Name Date

Section 4.2 Summary

Mutations

Textbook pages 136–145

Before You Read

What do you think of when you read or hear the word "mutation?" Is mutation always harmful? Is mutation always helpful? Record your thoughts on the lines below.

Mark the Text

In Your Own Words

Highlight the main idea in each paragraph. Stop after each paragraph and put what you just read into your own words.

Reading Check

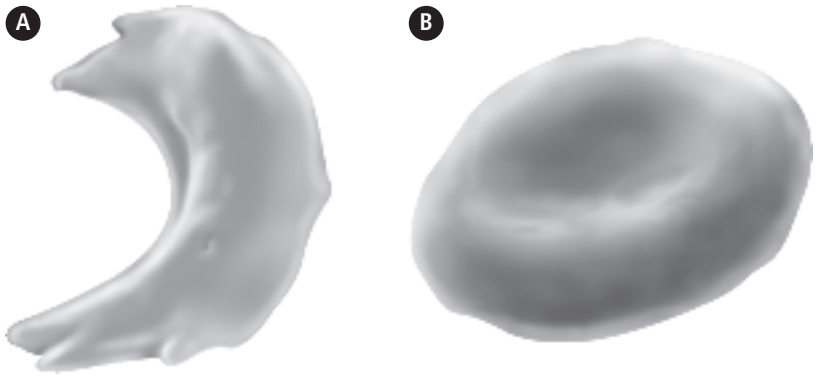
1. What is a gene mutation?

What is a gene mutation?

A **gene mutation**, or mutation for short, is a change in the genetic material (DNA) of a gene. Changes to DNA may cause proteins to be made incorrectly or with an incorrect shape. Factors in the environment, called **mutagens**, can cause mutations. Radiation, such as X rays and UV rays, is an example of a mutagen. Cigarette smoke and other poisonous chemicals such as pesticides are also mutagens.

Are mutations harmful?

Some mutations can be harmful to an organism. Harmful mutations are called **negative mutations**. For example, some people are born with a mutated gene that makes their red blood cells have a curved shape instead of the normal disc shape. The curved shape prevents the cells from carrying oxygen well and blocks blood flow in blood vessels.



A mutated gene is responsible for red blood cells being curved (A) instead of disc shaped (B).

Some mutations can be helpful to an organism. Helpful mutations are called **positive mutations**. For example, some plants carry a mutated gene that protects them from certain diseases. Some people have a mutated gene that produces a special kind of protein. This protein prevents the virus called HIV from infecting the person. This type of mutation benefits an individual.

Most mutations have no effect on an organism. These mutations are called **neutral mutations**. For example, the Spirit Bears of coastal British Columbia have a mutated gene that makes their fur white instead of black. This mutation does not affect their lives in any important way. ✔

Can mutations be fixed?

Some mutations can be treated with drugs or surgery. New techniques for treating gene mutations are called **gene therapy.** In one form of gene therapy, researchers replace a mutated gene with a healthy copy of the gene. The healthy gene must first attach to a chromosome within a patient's cells. Then the gene needs to make the correct type and amount of protein. These techniques are still experimental at this time.

