

chapter 1

Indicate the answer choice that best completes the statement or answers the question.

1. Which term describes the transformation of one cell into a multicellular adult?

- a. inheritance
- b. genetics
- c. reproduction
- d. development
- e. bioinformatics

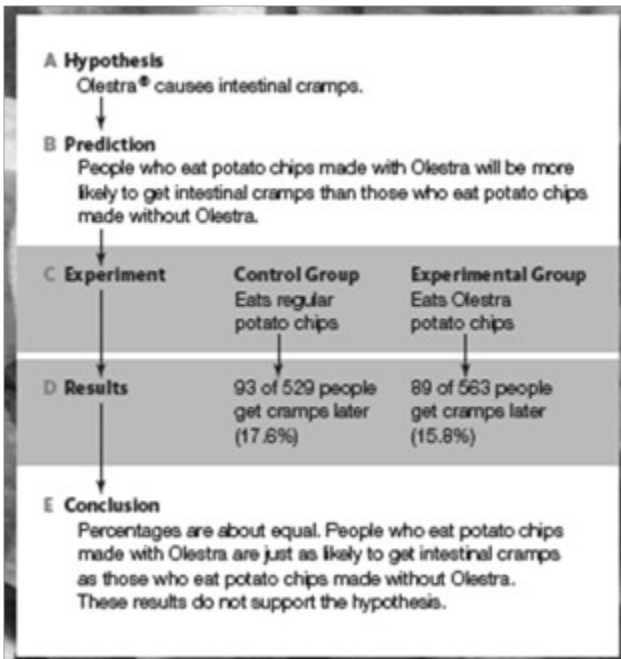


Figure 1.11 "Does Olestra® cause cramps?" experiment.

2. Refer to the accompanying figure. What was the independent variable in this experiment?

- a. the consumption of potato chips
- b. the number of bags of potato chips eaten
- c. the amount of time given to consume the bag of potato chips
- d. the presence of intestinal cramps
- e. the presence of Olestra® in the potato chips

3. The control group in an experiment _____.

- a. makes the experiment subjective
- b. is an additional replicate for statistical purposes
- c. is influenced by the dependent variable
- d. is only necessary for inductive reasoning
- e. is a standard of comparison for the experimental group

4. In an experiment, the experimental group is _____.

- a. not subjected to experimental error

chapter 1

- b. not exposed to experimental treatments
 - c. maintained under strict laboratory conditions
 - d. treated exactly the same as the control group, except for one independent variable
 - e. treated exactly the same as the control group, except for one dependent variable
5. Suppose that in an experiment, data obtained from a subset of samples differ from the results obtained from the entire experimental group. This could be explained by ____.
- a. probability
 - b. trend analysis
 - c. inductive reasoning
 - d. statistical significance
 - e. sampling error
6. An experimenter surveyed one-half acre of a desert preserve and found three cactus wren nests. Assuming that the habitat is fairly uniform, how many nests would he expect to be in the entire 200-acre preserve?
- a. 6
 - b. 200
 - c. 600
 - d. 1200
 - e. 6000
7. Organisms designated as producers usually obtain their energy from ____.
- a. other producers
 - b. dead consumers
 - c. decomposers
 - d. the environment
 - e. themselves
8. To arrive at a conclusion based upon observations, scientists use ____.
- a. inductive reasoning
 - b. deductive reasoning
 - c. subjective reasoning
 - d. logical intuition
 - e. biased methods
9. Plants use energy from the sun to produce nutrients; therefore, plants are ____.
- a. consumers
 - b. reproducers
 - c. producers
 - d. decomposers
 - e. developers
10. Which term refers to an increase in number, size, or volume in the cells of an organism?

