Chapter 1

Human Biology, Science, and Society

Objectives

After studying this chapter, students will be able to

* Summarize the specific characteristics most biologists accept as the signs of life.
* Describe the classification system used to group all living organisms.
* Discuss the steps of the scientific method and how it may apply to daily life.
* Compare and contrast the different sources that disseminate scientific information.
* Explain the fundamental tools used for learning and improving critical thinking skills.
* Indicate the importance of science in today’s world.

Suggested Lecture Outline

1.1 The characteristics of life

1. Are different from nonliving things
2. Require energy and raw materials
3. Are composed of cells
4. Maintain homeostasis
5. Respond to their environment
6. Grow and reproduce
7. Populations of living things evolve

1.2 How humans fit into the natural world

1. Classification system: domain, kingdom, phylum, order, class, family, genus, and species
2. Defining humans: bipedalism, opposable thumbs, large brain, capacity for complex language
3. Study of humans at different levels of biological organization

1.3 Science is both a body of knowledge and a process

1. Scientific method: a process for testing ideas
   1. Observe and generalize
   2. Formulate a hypothesis
   3. Make a testable prediction
   4. Experiment or observe
   5. Modify the hypothesis as necessary and repeat steps 3 and 4
2. Making findings known
3. Well-tested hypothesis becoming a theory

1.4 Sources of scientific information vary in style and quality

1.5 Learning to be a critical thinker

1. Become a skeptic
2. Appreciate the value of statistics
3. Learn to read graphs
4. Distinguish anecdotes from scientific evidence
5. Separate facts from conclusions
6. Understand the differences between correlation and causation

1.6 The role of science in society

1. Science improves technology and the human physical condition
2. Science has limits
3. The importance of making informed choices

Additional Sections

1. Current Issue: Mandatory Childhood Vaccinations
2. MJ’s BlogInFocus Topics: *The human hand makes a good fist,* Antibiotic Resistance Science and the popular press

MJ’s BlogInFocus Question: *Who should pay for very expensive drugs?*

1. Health and Wellness: The Growing Threat of Antibiotic-Resistant Bacteria

Lecture Hints

• Ask the students what it means to them to be alive. Contrast their responses with what is required for bacteria and viruses to live.

• Elicit examples of the three domains from the students’ environment (for example, the four kingdoms of Eukarya).

• Elicit examples of human features from the class. Contrast students’ responses with what is characteristic of bacteria and viruses.

• Present the levels of biological organization as an introduction to subjects that will be covered in later chapters. Give specific examples of these levels that students are familiar with.

• Research earlier forms of classification to show the development of scientific thinking. Emphasize that these theories were accepted as “the answer” to classification at the time. What changed?

• Scientists belong to two basic categories: lumpers or spreaders. Which category do students tend to fall into?

• Stress that the scientific method applies to any area of research, for example, business, communications, or psychology.

• Emphasize to students that learning to be a critical thinker may be the most important part of this chapter for a nonmajor. Students need to think and evaluate data before accepting it—from any source. Emphasize the difference between anecdotal evidence and scientific evidence.

• Use the applications of science to interest students in the course.

Media Guide

Listed next are the portions of the Instructor’s Resource Materials and Interactive Physiology for Human Biology that are relevant to this chapter. Some of these resources are available in Pearson Mastering Biology only.

Instructor Resources

• ABC News Video: The Safety of Dietary Supplements

• Human Biology Animations: Signs of Life, the Scientific Method

• All images and tables (labeled and unlabeled in .jpeg and PowerPoint formats)

• PowerPoint presentations

• Clicker Questions (PRS-Enabled)

Class Demonstrations and Student Activities

• Explore the MasteringBiology Web site.

• Have the students bring in examples of various phyla; pass them around.

• Have the students classify the living organisms in their environment—that is, the classroom, residence, and around campus.

• Separate the class into groups of 5 or 6 students and provide a bucket of assorted screws to each group. Ask the groups to classify the screws. What criteria did they develop and use? Were they lumpers or spreaders?

