for all course material as printed in the 10th edition.

3) Lab notebook. You will need some sort of lab notebook to record experimental procedures and results in. This can be any type of notebook, e.g. a simple spiral-bound notebook or a binder with loose-leaf pages, or a more formal lab notebook. But it does have to be something that you can turn in; notebooks will be collected for nominal "grading" twice during the quarter.

4) Lab coat or apron, and appropriate clothing for laboratory sections. At times, we will be working with potentially pathogenic organisms as well as using various stains and dyes. Students should have a lab coat to protect themselves and their clothing. For safety reasons, all students must wear closed toe shoes and long pants. Individuals with long hair will be required to pull their hair back. Gloves will be provided and must be worn when working with microorganisms. Lab coats can be purchased at the Coyote bookstore. Lab coats/aprons will only be required during the lab section unless otherwise noted. No eating or drinking is allowed in the laboratory room; all food/drinks must be stowed in the "cubbies" by the laboratory door.

Grading:
One final grade will be given for the entire course out of a total of 600 points. This will include 500 points from the lecture section and 100 points from the laboratory section. Note that some homework assignments may cover topics covered in the laboratory section. Points are broken down as follows:

Lecture section	Points
Exam 1	120
Exam 2	120
Final	120
Homework	30
Group presentations	10

Lab section	Points
Lab practical exam	40
Lab reports (2)	50
Lab Notebooks	10

The grading scale (as a percentage of the total 600 points) is as follows:

92-100%	A	90-91.9%	A-	88-89.9%	B+
82-87.9%	B	80-81.9%	B-	78-79.9%	C+
72-77.9%	C	70-71.9%	C-	68-69.9%	D+
61-67.9%	D	60-61.9%	D-	0-59.5%	F

Attendance policy:
Labs are an extremely important part of this class and cannot easily be "made-up". Any make-up lecture or lab practical exams must be approved by the instructor prior to the date of the exam (where possible and granted on a "case-by-case" basis) and only with documented proof of the reason for the absence (*e.g.* physicians note, grad/professional school interview). As stated in the CSUSB Bulletin, students who fail to attend two consecutive class meetings during the first three weeks of the quarter without contacting the faculty member or making special arrangements may be dropped to make room in the class for students on the waiting list.

Exam policy:
Lecture section exams 1 and 2 will cover materials from lectures 1-9 and 10-18 respectively (see course schedule below). The final exam will be in principle be comprehensive but will focus on material from lectures 19-28. As stated above, any make-up lecture or lab practical exams must be approved by the instructor prior to the date of the exam (where possible and granted on a "case-by-case" basis) and only with documented proof of the reason for the absence, e.g. a physician's note note). Lecture exams will mainly be based on material covered in lecture and on the lecture powerpoint slides. While the lecture content will draw heavily on the textbook, material in the textbook that is not covered in lecture or on the slides will not be on the exam unless explicitly stated. A study guide will be provided for each exam 4-5 days prior to the exam. Exams will contain a mix of multiple choice and true/false questions, short answer, essay, and diagram drawing/labeling questions.

Group presentations:
Near the end of the term, groups of four students will present on specific topics in microbiology. Each student in the group will present on a different subtopic within the chosen topic, and students will be individually graded based on the presentation of their subtopic (5 points for information presented; 5 points for quality/clarity of presentation/slides; 5 points for annotated bibliography; 5 points for preparation of three multiple choice or short answer questions based on presentation content). Groups may choose from one of the following topics: **Emerging infectious diseases (e.g. Ebola, Zika virus), Tuberculosis, Fecal transplants, Probiotics, Microbes and biofuel production, Antibiotic resistance, Discovery of new antibiotics/drugs, Vaccination, Origins and use of CRISPR/Cas9**; alternatively, groups can propose their own topic of interest, subject to approval of the instructor. Some class/lab time will be set aside for research of topics and preparation of presentations. Additional details will be given during the second week of class.

Extra credit:
An extra credit assignment worth 6 points (extra 1% added to final grade) will involve writing a short report summarizing a recent article concerning microbiology in the popular press. Further details on the assignment will be given during class. The assignment is due Monday March 16th (last day of class). Extra credit questions may also be included in exams at the instructor's discretion.

