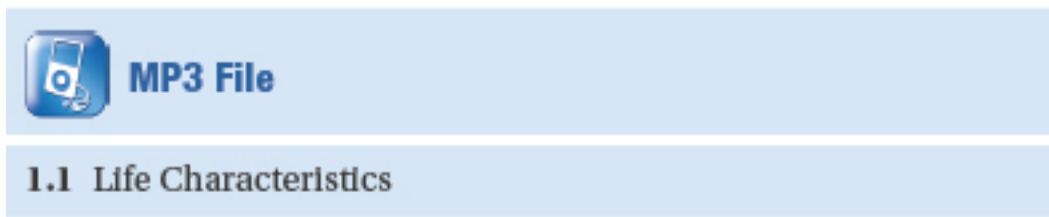




- Enhance your study of this chapter with media! Visit www.mhhe.com/maderhuman13e and go to “Media Study Tools” for this chapter to access the following:



SUMMARIZE

1.1 The Characteristics of Life

The Characteristics of Life

Biology is the study of life. All living **organisms** share common characteristics; they

- have levels of organization—**atoms, molecules, cells, tissues, organs, organ systems, organisms, populations, community, ecosystem, and biosphere;**
- acquire materials and energy from the environment. **Metabolism** is the sum of the reactions involved in these processes. **Photosynthesis**, which occurs in organisms such as plants, is responsible for producing the organic molecules that serve as food for most organisms.

Page 18

- **reproduce;** and experience **growth**, and in many cases **development;**
- maintain **homeostasis** to maintain the conditions of an internal environment;
- respond to stimuli; and
- have an evolutionary history and are adapted to a way of life.

1.2 Humans Are Related to Other Animals

Humans Are Related to Other Animals

The classification of living organisms mirrors their evolutionary relationships. Humans are mammals, a type of **vertebrate** in the animal **kingdom** of the **domain** Eukarya. Humans differ from other mammals, including apes, by their

- highly developed brains;
- completely upright stance;
- creative language; and

- ability to use a wide variety of tools.

Humans Have a Cultural Heritage

Humans Have a Cultural Heritage Language, tool use, values, and information are passed on from one generation to the next.

Humans Are Members of the Biosphere

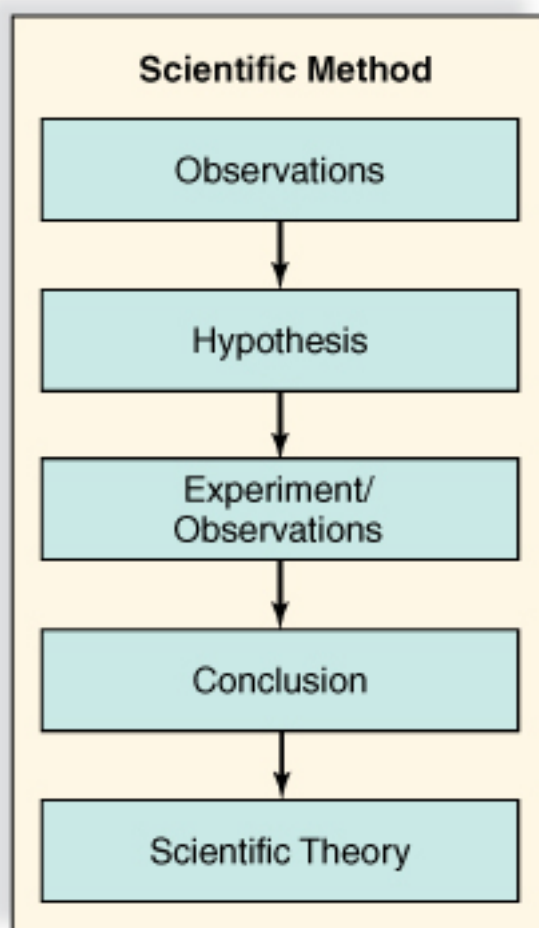
Humans Are Members of the Biosphere Humans depend on the biosphere for its many services, such as absorption of pollutants, sources of water and food, prevention of soil erosion, and natural beauty. Human population growth and use of resources threaten the **biodiversity** of the biosphere and is leading to the **extinction** of many species.

1.3 Science as a Process

Science as a Process

Science is a way of knowing about the natural world. The **scientific method** consists of

- making an observation;
- formulating a **hypothesis**;
- carrying out experiments and observations to collect **data**;
- coming to a **conclusion**; and
- presenting results of the study for peer review.