• Have the class formulate a hypothesis and follow the scientific method through to a conclusion as a class project.

• Elicit ideas from students about how the scientific method applies to their majors.

• Have the students identify a television ad that is based on anecdotal evidence and ask them to evaluate it and compare it to other evidence on the same subject (from journals or reliable Web sites).

Suggestions for Possible Assignments

Any of the following questions or topics can be used as a starting point for a discussion, abstract, paper, debate topic, or poster session:

• Do nonliving things share any of the characteristics of life with living beings?

• What human characteristics are shared with nonhuman beings? Which are not shared?

• Is evolution happening now? What evidence is there for the answer to this question?

• As suggested earlier, use the scientific method as the basis for a class research project, such as the frequency of texting between men and women on campus.

• Have students set up an observation area outside the cafeteria and note the number of people who are underweight, normal weight, or overweight. Construct a frequency and bar graph from the data and analyze it.

• Compare the accuracy and thoroughness of the claims of advertising for or labels on nutritional supplements to information published in scientific journals.

• What are the current patterns of antibiotic resistance as reflected by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO)? Is there a difference between developed and developing countries? Which microorganisms are the worst threat to humans?

• What role has technology played in the advancement of society? Has this been good or bad, and by what standards?

• Can science solve all problems? Why or why not?

• How does the medical concept of informed consent apply to decisions regarding scientific problems in our society?

Case in Point

I Want My Food Supplements Natural

Natural dietary supplements are botanical products that are prepared in a variety of ways and ingested in a variety of forms. They may be fresh or dried, in tablets, powders, or even in tea bags. They provide a source of vitamins, minerals, or needed amino acids. They may even be used as a substitute for hormonal therapy, such as the use of phytochemicals of soy products to prevent excessive calcium loss from bones after menopause or to relieve the effects of hot flashes.

A question that should be asked is “How safe are natural food supplements?” The safety of botanicals can depend on their source and the form in which they are ingested. There are few federal regulations related to food supplements. There are no requirements for standardization, and the use of the word natural on the label does not ensure quality. Reputable manufacturers and suppliers will, generally, produce a more reliable product than lesser-known businesses. Supplements taken as teas generally contain less of the active component than oils or tinctures. Also, no product should be taken in excessive amounts.

Questions

1. Should I consider natural forms of diet supplementation?

2. How can I be sure I’m getting the vitamins and minerals that I need?

Investigate

Margină, D., et al. Natural Products-Friends or Foes? *Toxicology Letters* 236(3): 154–67, 2015. doi: 10.1016/j.toxlet.2015.05.009. Epub May 14, 2015. Review.

Gardiner, P., et al. [Online Education for Improving Communication and Documentation of Dietary Supplements Among Health Professionals Practicing in a Hospital Setting.](http://www.ncbi.nlm.nih.gov/pubmed/26270001) *Journal of Alternative and Complementary Medicine* 21(10): 638–44, 2015.

Answers to Case in Point

1. This depends on each person’s preferences. It is more difficult to conduct research on natural forms of supplementation because they are not standardized. Also, products from major manufacturers are easier to find.

2. There are many sources on the Web that allow people to evaluate their diet. These programs can indicate possible deficiencies and suggest types of supplements. One caution is the use of a site that also sells supplements. Such sites might tend to recommend their own products over other sources. Another caution is to research the source of the supplement if it is not a major manufacturer.

Answers to Concept Review and Apply What You Know

Answers to Concept Review and Apply What You Know questions can be found in the Instructor’s Resources Area of MasteringBiology.

Answers to Test Yourself

Answers to Test Yourself questions can be found in the back of the student textbook.

Integrating MJ’s Human Biology Blog

The author posts commentary and links to recent articles from the news or scientific journals on MJ’s Human Biology Blog. This material covers chapter-relevant topics and could be assigned as extra reading or used as a starting point for class discussions. Given the timeliness of the topics and the possible controversial nature of some of them, opposing opinions should be easy to generate.