chapter 1

- a. growth
- b. development
- c. reproduction
- d. evolution
- e. inheritance

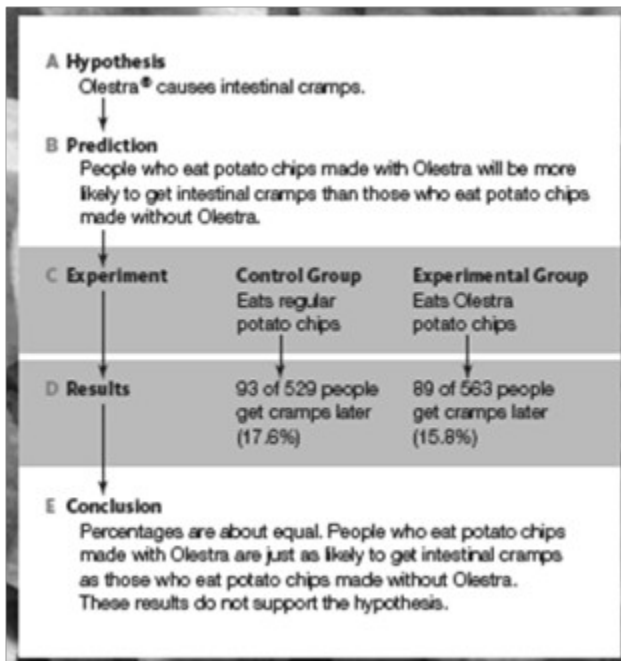


Figure 1.11 "Does Olestra® cause cramps?" experiment.

11. Refer to the accompanying figure. What was the dependent variable in this experiment?
- a. the presence of intestinal cramps
 - b. the amount of chips eaten
 - c. the taste of Olestra® versus regular chips
 - d. the final weight of the test subjects
 - e. the presence of general adverse health reports
12. Which organisms are multicellular eukaryotes, the majority of which are photosynthetic producers?
- a. plants
 - b. animals
 - c. fungi
 - d. bacteria
 - e. archaea
13. Which is the correct format for the scientific name of modern humans?
- a. Homo Sapiens
 - b. *Homo Sapiens*
 - c. homo sapiens
 - d. *Homo sapiens*

chapter 1

e. *Homo sapiens*

A scientist randomly divided a group of 100 lab rats into two groups of 50. One group was fed regular rat chow while the other was fed the same amount of rat chow with added DDT. Both groups were housed in the same room with the same environmental conditions. At the end of the experiment, rats were weighed and the mean difference calculated.

14. Refer to the accompanying narrative. Which variable(s) were manipulated by the scientist?

- a. DDT only
- b. temperature only
- c. weight differences only
- d. both DDT and weight differences
- e. both temperature and weight differences

15. Which function does not directly involve the instructions coded in an organism's DNA?

- a. development
- b. cell growth
- c. need for nutrients
- d. inheritance
- e. reproduction

16. A testable explanation for a natural phenomenon is a(n) _____.

- a. experiment
- b. hypothesis
- c. prediction
- d. model
- e. conclusive description

17. The eighteenth-century naturalist Carolus Linnaeus is known for developing _____.

- a. the theory of natural selection
- b. a system for naming and classifying organisms
- c. the biological species concept
- d. the first microscope
- e. the scientific method

18. Which process describes the ability of living organisms to maintain an internal environment within a tolerable range?

- a. metabolism
- b. homeostasis
- c. development
- d. respiration
- e. observation

19. Four of the five answers listed below are kingdoms into which living organisms are classified. Select the exception.

- a. Animalia
- b. Protista

chapter 1

- c. Eukarya
- d. Fungi
- e. Plantae

20. As energy is transferred among organisms, some escapes from the environment as ____ energy.

- a. electrical
- b. heat
- c. light
- d. mechanical
- e. nuclear

21. Which statement could be considered a scientific theory?

- a. Beauty pageant contestants are becoming increasingly more beautiful.
- b. Chemistry and physics are more exact sciences than biology.
- c. Change occurs in the inherited traits of a population over generations.
- d. The growth of a plant is faster in a growth chamber than in a greenhouse.
- e. Eating grapefruit prevents weight gain.

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22. Refer to the accompanying narrative. Which dependent variable was measured?

- a. DDT
- b. temperature
- c. weight
- d. amount of food
- e. length of day

23. Grass growing in a field is eaten by a deer. Later on, the deer dies and its body is decomposed, in part, by bacteria. In this scenario, which organism(s) are consumers?

- a. grass only
- b. deer only
- c. bacteria only
- d. grass and bacteria
- e. deer and bacteria

24. With the discovery of the Pinocchio frog in 2008, researchers needed to classify and assign a scientific name to this new species in a process known as ____.

