Chapter 14 Review

READING TOOLBOX

1. **Prefixes** Use a dictionary to look up the meanings of the prefixes *non-* and *dis-* and the word *junction*. Use this information to explain the meaning of the term *nondisjunction*.
2. **Concept Map** Construct a concept map that differentiates the many kinds of mutation. Try to use the following terms: *mutation, point, insertion, deletion, silent, missense, frameshift, nonsense, amino acids, chromosomal, deletion, duplication, inversion, translocation,* and *gene rearrangement*.

Using Key Terms

3. Use the following terms in the same sentence: *gene regulation, operon, transcription factor, prokaryote,* and *eukaryote.*

In each of the following sentences, replace the incorrect term(s) with the correct key term(s).

4. New alleles arise from *gene regulation*.
5. *Mutation* is the condition of having multiple sets of chromosomes.

Understanding Key Ideas

6. All genetic differences among organisms originate as some kind of
   a. DNA. **c.** mutation.
   b. gene. **d.** amino acid.
7. A point mutation occurs when
   a. a gene's location changes.
   b. long segments of a gene are lost.
   c. gametes are forming during meiosis.
   d. one nucleotide is replaced with a different nucleotide.
8. How does the karotype of a person with Down syndrome differ from a normal karotype?
   a. It lacks a chromosome.
   b. It has two sex chromosomes.
   c. It has twice the number of chromosomes.
   d. It has an extra copy of a single chromosome.
9. The *lac* operon shuts off the production of lactose enzymes when
   a. lactose is present. **c.** glucose is present.
   b. lactose is absent. **d.** glucose is absent.
10. Which of the following is found primarily in eukaryotic genomes?
    a. introns **c.** operators
    b. operons **d.** promoters
11. Plasmids are
    a. long pieces of eukaryotic DNA.
    b. circular pieces of bacterial DNA.
    c. broken pieces of large chromosomes.
    d. pieces of viral RNA that move between species.
12. An example of a mobile genetic element is
    a. a transposon. **c.** a cancer cell.
    b. a bacterium. **d.** a hox gene.
13. Programmed cell death is called
    a. aging. **c.** apoptosis.
    b. cyclin. **d.** transposition.

Explaining Key Ideas

14. **Explain** how a genetic disorder can result from a mutation.
15. **Summarize** the role of genetic switches in gene expression.
16. **Outline** the roles of proteins in gene expression.
17. **List** ways that genetic material can be transferred by mechanisms other than chromosomes.

This image shows that specific genes regulate the development of specific parts of animal bodies. Use the image to answer the following question(s).





18. **Describe** the role of *hox* genes in development.
19. **Identify** which kind(s) of mutation could result in a group of homeotic genes being duplicated.

Assignment Guide

Section	Questions
1	1, 2, 4, 5, 6, 7, 8, 14, 19, 20, 22, 23
2	3, 9, 10, 15, 16, 24, 27, 32
3	11, 12, 13, 17, 18, 21, 25, 26, 28, 29, 30, 31

Review

Reading Toolbox

1. *Non* means "not," *dis* means "opposite," and *junction* means "joining together." Therefore, *nondisjunction* most likely means "not the opposite of joining together" which is simply "staying together."
2. See previous page for answer to concept map.

Using Key Terms

3. *Gene regulation* in *prokaryotes* involves an *operon*; *eukaryotes* rely more on *transcription factors.*
4. New alleles arise from *mutations.*
5. *Polyploidy* is the condition of having multiple sets of chromosomes.

Understanding Key Ideas

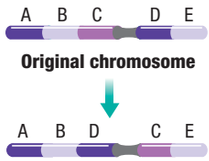
6. c **7.** d **8.** d **9.** b
10. a **11.** b **12.** a **13.** c

Explaining Key Ideas

14. A mutation can change one or more of the amino acids for which a gene codes. If the protein doesn't function normally, the cell(s) may not function normally.
15. Genetic switches start or stop the transcription and translation of specific genes under specific conditions.
16. Proteins serve as enzymes during replication, transcription, and translation. Proteins interact with DNA and other proteins to form genetic switching systems.
17. Exchange of plasmids in prokaryotes, reverse transcription by retroviruses, and transposons transfering genetic material.
18. Hox genes control the differentiation of cell types in animals that have a head to tail orientation.
19. a chromosomal duplication

Using Science Graphics

This image shows a specific type of mutation. Use the image to answer the following question.