Student learning outcomes (LOs):
Upon successful completion of this course, students will be able to:
LO1 – Describe the diversity of the microbial world in comparison to macroscopic organisms, and how both cultivation-dependent and -independent techniques are used to understand microbial diversity, ecology, and physiology.
LO2 – Be able to independently research topics in microbiology and evaluate primary and secondary literature and popular press articles on microbiology.
LO3 - Effectively plan and execute laboratory procedures for the growth, isolation and identification of microorganisms.
LO4 - Evaluate the results of a hypothesis driven experiment.
LO5 - Apply concepts from the physiology, metabolism, and genetics of microbes to broader ideas in biology such as ecosystems, symbiosis, and biomes, both in microbes associated with humans and in other environments.

Accommodations for disabilities:
CSUSB Syllabus Policy (2.g) states that at a minimum, each course syllabus must contain a statement of ADA compliance (below are the 2007-08 official statements for supporting students with disabilities), and the reminder that it is the student's responsibility to seek academic accommodations for a verified disability in a timely manner. If you are in need of an accommodation for a disability in order to participate in this class, please let the instructor know as soon as possible and also contact Services to Students with Disabilities at UH-183, (909) 537-5238.

University Policies:

Plagiarism and cheating: Instances of academic dishonesty will not be tolerated. If a student is found cheating or plagiarizing (presenting the work of another as your own, or the use of another person's ideas without giving proper credit), penalties will be incurred, up to and including an automatic grade of "F" for the course and a petition filed to request dismissal of that student from the University. Refer to Academic Regulations and Procedures in the CSUSB Bulletin of Courses for university policies on cheating and plagiarism (http://bulletin.csusb.edu/academic-regulations/).

Classroom protocol: Students are expected to behave respectfully toward all members of the classroom community, including but not limited to prompt attendance to all class meetings, appropriate classroom behavior, and respect for the teaching and learning process. Cell phone use during class will not be tolerated.

Dropping and adding classes: You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. found in the CSUSB Bulletin of Courses (http://bulletin.csusb.edu/academic-regulations/).

Statement on Diversity, Inclusion and Equity: In accordance with the CSUSB community Core Values, the course instructor is committed to providing a course and classroom environment that respects and provides equity in opportunity to all students, and embraces all aspects of people, including race, ethnicity, gender identity and/or expression, sexual orientation, socioeconomic background, age, religion, veteran status, and ability. For more information on the CSUSB Core Values, see the Office of Diversity and Inclusion website (https://www.csusb.edu/diversity-inclusion/strategic-plan/core-values).

Emergency Management and Safety Guidelines: Students should refer to the Office of Emergency Management and Business Continuity for information regarding emergency management and safety guidelines. For more information, please see the CSUSB Preparedness Reference Guide (https://www.csusb.edu/emergency-management/preparedness/preparedness-reference-guide).

Tentative lecture schedule (may be subject to change):

All slides for individual lectures will be available in the Course Content section of the course Blackboard page by 7 am of the morning of each lecture.

