CELL BIOLOGY

Course Description: A study of cellular structures and processes to explore strategies for cellular and organismal function. Emphasis will be placed on the biology and chemistry of basic cellular mechanisms. Topics include biomolecules, cellular architecture, gene regulation, catabolism, protein structure and function, membrane structure and function, transport, enzymes, cellular trafficking, cytoskeleton, cell communication/signal transduction, regulation of cell proliferation and cancer. Laboratory will emphasize basic techniques common to the overlapping fields of cell biology, biochemistry, and molecular biology. Hot topics include SiRNA, genomics, regulation of chromatin structure, SNPs and DNA microarrays. Critical thinking and analytical skills are practiced.

LEARNING OBJECTIVES

Knowledge: Students should be able to:
1. List the major macromolecules found in the cell and the monomers from which these polymers are constructed.
2. Understand the properties of each class of macromolecule and the roles that each plays in various cellular functions.
3. Understand the properties of water and the roles it plays in all cellular processes, eg. protein folding.
4. Describe the structure and differentiate the functions of the major parts of the cell, including:
   - cell (plasma) membrane
   - nucleus
   - chromosomes
   - nucleolus
   - mitochondria
   - chloroplasts
   - endosomes
   - lysosomes
   - endoplasmic reticulum
   - peroxisomes
   - ribosomes
   - golgi complex
   - cytoskeleton
   - Clathrin-coated vesicles
   - extracellular matrix
5. Describe the structure and properties of biological membranes.
6. Distinguish various kinds of transport across biological membranes.
7. Explain the roles of ATP and NADH (NADPH) in cellular activity and metabolism.
8. Describe how electron transport is linked to ATP generation.
9. Describe how proteins and lipids localize within cells
10. Understand information flow embodied by the Central Dogma, and how this can be used to study and manipulate gene expression.
11. Appreciate various cellular processes in terms of the energetics of the molecules involved.
12. List components of the cytoskeleton and describe how they maintain or modify cell structure.
15. Understand the approach and products of “genomics” or other “Systems Biology” approaches.
16. Describe examples of chemical signaling mechanisms in cells and organisms.
17. Describe regulation and control of the cell cycle
18. Describe alterations to cell function which accompany cancer

Skills: Students should be able to:
1. Formulate an hypothesis from available information and devise means for testing this hypothesis experimentally.
2. Propose practical experimental procedures to:
   a. fractionate, label or visualize specific cellular compartments or components.
   b. identify, quantify, and characterize protein and nucleic acid.
   c. determine DNA sequences and their polymorphisms
3. Use the following equipment in a safe and professional manner:
   a. high power light and phase-contrast microscopes, including oil immersion lens.
   b. centrifuge
   c. spectrophotometer
   d. incubators
   e. electrophoresis equipment
   f. micropipetting devices
   g. standard laboratory glassware.
4. Take necessary safety precautions when dealing with electricity, hazardous chemicals, flammable solvents, acids or alkalies.
5. Graph and interpret the results of cell biology experiments.
6. Communicate experimental procedures, results and outcomes in a professional manner.
7. Perform basic laboratory mathematics including concentration and dilution calculations.

Major Course Requirements

Tentative Evaluation: Your final grade will be based on the percentage you earn out of the total possible points, weighted as specified below. Individual extra credit is not possible, but bonus points may be built into exams or other assignments. Statistical manipulations, if used (at the Instructor’s discretion), will be performed only once, at the end of the semester. A 10-point grading scale will be used:

A = 90 - 100 %
B = 80 - 89.9 %
C = 70 - 79.9 %
D = 60 - 69.9 %
F = 0 - 59.9 %

Components of Course Grade (Tentative)

I. Lecture (75 %)
   3 Exams @ 100 pts = 300
   Final Exam = 100
   Quizzes; Other Assignments = 100

II. Laboratory (25 %)
   Lab Reports/Assignments = 150
   Lab Quizzes = 100
The time schedule may require adjustment. Should this be the case, the assignments and weighting may change slightly. Additional assignments may or may not be provided at the Instructor's discretion. Such assignments might include homeworks, group projects, reading assignments, quizzes, seminar attendance, etc. Regardless of any such changes, the lecture and laboratory weighting of your grade shall remain at 75 % and 25 %, respectively. For example, if you make 90 % of total points available for the lecture and 80 % of total points available for the laboratory portion, then your grade would be calculated as:

\[(0.9 \times 75) + (0.8 \times 25) = (67.5) + (20) = 87.5/100 \text{ possible} = B\]

An assignment will likely be due during the last week of class.

