

8-22-2020: *This is it! Please let me know if you see any errors!*

Syllabus – Fall 2020

BIOLOGY 111 sec. 16: Intro. To Cell and Molecular Biology (CRN 11215)

TR 10:50 a.m. - 12:05 p.m., RITA 101 (online until Sep. 14th)



INSTRUCTOR:

Mrs. Kathleen E. Janech, M.S.

janechk@cofc.edu

(email is the best way to reach me – please make sure to use your CofC email only!) I do my best to reply the same day if the email is received before 5 p.m., but I do not check my emails after 5 p.m. or over the weekend.

Also, please include your **course number and section number**, and don't email my husband by mistake!

OFFICE LOCATION (once we are back on campus): 65 Coming St., Rm. 214

(I am on the second floor of this little beige house, just across Coming St. from the loading dock area of RITA).

STUDENT HOURS (drop-in on Zoom): Tuesdays 1 p.m. - 2 p.m. EDT. (access

from the Zoom portal at the top of the OAKS course page). These are optional, and feel free to drop-in at any time during the hour, and stay for

only as long as you need to. You are welcome to email me to schedule an appointment at another time or

location. These will not be recorded. **Please attend, introduce yourself and ask questions! I am here to help!**



Course Description

This course is intended to be a foundation course for science majors, providing an introduction to basic principles of biology and emphasizing the concept of structure and function in biological systems at the molecular and cellular levels. By the end of this course, you should also be actively aware of many of the intricate connections between the study of biology and chemistry.

Supplemental Instruction (SI):

Supplemental Instruction, or SI, is a collaborative, peer-assisted group study session, led by a student who has previously successfully completed the course. The SI leader helps students, in weekly sessions outside of class, to develop strategies in order to successfully master the material. More info. can be found at

<http://csl.cofc.edu/?referrer=webcluster&> The SI instructor for this class is **Dani Gottlieb**

(gottliebnd@g.cofc.edu). Session times and locations will be announced during class. **Attending at least one session each week is highly recommended.**

Co-requisites

BIOL 111 Laboratory – you **MUST** enroll in a lab section in addition to this lecture.

Required Course Materials



1. **Textbook:** *Biological Science* by Freeman, et al., 7th Edition (Pearson Publishers), with the 2 newts on the cover. You can buy it (hardcover, loose-leaf version or digital), rent it, borrow it, or share it with a classmate, but you **MUST** have access to this textbook! Use the text and figures to preview and to reinforce what you are learning in class. There are self-quizzes that can be great study guides, as well as a variety of web links to help you understand the material. There is a lot of material to cover in this course, so **keep up with the reading!** Course ID for the digital version is JANECH88188

2. **Computer and online access:** All students must have access to a computer equipped with a web camera, microphone, and Internet access. **You will be required to download, install and use Respondus Lockdown Browser and Monitor for certain quizzes and exams. Prof. Janech will be providing further instructions about this.** Resources are available to provide students

with these essential tools if they need assistance - please let me know if you need help accessing those resources. *****This is especially important since we are starting the Fall 2020 semester remotely due to the pandemic, and might also be necessary if there are any issues with inclement weather this semester.***** Once we are back on campus, due to social distancing requirements, this class will include a variety of online and technology enhanced components to reinforce continuity of learning for all enrolled students, including recorded Zoom lectures.

Online access through MyCharleston to OAKS (<http://blogs.cofc.edu/oaks/students/getting-started/>) and Voice Thread will be essential. You also must regularly check your CofC email, since that is how I will send updates. A helpful website for all things technology at CofC is: <http://blogs.cofc.edu/sits/> The Remind app will also be used as a backup communication resource.

Suggested Course Material

The **Study Guide** for *Biological Science* by Freeman, 7th Edition, (Pearson Publishers). This is not required, but it is usually available in the book store and is very helpful for many students. The Mastering Biology website that goes with the text also offers additional resources.

Center for Student Learning – I encourage you to utilize the Center for Student Learning (CSL) and their academic support services for assistance with study strategies and course content. They offer tutoring, Supplemental Instruction, Study Skills appointments, and workshops that help students of all abilities become more successful throughout their academic career. Services are available to you at no additional cost. For more information, please visit the CSL website at <http://csl.cofc.edu>, or call (843) 953-5635, or drop by their location on the first floor of the Addlestone Library.