- a. development
- b. taxonomy
- c. deductive reasoning
- d. pseudoscience
- e. subjectivity

chapter 1

25. Four of the five answers listed below are steps of the scientific method. Select the exception.

- a. observation
- b. hypothesis
- c. experimentation
- d. philosophy
- e. conclusion

26. A consistent natural phenomenon that cannot be described by a complete scientific explanation is known as a ____.

- a. scientific theory
- b. law of nature
- c. hypothesis
- d. scientific law
- e. scientific method

27. As part of the scientific method, a scientist proposes and tests ____.

- a. laws
- b. theories
- c. hypotheses
- d. principles
- e. facts

28. Four of the five answers listed below are characteristics of living organisms. Select the exception.

- a. energy use
- b. homeostasis
- c. development
- d. response to stimuli
- e. diversity

29. All of the coyotes (*Canis latrans*) living in the Mojave Desert constitute a(n) ____.

- a. ecosystem
- b. community
- c. biosphere
- d. organism
- e. population

30. Which features characterize all prokaryotes?

- a. photosynthetic
- b. multicellular
- c. has nuclei
- d. resides in extreme environments
- e. lacks nuclei

chapter 1

31. About 12 to 24 hours after the last meal, a person's blood sugar level normally varies from 60 to 90 mg per 100 ml of blood, although it may rise to 130 mg per 100 ml after meals high in carbohydrates. Yet, the blood sugar level is maintained within a fairly narrow range, despite uneven intake of sugar. This is possible due to the process of ____.

- adaptation
- homeostasis
- inheritance
- metabolism
- development

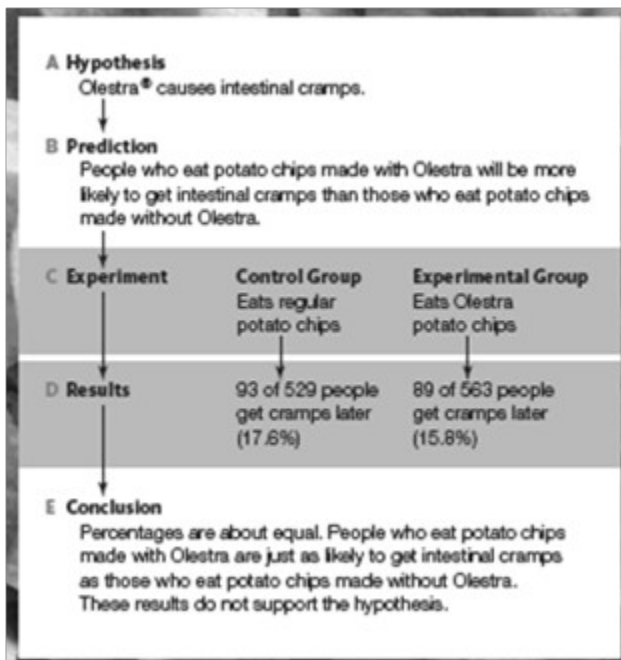


Figure 1.11 "Does Olestra® cause cramps?" experiment.

32. Refer to the accompanying figure. Suppose only 10 test subjects had been used in this study and 4 out of 5 participants (80 percent) who ate chips with Olestra® reported intestinal cramps. Given the difference between this result and the actual experimental results of 15.8 percent, what might be the most likely reason for these different results?

- The researcher was biased in the data analysis.
- Human error was responsible for the incorrect data.
- The Olestra® potato chips were given to the wrong group.
- There is a sampling error due to a small sample size.
- The statistical probability was calculated incorrectly.

33. Which is the most diverse and inclusive taxon?

- domain
- genus
- kingdom
- phylum
- species

34. Which eukaryotes break down food externally and then absorb nutrients?

chapter 1

- a. bacteria
- b. plants
- c. fungi
- d. animals
- e. protists

35. A scientific name consists of the ____.

- a. family name only
- b. genus name only
- c. specific epithet only
- d. family name and genus name
- e. genus name and specific epithet

36. A scientific researcher performs four of the five tasks below. Select the exception.

- a. revises a hypothesis based on data collected
- b. manipulates dependent variables
- c. reviews other research results obtained by other scientists
- d. examines the effects of independent variables
- e. draws conclusions based only on appropriate experimental data

37. An experimental result that is statistically significant is ____.

- a. likely to occur by chance alone
- b. unlikely to occur by chance alone
- c. scientifically significant or important
- d. the result of an experiment with only one variable
- e. influenced by sampling error

38. A scientist is investigating the results of varying temperature on the growth rate of a bacterial culture. In this experiment, temperature is the ____.

