Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring
Year: 2025
Course Prefix: BIOL
Course and Section #: 1620-601
Course Title: College Biology II
Credits: 3

Course Description

BIOL 1620 Provides the second semester material in the two semester introductory course designed for biology majors. Covers the evolution of life, the relationships between major taxa, anatomy and physiology of these major taxa, and interactions between living organisms and their environments. Discusses major current issues in the biological field.

Course Attributes

This course has the following attributes:

☐ General Education Requirements

☐ Global/Intercultural Graduation Requirements

☐ Writing Enriched Graduation Requirements

☐ Discipline Core Requirements in Program

☒ Elective Core Requirements in Program

☐ Open Elective

Other: *Click here to enter text.*

Instructor Information

Instructor Name: *Dr. Jeoffrey Zhan*

Student Learning Outcomes

Upon successful completion, students should be able to:

1. Analyze phylogenetic trees and the morphological and molecular data that are used to construct them
2. Explain how fossil and phylogenetic evidence work together to illustrate how life is related and has evolved on Earth
3. Summarize the major hypotheses and theories that explain the evolution of life on Earth from unicellular to complex multicellular life forms as well as the evidence that supports these hypotheses and theories
4. Compare the anatomy and physiology of the major taxa of living organisms
5. Describe the scientific interpretation of animal behavior

6. Investigate how we study ecological systems at the organismal, population, community, ecosystem, and biosphere levels
7. Evaluate ways humans impact and modify organisms and what tools we can use to avoid, mitigate, and repair negative impacts

Upon successful completion, students should have the following attitude(s)/traits:

1. Confidence in understanding that scientific principles and processes of evolution are sufficient to describe how living organisms originated anddiversified
2. Appreciation of the diversity of living organisms, their structure and function
3. Appreciation of the dynamics of interactions and interdependencies of biotic and abiotic components of the biosphere, the impact of humans on the biosphere

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Course Materials and Texts

Campbell, Neil A. and Reece, Jane B. Biology. Benjamin Cummings. San Francisco. Any edition 8th or newer

Course Requirements

Course Assignments, Assessments, and Grading Policy

There are 700 points possible in this course (detailed below). The following grading scale applies with no exceptions (These are the minimum point values for the listed letter grades):

Letter Grade	Minimum points
A	600
B+	590
B	540
C+	530
C	460
D+	450
D	380
E	<380

Item	Possible Points	Total Possible
Pre-test	50 pts	50 pts
4 Exams	100 pts each	400 pts
10 Reading quizzes	10 pts each	100 pts
Your-Choice Assignments	Varies	100 pts
Post-test	50 pts	50 pts

Required or Recommended Reading Assignments

Campbell Chs 25-26
Campbell Chs 22-23

Campbell Ch 27
Campbell Ch 28
Campbell Ch 32
Campbell Chs 33-34
Campbell Ch 31
Campbell Chs 29-30
Campbell Chs 35, 37 (optional)
Campbell Chs 39, 51 (Optional)
Campbell Chs 52, 53
Campbell Chs 54-55

General Description of the Subject Matter of Each Lecture or Discussion

Major Topics 10
Major Points:
- Describe common ancestor of all plants
- How are charophytes related to plants and why are they NOT plants?
- Derived traits of plants = alternation of generations, walled spores in sporangia, multicellular gametangia, apical meristems
- What enabled transition of plants to land? What were challenges and benefits of life on land?
- Evolutionary trends in plants (reduced gametophyte, increased sporophyte... spores -> vascular tissue -> seeds -> flowers)
- Timeline of those "events"
- Four major plant groups (non-vascular, seedless vascular, naked seed, flowering seed)
- Plant phyla: Liverworts, Hornworts, Mosses, Lycophytes, Pterophytes(Monilophytes), Ginkgos, Cycads, Gnetophytes, Conifers, Anthophytes)
- For those phyla, know: major anatomy, life cycle, rough timeline of emergence in fossil record)Major Topics 11
Major Points:
- When, Why/How did seeds evolve?
- Seeds are diploid embryo surrounded by haploid gametophyte tissue and some food in a protective coating
- Why are seeds handy?
- Derived traits of seed plants
- Life cycles include heterospory and pollen
- Gametophyte makes gametes, Sporophyte makes spores, spores grow into gametophyte
- Heterosporous plants have two DIFFERENT types of spores (meaning two different gametopyhytes)
- Pollen is the gametophyte generation (makes male gametes)
- Gymnosperms vs Angiosperms
- Angiosperm double-fertilization can lead to triploidy
Major Topics 12
Major Points:
- Define "behavior"
- Bad ideas in study of behavior: Nature vs nurture, reinforcement "theory", universality
- Proximate vs ultimate (evolutionary) causes for behaviors
    proximate = immediate stimuli, physiological and anatomical mechanisms
    ultimate = evolutionary significance of a behavior (why that behavior evolved)
- Types of behavior:
    - fixed action pattern
    - taxis / kinesis
    - learned (habituation, imprinting, spatial, associative)
- Classical vs Operant conditioning
- Superstition = False signal still elicits a behavior, this makes sense evolutionarily, even though it seems dumb
- Cognition seems to be somewhat rare
- Behaviors influence fitness and are selected for (or against) by the environment like any other trait
- Behavioral traits are rarely the result of a single gene though