Recording of Classes (via Zoom)

Once we are back on campus, class sessions will be recorded via both voice and video recording in order to facilitate class attendance with social distancing measures in place. Although I do not intend to video record

anyone but myself, by attending and remaining in this class, the student consents to potentially being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class. Please let me know if you have any questions.

Institutional Syllabus Statement Regarding the Fall 2020 Semester

The College of Charleston is committed to promoting the health and safety of our campus community. To that end, all faculty and students must abide by public health guidelines that include practicing social distancing in the classroom and elsewhere on campus, following signage indicating the entrance, exit, and traffic flow in and around campus buildings, wearing a mask or cloth face covering while in the presence of others, washing or sanitizing hands frequently, sanitizing individual and shared learning and work spaces, and staying home when sick. **These practices are mandatory.** Students will not be allowed to attend class without an appropriate face covering or when showing symptoms of illness.

Due to social distancing requirements, the number of students allowed in the classroom at one time is significantly reduced. As a result, most in-person courses will include a variety of online and technology enhanced components to ensure continuity of learning for each student throughout the semester. These strategies will vary by course section and students are advised to read each syllabus carefully. Faculty have planned each course to enable all students, whether they are in the classroom or working remotely, to be fully engaged in the learning experience. Before the drop/add deadline, students should decide whether the course plan on the syllabus matches their own circumstance. All faculty will use OAKS to facilitate student access to the course syllabus, course materials, and the gradebook. The College of Charleston's standard grading system is in effect. **Once we are back on campus, the plan for this course is to divide the students into two groups, and I will tell you whether you will be able to attend on Tuesdays or Thursdays, with the expectation that you will attend remotely via Zoom on the day that you are not physically present in class.**

There is a possibility that the semester will be disrupted by weather or the pandemic. Every course syllabus will include a plan for a change in modality to ensure the continuity of learning in the event in-person classes must be suspended. Regardless of the method of instruction, all courses will move online for one week after Thanksgiving. Final exams will be administered online. Therefore, all students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools.

The College anticipates that some members of the community will fall ill or test positive for the coronavirus, and then be required to quarantine thereby missing class, assignments, and assessments. Faculty are expected to provide reasonable accommodations as determined by the content, level, and expectations of their courses for students who become ill or indicate a need to isolate themselves. **Communication with the instructor will be essential so that alternate plans can be arranged, and it is imperative that, even if ill or in difficult circumstances, the student finds a way to communicate in a timely manner.** To the extent possible, arrangements will be made for students with COVID-19 related absences to continue in the class. Faculty are encouraged to make explicit in their syllabus what sorts of accommodations students can expect with respect to missed course meetings, assignments, and assessments. However, students should be aware that extended absences for any reason cannot be accommodated in every course. Missed assignments and assessments may result in poor or failing grades. If a student is absent from class for an extended period, a withdrawal (W) before the deadline should be strongly considered. In all cases, assigning course grades is the responsibility of the instructor consistent with the grading policy published on the syllabus.

Inclement Weather, College Closure, and the Class Schedule

If the College of Charleston closes and members of the community are evacuated due to inclement weather or for any other reason, students are responsible for taking course materials with them in order to continue with course assignments consistent with instructions provided by faculty. In cases of extended periods of institution-wide closure where students have relocated, instructors may articulate a plan that allows for supplemental academic engagement despite these circumstances.

Teaching Philosophy

I encourage participation and interaction in my lectures and will do my best to create a fantastic learning environment. However, it is not all up to me. I depend on you, the student, to also take an active role in your education (after all, you pay to be here!) by challenging me with questions and participating. I will also help you discover learning resources available to you that will help you throughout your education.

How to Take This Course

(with credit & thanks to, and in memory of, Dr. Conseula Francis)

Any course, in any given semester, is a journey, often to a place you haven't been before. You may be super excited about the trip, eager to get going and explore the sites. Or maybe you are here because you were told to take this course. Or maybe you are somewhere in-between. Imagine, if you will, that we're all standing at the base of a mountain. We all have to decide how we're going to climb it, and you alone can decide the manner of your exploration.

