Guided Chapter Tour

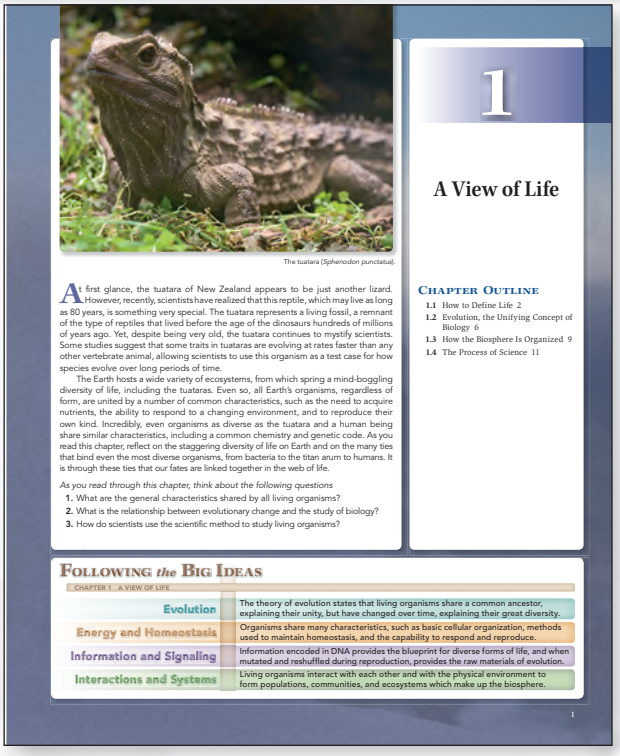
Pedagogy

Chapter Opener Each chapter opener now includes two to three questions designed to integrate the subject matter into the chapter and stimulate class discussions.

Chapter Outline The major sections that will be discussed in the chapter are listed for easy reference.

Before You Begin The content of each chapter is linked with material from earlier in the text. The questions designate important topics that students should understand before proceeding into the chapter.

Following the Big Ideas This section highlights the Big Ideas from the AP Curriculum Framework covered in the chapter.



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A View of Life

The tuatara (*Sphenodon punctatus*).

At first glance, the tuatara of New Zealand appears to be just another lizard. However, recently, scientists have realized that this reptile, which may live as long as 80 years, is something very special. The tuatara represents a living fossil, a remnant of the type of reptiles that lived before the age of the dinosaurs hundreds of millions of years ago. Yet, despite being very old, the tuatara continues to mystify scientists. Some studies suggest that some traits in tuataras are evolving at rates faster than any other vertebrate animal, allowing scientists to use this organism as a test case for how species evolve over long periods of time.

The Earth hosts a wide variety of ecosystems, from which spring a mind-boggling diversity of life, including the tuataras. Even so, all Earth's organisms, regardless of form, are united by a number of common characteristics, such as the need to acquire nutrients, the ability to respond to a changing environment, and to reproduce their own kind. Incredibly, even organisms as diverse as the tuatara and a human being share similar characteristics, including a common chemistry and genetic code. As you read this chapter, reflect on the staggering diversity of life on Earth and on the many ties that bind even the most diverse organisms, from bacteria to the titan arum to humans. It is through these ties that our fates are linked together in the web of life.

As you read through this chapter, think about the following questions

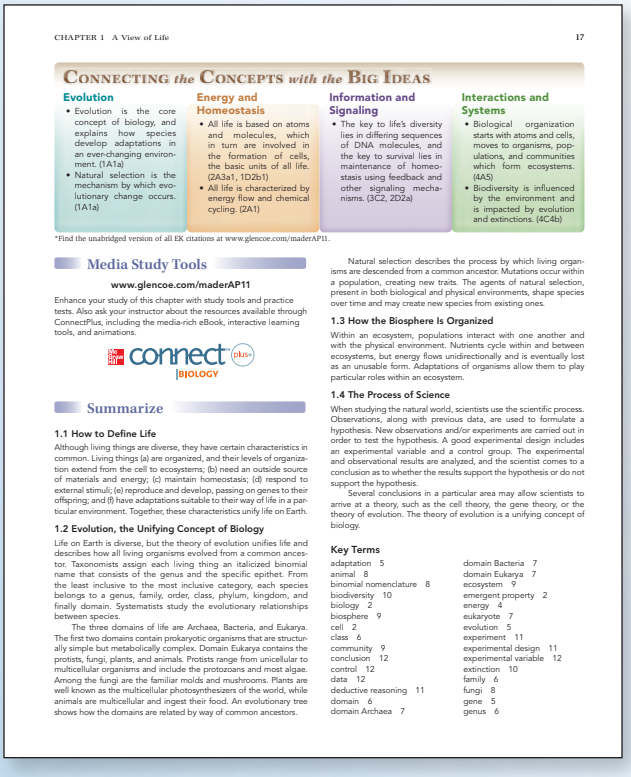
1. What are the general characteristics shared by all living organisms?
2. What is the relationship between evolutionary change and the study of biology?
3. How do scientists use the scientific method to study living organisms?