- How does the story of cuckoos depend on the evolutionary pressures on behaviors?
Major Topics 13
Major Points:
- Ecology is study of interactions between organisms and environment
- Increasing scale of complexity: Organismal -> Population -> Community -> Ecosystem -> Landscape -> Global
- Climate is not weather
- Major biome categories (Tundra, Desert, Tropical Rainforest, etc) are broadly shaped by temperature and precipitation (climate!)
- What controls species distributions? Dispersal barriers and environmental filtering
- Ecological change and evolutionary change feed off of each other

- How do you read a chart that shows uncertainty?
- What is a "model?"
- What are the causes of current rapid climate change?
- What does population genetics reveal about extant human population(s)?
Major Topics 14
Major Points:
- Population vs Community
- Symbioses are a spectrum from Parisitism to Mutualism
- Competition leads to resource partitioning because competition is bad for everyone involved
- "Niche" is how an organism makes a living. Realized niche is fundamental niche minus competition
- Trophic structure is limited by thermodynamics
- Why are big fierce animals rare?
- How to define and measure biodiversity? (richness and evenness)
- How to compare similarity of two communities with a bunch of different species? (How to read an ordination plot)
- Community ecology in "real life"
    - Microbiomes
    - Forensics
- Attine ants as a model system to study ecological interactions (Behaviors, Pathogens, Competition, Population growth, coevolution, symbioses, microbiomes, etc.)

Major Topics 1
Major Points:

- Early Earth conditions and the rise of oxygen
- Redox reactions
- Metabolism
- Environmental change relates to evolutionary pressures
- Mutations + Heritability + Selection Coefficient = Evolution
- Evolution is not goal oriented
- How to read a phylogeny (clades, ancestral nodes, sisters)
- Homologies (Orthologs and Paralogs) vs Analogies
- Organisms' evolutionary history is documented in their genomes
- Horizontal (Lateral) Gene Transfer
- Phylogenies are testable and falsifiable explanations of observed diversity (hypotheses) that make predictions
Major Topics 2
Major Points:
- Catabolism + Anabolism = Metabolism
- "Life" uses information to direct work in order to reduce entropy for a little while
- How do laws of thermodyanics relate to life?