Date	Lecture # and topics	Textbook Chapters	Lab reminders
M Aug 24	1: Introduction to microbiology	1	
W Aug 26	2: Intro to microbial diversity	20-24	
M Aug 31	3: Microbial structure I	3-5	Bring in soil sample
W Sep 2	4: Microbial structure II	3-5	
M Sep 7	**No class/lab (Labor Day)**		
W Sep 9	5: Microbial nutrition and growth I	7	**No Lab**
M Sep 14	6: Microbial nutrition and growth II	7	
W Sep 16	7: Microbial metabolism I	10-12	
M Sep 21	8: Microbial metabolism II	10-12	
W Sep 23	9: Microbial metabolism III	10-12	
M Sep 28	**Exam 1 (Lectures 1-9)**		
W Sep 30	10: Control of microbial growth	8	
M Oct 5	11: Antimicrobial drugs	9	***Bacillus* report draft due**
W Oct 7	12: Gene regulation I	13-15	
M Oct 12	13: Gene regulation II	13-15	Sample for isolate project
W Oct 14	14: Microbial genetics	16-18	
M Oct 19	15: Microbial genetics II	16-18	**Peer review of *Bacillus***
W Oct 21	16: Microbial genetics III	16-18	**draft due**
M Oct 26	17: Viruses I	6,26	**Lab report 1 due (*Bacillus*)**
W Oct 28	18: Viruses II	6,26	
M Nov 2	19: Fungi	25	**Lab practical exam; Lab Notebooks collected**
W Nov 4	20: Protists	24	
M Nov 9	**Exam 2 (Lectures 10-18)**		**No Lab**
W Nov 11	**No class: Veterans Day**		
M Nov 16	21: Human Microbiome	34	
W Nov 18	22: Immunology I (innate)	32	
M Nov 23	23: Immunology II (adaptive)	33	
W Nov 25	24: Microbial pathogenesis I	35	
M Nov 30	25: Microbial pathogenesis II	38-40	
W Dec 2	Group Presentations		
Dec 7-12 tbd	**Final exam (Lectures 19-28; cumulative)**		**Lab Notebooks collected** **Lab report 2 due (isolate)**

Tentative laboratory schedule

All numbered Exercises are in Harley Lab Exercises in Microbiology (10th ed). Other experiments will be explained in detail during the lab section.

Week 1 (Aug 24/26)

Lab safety/safety sheets
Exercise 1: General microscopy
Exercise 3: Dark field microscopy
Exercise 4: Phase contrast microscopy
Exercise 14: Aseptic technique
Exercise 15: Spread plate technique
Exercise 16: Streak plate technique (part 1)
Exercise 16 part 2: Differential, selective media

Week 2 (Aug 31/Sep 1)

Enrichment for *Bacillus* spp. from soil sample
(Observe plates from Exercise 16)
Exercise 53: Rectal culture, *E. coli* isolation (EMB)
(Observe plates from Exercises 15, 16)
E. coli isolation: Restreak on EMB
Bacillus isolation: Restreak on TSA, MSA
Exercise 7: Smear prep, simple staining
Exercise 8: Gram stain
Exercise 6: Negative stain
Exercise 11: Capsule staining

Week 3 (Sep 7/9)

No lab - Labor Day

Week 4 (Sep 14/16)

E. coli isolation: Gram stain, stock prep.
Exercise 18: Anaerobic Bacteria
Exercise 19: Determination of bacterial numbers
Exercise 49: Enumeration of Soil Bacteria
Characterization of *Bacillus*: Gram staining
Bacillus stock, liquid culture preparation

Week 5 (Sep 21/23)

Exercise 22: Starch hydrolysis test
Exercise 23: Lipid hydrolysis
Exercise 26: Casein hydrolysis
Exercise 27: Gelatin hydrolysis
Exercise 29: Coagulase/DNase activity
Characterization of *Bacillus*: Ex. 22, 23, 26, 27, 29
Discuss Enrichment/Isolation project
(Observe results from Lab 5 Ex. 18, 49)

Week 6 (Sep 28/30)

Exercise 10: Endospore staining
Exercise 20: Fermentation test
Exercise 21: Triple sugar iron agar test
Exercise 25: IMViC tests
Exercise 28: Catalase test
Exercise 34: Nitrate reduction
Characterization of *Bacillus*: Endospore staining (Ex 10), Ex. 20, 21, 25, 28, 34 tests
Characterization of *E. coli*: Ex. 20, 21, 25 tests
Discuss/plan Enrichment/Isolation project
Inoculate your *E. coli* for plaque assay
(Observe results from Lab 5)

Week 7 (Oct 5/7)

Exercise 48: Plaque assay (on your *E. coli*)
Discuss/plan Enrichment/Isolation project (final proposal)
Exercise 13: Media preparation (for isolate project)
(Observe results from Lab 6; use results to confirm identity of your *E. coli* isolate)
Remember to bring sample for isolate project
First draft of *Bacillus* isolate lab report due

Week 8 (Oct 12/14)