<p><u>Day Hiker</u> You're sticking to the trail because you're certain of where it goes. You want the basics - lists, order of processes, details to memorize. There is nothing wrong with this approach, especially if the material is new to you. A successful day hiker will take notes during class, read all related pages in the book after class, and review their notes at least twice a week. A day hiker may do well on quizzes, but they will have to dig a little deeper for exams to really understand the connections between all aspects of the material. They will use the resources at the Center for Student Learning (CSL), and be familiar with Bloom's Taxonomy as they work toward greater understanding.</p>	<p><u>Backpacker</u> You're ready to spend a few days on this mountain and you have supplies (already existing knowledge, interest, inclination) to help you. You have a grasp of the basics, and are ready to explore beyond them. Backpackers will hone their note-taking skills in class, read all related pages in the book both before and after class, and really spend time digesting all of the information that is contained in the figures in the textbook. They ask questions of the professor, either during student drop-in hours at the office or by email. Backpackers know that to succeed, they must approach with effort and learn and grow from their mistakes. They work with resources at the Center for Student Learning (CSL), are working to achieve the higher orders of understanding in Bloom's Taxonomy, and practice recalling</p>	<p><u>Trailblazer</u> You are blazing your own way, finding new routes up the mountain and new connections between all aspects of the material, things others may not see. You are passionate about, and interested in, not only <i>what</i> and <i>why</i>, but also <i>how does this connect to other things in the bigger picture?</i> Trailblazers often use different colors when taking notes, and read more in the book than is required, because they really want to understand the whole picture. They study the figures and try to draw them on their own for recall practice and mastery. They ask questions and spend a lot of time with the material. For trailblazers, this course is part of the expedition to discover all that science has to offer. They take advantage of EVERY opportunity to learn from their mistakes. They often make use of resources at the Center for Student Learning (CSL), actively work with the</p>
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	material from memory.	material to achieve the higher orders of understanding in Bloom's Taxonomy, and often quiz themselves and those that they study with, because they know that practicing information recall from memory as often as possible is one of the best ways to learn.
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No matter which path you choose, remember that all explorers need to do their best to **limit outside distractions**. Yes, life happens, and the current situation with coronavirus is challenging, but really try to give your brain the gifts of time and focus - try to find a good work space and a routine that works for you.

Course Policies and Requirements

Accommodations

Any student in this class who has a documented disability should speak to me as soon as possible, as well as contact the Center for Disability Services (CDS/SNAP program), located on the first floor of the Lightsey Center, Suite 104, (843) 953-1431, SNAP@cofc.edu

Class Delivery Format

Due to the coronavirus pandemic, the first few weeks of this class will occur online as "Distance Education", a course format that requires students to be self-motivated, disciplined, organized and task-driven. **Some students are under the impression that distance education classes are easier than traditional face-to-face classes. This is not true. In fact, distance education courses are often more challenging than traditional classes and you should be prepared to spend several hours on this class each day, including additional time on the weekends.** It is critical that you complete work for this class each day and not wait until the day before a deadline to begin working on a module.

This class is being presented in an **asynchronous** format - you will be able to complete lectures and quizzes when it is most convenient to you—you are not required to login to the Internet at a specific time each day to interact with your classmates or me. **However, you must have regular access to a computer with a reliable high-speed internet connection and computer with a microphone and/or web-cam throughout the duration of this course. Computer failure/unavailability does not constitute an excuse for not completing work by the due dates.** So please do not wait until the last minute to complete work for a module.

This class will be administered through OAKS, the College of Charleston's learning management system. To access OAKS go to <http://my.cofc.edu> and login to My Charleston. The OAKS icon is the acorn located in the upper righthand corner of the screen.

Since the course will be solely online for a few weeks, and we will not yet be able to have a face-to-face class, I expect you to regularly login to OAKS to complete lecture videos and Voice Threads, look for course updates (in the News section on the course homepage), complete quizzes, etc. Please also check your email regularly as I will send e-mail updates to the class through OAKS to update you on class events and assignments.

If you are someone who feels uncomfortable with technology, the College offers a number of resources to help you develop your technological competency, in general, but specifically within the context of this online class. Visit

<http://blogs.cofc.edu/studentreadinessforonlinelearning/> to access those resources. And, if you experience technological problems during the class, please contact me immediately at janechk@cofc.edu.

