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Fundamentals of Biology II (LIFE121 sect 001)

Fall 2016
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Lectures: Henzlik Auditorium, MWF 12:30 PM – 1:20 PM

The syllabus will be updated as the semester progresses. The current copy will always be available on Canvas (canvas.unl.edu). Canvas is a replacement for Blackboard. To be successful in this class you will need to use Canvas to receive lecture information, connect to MasteringBiology, and check on grades.

Contents

Learning Goals

The broadest goal of this class is to prepare students for upper level courses in the life sciences by exposing them to conceptual thinking in topics that include evolution, diversity, physiology, and ecology. The following core learning outcomes have been identified for this course. Words in orange may vary by section, but are included as goals in this section of LIFE 121. More specific Learning Objectives are listed later in this document.

1) Structure and function: Structures of cells and multicellular systems are related to their function

- Explain the origins, similarities and differences of the three domains of life (Bacteria, Archaea, and Eukarya).
- Explain the basic functions of multi-cellular systems.

- Explain the consequences and utility of pressure differences and osmolarity differences for cells and organisms.

2) Evolution: The scientific theory and principles of evolution underpin all of biology
- Explain how selection, gene flow, mutation, and drift affect allele frequencies (microevolution).
- Explain models of speciation (macroevolution).
- Explain how biological information is used to generate a phylogenetic tree and how to interpret the relationships displayed on a tree.
- Explain the origin and scope of biological diversity (including humans).
- Explain the position of humans within the tree of life including major adaptations along that lineage

3) Pathways and transformations of energy and matter: life processes in living systems organize and convert matter and energy
- Explain and connect fundamental metabolic pathways at the organismal level.
- Explain conversion of light energy into chemical energy.
- Describe the limitations inherent in transformations of energy and matter, especially at the population level.

4) Information flow, exchange and storage: Inheritance and expression of genetic material
- Explain how cell division generates new cells.
- Explain how gene expression drives development and responds to environmental conditions.

5) Systems: Understanding biological systems requires both reductionist and holistic thinking because novel properties emerge as simpler units assemble into more complex structures
- Provide examples of structural complexity and information content at the cellular, organismal, population and ecosystem levels.
- Explain the flow of energy, materials and information among cells, organisms, populations and ecosystems.
- Explain homeostasis and give examples of positive and negative feedbacks at the cellular, organismal, population and ecosystem levels.
- Connect specific biological systems to the Earth's ecosystem as a whole.

Furthermore, this course satisfies ACE Student Learning Outcome 4: *Use scientific methods and knowledge of the natural and physical world to address problems through inquiry, interpretation, analysis, and the making of inferences from data, to determine whether conclusions or solutions are reasonable.*

Prerequisites

Completion of High School Chemistry or CHEM 109. Completion of LIFE 120 and LIFE 120L is required. Concurrent or prior enrollment in LIFE121L is required.

Contact Information and Office Hours

Chad's office hours are Monday 2:30 PM – 3:30 PM or by appointment. Busy/free times on my calendar can be viewed at http://www.unl.edu/cbrassil/calendar. In addition, you can stop by Chad's office any time, 416 Manter Hall or call at 402-419-0076. Chad can be reached via email at cbrassil@unl.edu, although you will receive a more immediate answer via phone or by drop-in.

Clay's office hours are Thursday 11:00 AM – 12:00 PM or by appointment. If you would like to make an appointment, please look at Clay's calendar at http://cressler.weebly.com/calendar and email him at ccressler2@unl.edu with one or two suggested meeting times. For any other questions, feel free to email, call at 402-890-7300, or stop by Clay's office (424 Manter). An important note about email: if you send an email late at night or on the weekend, it is likely that you will not receive a reply until the following weekday morning.

The teaching assistant for the course is Erica North. Her office hours are Thursday 1:30 PM – 2:30 PM in 416 Manter Hall or by appointment. Erica can be reached via email at erica.m.north.94@gmail.com.