Isolate project: Initial enrichment from sample of your choice
(Observe Ex 48 results)
Start *E. coli* TSB (for Kirby-Bauer tests) and TSA streak plate (for Enterotube)
Start *Bacillus* TSB cultures from your stock for Exercise 18, 39, 40 (Lab 10)

Week 9 (Oct 19/21)

Isolate project: Inoculate or streak for isolation
Exercise 18: Effects of oxygen on growth (controls and your *Bacillus*)
Exercise 39: Effects of temperature on growth (controls and your *Bacillus*)
Exercise 40: Effects of pH on growth (controls and your *Bacillus*)
Exercise 43: Kirby-Bauer antimicrobial susceptibility test (controls and your *E. coli*)
Exercise 36: Enterotube test system on your *E. coli* isolate (from TSA colony)
peer review of *Bacillus* isolate draft due

Week 10 (Oct 26/28)

Exercises 29, 54: Identification of Staphylococcal pathogens
Exercise 56: Identification of Streptococcal pathogens
(Observe results from Lab 9)
Isolate project: Secondary streak for isolation
Final draft of *Bacillus* isolate lab report due

Week 11 (Nov 2/4)

Lab Practical Exam
Lab Notebooks will be collected
Isolate project: Gram stain/morphology, stock preparation
(Observe results from Lab 10)

Week 12 (Nov 9/11)

No lab (Veteran's Day)
Isolate project: Inoculate culture for DNA isolation (Thursday or Friday)

Week 13 (Nov 16/18)
Isolate project: DNA isolation
(Observe results from Ex. 29, 54, 56)
Isolate project: 16S rRNA gene PCR
Isolate project: Testing of isolates 1 (using previous tests)

Week 14 (Nov 23/25)
Isolate project: Gel electrophoresis of PCR products
Isolate project: Testing of isolates 2 (using previous tests)
(Observe results from Lab 13)

Week 15 (Nov 30/Dec2)
Isolate project: 16S rRNA gene sequence analysis, using LPSN and other resources
Isolate project: Testing of isolates 3 (using previous tests)
(Observe results from Lab 14)

Lab notebooks collected at final exam
Lab report 2 (isolate project) due on the day of the final exam

BIOL 3300 – Genetics
Fall 2020 Syllabus

General Information

Instructor: Mike Chao, Ph.D.
Office: BI-318 (or research lab BI-306)
Phone: (909) 537-5388
email: mchao@csusb.edu

Office hours: TBD
Course website: http://csusb.blackboard.com

Description

This course discusses primarily classical genetics and genetic analysis in model organisms. It is designed for biology/biochemistry majors and pre-professional students. A grade of "C" or higher in BIOL 2020 or BIOL 202 is a prerequisite for this class. Classes will meet 7:30 - 8:45 AM Monday Wednesday and Friday in CS-122.

If you need an accommodation for a disability in order to participate in this class, please let the instructor know ASAP and also contact Services to Students with Disabilities at UH-183, (909) 537-5238.

Student learning outcomes

Student learning outcomes for this class are built around the BioCore Guide (Brownwell *et al*. (2017). CBE Life Sci. Ed. 13(2). https://doi.org/10.1187/cbe.13-12-0233), a tool for interpreting the core concepts of "Vision and Change for Biology Majors", a document produced by the American Association for the Advancement of Science (AAAS) in 2011 to outline biology curricula in higher education. Categorized based on the five core concepts listed in these documents, students that complete this course will be able to:

Evolution: (1) understand that phenotypic change arises from genetic variation; (2) use mathematical tools to make predictions of frequencies of phenotypic change; (3) describe the basic biochemical mechanisms that cause genetic mutations to occur at the molecular level.

Information flow: articulate the basic rules for the heredity of genetic information at the (1) organismal (Mendelian) level; (2) the cellular (meiotic) level; (3) the molecular level (the Central Dogma); and (4) use the tools of genetics to analyze mechanisms that regulate information flow in organisms.

Structure function relationship: (1) compare the structure of regulatory systems for prokaryotic and eukaryotic operons and genes; (2) relate the structure of operons and genes to the regulation of gene expression through interactions with gene products (proteins); and (3) describe how changing or engineering gene structures can lead to new functions of gene products (proteins).