20. What type of mutation is shown in the image?
- **a.** chromosomal deletion
- **b.** chromosomal inversion
- **c.** chromosomal duplication
- **d.** chromosomal translocation

21. Use this table to make a graph. Be sure to choose the appropriate graph type and to add labels.

Genetic Similarity Between Humans and Other Species*

Common name	Genus name	Similarity
Dog	*Canis*	81%
Mouse	*Mus*	79%
Rat	*Rattus*	70%
Chicken	*Gallus*	67%
Pufferfish	*Takifugu*	65%
Zebrafish	*Danio*	63%
Fruit fly	*Drosophila*	39%
Bee	*Apis*	33%
Nematode	*Caenorhabditis*	31%
Mouse-ear cress	*Arabidopsis*	17%
Rice	*Oryza*	15%
Slime mold	*Dictyostelium*	16%
Yeast	*Saccharomyces*	11%
Bacterium	*Escherichia*	10%

* percentage of human genes that are similar to genes in each of these species

Critical Thinking

22. Applying Logic What are the possible effects of a point mutation on the results of a gene? Starting with the same codon, give specific examples.

23. Applying Related Information Can genetic changes due to nondisjunction occur in bacteria?

24. Evaluating an Argument A classmate states that damage to introns is very likely to affect the synthesis of a protein but damage to exons is not. Argue against this statement.

25. Analyzing Language Scientists often state that the genetic code is universal. Explain what this statement means.

26. Inferring Relationships What does the presence of similar homeotic gene sequences among many eukaryotes suggest about evolutionary relationships among these organisms?

Connecting Key Ideas

27. Genomes and Reproduction In what ways do mobile genetic elements and sexual reproduction have similar functions?

28. Genomes and Ecology What is the main difference between the symbiosis of lichen and the endosymbiosis that is thought to have led to mitochondria and chloroplasts?

29. Genomes and Evolution Antibiotic resistance in bacteria is often used as an example of coevolution. Explain the connection.

Methods of Science

30. Experimental Setup The scientist who first suspected, and later discovered, the existence of transposons was Barbara McClintock. She conducted her main experiments by using corn kernels that were the product of many generations of self-fertilization of the same corn plants. Why did she use this kind of corn?

Writing for Science

31. Writing for an Audience Draft a lecture for younger students entitled "Are We Controlled by DNA?"

Technology Skills

32. Using Computer Graphics Use library or Internet resources to find information about technologies for three-dimensional modeling and visualization of complex biological molecules. Bring or show examples to your class of three-dimensional models of DNA, RNA, and proteins.

Using Science Graphics

20. b

21. Most students will construct a bar graph. Suggest that they place percentages on the *x*-axis and common names on the *y*-axis. This arrangement makes the graph easier to interpret.

Critical Thinking

22. Sample answer:

Silent: the codon UAU (which codes for Tyr) could be changed to UAC (which STILL codes for Tyr).

Missense: the codon UAU (which codes for Tyr) could be changed to UGU (which codes for Cys).

Nonsense: the codon UAU (which codes for Tyr) could be changed to UAA (which codes for "stop").

23. No, bacteria have only one long circular chromosome and do not replicate like a eukaryote.

24. The opposite is more likely to be true. Damage to introns, the non-coding segments, will not affect protein synthesis, but damage to exons, expressed segments, will alter protein synthesis.

25. The same four nucleotides are found in all organisms, and the same triplet combinations dictate the same amino acids to produce proteins.

26. The similarity of homeotic sequences in eukaryotes suggests that hox genes are inherited from a common ancestor.

27. Mobile genetic elements create new genetic combinations; alleles are exchanged and recombined in sexual reproduction. Both processes increase genetic variation.

28. Alga and fungus live somewhat independently in a lichen. Mitochondria and chloroplasts have lost their independence.

29. Sample answer: Humans use antibiotics to combat bacteria; bacterial genes change over time; some bacteria become resistant to antibiotics; these bacteria may pass on the resistance genes. So, the frequency of antibiotic resistance increases as humans use more antibiotics.

Methods of Science

30. If corn plants cross-fertilize, rather than self-fertilize, new genes can be introduced and effect changes. She needed to ensure that the genetic changes she observed had come from the same plant.

Writing for Science

31. Student products should emphasize the fact that DNA is the "blueprint" for protein synthesis. They should also include examples of the many uses of proteins in the body to illustrate that we are some what controlled by DNA.

Technology Skills

32. Check students' work for accurate images from reputable sources of information.