Class Attendance

You are expected to attend all of your assigned meetings of the class (more information will be forthcoming, once we can meet face to face again on campus). Students are responsible for **getting their own notes from a classmate and/or from the recorded Zoom lectures, which will be posted on OAKS**, for any class missed. Exams will be based almost entirely on lectures with the text used for background information and reinforcement. **You will not do well in this course if you miss lectures. This material is challenging and requires work on your part for success!**

Assignment

One homework assignment will be assigned during the semester. This assignment is intended to reinforce material covered in class and to encourage critical thinking. It will require you to seek information from sources outside of class and in addition to your textbook. Due date is given on the course calendar below. **Because of the assignment and other REAL opportunities to EARN credit in this course, I do not offer any extra credit projects.** All students are expected to turn in their assignment by the beginning of the class period on the date scheduled, and they will only be accepted **typed and stapled/glued** (otherwise points will be lost). An assignment will lose one full letter grade for every day of delay (**any time after 5 p.m. counts as the next day**). You should hold onto all graded assignments until the final grade has been turned in.

Honor Code

Students are required to adhere to the guidelines outlined by the Honor Board in the Student Handbook (please see <http://deanofstudents.cofc.edu/policies-and-procedures/honor-code-and-code-of-conduct.php>) **This includes lying, which will not be tolerated in this course.** All work that you turn in for this course (whether for assignments, quizzes, or exams) must be **your own independent scholarship**. *Students should be aware that unauthorized collaboration—working together without permission—is a form of cheating; this includes collaborating with classmates or other individuals on online quizzes or exams.* Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance. Any form of plagiarism (intentional and unintentional), cheating, or presenting someone else's work as one's own will be treated as a serious academic transgression and will be communicated accordingly by the instructor as an honor code violation to Student Affairs. Be especially cautious of plagiarism when using Internet sources. **Cheating, attempted cheating, or plagiarism will result in a grade of zero on that assignment, quiz or exam and may result in a final overall grade of F or XXF (failure due to academic dishonesty) for the course.**

Quizzes

Several short quizzes will be given throughout the semester on OAKS. They are intended to assist students in keeping up with the large amount of information in this course by encouraging them to prepare and study/read/review **EVERY** day. **It is your responsibility to keep up with due dates and times!** A missed quiz will result in a 0 for that quiz, unless you talk to me to explain the situation (serious illness, including but not limited to COVID-19, family responsibilities, other extreme circumstances). The College will not be using Absence Memos this semester, so it is imperative that you communicate with me and tell me the truth, so that I can work with you. **Your lowest quiz score will be dropped in the final grade calculation.** All cell phones, Apple watches, pagers, iPods, iPads, tablets, laptops, etc. are to be **turned off and put away** during each quiz, and you

are **expected to take them by yourself without other people, notes, books or websites**. The use of any wireless communication device during a quiz, test, or final exam is a violation of the Honor Code.

Exams

In this course, there are 4 regular exams scheduled during the semester (see calendar below for dates) and 1 cumulative final exam scheduled during the final examination period. **Any exams taken during the period of classes being exclusively online will also be online. Once we are back in class on campus, I anticipate using Akindi sheets for you to “bubble in” your answers during the exam in class, but depending on circumstances I may have to stick with online exams then as well.** Anyone who misses an exam will receive a 0, unless you talk to me to explain the situation (serious illness, including but not limited to COVID-19, family responsibilities, other extreme circumstances). The College will not be using Absence Memos this semester, so it is imperative that you communicate with me and tell me the truth, so that I can work with you. If you have any conflicts with the scheduled exams, you must see me ahead of time, well before the exam date. **All cell phones, Apple watches, pagers, iPods, iPads, tablets, laptops, etc. are to be turned off and put away completely during each exam. The use of any wireless communication device during a quiz, test or final exam is a violation of the Honor Code.**

Grading

The quizzes will count for a total of 15% of your final grade. The assignment will count for 10% of your final grade. The 4 regular exams will count for a total of 60% of your final grade. The cumulative final exam will count for 15% of your final grade. Grade calculation formula (try for yourself in an Excel spreadsheet):

$[(\text{Quiz avg.}) * 0.15] + [(\text{Assign.}) * 0.10] + [(\text{Exam avg.}) * 0.60] + [(\text{Final exam score}) * 0.15] = \text{Final grade}$

The following quote is just a reminder that whether you come into this course with lots of prior knowledge or not, work on your part will be the key to your success!