Transformations of energy and matter: analyze how operons and gene networks are regulated to support the metabolic needs of cells and organisms

Systems: (1) analyze how genes within operons and networks operate interdependently with each other; (2) understand how small perturbations of genes may lead to large systemic effects at the cellular or organismal level; (3) gain an appreciation for how the environment-to-genotype-to-phenotype pathway depends on the integration and cooperation of many different cellular systems.

Materials for lecture and lab

6. The primary material required for this class are the lecture notes modified from MIT Open Courseware. The original notes can be obtained from https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/. A modified set of notes are available for download on Blackboard.
7. As supplemental reading and as a study resource, any relatively modern genetics textbook will do. I recommend that you obtain an inexpensive, used genetics textbook by any reputable author/publisher that has been published since 2000. For reference, note that the MIT Open Courseware notes that this course is based on are from 2004. We are mostly discussing mostly classic genetic concepts that remain relevant to this day, so older (but still modern) textbooks will be fine.
8. Handouts: these will cover some concepts in greater detail than we are able to cover during lecture and will be available for download via Blackboard. Some handouts are optional supplemental material. The tetrad analysis handout is required.
9. Lab syllabus and lab manual: These will be provided as a separate document by your lab instructor.

Expectations

1. The assigned readings for the course (the MIT Open Courseware notes) are very short and concise. Therefore, the expectation is that students shall read and study the assigned reading ahead of each class meeting.
2. We will be using a team-based learning approach in class. We will also be utilizing a flipped classroom model and will almost exclusively be doing problem solving exercises in class - it will be your responsibility to do the reading! Be accountable to yourself and to your teammates.
3. Exams will be take-home, open book, open Internet, and open discussion TEAM exams. All exams will be problem-solving based. Therefore, your focus should not be on memorizing key phrases but on genetic concepts and problem solving. There will be ample examples for you to work on in class and at home on your own (or with your team).
4. Lab is a mandatory component of BIOL 3300. Due to the nature of the experiments, you may be required to perform some lab work outside of normal laboratory hours. See lab syllabus (available on course website) for more information on the lab.

Grading

Midterm exam:	3 x 200 = 600 points
Final exam:	200 points (effectively the 4th midterm exam)
Quizzes:	100 bonus points
Lab:	200 points (see lab syllabus for details)
Total:	1000 points maximum

1000-920 points:	A
919-900 points:	A-
899-880 points:	B+
879-820 points:	B
819-800 points:	B-
799-780 points:	C+
779-720 points:	C
719-700 points:	C-
699-680 points:	D+
620-679 points:	D
619-600 points:	D-
<600 points:	F

***No make-up exams or quizzes will be permitted unless arrangements are made <u>prior</u> to the scheduled exam or quiz time or a major medical emergency has occurred*.** Appropriate documentation may be required. Make up exams will be of the instructor's choosing and may include either an all essay exam or an oral exam.

Extra credit

Extra credit may be awarded ***at the instructor's discretion*** by attending the Biology Department seminar series. The seminar is on certain Fridays (schedule may vary) from 4:00 - 5:30 PM. The schedule, when available, will be posted on Blackboard. Each seminar is worth 5 points, for a total of 20 possible extra credit points. There will be no other extra credit opportunities.

Laboratory

Lab is worth 200 points, or 20% of your total grade. You must pass the lab with a C or higher grade (144 points or more) to pass the course. The laboratory manual and syllabus (available on the course website) contains detailed information on lab grading.

Other miscellany

We will be using Twitter (#biol3300) to conduct live polling in class. Unlike clickers, Twitter polls are 100% anonymous and I will not use it to track student identities. You can also use that hashtag to post genetics questions to my twitter account @mchao_csusb. While this is not mandatory, I encourage you to participate. You may wish to make a throwaway Twitter account for this class if you do not use Twitter regularly.

Policy on cheating and plagiarism

If a student is found cheating or plagiarizing, the course grade will be automatically recorded as an “F”. Additionally, a petition will be filed to request dismissal of that student from the University.

Schedule

See schedule spreadsheet available as a separate document on Blackboard.