Instructor's Manual

to accompany

Life: The Science of Biology, Eleventh Edition

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Chapter 1: Studying Life

OVERVIEW

Chapter 1 introduces biology as the science of studying biological diversity through an evolutionary framework. This very broad chapter begins its discussion with crucial stages of evolutionary history, such as the origin of life and the evolution of photosynthesis. Unifying themes such as the genetic code, the production of proteins, and phylogenetics (with the tree of life) are introduced. Further, ecological topics, such as biological interactions and the definitions of an ecosystems, biomes and biosphere are also covered. The second third of the chapter is dedicated to an exploration of the scientific philosophy and method. Finally, the last part of the chapter connects the concepts of human health and well-being with modern biological understanding. This section includes the medical field, the green revolution and food production, and management of natural resources.

WHAT'S NEW

In Key Concept 1.1, the section of the book beginning with the fourth subheading *Biological information is stored in a genetic code common to all organisms* has been extensively reworked with significant added material. Figures 1.5 and 1.6 are new and introduce the process of Mendelian genetics and how genetic material is coded into proteins. Figure 1.8, comparing East Asian and African individuals, is new. The accompanying text discusses racial differences and genomics. In addition, an unnumbered figure has been added to introduce the phylogeny of apes (including humans), and Figure 1.9, introducing the tree of life, has been modified. Key Concept 1.2, which is about the scientific method, has been re-titled and rewritten. Included in this section are references to the completely updated Work with the Data and its associated questions, which has students examine and process data directly related to the experiments. Key Concept 1.3 has received only modest changes.

CHAPTER OUTLINE

Investigating Life: *Corals in Hot Water*

1.1 Living Organisms Share Similarities and a Common Origin

Life arose from non-life via chemical evolution
Cellular structure evolved in the common ancestor of life
Photosynthesis allows some organisms to capture energy from the sun
Biological information is stored in a genetic code common to all organisms

Populations of all living organisms evolve
Biologists trace the evolutionary tree of life
Cellular differentiation and specialization underlie multicellular life
Organisms extract energy and raw materials from the environment
Living organisms must regulate their internal environment
Living organisms interact

1.2 Biologists Investigate Life through Experiments That Test Hypotheses

Observing and quantifying are important skills
Scientific methods combine observation, experimentation, and logic
Good experiments have the potential to falsify hypotheses
Statistical methods are essential scientific tools
Investigating Life: *Corals in Hot Water*
  Experiment
  Work with the data
Discoveries in biology can be generalized
Not all forms of inquiry are scientific

1.3 Understanding Biology Is Important for Health, Well-Being, and Public-Policy Decisions

Modern agriculture depends on biology
Biology is the basis of medical practice
Biology can inform public policy
Biology is crucial for understanding ecosystems
Biodiversity helps us understand, enjoy, and appreciate our world
Apply What You've Learned

CHAPTER OPENER RESOURCES

Discussion Questions

1. Biodiversity is not spread evenly across Earth. Which areas would you expect to have higher diversity and which would you expect to have lower diversity? Why?
[*Note to Instructor*: Investigating this question should lead students to the topic of "biodiversity hot spots."]

2. Changes in temperature due to global climate change maybe one of the most important phenomena taking place on our planet. However, changing temperature is likely to affect different locations very differently. Consider how rising temperature might differentially affect a forest, a coral reef, and a coastal city.

3. Changes in CO_2 have been implicated in major effects on marine life. How would you expect changes in atmospheric CO_2 to affect ocean life?
[*Note to Instructor*: This question will bring students' attention to ocean acidification and the role of pH in shell and skeletal formation.]

Online Resources

American Museum of Natural History: What is biodiversity?
http://www.amnh.org/our-research/center-for-biodiversity-conservation/about/what-is-biodiversity

NASA: Graphic: The relentless rise of carbon dioxide
http://climate.nasa.gov/climate_resources/24/

NASA: Climate change: How do we know?
http://climate.nasa.gov/evidence/

NASA: Scientific consensus: Earth's climate is warming
http://climate.nasa.gov/scientific-consensus/

NOAA PMEL Carbon Program: Ocean Acidification: The Other Carbon Dioxide Problem
http://pmel.noaa.gov/co2/story/Ocean+Acidification

KEY TERMS

adaptation
aerobic
anaerobic
Archaea
Bacteria
binomial nomenclature
bioinformatics
biology
biome
biosphere
cellular specialization
community
comparative experiment
controlled experiment
cyanobacteria
data
deductive logic
DNA (deoxyribonucleic acid)
ecosystem
effector
effector mechanisms
eukaryotes
gene
genetics

genome
genomics
genus
hypothesis
inductive logic
internal environment
liposome
metabolism
model systems
mutation
nucleic acid
nucleotide
nucleus
null hypothesis
organ
organ system
photosynthesis
phylogeny
population
prokaryotes
protein
protists
RNA (ribonucleic acid)
sensory mechanisms
signaling mechanisms
symbiosis
tissue