- Overview of known 'big picture' phylogeny of living things (thermodynamically open systems)
- Major nutritional groups (Energy, Electrons, Carbon)Major Topics 3
Major Points:
- Nature of Science
- Fact, Hypothesis, Law, Theory
- Laws are descriptions that work so well we can use them for cool stuff
- Theories are explanations that work so well we can build new laws and theories off of them
- Lamarckian vs Darwinian evolution
- Mechanisms of evolution (Mutation, Selection, Gene Flow, Genetic Drift)
- Natural selection can only work with what is has (historical constraints) ...giraffe dissection
- All so-called "arguments" against evolution have so far been really pathetic
- Strong evidence that chimpanzees are humans' closest living relativeMajor Topics 4
Major Points:
- Bacteria and archaea
- Commonalities and differences
- Lateral (horizontal) gene transfer
- Where do plastids (chloroplasts, mitochondria, etc) come from and what evidence do we have for our theory?
- What is symbiosis?
- Metabolic cooperation ... metabolic tasks distributed among different species
- Global importance of "prokaryotes" (What processes do they control? Why is basic research worth pursuing?)
Major Topics 5
Major Points:
- Most eukaryotes are "protists"
- "Protists" are polyphyletic and a negatively defined group
- Eukaryotes are broadly divided into "supergroups" (your textbook is out of date on eukaryote phylogeny)
    - But we will still look at some supergroups and learn what makes each a "group"
    - SAR: Stramenophiles, Alveolates, Rhizarians
    - Archiplastida: shared plastid origin
    - Excavata
    - Amoebozoa
    - Opisthokonta
- Secondary endosymbiosis (and tertiary) ... What are the indicators and evidence
- "Protists" are ecologically and medically important (what are some examples?)Major Topics 6
Major Points:
- Defining characteristics of metazoans
    - Nutirtional mode
    - Multi-cellularity
    - Sexual reproduction with dominant diploid stage (usually)
    - Developmental genes
- Evolutionary timeline of metazoans
- HOW are metazoans multicellular? How did that evolve?
- Metazoan fossil evidence
- Cambrian radiation (when?, why?, so what?)
- Animal body plans (symmetry? tissues? body cavity?)
- Developmental biology (how did "tube" form?, tissue differentiation, "body plan" Hox genes code for transcription factors)
- How do we build animal phylogenies today vs how did we used to?Major Topics 7
Major Points:
- Most metazoans are invertebrates
- We're only covering SOME of the phyla of metazoans...of the ones we cover, know:
    - Major groups within that phylum
    - Life cycles
    - Symmetry, tissues, body cavity

- What ties them together as a group?
- What traits did the common ancestor of metazoans have?
- We go a bit deeper into one phylum, Chordata:
- What 4 traits make a chordate a chordate?
- Evolutionary history and major developmental hallmarks of Chordata
- Chordates, Craniates, Vertebrates, Gnathostomes, Tetrapods, Amniotes, Mammals
- How do humans fit these traits?
- Like ALL other extant clades, true phylogeny of Chordata is made up of mostly extinct species
- How did tetrapods transition to land? When? Where?
- Birds are totally dinosaurs, yo!
- We go further into one group of chordates, the mammals:
- What are derived traits of mammals?
- Evolutionary trends in mammals
- Evolutionary convergence of Monotremes, Marsupials, Eutherians
- Hominids vs Hominins
- Evolutionary trends of hominins
- Interbreeding between humans and other hominins
- Hominin expansion from AfricaMajor Topics 8
Major Points:
- Main fungal phyla (Chytrids, Zygos, Glomeros, Ascos, Basidios)
- Fungi are closely related to metazoans
- Fungal body plans (tiny blob, filament, or both)
- Life cycle of dikarya is a bit weird (karyogamy does not immediately follow plasmogamy)
- Sexual AND asexual reproduction (advantages of each?)
- Global importance of fungi
- Lichens are fungi that farm green stuff (several species make up a single organism)
- Fungi are expert symbionts (all plants depend on them)Major Topics 9
Major Points:
- Carnivorous plant evolution (what pressures? likely evolutionary pathway?)
- Why do carnivorous plants live where they do?
- What are N,P,K and what do plants use thhem for?
- What forms of N,P,K can plants use?
- What is going on at the interface of plant roots and soil?
- Nutrient cycles on Earth.... N,P,K
- Cation exchange in soil.... what is it? how is it done? what would happen without it, and how does that relate to plant carnivory?

- What is a GMO?
- What is a transgenic organism
- Where are transgenic organisms found in nature, and how did humans learn to create them ourselves?
- What is difference between artificial selection and modern targeted mutations?
- Why is scientific literacy so important for society?

Required Course Syllabus Statements

Generative AI

This course requires you to complete assignments that assess your understanding, application, and problem-solving ability applied to chemistry. You are expected to do your own work. Problem solving and scientific thinking are tools that are necessary for students to learn in this course. The use of artificial intelligence (AI) tools, such as chatbots, text generators, paraphrasers, summarizers, or solvers, is prohibited for all written assignments. Using these tools for those written assignments (Essays, book reviews) will be considered academic dishonesty and will be handled according to the university's academic honesty

policy. If you have questions about acceptable use of AI tools, please consult the instructor before submitting your work.

Using Remote Testing Software

☒ This course does not use remote testing software.

☐ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities

Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity

At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX
Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation
UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.
To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.