"Hard work beats talent when talent doesn't work hard" - Tim Notke

Letter grades will be determined by the following breakdown:

≥93% = A 90-92 = A- 87-89 = B+ 83-86 = B 80-82 = B- 77-79 = C+ 73-76 = C

70-72 = C- 67-69 = D+ 63-66 = D 60-62 = D- ≤59 = F 0 due to acad. dishonesty = XXF

Please teach yourself how to check on your grade in this course on OAKS, and follow along during the semester. Any errors can be brought to my attention, and are much easier to fix the sooner they are detected!

My Expectations of Students in my class (especially once we get back on campus):

1. **Proper Deportment:** In this class, you are expected to be respectful of your teacher and other students. Talking, texting and computer use are prohibited. If you need to do these things, please leave the room until you are finished. Help me create a learning-focused environment for you and everyone around you – please be courteous and pay attention! If you have a question, please ask me – I love questions from students! **This includes the COVID-19 addendum from the Student Code of Conduct: In a classroom setting, all faculty**

members have the authority to deny entry to any student who does not have and/or refuses to put on a face covering.

2. Electronic device policy (please note that I will try to be more flexible when we are back on campus, given the circumstances of this fall semester, but I really do prefer that students **handwrite their notes! Studies have shown retention is better!):** Research has shown that learning is negatively affected when students and those around them use phones or other devices during class. Therefore, because we all deserve a learning-focused environment, the use of wireless communication devices during class is prohibited, other than to respond to a Cougar Alert announcement - therefore please **SILENCE** all cell phones, pagers, iPods, iPads, tablets, laptops and anything with alarms before coming into my class **AND PUT THEM AWAY**. If you forget to do so you **RISK BEING PERSONALLY REMINDED DURING CLASS** and you may be asked to leave and not to return that class period. ***If you have a legitimate need to use a laptop or flat tablet with a stylus, please see me to discuss.*** The **only exception to this policy** is that I will allow you to use your phone to make **audio recordings of my lectures - no video please** (there are several free apps available to use for this). In that case, you may have your phone face down on the desk only. Please **DO NOT** take photos of my slides (except for long announcements) - you need to write your notes, and write down the page numbers of the figures to find them in the textbook.

3. This is a large class, and it will take me some time to learn your names. However, I have an excellent memory and I can see everyone, even in such a large classroom, so please stay awake, participate and be attentive. It is important that you start presenting yourself as a serious, professional student when dealing with faculty and other students in the class. **One day you will be asking for letters of recommendation – start thinking now about what you want those letters to say about you, and act accordingly.**

COURSE CALENDAR

Exam dates are firm – but topics covered on certain days are subject to change

Date	LECTURE TOPIC	Chapter
August		
T 25	Welcome, Introduction to Cells, start Prokaryotes	1.1, 1.2, 1.3, 1.5, 7.1
R 27	Prokaryotic and Eukaryotic Cell Structure, Microscopes / <i>Last day for Drop/Add is MONDAY!</i>	7.1, 7.2, Bioskill 9, p. 36 & 37
September		

T 1	Eukaryotic Cell Structure – (normally would do a drawing activity in class, so we'll see how it works online!)	7.2, Ch. 12 p. 258, 7.3 p. 158, 7.5 p. 161, Ch. 27 p.562-563, Ch. 4 p. 99, 7.6
R 3	Start Cell Membranes & Transport, Diffusion & Osmosis, Channels & Carriers, start Pumps	7.6, 6.3, 6.4
T 8	Finish Pumps, Cell to Cell connections, Atoms & Bonding	6.4, 11.1, 11.2, 2.1
R 10	Bonding, Properties of Water, pH	2.1, 2.2
T 15	**EXAM 1**	
R 17	Properties of Water, Acids, Bases & pH, Organic molecules	2.2, 2.4, 2.5, 2.3 (part)
T 22	Functional Groups, some Energy, Macromolecules: Proteins	2.5, 3.1, 3.2, 3.3, prions p. 90-91
R 24	Macromolecules: Proteins, start Nucleic Acids	4.1, 4.2
T 29	Macromolecules: finish Nucleic Acids	4.2, 4.3, 4.4
October		
R 1	Macromolecules: Carbohydrates & start Lipids	5.1, 5.2, 5.3, 6.1
T 6	Finish Lipids, Distant Cell Signaling	6.1, 6.2, 2.3, 11.3 (part)
R 8	**EXAM 2**	
T 13	Redox & ATP, begin Cellular Respiration, also look at part two of the lecture on Voice Thread?	2.3 (some), 8, Ch. 5 p. 117-118, start 9, VT
R 15	More Cellular Respiration	9.1, 9.2, 8.5, 9.3, 9.4
T 20	Finish Cell. Respiration & Fermentation, start Photosynthesis / <i>Midterm grades available after Noon or tomorrow</i>	9.5, 9.6, 10 fermentation finishes, and light starts, with the VT