Disability Assistance

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Class Periods

Readings are indicated by the chapter number from "Campbell Biology in Focus". The chapters should be read, pre-class videos should be watched, and the MasteringBiology assignment is due ***before*** the start of the listed class period. During our face-to-face time in the classroom we will proceed with the expectation that you have been exposed to the material at an introductory level, and we will work on a deeper understanding of the material.

Our class room meetings will be automatically recorded and posted in Canvas. These can be used to review material or catch up on missed class periods. Note, this means that your image and/or your voice may be included in these recordings.

Topics are structured around four major themes. The first quarter of the class is focused on evolution as a process. The second quarter of the class is focused on diversity and the history of life. The third quarter is focused on the form and function of plants and animals, in other words physiology. The last quarter of the class is focused on ecology.

The specific Learning Objectives for each of these class periods is listed later in this syllabus, organized in a separate table.

	Date	*No.*	**Assignment**	***Topic***
M	22-Aug	1	**Pre-assessment**: Exam Commons (Aug 22 – Aug 26)	Introduction to course; revisit key LIFE120 concepts, Ch 10-11
W	24-Aug	2	Ch 19.2	Evolution overview
F	26-Aug	3	Ch 21.1-21.2	Variation and Hardy-Weinberg Equilibrium
M	29-Aug	4	Ch 21.3	Selection and Drift
W	31-Aug	5	Ch 21.4	Variations of Natural Selection
F	2-Sep	6	Ch 22.1-22.2	Allopatric and Sympatric Speciation
M	5-Sep			NO CLASS
W	7-Sep	7	Ch 22.3-22.4	Hybrids & Speciation Speed
F	9-Sep	8	Ch 20.1-20.2	Phylogenic tree thinking
M	12-Sep	9	Ch 20.3	Constructing Phylogenies
W	14-Sep	10	Ch 20.4-20.5	Molecular Clocks & Domains of Life
F	16-Sep	11		Synthesis and Review
M	19-Sep		**EXAM 1**: Exam Commons (Sept 16 – Sept 20)	
W	21-Sep	12	Ch 24.1-24.2	Origin of Life and Prokaryote Structure
F	23-Sep	13	Ch 24.3-24.4	Prokaryote Genetics and Diversity
M	26-Sep	14	Ch 25.1-25.2	Evolution of Eukaryotes
W	28-Sep	15	Ch 26.1-26.2	Early Land Plants and Fungal Associations
F	30-Sep	16	Ch 26.3-26.4	Land Plants
M	3-Oct	17	Ch 27.1-27.2	Early Animals
W	5-Oct	18	Ch 27.3-27.4	Animal Diversity
F	7-Oct	19	Ch 27.5-27.6	Land Animals
M	10-Oct	20		Synthesis and Review
W	12-Oct		**EXAM 2**: Exam Commons (Oct 10 – Oct 13)	
F	14-Oct	21	Ch 29.2	Plant transport
M	17-Oct			NO CLASS
W	19-Oct	22		Plant transport
F	21-Oct	23	Ch 29.7 & Table 29.1	Phloem and Essential nutrients
M	24-Oct	24	Ch 29.5-29.6	Xylem and Stomata
W	26-Oct	25	Ch 32.2-32.3	Feedback and Hormones
F	28-Oct	26	Ch 32.4	Osmoregulation
M	31-Oct	27	Ch 33.1-33.2	Animal Nutrition
W	2-Nov	28	Ch 33.4-33.5	Diet adaptations and Hormonal Regulation
F	4-Nov	29	Ch 34.1 & 34.5	Circulation and Respiration
M	7-Nov	30	Ch 36.1	Sexual/Asexual Reproduction
W	9-Nov	31		Synthesis and Review
F	11-Nov		**EXAM 3**: Exam Commons (Nov 9 – Nov 13)	
M	14-Nov	32	Ch 40.1	Global Abiotic Controls on Distribution
W	16-Nov	33	Ch 40.3 & 40.5	Mathematics of Population Growth
F	18-Nov	34		Mathematics of Population Growth
M	21-Nov	35	Ch 40.6	Density Depend. and Trade-offs
W	23-Nov			NO CLASS

