

LIFE 121 Fundamentals of Biology II

Consensus Syllabus

Current Instructors: Joe Dauer, Clay Cressler, Kristi Montooth, Roberto Cortinas, Chad Brassil, Bill Glider

Common Text: Urry, LA, ML Cain, SA Wasserman, PV Minorsky, and JB Reece. 2016. Campbell Biology in Focus, 2nd edition. Pearson.

The following topics are covered by all sections

Evolution

- Evolution by natural selection: variation, inheritance, and selection. (Ch 19.2)
- Hardy-Weinberg: expected genotype frequencies (Ch 21.2)
- Effects of selection, drift, gene flow, and mutations (Ch 21.1, 21.3)
- Types of selection (directional, balancing, sexual) and limits to selection (Ch 21.4)
- Speciation: Reproductive isolation, Ecological speciation, Incipient speciation, diversification (Ch 22)
- Creating and interpreting phylogenetic trees (Ch 20.1-20.3)
- Molecular Clocks (Ch 20.4)

Diversity of Life

- Major adaptations or key innovations that enabled important evolutionary transitions
- Three domains of life (Ch 20.5)
- Microbial metabolic diversity (Ch 24.2)
- Endosymbiosis (Ch 25.1)
- Evolution of Multicellularity (Ch 25.2)
- Land plant adaptations (Ch 26.1)
- Mycorrhizal Fungi and the invasion of land (Ch 26.2)
- Seeds (Ch 26.4)
- Land colonization by animals, including arthropods (Ch 27.3, 27.4)

Plant and Animal Physiology

- Compare/Contrast the major animal and plant systems
- Inputs and outputs of matter and energy at an organismal level
- Regulation and homeostasis: endocrine hormones, thermoregulation (Ch 32.1-32.2)
- Water balance in animals and kidneys (Ch 32.3)
- Water balance in plants: transport and stomata (Ch 29.2, 29.5, 29.6, 29.7)
- Animal digestion (parts of Ch 33, varies by section)
- Glucose regulation (Ch 33.5)
- Circulatory and Respiratory (Ch 34.1, 34.5)

Ecology

- Mechanisms of Global Climate and Terrestrial Biomes (Ch 40.1)
- Exponential and Density-dependent Growth, Metapopulations (Ch 40.3, 40.5, 40.6)
- Species interactions and community structure (Ch 41.1)
- Diversity, Stability, Keystone Predation, and Trophic Cascades (Ch 41.2)
- Disturbance and succession (Ch 41.3)
- Ecosystem Energy, Trophic Structures, Net Primary Production (Ch 42.1, 42.2)
- Ecosystem Matter: Pools, Fluxes, Carbon (Ch 42.3)
- Biogeochemical Cycles (Ch 42.4)
- Climate Change

All students take the same lab section with the following exposure (with the exception of summer CPBS students who have a field-based experience with the same main headings, but different specific implementation)

- Contact with real, physical organisms from across the diverse Tree of Life
 - Bacteria clade (Ch 24.4), Eukaryote clade (Ch 25.3), Animal fossils in Morrill Hall (Ch 27.3, 27.4), Plant clade (Ch 26.3), Vertebrate dissection on comparative digestion (Ch 33.4)
- Scientific inquiry: gather evidence to address a question, quantitatively reason through that evidence, and place those results in the context of existing knowledge
 - Drosophila selection cage on ebony
 - Tree phylogeny: leaf morphological-based and GenBank-based
 - Crayfish agonistic behavior
 - Comparative plant transpiration: Corn, Teosinte, Sorghum, Switchgrass
 - Paramecium-based food webs
- Communicate scientific results in writing, figures, and statistics
 - Write 5 abstracts in the format of the journal Nature
 - Statistics using www.graphpad.com: Null distribution and p-values, Chi-square test on frequencies, t-test on continuous means

The following are covered by some, but not all sections

- Historical views on Biological Change over time: Fossils and Lamarck (Ch 19.1)
- Creating and Interpreting Graphs and tables
- Adaptation across gradients: local adaptation and ecotypes
- Adaptation vs. Acclimation
- Genome evolution, genome diversification, gene trees
- Gene duplication (Ch 21.1)
- Fossil formation, geologic time, plate tectonic, species radiations (Ch 23.1-23.2)
- Evo-devo: homeotic genes (Ch 23.3)

- Evolution is not goal oriented (Ch 23.4)
- Origin of Life (Ch 24.1)
- Prokaryote Genetics: Transformation, Transduction, Conjugation (Ch 24.3)
- Prokaryote Diversity (Ch 24.4) [although all students exposed in lab]
- Eukaryote Diversity, especially single-celled (Ch 25.3, 25.4) [although all exposed in lab]
- Land Plant Diversity (Ch 26.3) [although all exposed in lab]
- Early Animals and Cambrian Explosion (Ch 27.1, 27.2)
- Animal digestion (parts of Ch 33, varies by section) [all exposed to Ch 33.4 in lab]
- Neuron signals and receptors (Ch 37.1, 37.4, 38.4)
- Signaling in plants (Ch 28.1, 28.2, 31)
- Plant Shoot and Root architecture (Ch 29.1)
- Sexual and asexual reproduction (Ch 36.1)
- Aquatic Biomes (Ch 40.2)
- Dispersion and Life Tables (Ch 40.4)
- Island Biogeography (Ch 41.4)
- Disease Ecology (Ch 41.5) and Immune System overview (Ch 35)
- Conservation Biology (Ch 43.2)