- a. dependent variable
- b. independent variable
- c. control
- d. model
- e. hypothesis

39. Which domain(s) is/are made up of organisms without nuclei?

- a. archaea only
- b. bacteria only
- c. eukarya only
- d. both archaea and bacteria
- e. both bacteria and eukarya

40. A hypothesis that has been repeatedly and rigorously tested and supported is known as a ____.

chapter 1

- a. model
- b. testable prediction
- c. scientific method
- d. scientific theory
- e. result

41. The transmission of DNA to offspring is known as ____.

- a. taxonomy
- b. development
- c. homeostasis
- d. inheritance
- e. differentiation

42. Which term describes the collection of all populations living in the same area?

- a. ecosystem
- b. community
- c. biosphere
- d. organism
- e. population

43. Energy flows ____ in an ecosystem.

- a. in one direction
- b. in two directions
- c. from consumers to producers
- d. from the biosphere to the sun
- e. from decomposers to producers

44. Critical thinking is the process of ____.

- a. finding fault in yourself
- b. unconditionally accepting information from a trusted source
- c. designing a scientific experiment
- d. making a hypothesis
- e. judging the quality of information before accepting it

45. In order to reduce bias and subjectivity, scientists perform experiments that yield ____ results.

- a. ambiguous
- b. imprecise
- c. quantitative
- d. qualitative
- e. subjective

46. In the experiment with peacock butterflies, researchers noticed that the butterflies folded their wings and made hisses and clicks in the presence of bird predators. They therefore hypothesized that these behaviors helped the butterflies escape

chapter 1

predation. Next, they predicted that removal of the spots on the butterfly's wings and/or removal of the ability of the butterfly to hiss and click will result in a greater risk of predation. To arrive at the hypothesis, the researchers used _____, while developing the prediction used _____.

- a. deductive reasoning; inductive reasoning
- b. inductive reasoning; deductive reasoning
- c. critical thinking; inductive reasoning
- d. pseudoscience; critical thinking
- e. deductive reasoning; critical thinking

47. Populations within California's Antelope Valley interact with their physical environment (e.g., sunlight and water) to sustain life. This scenario describes a(n) _____.

- a. population
- b. community
- c. biosphere
- d. ecosystem
- e. organism

48. Suppose the Pinocchio frog, which was discovered in the remote Foja Mountains in New Guinea, is determined to be a new species based on the biological species concept. Why might the criteria of this concept not be applicable to these frogs?

- a. DNA analyses must be conducted before a species can be defined by the biological species concept.
- b. The small Pinocchio frog population introduces too much sampling error to assess reproductive behaviors.
- c. Geographical barriers may prevent Pinocchio frogs from interbreeding with other frog populations.
- d. Experiments must be conducted to determine whether Pinocchio frogs can breed with other frog species in captivity.
- e. The biological species concept is subjective and inherently biased.

49. The smallest unit of life that can survive and reproduce on its own is a(n) _____.

- a. atom
- b. cell
- c. molecule
- d. organ
- e. population

Match the following terms with the appropriate description.

- a. atom
- b. cell
- c. organ system
- d. population
- e. community
- f. ecosystem
- g. emergent property

chapter 1

h. tissue

50. all arctic animals, plants, and other living organisms interacting with their physical environment

51. smallest unit of life

52. arctic foxes, polar bears, fish, mosses, and shrubs (all species in the arctic tundra)

53. oxygen required by animals in the arctic tundra

54. group of arctic foxes in the arctic tundra

55. circulatory system of polar bears

56. the schooling of arctic fish

57. the fat layer under a polar bear's skin

Imagine that a researcher for a large food company believes that he has developed a new drug that increases appetite. He names the drug "EatMore" and designs an experiment to test his hypothesis. He uses two groups of mice: one group is given the drug and the other group given a placebo sugar pill. The appetite levels are assessed by measuring the amount of food consumed by the mice in each group for one week. At the end of the experiment, he reported that on average, mice that received the "EatMore" drug consumed 2.5g of food/day and mice that received the placebo consumed 5g of food/day. Statistical analysis of the data showed the difference to be statistically significant.

Match the following terms with the conditions related to the accompanying experiment.

a. independent variable

b. dependent variable

c. experimental group

d. control group

58. the amount of food consumed

59. the mice that received the placebo

60. the "EatMore" drug

61. the mice that received the "EatMore" drug

Match the terms with the most suitable description.

a. statement of what should occur if the hypothesis is correct

b. the chance that an event will occur

c. testable explanation

d. time-tested hypothesis

e. statements or methods that appear scientific but do not follow scientific principles

62. hypothesis

63. probability

chapter 1

64. scientific theory

65. prediction

66. pseudoscience

Match the statement to the most appropriate function, process, or trait listed below.