Every attempt will be made to follow the time and evaluation schedules shown here. It is the student’s duty to attend each class session, read messages from the Listserv and to be aware of all assignments, deadlines, changes.

Exams will be a mixture of multiple choice, matching, fill-in the blank, short answer, labeling, calculations and essay questions. Some will require analysis and interpretation of data or experimental design to assess critical thinking skills. Some questions will be derived from laboratory activities. The Final Exam (Wednesday, Dec. 12 from 8:00 - 10:30 AM) will contain new material from the end of the semester.

Quizzes may be given at any time in class. There will be no makeups. Homeworks and other assignments may be given in class. The other assignments may include data interpretation, experimental design, calculations, opinion papers, research article summaries, etc. They will generally be due at the start of lecture class the following week. You are encouraged to get together and work on them as a group. However, unless specified otherwise, the assignments must be turned in individually and be written in your own words, NOT COPIED. An assignment grade of ZERO will be given if the work is not in your own words.

Required Readings


You will need to purchase a packet of laboratory handouts from the bookstore. A class announcement will be made when these are ready.

BlackBoard: Course-associated site for posting notes, readings, labs, data, etc.

Course Listserv: All students must subscribe to the class listserv, using your official University-mandated email account (firstinitiallastname@islander.tamucc.edu). You may ask questions of interest to the instructor or other students on the class listserv, eg. clarification of an assignment, as well as receive important class announcements. You are encouraged to subscribe to the Opportunities Listserv as well.

To subscribe, send an e-mail to “Cellbio-list-request@Listserv.tamucc.edu”. Make sure that your e-mail address appears in the “From:” heading, and that the word “subscribe” is typed in the subject line. You will receive a subscription acknowledgement confirming that you have done everything correctly. To post messages to the listserv, send to “Cellbio-list@Listserv.tamucc.edu”. Because of security concerns, you should post messages from the official TAMUCC computer account (Islander) that is used to subscribe to the listserv. At the end of class, please send an e-mail to “Cellbio-list-request@Listserv.tamucc.edu” with “unsubscribe” in the subject heading. Please use this service to ask questions about class materials, dates, assignments, etc.
You should also subscribe to the Opportunities Listserv using the same procedure: “opportunities-list-request@Listserv.tamu.edu” This service provides notification of scholarships, research and volunteer opportunities and science-related job opportunities.

**Recommended or Supplemental Reading:** Supplemental readings will be posted on the Blackboard course site.

**Text-Associated Website:** www.classwire.com/garlandscience

**List of Supplies**
You will need a laboratory notebook, “sharpie”, calculator, laboratory coat, and safety glasses.

**Course Policies**

**ALL E-MAIL COMMUNICATIONS WITH THE INSTRUCTOR OR LAB TA MUST BE MADE THROUGH YOUR OFFICIAL UNIVERSITY E-MAIL (@ISLANDER), BY UNIVERSITY RULE.**

**Attendance/tardiness, Late work and Make-up Exams** You are expected to attend all classes and labs in a timely manner. Important new material, as well as schedule changes and quizzes may occur at any time. It is expected that you will take notes, ask/answer questions, and participate in group activities.

**LATE WORK will not be accepted, except as below, or unless otherwise specified.**
Attendance is the student’s responsibility. You are responsible for the material covered in every lecture, even if it is not in the book, regardless of your attendance. Nothing missed during an unexcused absence can be made up. An excused absence allows us to make alternative arrangements to complete an assignment. Only unavoidable absences are excused. Routine events (holiday travel, non-emergency medical visits, parent-teacher conferences, household or auto repairs) should be scheduled to avoid conflicts with class. An acceptable excuse must be:
• from an appropriate source (doctor, dentist, funeral director) stating the nature of the event
• In writing, on official letterhead, and signed (it will not be returned)
• presented prior to, or within 1 week of, the absence
• It must state the dates for which the excuse applies

There are No make-up examinations: For some scheduled events, you may arrange to take a lecture exam before, but not after, its scheduled time. Quizzes cannot be made-up.

**Expectations:**

**You are responsible for your own education.** Take notes in class as some new information may be presented. Lecture notes from the instructor, when made available, do not represent everything you need to know. Read the book and handouts for further detail not covered in class, and to be prepared for laboratory. If you don’t understand, then please ask, or see the instructor after class. Don’t allow yourself to fall behind. Be diligent and thorough on written assignments and examination answers. If you are not sure of an answer, at least try. For many people, putting anything down on paper clarifies their thinking and helps with recall. Also:
• Be aware of university-imposed deadlines (ie drop dates)
• Be aware of test times and dates, including changes which may be announced in class
• Check your exams for clerical errors. The test score is not the end of the learning process. Review tests to determine why you missed an answer. Correcting your mistakes is an effective way to learn material (reflective learning).
• Work on all assigned homework problems in a timely manner. Seek tutorial help from classmates or the
course/laboratory Instructors.