Over time, widely accepted concepts and ideas that explain patterns in the natural world may become principles of **scientific theories**.

How the Cause of Ulcers Was Discovered

How the Cause of Ulcers Was Discovered Dr. Marshall followed Koch's postulates to show that *H. pylori* causes ulcers.

How to Do a Controlled Study

- In an **experiment**, the **test group** is exposed to the **experimental variable**, while the **control group** is not. The control group may be given a **placebo** to ensure that the participants all behave the same during the experiment.
- All groups are otherwise treated the same, and it is best if the subjects and the technicians do not know what group they are in.
- The results and conclusion are published in a scientific journal.

Scientific Journals Versus Other Sources of Information

Scientific Journals Versus Other Sources of Information Primary sources of information are best; if secondhand sources are used, the reader needs to carefully evaluate the source. The Internet is not regulated, although URLs that end in .edu, .gov, and .org most likely provide reliable scientific information.

1.4 Making Sense of a Scientific Study

Making Sense of a Scientific Study

In general, when assessing a scientific study you should beware of anecdotal and correlational data because they need further study to be substantiated. When examining graphs, ensure that they clearly show the relationship between quantities.

Statistical Data

Statistical Data The **standard error** tells us how uncertain a particular value is. The statistical significance tells us how trustworthy the results are. The lower the statistical significance, the less likely the results are due to chance and the more likely they are due to the experimental variable.

1.5 Science and Social Responsibility

Science and Social Responsibility

Scientific information is based on observation and experimentation. Therefore, scientists need not make value judgments for us. The use of modern **technology** has its risks, and all citizens need to be able to make informed decisions regarding how and when technology should be used.

ASSESS

Testing Your Knowledge of the Concepts

1. Name and describe the basic characteristics of life. (pages 2–6)
2. What is homeostasis, and why is it important? Give some examples that show how systems work together to maintain homeostasis. (page 4)
3. What are the major domains and kingdoms of life? (pages 7–8)
4. How do human activities threaten the biosphere? (page 9)
5. Discuss the importance of a scientific theory, and describe several theories basic to understanding biological principles. (page 10)
6. With reference to the steps of the scientific method, explain how scientists arrive at a theory. (page 10)
7. What are Koch's postulates, and what are they used for? (page 11)
8. What is a control group, and what is the importance of a control group in a controlled study? (page 12)
9. How do science and technology improve our lives? (pages 16–17)

Page 19

In questions 10–13, match each description with the correct characteristic of life from the key.

Key:

1. Life is organized.
 2. Living organisms reproduce and grow.
 3. Living organisms respond to stimuli.
 4. Living organisms have an evolutionary history.
 5. Living organisms acquire materials and energy.
-
10. Human heart rate increases when the person is scared.
 11. Humans produce only humans.
 12. Humans need to eat for building blocks and energy.
 13. Similar cells form tissues in the human body.
 14. The level of organization that includes two or more tissues that work together is a(an)
 1. organ.

2. tissue.
3. organ system.
4. organism.

15. The level of organization most responsible for the maintenance of homeostasis is the level.

1. cellular
2. organ system
3. organ
4. tissue

16. In an experiment, the is exposed to the experimental variable.

1. est group
2. control group
3. Both a and b are correct.
4. Neither a nor b is correct.

17. Humans belong to all of the following groups, except

1. the animal kingdom.
2. domain Eukarya.
3. invertebrates.
4. mammals.

ENGAGE



Dependent and Independent Variables

The virtual lab “Dependent and Independent Variables” provides an interactive tutorial for how scientists construct scientific experiments.

Thinking Critically About the Concepts

1. Viruses are generally lumped into a “germs” grouping with bacteria. Viruses are composed of a small

amount of genetic material (DNA or RNA) wrapped in a protein coat. Can something so simple be considered a living organism? Why aren't viruses mentioned in the system of classification covered in section 1.2? (*Hint*: Consider the shared characteristics of all living organisms.)

Answer

2. Can anecdotal data ever be considered a reliable data source for scientific research? Why or why not? If not, what purpose can anecdotal data serve?

Answer

3. In the case of Europa and Titan, if life were found to exist there, would that change our definition of the basic characteristics of life? Would that change our definition of a biosphere?

Answer