F	25-Nov			NO CLASS
M	28-Nov	36	Ch 41.1	Species Interactions
W	30-Nov	37	Ch 41.2	Community Interactions
F	2-Dec	38	Ch 41.3 & Ch 42.1	Succession & Ecosystems
M	5-Dec	39	Ch 42.2-42.3 **Post-assessment**: Exam Commons (Dec 5 – Dec 9)	Ecosystem energy
W	7-Dec	40	Ch 42.4	Ecosystem cycles (& Student Evaluations)
F	9-Dec	41		Synthesis and Review
	17-Dec		**EXAM 4**: Exam Commons (Dec 9 – Dec 14)	

Required Materials

1) Urry, LA, ML Cain, SA Wasserman, PV Minorsky, and JB Reece. 2016. Campbell Biology in Focus. 2nd Edition. Paper or ebook version.

MasteringBiology Access Code (get this packaged with Campbell Biology in Focus for best price, see next section). Note, you will want the "Modified Mastering" that integrates with Canvas, which is different than the standard Mastering. In addition, purchasing the copy with eText will give you free access to LearningCatalytics, a required tool for the course. The correct version is what is available to purchase from the University Bookstore.

If you took LIFE 120 this is the same text and can be used at no additional cost. If you purchased the 1st edition with eText, you will automatically be moved to the 2nd edition when you login with access to the 2nd edition eText. See directions below in the "MasteringBiology" section for instructions on using previously purchased MasteringBiology access.

2) A ***smartphone, tablet, or notebook computer*** which can run LearningCatalytics is also required. LearningCatalytics is included with the purchase of MasteringBiology with eText. Otherwise you will need to purchase it separately.

Attendance

Attendance is not formally taken at lectures, but regular attendance will increase your chance of maximizing the Learning Catalytics portion of your grade (see below). Lectures are structured to be interactive so as to enhance your learning, and attendance is encouraged for successful completion of the course.

Grades

Grades will be posted on Canvas throughout the course. Cumulative grade percent will be determined using the following weighting by category. Details on categories are listed below.

Percent	Category
2%	**Surveys**
4 %	**Pre-class Videos (drop lowest 3)**
10%	**MasteringBiology (drop lowest 3)**
13%	**Learning Catalytics (50% right for full credit)**
4 %	**Post-class Quizzes (drop lowest 3)**
65%	**Exams (4 total)**
2%	**Team Peer Assessment**

Total points within each category will be summed and weighted by the percent contribution to the cumulative grade. Each exam, including the last exam, will focus on material covered during that quarter of the semester. Integrative questions may address broad concepts from previous sections of the course.

Final letter grades will be determined via the following scale, in other words 90.0% or higher is an A-.

Letter	F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Min %		60.0%	63.0%	67.0%	70.0%	73.0%	77.0%	80.0%	83.0%	87.0%	90.0%	93.0%	98.0%

Do not email me or stop by my office following the posting of final grades with a request that your letter grade be adjusted. Requests for a higher course letter grade following the posting of final letter grades will not be honored, unless they represent a specific error in grade calculation. In general across your college career, any such requests erode respect from the instructor, diminishing the opportunity for positive future interactions with that professor, or potentially other professors with whom that professor interacts. Take responsibility for your grade during regular course assignments, and then take ownership for the grade you earned at the end of the course. The time to discuss course performance with your instructor is during the 15 regular weeks of the semester.

Note, ***plagiarism or cheating*** will not be tolerated in this class. Plagiarism, cheating or any other violation of the UNL Student Code of Conduct will be rewarded with an F for the course and your case will be forwarded to the University Judicial Board.

Surveys

At various times throughout the course you may be asked to complete surveys. For example, the first survey gathers information that is used to place you into effective groups. Other surveys may ask you opinion on various educational research activities that are taking place in our classroom. All of the surveys are graded on a participation basis.

The first and last week of class you are assigned a pre-assessment and a post-assessment to be completed in the exam commons. For completing these you earn participation points in the surveys category.

Pre-class Videos

Before nearly every class period, there is an assigned reading in the class schedule above. Accompanying that reading is an online pre-class video. The video is a mini-lecture reviewing the material from the reading. You should read the text AND watch the pre-class video, all before coming to class that day. You will be assigned a grade based on the fraction of the pre-class videos you fully watch before each class period. The 3 lowest scores are dropped automatically by Canvas. This accommodates possible technical glitches, days you forget, etc.