* Keep track of your progress in class.

**The following procedures will be enforced:**

* All major exams are the property of the instructor and may not be removed from class, copied, reproduced or photographed in any way. Violation will result in a grade of “F”
* You must be prepared to present a photo ID at all examinations
* If you leave an examination room—for any reason—you must hand in your test and you will not be allowed to resume the examination. Attend to personal matters (e.g., rest room visits) before the examination.

**Cell Phone/Electronic Device Usage Policy on Disruptive Behavior:**

As adult university students, you are expected to act with courtesy and common sense. Disruptive, disrespectful, or abusive language/behavior towards anyone in class (student, staff, faculty) will not be tolerated and could result in permanent removal from class. This includes tardiness to class, talking in class, insubordination, and electronic disturbances (cell phones, ipods, etc). **Turn it off.** Hazardous materials are used in the laboratory so “play” or reckless behavior will not be allowed. Children are not allowed in class or lab.

**Academic Integrity/Plagiarism.**

University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in appropriate action at the discretion of the instructor, including failure of the course. **Everything should be in your own words.**

**Dropping a Class**

I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. **Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class.** Be aware of the last day to drop a class with an automatic grade of “W” this term.

**Preferred methods of scholarly citations** *(Format from J. Experimental Marine Biology and Ecology)*


**Grade Appeals**

As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.
Disabilities Accommodations*
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

Tentative Syllabus
(course schedule)

Wk1: Aug 22, 24  
Cells, Organelles, Genomes, Microscopy (Ch 1)  
No Lab; Take-Home Lab Handouts To Work On

Wk 2: Aug 27, 29, 31  
Microscopy, Water, Chemical bonds, Macromolecules (Ch 1, 2)  
Lab 1: Intro, Lab Calcs, Pipetting

Wk 3: Sep 5, 7  
Energetics, Enzymes, Prot Str Catalysis (Ch 2, 3)  
No Lab

Wk 4: Sep 10, 12, 14  
Protein conformation & energy, Protein functions & motions; (Ch 4)  
Lab 2: Lab Calcs revisited; Pipetting; Microscopy

Wk 5: Sep 17, 19, 21  
Catalysis, Antibodies & Regulation (Ch 4) EXAM I  
Lab 3: Microscopy; More lab calcs

Wk 6: Sep 24, 26, 28  
Gene expression Regulation of gene expression; Protein turnover; Pattern development; Genome structure, (Ch 7, 8, 9)  
Lab 4: Enzyme analysis

Wk 7: Oct 1, 3, 5  
Membrane structure, function & transport, membrane potential (Ch 11, 12)  
Lab 5: Enzyme analysis Cont’d

Wk 8: Oct 8, 10, 12  
Catabolism: glycolysis, TCA (Ch 13); EXAM II  
Lab 6: Evolution of proteins I. Protein electrophoresis

Wk 9: Oct 15, 17, 19  
Mitochondria: Ox Phos, E.T.,Proton pumping (Ch 14; Media)  
Lab 7: Evolution of proteins II. Western blotting

Wk 10: Oct 22, 24, 26  
ATP synthesis; Intracellular compartmentation/transport (Ch 14, 15)  
Lab 8: Human SNPs I. Genomic DNA, PCR

Wk 11: Oct 29, 31; Nov 2  
Protein Sorting: translocations, vesicular, secretory paths (Ch 15)  
Lab 9: Human SNPs II. Electrophoresis, PCR
Wk 12: Nov 5, 7, 9  Endocytic paths, Cell communication: principles, G-proteins (Ch 15, 16)
Lab 10: Human SNPs III. PCR cleanup, DNA sequencing rxs

Wk 13: Nov 12, 14, 16  EXAM III, Cell communication: G-prot- & enzyme-linked receptors (Ch 16)
Lab 11: Human SNPs IV. Rx cleanup, Run DNA sequencing

Wk 14: Nov 19, 21  Cytoskeleton: Intermediate filament, microtubules, Actin (Ch 17)
Lab 12: Human SNPs V. Bioinformatics

Wk 15: Nov 26, 28, 30  Cell cycle, division and control; Cell death; Tissues/matrix/junctions (Ch 18, 20)
Lab 13: Cytoskeleton immunohistochemistry

Wk 16: Dec 3  Cancer, Tumor ecology (Ch 20)
Lab 14: Lab wrap up

Wk 17: Dec 12  FINAL EXAM; 8:00 – 10:30 AM