R 22	More Photosynthesis	10
T 27	Finish Photosynthesis, start Cell Cycle / <i>Tomorrow is the last day to withdraw with a grade of "W"</i>	10, 12
R 29	Finish Cell Cycle, Mitosis and Cancer / Bio. Assign. Due	12, Ch. 13 p. 281, Ch. 19 p. 387 & 390
November		
T 3	OFF - Election Day - Please vote!!!	
R 5	**EXAM 3**	
T 10	DNA Replication	15 (just what I cover)
R 12	Finish DNA Replication and Meiosis	15, 13, Ch. 14 p. 297
T 17	Start Mendel, Chromosomes, Linked Genes and Inheritance	14
R 19	More on Inheritance	14
T 24	Finish Inheritance - Last day on campus for in-person instruction	14
R 26	OFF – Happy Thanksgiving!	
December		
T 1	**EXAM 4** (will be taken online, like a big quiz in OAKS)	
R 3	Last day of class for this course!	TBA – parts of Ch. 16?
Fri. 4	Official last day of classes for the fall semester	
Tues. Dec. 8	Final exams begin	

Tues. Dec. 8th	Study and take your final exam on OAKS!	(Will probably open the Final Exam on OAKS today - I will definitely let you know!)
Thursday, Dec. 10th	FINAL CUMULATIVE EXAM on OAKS will be due by 10 a.m. TODAY! (This was the assigned time on the Final Exam schedule). It will close and not reopen.	

**** Please note: as stated in the Undergraduate Catalog:**

<http://catalog.cofc.edu/content.php?catoid=14&navoid=671#final-examinations>

“Examinations **must** be taken at the time scheduled (<https://registrar.cofc.edu/pdf/exam-schedule-fall2020.pdf>), **except** when:

1. Two or more exams are scheduled *simultaneously*.
2. Legitimate **AND** documentable extenuating circumstances prevent the student from completing the examination at the scheduled time (e.g., burial services for an immediate family member).”

Learning Goals and Objectives

Learning Goals & Objectives for Biology 111 and 111L Introduction to Cell and Molecular Biology/ BIOL 112 & 112L Evolution, Form, and Function of Organisms

Department: Biology

This general education science sequence provides a background for understanding and evaluating contemporary topics in biology. Students develop a foundational understanding of core concepts to use and on which to expand in upper level courses. They also develop the critical competencies that form the bases for the practice of science and use of scientific knowledge.

Core Concepts

This 2-semester course sequence in general biology addresses fundamental principles in biology to prepare students for sophomore and upper level courses in biology:

- **EVOLUTION:** The diversity of life evolved over time by processes of mutation, selection, and genetic change. The theory of evolution by natural selection allows scientists to understand patterns, processes, and relationships that characterize the diversity of life.
- **STRUCTURE AND FUNCTION:** Basic units of structure define the function of all living things. Structural complexity, together with the information it provides, is built upon combinations of subunits that drive increasingly diverse and dynamic physiological responses in living organisms. Fundamental structural units and molecular and cellular processes are conserved through evolution and yield the extraordinary diversity of biological systems seen today.
- **INFORMATION FLOW, EXCHANGE, AND STORAGE:** The growth and behavior of organisms are activated through the expression of genetic information at different levels of biological organization and depend on specific interactions and information transfer.
- **PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamic and will be explored to understand how living systems operate, how they maintain orderly structure and function, and how

physical and chemical processes underlie processes at the cellular level (i.e. metabolic pathways, membrane dynamics), organismal level (i.e. homeostasis) and ecosystem level (i.e. nutrient cycling).

· **SYSTEMS:** Living systems are interconnected and interacting and biological phenomena are the result of emergent properties at all levels of organization, from molecules to ecosystems to social systems. The course will explore the dynamic interactions of components at one level of biological organization to the functional properties that emerge at higher organizational levels.