MasteringBiology

MasteringBiology is an online set of exercises and quizzes. The due date for completing assignments is the start of class on the due date. After the start of class, MasteringBiology scores will be reduced 5% for each hour past the deadline. The 3 lowest scores for MasteringBiology assignments are dropped automatically by Canvas. This accommodates possible technical glitches, days you forget, etc.

Register for MasteringBiology within Canvas, which will connect the accounts. ***Please follow these step-by-step directions carefully in order to minimize problems with MasteringBiology.***

A) If you purchased MasteringBiology for LIFE 120, follow these directions:

1) Log in to http://www.pearsonmylabandmastering.com/ with your Pearson account. Check to see if your previous LIFE 120 course is listed. You probably have to click on the Inactive section since it is an old course. If you don't see it, try a different Pearson account until you find the account you used for LIFE 120.

2) Once you have confirmed that your Pearson account has Mastering connected to it, then and only then, click on the "MyLab and Mastering" menu item in Canvas and connect Canvas to your Pearson account. Log in with that Pearson account, and accept any legal notifications. Now jump to step #3 below.

B) If you have not previously taken LIFE 120 and have just purchased Mastering, follow these directions:

1) Click on the "MyLab and Mastering" menu item in Canvas and connect Canvas to your Pearson account. Log in with your Pearson account, enter your access code and accept any legal notifications. If you don't already have a Pearson account, you can create one.

2) Click on a link to take you to the Mastering Home Page. If it hangs on this step, be sure your browser is allowing pop-ups for Canvas and/or Mastering.

Everyone (A & B):

3) Once you are on the Mastering home page, find and click on the Learning Catalytics link.

4a) If it asks you for a Session ID, everything is working. The Session ID will be displayed during class on the projector.

4b) If it asks you to purchase LearningCatalytics, that means you purchased a version of Mastering that does not contain access to the eText and therefore does not contain a free copy of LearningCatalytics. You now need to purchase LearningCatalytics. You now need to purchase LearningCatalytics ***through the link in Mastering with your same Pearson account from above***. The 6-month access is adequate for this course.

Learning Catalytics

A typical class period will include a number of questions deliver via the Learning Catalytics program. Many of these will include an explicit discussion with your neighbor. Learning Catalytics questions will be scaled so that if you get 50% or more correct for the questions which can be automatically graded during the semester, you will get full credit for this portion of the total grade. Note, points per question varies, with team assessments generally being worth more points. Keeping the percentage low (50%) accommodates the fact that questions are designed for you to practice learning the material, but still rewards you for doing well. Keeping the percentage low also accommodates students who need to miss a class period for various reasons.

Post-class Quizzes

Post-class quizzes are available as a Canvas Assignment immediately following class. The quiz is due by midnight that same evening. The purposes of these classes are to provide you with additional, spaced opportunities to review the material and check your level of understanding.

Exams

Exams are taken individually on computer-based system called Maple TA. Question types include multiple choice, multiple selection (or many choice), drop-down options, numerical, etc.

Exams are proctored at the Exam Commons, located in the southeast corner of Adele Coryell Hall Learning Commons (Love Library North; http://dlc.unl.edu). You need to pre-schedule an exam time in advance. Two weeks before the opening date of the exam you should receive an email notification that your scheduling window has opened. All students are responsible for self sign-up and early sign-up is recommended. Time slots fill up quickly. Login to their website to schedule an exam time https://dlc-reserve.unl.edu/. Plan ahead!

If you miss your scheduled exam time, you will be locked out of the exam. If you contact an instructor, we can request a make-up opportunity; however, the ***same exam due date still applies***. Furthermore, this will be dependent on the availability of time slots in the Exam Commons, which can be very limited. In addition, there will likely be a delay in the time it takes for us to view your email, submit the request, and for that request to be approved. For example, if you scheduled your exam for the last day and you miss it, it is very likely you will not be able to take the exam. Do not miss your scheduled exam time!