- a. development
- b. reproduction
- c. photosynthesis
- d. growth
- e. homeostasis

67. a process performed only by producers

68. this characteristic of all living organisms buffers the effects of environmental change

69. the process by which a single cell is transformed into a multicellular adult

70. process by which one generation replaces another

71. increase in cell size, number, and volume

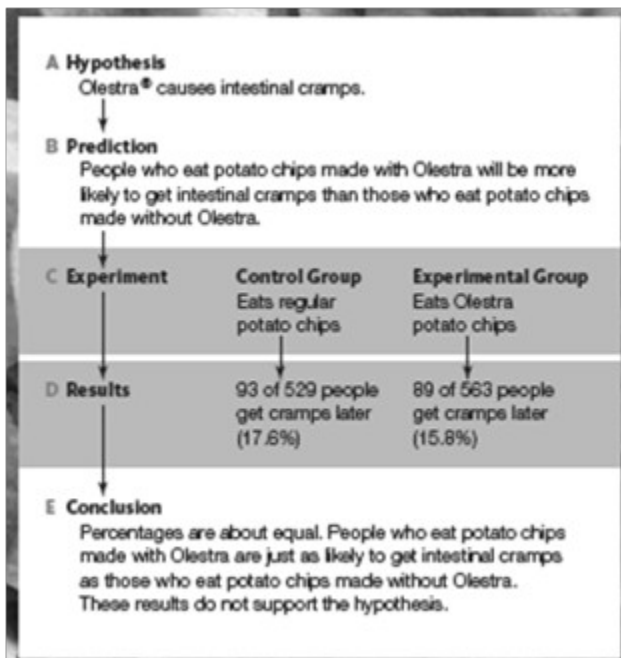


Figure 1.11 "Does Olestra® cause cramps?" experiment.

72. Refer to the accompanying figure. In this experiment, which variables were not controlled that may affect the results?

chapter 1

73. Why do researchers repeat experiments several times?

Imagine that a researcher for a large food company believes that he has developed a new drug that increases appetite. He names the drug "EatMore" and designs an experiment to test his hypothesis. He uses two groups of mice: one group is given the drug and the other group given a placebo sugar pill. The appetite levels are assessed by measuring the amount of food consumed by the mice in each group for one week. At the end of the experiment, he reported that on average, mice that received the "EatMore" drug consumed 2.5g of food/day and mice that received the placebo consumed 5g of food/day. Statistical analysis of the data showed the difference to be statistically significant.

74. Answer the following questions about the accompanying experiment.

- a. What is the researcher's hypothesis?
- b. What might be the researcher's prediction?
- c. Why is this experiment performed using a model organism, rather than on humans?
- d. Was the researcher's hypothesis correct?
- e. What may be some alternate explanations for the outcome?

75. Arrange the following terms in order from least inclusive to most inclusive.

- a. biosphere
- b. cell
- c. atom
- d. population
- e. organ
- f. community
- g. ecosystem

76. The cell theory has three parts: (1) all organisms consist of one or more cells; (2) the cell is the basic unit of life; and (3) all cells arise from existing cells. As a scientific theory, how could the cell theory be disproven?

77. A person is declared to be dead upon the irreversible cessation of spontaneous body functions (brain activity or blood circulation and respiration). However, only about 1 percent of a person's cells have to die in order for all of these things to happen. How can someone be dead when 99 percent of his or her cells are still alive?

78. Why would you think twice about ordering from a café menu that lists the specific epithet but not the genus name of its offerings? Hint: Look up *Homarus americanus*, *Ursus americanus*, *Ceanothus americanus*, *Bufo americanus*, *Lepus americanus*, and *Nicrophorus americanus*.

79. Once there was a highly intelligent turkey that had nothing to do but reflect on the world's regularities. Morning always started out with the sky turning light, followed by the master's footsteps, which were always followed by the appearance of food. Other things varied, but food always followed footsteps. The sequence of events was so predictable that it eventually became the basis of the turkey's theory about the goodness of the world. One morning, after more than 100 confirmations of the goodness theory, the turkey listened for the master's footsteps, heard them, and had its head chopped off. Any scientific theory is modified or discarded upon discovery of contradictory evidence. The absence of absolute certainty has led some people to conclude that "facts are irrelevant—facts change." If that is so, should we stop doing scientific research? Why or why not?