Chapter Outline

Following the Big Ideas

CHAPTER 1 A VIEW OF LIFE

Evolution	The theory of evolution states that living organisms share a common ancestor, explaining their unity, but have changed over time, explaining their great diversity.
Energy and Homeostasis	Organisms share many characteristics, such as basic cellular organization, methods used to maintain homeostasis, and the capability to respond and reproduce.
Information and Signaling	Information encoded in DNA provides the blueprint for diverse forms of life, and when mutated and reshuffled during reproduction, provides the raw materials of evolution.
Interactions and Systems	Living organisms interact with each other and with the physical environment to form populations, communities, and ecosystems which make up the biosphere.



CHAPTER 1 A View of Life 17

Connecting the Concepts with the Big Ideas

Evolution
- Evolution is the core concept of biology, and explains how species develop adaptations in an ever-changing environment. (1A1a)
- Natural selection is the mechanism by which evolutionary change occurs. (1A1a)

Energy and Homeostasis
- All life is based on atoms and molecules, which in turn are involved in the formation of cells, the basic units of all life. (2A3a1, 1D2b1)
- All life is characterized by energy flow and chemical cycling. (2A1)

Information and Signaling
- The key to life's diversity lies in differing sequences of DNA molecules, and the key to survival lies in maintenance of homeostasis using feedback and other signaling mechanisms. (3C2, 2D2a)

Interactions and Systems
- Biological organization starts with atoms and cells, moves to organisms, populations, and communities which form ecosystems. (4A5)
- Biodiversity is influenced by the environment and is impacted by evolution and extinctions. (4C4b)

*Find the unabridged version of all EK citations at www.glencoe.com/maderAP11.

Media Study Tools

www.glencoe.com/maderAP11

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Summarize

1.1 How to Define Life

Although living things are diverse, they have certain characteristics in common. Living things (a) are organized, and their levels of organization extend from the cell to ecosystems; (b) need an outside source of materials and energy; (c) maintain homeostasis; (d) respond to external stimuli; (e) reproduce and develop, passing on genes to their offspring; and (f) have adaptations suitable to their way of life in a particular environment. Together, these characteristics unify life on Earth.

1.2 Evolution, the Unifying Concept of Biology

Life on Earth is diverse, but the theory of evolution unifies life and describes how all living organisms evolved from a common ancestor. Taxonomists assign each living thing an italicized binomial name that consists of the genus and the specific epithet. From the least inclusive to the most inclusive category, each species belongs to a genus, family, order, class, phylum, kingdom, and finally domain. Systematists study the evolutionary relationships between species.

The three domains of life are Archaea, Bacteria, and Eukarya. The first two domains contain prokaryotic organisms that are structurally simple but metabolically complex. Domain Eukarya contains the protists, fungi, plants, and animals. Protists range from unicellular to multicellular organisms and include the protozoans and most algae. Among the fungi are the familiar molds and mushrooms. Plants are well known as the multicellular photosynthesizers of the world, while animals are multicellular and ingest their food. An evolutionary tree shows how the domains are related by way of common ancestors.

Natural selection describes the process by which living organisms are descended from a common ancestor. Mutations occur within a population, creating new traits. The agents of natural selection, present in both biological and physical environments, shape species over time and may create new species from existing ones.

1.3 How the Biosphere Is Organized

Within an ecosystem, populations interact with one another and with the physical environment. Nutrients cycle within and between ecosystems, but energy flows unidirectionally and is eventually lost as an unusable form. Adaptations of organisms allow them to play particular roles within an ecosystem.

1.4 The Process of Science

When studying the natural world, scientists use the scientific process. Observations, along with previous data, are used to formulate a hypothesis. New observations and/or experiments are carried out in order to test the hypothesis. A good experimental design includes an experimental variable and a control group. The experimental and observational results are analyzed, and the scientist comes to a conclusion as to whether the results support the hypothesis or do not support the hypothesis.

Several conclusions in a particular area may allow scientists to arrive at a theory, such as the cell theory, the gene theory, or the theory of evolution. The theory of evolution is a unifying concept of biology.

Key Terms

adaptation 5
animal 8
binomial nomenclature 8
biodiversity 10
biology 2
biosphere 9
cell 2
class 6
community 9
conclusion 12
control 12
data 12
deductive reasoning 11
domain 6
domain Archaea 7
domain Bacteria 7
domain Eukarya 7
ecosystem 9
emergent property 2
energy 4
eukaryote 7
evolution 5
experiment 11
experimental design 11
experimental variable 12
extinction 10
family 6
fungi 8
gene 5
genus 6

Connecting the Concepts with the Big Ideas Located at the end of each chapter these boxes include the most important items from the AP Curriculum Framework found within that chapter's pages. They also include citations for the illustrative examples.

Media Study Tools This feature provides a link to the Mader Online Learning Center, which contains animations, videos, and multimedia assets that can help the student succeed in their study of biology. In many chapters, icons direct teachers and students to the presence of 3D animations that may be used to further student comprehension of difficult topics.

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