You must bring your N-Card. Before you begin an exam, you must place your personal items in your pre-assigned locker and check-in with Digital Learning Center staff at the front desk. No notes, electronic devices, calculators, cell phones, headphones or ear buds. The only exception to this is an approved language translator for English Language Learners, electronic or book format and/or an English Dictionary. You cannot bring your own calculator to the exam; however, you may use the Windows-based calculator on the computer.

Team Peer Assessment

Properly preparing for class will prepare you to be a productive member of your team. Near the end of the semester, you will be asked to rate members of your Learning Catalytics Team. Completing the rating of other team members will be part of the "Surveys" score. The rating from your fellow team members will form your Team Peer Assessment score.

Extra Credit

Extra credit is available for completing a book report from the Extra Credit Book List. Four points will be added to the score of your third exam if you complete a valid, and thoughtful book report. The report should be 450-550 words long. It should briefly summarize the key point or purpose of the book, but also evaluate the quality and style of the book. See the example book reviews from the Quarterly Review of Biology to get a sense of style and tone. The due date is Friday, November 18. Reports should be submitted via Canvas in the "Assignments" section.

Learning Objectives

The course Learning Goals near the top of the syllabus describe general themes that may cross a number of specific points. The Class Periods schedule near the middle of the syllabus lists assigned chapters, homework, and general topics for each class. The Learning Objectives listed here are the very specific things that you are expected to be able to do in this class. In class activities and assessments designed to reinforce and practice these Learning Objectives. Exams are structured to assess these specific, measurable Learning Objectives.

Lecture	Chapter	Learning Objectives
2	19.2	Tell the story of the discovery of evolution, including key people and places
		Articulate the intellectual background and key historical observations in which the idea of evolution arose
		Explain how heritable variation and differential fitness leads to evolution by natural selection
3	21.1	Explain sources of variation among individuals
		Trace the possible fates of different kinds of mutations, along with the likelihood of those outcomes and the roles they play in evolution
		Describe the consequences for genetic variation of short generation times
		Describe the role that sex plays in evolution
	21.2	Calculate allele frequencies based on genotype frequencies
		List the assumptions of Hardy-Weinberg equilibrium

		Predict genotype frequencies based on allele frequencies for a population in Hardy-Weinberg equilibrium
4	21.3	Contrast the consequences of natural selection, drift, and gene flow
		Identify conditions under which drift plays a larger role, and the consequence of that drift
		Identify conditions under which gene flow occurs, and the potential consequences
5	21.4	Characterize selection as directional, disruptive, stabilizing, sexual selection, heterozygote advantage, or frequency-dependent, and the describe the consequences of each
		List constraints of evolution by natural selection: existing variation, historical constraints, trade-offs, chance
6	22.1	Apply various species concepts in the context of their utility
		Classify reproductive isolating mechanisms, especially pre-zygotic and post-zygotic as a key point of differentiation
	22.2	Describe the steps in allopatric speciation and the evidence for allopatric speciation
		Describe mechanisms and examples of sympatric speciation
7	22.3	Interpret a hybrid zones by applying principles of speciation
		Describe 3 possible outcomes of secondary contact
	22.4	Characterize the range of timescales over which speciation occurs
		List evidence for the number genes involved in reproductive isolating mechanisms
8	20.1	Interpret relatedness from a phylogeny while using appropriate terminology
	20.2	Differentiate a homology from convergent evolution using appropriate evidence
9	20.3	Differentiate monophyletic from non-monophyletic categorizations
		Differentiate shared derived characters from shared ancestral characters
		Given a set of characters for species, construct the most parsimonious tree
10	20.4	Explain how a molecular clock works
		Predict the speed and reliability of different molecular clocks and describe strategies to overcome these limitations
	20.5	List the three domains of life and their evolutionary relationship
		Define Horizontal Gene Transfer and its role in the evolution of early life on the planet
12	24.1	List the hypothesized order of events that lead to the origin of life and the evidence for each
	24.2	Differentiate among prokaryote morphological structures based on function
		Categorize metabolic diversity in prokaryotes
13	24.3	Name and describe the 3 mechanisms of genetic recombination in prokaryotes
	24.4	Sort bacteria into 1 of the 5 major clades based on key characteristics
		Describe environments in which you would be likely to find Archaea