Blog URL: http://humanbiologyblog.blogspot.com/

Sample Blog Posts Related to Chapter 1

[*Recalled Dietary Supplements Return to the Shelves*](http://humanbiologyblog.blogspot.com/2014/10/recalled-dietary-supplements-return-to.html)

[*Problems with Herbal Supplements*](http://humanbiologyblog.blogspot.com/2014/04/problems-with-herbal-supplements.html)

*Antibiotic Use in Farm Animals Is Still Increasing*

[*Superbug Deaths in Los Angeles*](http://humanbiologyblog.blogspot.com/2015/02/superbug-deaths-in-los-angeles.html)

[*Measles Continues to Make a Comeback*](http://humanbiologyblog.blogspot.com/2015/01/measles-continues-to-make-comeback.html)

[*Stem Cell Paper Challenged*](http://humanbiologyblog.blogspot.com/2014/04/stem-cell-paper-challenged.html)

[*Journalistic Bias in Science Reporting*](http://humanbiologyblog.blogspot.com/2012/10/journalistic-bias-in-science-reporting.html)

*California Passes Strict Child Vaccination Law*

Popular Joint Pain Supplements Don’t Work

Example of Classroom Application

Using the posting for *Antibiotic Use in Farm Animals Is Still Increasing*, investigate the state and national and international limits of antibiotic use in animals. What are the enforcement of these limits and the punishment if exceeded?

Additional Resources

Books

• Alfaro-LeFevre, R. *Critical Thinking, Clinical Reasoning, and Clinical Judgment: A Practical Approach*, Elsevier Health Sciences, 2016.

* Arp, R. and J. C. Watson. *Critical Thinking: An Introduction to Reasoning Well*, Bloomsbury Academic, 2015.
* Brooks, M. *At the Edge of Uncertainty: 11 Discoveries Taking Science by Surprise*, The Overlook Press, 2016.
* Bucchi, M. *Science and the Media: Alternative Routes to Scientific Communications*, Taylor & Francis, Inc., 2013.
* Cordell, D. M. *Using Images to Teach Critical Thinking Skills: Visual Literacy and Digital Photography Using Images to Teach Critical Thinking Skills: Visual Literacy and Digital Photography*, Libraries Unlimited, 2015.
* Erickson, M. *Science, Culture and Society: Understanding Science in the 21st Century*, Wiley, 2016.
* Ferguson, K. *Stephen Hawking: An Unfettered Mind*, Palgrave Macmillan, 2013.
* Gil-Aluja, J. *Scientific Methods for the Treatment of Uncertainty in Social Sciences*, 2015.
* French, S. *Philosophy of Science: Key Concepts*, Bloomsbury Academic, 2016.
* Jevons, W. S. *The Principles of Science: A Treatise on Logic and Scientific Method* (Classic Reprint), FB &c Ltd, 2015.
* Mazzotti, M. *The History of Science*, Taylor & Francis, 2016.
* Moreira, T. *Science, Technology and the Ageing Society*, Taylor & Francis, 2016.
* Piper, R. *Animal Earth: The Amazing Diversity of Living Creatures*, Thames & Hudson, 2015.

Web Sites

Find the URLs and links to these Web sites on the MasteringBiology Web site.

The Biology Project: Human Biology

This Web site contains a variety of general information concerning human biology.

Essays on Science and Society

This Web site contains a collection of essays relating to science and society from various perspectives.

European Commission Research: Relationships Between Science and Society

This Web site includes research collected from European countries exploring the various relationships between science and society.

Center for Science, Policy, and Outcomes

This organization is dedicated to the political implications of science advances and research.

Elitism versus Checks and Balances in Communicating Scientific Information to the Public

The content of this Web site addresses the question of who should be able to access scientific information and what data should be available.

National Conference of Lawyers and Scientists

This is a meeting place for lawyers and scientists to discuss common problems and implications of scientific research and applications to the law and society.

Technology and Culture

This Web site is devoted to the discussion of the possible effects of science on societal culture and the effects of cultures on scientific research and application.