80. In 2005, researcher Woo-suk Hwang reported that he had made immortal stem cells from human patients. His research was hailed as a breakthrough for people affected by degenerative diseases, because stem cells may be used to repair a

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chapter 1

person's own damaged tissues. Hwang published his results in a peer-reviewed journal. In 2006, the journal retracted his paper after other scientists discovered that Hwang's group had faked their data. Does the incident show that results of scientific studies cannot be trusted? Or does it confirm the usefulness of a scientific approach, because other scientists discovered and exposed the fraud?

Name _____ Class _____ Date _____
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chapter 1

Answer Key

1. d
2. a
3. e
4. d
5. e
6. d
7. d
8. a
9. c
10. a
11. a
12. a
13. e
14. a
15. c
16. b
17. b
18. b
19. c
20. b
21. c
22. c
23. e
24. b

Name _____ Class _____ Date _____

chapter 1

25. d

26. b

27. c

28. e

29. e

30. e

31. b

32. d

33. a

34. c

35. e

36. b

37. b

38. b

39. d

40. d

41. d

42. b

43. a

44. e

45. c

46. b

47. d

48. c

49. b

Name _____ Class _____ Date _____
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chapter 1

50. f

51. b

52. e

53. a

54. d

55. c

56. g

57. h

58. b

59. d

60. a

61. c

62. c

63. b

64. d

65. a

66. e

67. c

68. e

69. a

70. b

71. d

72. The test subjects were not controlled for their gender, age, weight, health status, medication use, etc.

73. Sampling error may be unavoidable, but knowing how it can occur helps researchers design their experiments to minimize it. For example, sampling error can be a substantial problem with a small subset, so experimenters try to start with a relatively large sample, and they typically repeat their experiments. To understand why these practices reduce the risk of sampling error, think about flipping a coin. The chance that the coin will land heads up is one in two (1/2). With

chapter 1

just three flips, the proportion of times that heads actually land up may not even be close to 50 percent. With 1,000 flips, however, the overall proportion of times the coin lands heads up is much more likely to approach 50 percent.

74. a. The researcher's hypothesis is that the "EatMore" drug increases appetite.
b. The researcher's prediction might be: "If the EatMore drug increases appetite, then mice that receive the drug will eat more food than control mice that do not receive the drug."
c. The researcher performed the experiment using a model organism rather than humans for several reasons. One is that it is easier to control other variables in mice that may affect the outcome. For example, the researcher can select mice of the same age, sex, genetic background, etc. He can also control exactly what mice eat and measure it directly, which he could not do as easily with human subjects. In addition, as the researcher has just developed "EatMore," it is not yet approved for human use.
d. No, the researcher's hypothesis is not correct. Mice that received the "EatMore" drug ate less food and therefore did not have an increased appetite.
e. Some alternate explanations for the outcome may be that the drug had side effects that influenced how much food the mice ate. Perhaps it made the mice feel sick and not want to eat, or perhaps it made them drowsy, which made them eat less.

75. c, b, e, d, f, g, a

76. Like all hypotheses, a scientific theory can be disproven by one observation or result that is inconsistent with it.

Therefore, if a scientist discovered a living organism that did not consist of a cell or if they discovered a cell that spontaneously formed on its own, the theory would be disproven.

77. That 1% of the cells are responsible for coordinating the action of all the other cells, and for ultimately maintaining homeostasis in the organism as a whole.

78. When understanding the complete scientific name, you can see that the genus defines what each of these organisms is: American black bear, New Jersey tea, garden toad, or a snowshoe hare. At a café, you are probably interested in the tea (*Ceanothus americanus*)!

79. "Facts change." That is true in scientific research because science is open to new data and new interpretations of old data, which can lead to discarding or modifying formerly held tenets. This is a strength of science, not a weakness. It is this willingness to accept *change* that makes the phrase "scientific creationism" meaningless. Creationists have accepted as fact a set of immutable ideas, which are then supported by carefully chosen facts from the realm of science.

80. It is unfortunate that the respectable journal did not catch any experimental fraud; however, this is an example of "facts change." The process of science did work, and when the results could not be confirmed the article was retracted. It is important to hold scientists accountable for their work, and this scientist was held accountable and lost his research privileges. As in all professions, just because one person is unethical it is not fair to judge the work of everyone in that profession based on one person's actions.