14	25.1	List the steps in the endosymbiont theory, the associated evidence, and its consequences for Eukaryotic evolution
	25.2	List the steps in the evolution of multicellularity along with supporting evidence
		Describe the number of genes involved in the evolution of multicellularity and the evidence for this statement
15	26.1	List the major traits of Land Plants, the phylogenetic history of those traits in related clades, and the supporting fossil evidence
		Explain how each trait of Land Plants facilitated the transition to land
		Define relationships and the terminology in "Alternation of Generations"
	26.2	Describe fungal nutrition and the major adaptations involved
		Draw a fungal life cycle, labeling the unique stages of fungi and their genetic state
		Describe the relationship mycorrhizae have with plants, and list the evidence for this relationship being central to the colonization of land by plants
16	26.3	Define the function and evolutionary history of key anatomical traits across clades: rhizoids, vascular tissue, roots, leaves, xylem, phloem
		Describe the relationship between and relative size of sporophytes and gametophytes in bryophytes, lycophytes, monilophytes, and seed plants
	26.4	Relate the principle of Alternation of Generations to the specific case of Seed Plants
		Describe how seeds and pollen are adaptive and how that is supported by historical and current distributions
		Label the parts of a flower and the role each plays in reproduction
17	27.1	List the animal groups documented during the Ediacaran
		Delineate the unique features of Animals, Eumetazoans, Porifera, and Cnidarians, including multicellularity, tissue structure, and feeding mode
	27.2	Describe what occurred during the Cambrian explosion and theories as to why it occurred
		Define Bilaterians in terms of structure, phylogeny, and diversity
18	27.3	Differentiate among animal body plans
		Describe Arthropod diversity, body plan, and fossil history
	27.4	Trace the lineage of major adaptations through early Chordates to Tetrapods
19	27.5	Explain which clades invaded land and the adaptations that facilitated the transition
	27.6	Trace the lineage of major adaptations through Tetrapods to Humans
21 & 22	29.2	Differentiate apoplastic from symplastic routes
		Describe the steps in transporting solutes across membranes in plants including proton pumps, cotransport, and ion channels, as well as the utility of each mechanism
		Make quantitative predictions about solute potential, water potential, and pressure potential change in a plant cell placed in a solution
23	29.7	Describe the mechanism by which phloem operates and the utility of phloem while connecting cross membrane transport mechanisms to bulk flow

	Table 29.1	List the major elemental components of a plant while differentiating essential elements, macronutrients, and micronutrients
24	29.5	Describe the mechanism by which xylem operates and the utility of xylem while contrasting it with phloem
	29.6	Detail the cellular mechanisms, organismal cues, and environmental conditions that result in opening and closing of stomata
25	32.3	Discriminate between a regulator versus a conformer
		Make predictions about how homeostasis is maintained in a feedback system, including the role of individual components and the level of the system as a whole
		Explain how adaptions maintain homeostasis in thermoregulation, including endothermic metabolism and anatomy, ectothermic behaviors, vasodilation/constriction, countercurrent exchange, acclimatization, and the role of the hypothalamus
	32.2	Contrast the role of hormones in organismal coordination versus other methods such as neurons
		Differentiate endocrine pathways such simple, neuroendocrine, and hormone cascades and identify feedback mechanisms in each
		Differentiate hormonal mechanisms of action including signal transduction, sex hormones, and differential response in tissues
26	32.4	Define osmolarity, hyperosmotic, isoosmotic, hypoosmotic, and list animals that are osmoregulators and osmoconformers
		Contrast adaptations for osmoregulation in freshwater ray-finned fish and saltwater ray-finned fish
		Contrast the mechanism and utility of the 3 major strategies used by animals to deal with nitrogenous waste
		Order steps in the creation of urine and relate these to protonephridia, Malpighian tubles, and nephrons in kidneys as well as to the animals in which these are found
27	33.1	Categorize and describe the source of essential nutrients in animals such as fatty acids, amino acids, vitamins, or minerals
		Identify which essential nutrients in animals are more or less likely to cause problems due to excess or deficient quantities, including categorizing specific vitamins as fat-soluble versus water-soluble
	33.2	Define what happens at each of the 4 main steps of food processing in animals Describe the unique features of food processing adaptations and the organisms in which they are found including: intracellular/extracellular digestion, gastrovascular cavity, alimentary canal, and gizzard
28	33.4	Discriminate among teeth as adaptations for diet
		Describe various adaptations utilized by animals to digest plant material, including those utilizing mutualists
	33.5	Interpret information on hormonal feedback mechanisms for digestion and satiation
		List and relate all components that maintain glucose homeostasis and how diabetes melitus disrupts that system