The specific topics covered in each course include:

Biology 111 & Biology 111L

- Chemical and physical properties of life
- Cell form & function
- Energetics, metabolism, and photosynthesis
- The cell cycle
 - Mitosis and cell reproduction
 - Meiosis and sexual reproduction
- Mendelian genetics / Patterns of inheritance
- Human Inheritance
- The molecular basis of inheritance
- DNA and protein production
- Regulation of gene expression
- Some aspects of biotechnology

Biology 112 & Biol 112 L

- The development of evolutionary thinking
- Basic evolutionary processes
- Comparative plant form & function
- Comparative animal form & function

Core Competencies

- **Nature of Scientific Knowledge**

- Understand the intellectual standards used by scientists to establish the validity of knowledge, evidence, and decisions about hypothesis & theory acceptance. These standards include: 1) science relies on external and naturalistic observations, and not internal convictions; 2) scientific knowledge is based on the testing of hypotheses and theories, which are under constant scrutiny and subject to revision based on new observations; 3) the validity of scientifically generated knowledge is established by the community of scientists through peer review and open publication of work.
 - Understand that new ideas in science are limited by the context in which they are conceived; are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many investigators.
 - Understand that science operates in a world defined by the laws of chemistry and physics.
 - Understand the differences and relationships among scientific theories, hypotheses, facts, laws, & opinions.
 - Understand the differences between science and technology, but also their interrelations.
 - Understand the dynamic (tentative) nature of science.
- **Scientific Methods of Discovery**
 - ^[1] Understand the methods scientists use to learn about the natural world (observing; questioning; formulating testable deductive hypotheses; controlled experimentation when possible; observing a wide range of natural occurrences and discerning (inducing) patterns).
 - Apply physical/natural principles to analyze and solve problems.
 - **Develop a Scientific Attitude**
 - Develop habits of mind that foster interdisciplinary and integrative thinking (within biology; between biology and other sciences; between science and other disciplines).
 - Develop an appreciation for the scientific attitude - a basic curiosity about nature and how it works.
 - **Develop scientific analysis and communication skills**
 - Develop quantitative reasoning skills (quantitatively expressing the results of scientific investigations, or patterns in nature and using knowledge of biological concepts to explain quantitatively-expressed data or patterns).
 - Understand the probabilistic nature of science and the use/application of inferential statistics to test hypotheses.
 - Develop scientific information literacy (library, internet, databases etc...); find and evaluate the validity of science-related information.
 - Communicate scientific knowledge, arguments, and ideas in a variety of different contexts (scientific, social, cultural), utilizing a variety of different media (scientific articles, policy statements, editorials, oral presentations etc.).
 - Develop cooperative problem-solving skills (working effectively in teams), but also habits of mind and skills that foster autonomous learning.
 - **Develop an appreciation for the impact of science on society.**
 - Develop an appreciation of humans as a part of the biosphere and the ^[2] impact of biological science on contemporary societal/environmental concerns.
 - Knowledge of the history of the biological sciences and the influences of politics, culture, religion, race, and gender on the scientific endeavor.

Signature assignments for measuring learning outcomes

Learning Outcome 1: Students apply physical/natural principles to analyze and solve problems.

This learning outcome is assessed using the poster (or scientific article) generated in Biology 112 lab as part of the multi-week student-directed independent research project. In this project students use data they collect (or has been collected in actual research investigations) to test an hypothesis of their choosing. These projects may be themed, with all student groups addressing different aspects of a larger question, emphasizing the interdependence of various research groups needed to address complicated problems. This multi-week project begins the class identifying what questions need to be addresses in the larger problem. Individual student groups then become experts in these areas of the larger problem. The smaller research teams develop a hypothesis, and write a research proposal to test their hypothesis. Students collect (or use already collected data), summarize and statistically analyze the data, and draw conclusions.

Learning Outcome #2 - Students demonstrate an understanding of the impact that science has on society.

Biology 112 lab Students produce a written document based on one of the case-based labs (examples - policy statement, article, stake-holder professional letter or poster) that requires them to research and apply biological knowledge or evidence to defend or critique a proposed solution to a biology-related societal issue. Although the choice of the specific issue or proposed solution is course-section specific, some examples of potential issues include

- exploring environmental/health impacts of genetically modified organisms
- the use of performance enhancing drugs in sports
- the development of antibiotic resistance in disease organisms

[1] This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can apply physical/natural principles to analyze and solve problems.*

[2] This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can demonstrate an understanding of the impact that science has on society.*