29	34.1	Contrast the utility of and organisms that use open and closed circulatory systems, including the terms blood, hemolymph, arteries, veins, and capillaries
		Contrast the utility of and the organisms that use single, double circulation, 3 chamber, and 4 chamber hearts
	34.5	Explain the different challenges faced by organisms conducting gas exchange in water versus air
		Describe how water movement in general and countercurrent exchange specifically, aids gas exchange in gills
		Compare air-based adaptations for gas exchange across different animals including systems that use a tracheael systems, lungs and alveoli, or skin
30	36.1	List mechanisms of asexual reproduction
		Define the twofold cost of sex and why, in the face of that cost, sex can still be adaptive
		Provide examples in which gender adaptations facilitate mating including cases of female-female mounting behavior, hermaphroditism, and sex changing fish
		Relate internal and external fertilization to colonization of land and to parental care
32	40.1	Explain how major structural features of earth shape major climate patterns, including latitude, mountains, water bodies, global circulation patterns, and the tilt of the earth
		Differentiate among the major terrestrial biomes, including the influence of climate and disturbance
33 & 34	40.3	Contrast the major categories of factors that determine distribution of a species, with an emphasis on abiotic examples
	40.5	Using words, equations, and graphs, describe the assumptions of and consequences of the exponential growth model
		Using words, equations, and graphs, describe the assumptions of and consequences of the logistic growth model, contrasting that with the exponential growth model
35	40.6	Provide examples of life history trade-offs
		Describe mechanisms of density-dependence and contrast those with density-independent situations
		Apply the terminology of metapopulations to examples
36	41.1	Categorize pairwise interactions based on key information or data
		Within competition, explain the relationship between key concepts such as exclusion, niche partitioning, and character displacement
		Within predation, use coloration terminology to categorize adaptations such as mimicry
37	41.2	Use the intuition behind the Shannon diversity index to interpret diversity scenarios
		Summarize the evidence for the relationship between diversity, stability and productivity
		Identify the basic structure and terminology of food chains and food webs

		Differentiate between dominant species, keystone species, and ecosystem engineers
		Differentiate between top-down and bottom-up control in food chains
38	41.3	Differentiate the history of ideas in community ecology, their proponents, and how they influences our current understanding of succession
		Describe the basic processes, outcomes, and weaknesses of the Intermediate Disturbance Hypothesis
		Apply basic succession terminology to ecological scenarios including primary, secondary, facilitation, inhibition, tolerance, disturbance and nonequilibrium dynamics
	42.1	Connect the 2nd law of thermodynamics to the idea that energy flows in ecosystems and conservation of mass to the idea that chemicals cycle in ecosystems
		Label trophic levels, including the detrital food chain, for organisms and diagrams
39	42.2	Differentiate between GPP, NPP, and NEP conceptually and in terms of expressions
		Utilize knowledge on the limits to NPP in aquatic and terrestrial systems to characterize ecosystems
	42.3	Relate physiological process to secondary production at the ecosystem scale by defining production efficiency and trophic efficiency
		Qualitatively predict the net production pyramids and biomass pyramids based on tropic efficiency and turnover time, relating this to real ecosystems
40	42.4	Relate the factors that control decomposition to the relative size of nutrient pools in different ecosystems
		Contrast the key processes (biotic and abiotic) in the water, carbon, nitrogen, and phosphorus cycle including an identification of the main reservoirs