✔ *Reading Check*

2. List three types of gene mutations.

_____

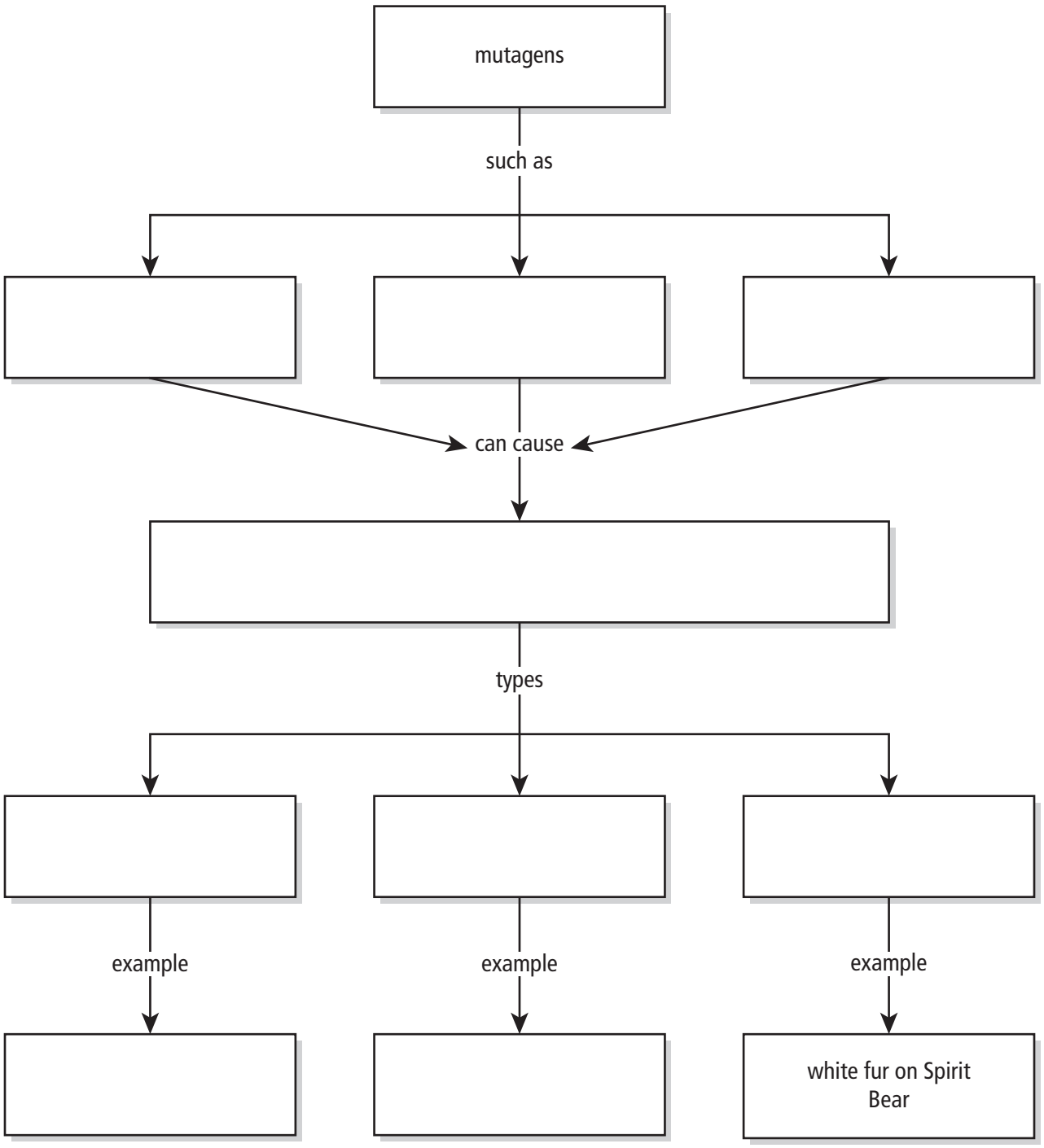
_____

_____

Use with textbook pages 136–141.

Mutations concept map

Complete the following concept map about genetic mutations.



Use with textbook pages 136–143.

Gene mutation

Answer the questions below.

1. What is a gene mutation?

2. Give the three types of gene mutations.

3. What type of mutation is beneficial to an organism?

4. Give one example of a negative mutation.

5. What type of mutation appears to have no effect on an organism?

6. What are mutagens?

7. Give four examples of environmental mutagens.

8. What are researchers doing to the mutated gene when they use gene therapy?

Name Date

Cloze Activity
Section 4.2

Use with textbook pages 138–143.

The effects of mutations

Vocabulary	
DNA	negative mutations
gene mutation	neutral mutations
gene therapy	organism
healthy gene	positive mutations
mutagens	proteins
mutated gene	

Use the terms in the vocabulary box to fill in the blanks. You will not need to use every term. You may use terms more than once.

1. A _____ is a change in the genetic material of a gene.

2. Changes to DNA may cause _____ to be made incorrectly or with an incorrect shape.

3. Factors in the environment, called _____ can cause mutations.

4. Radiation, cigarette smoke, and pesticides are examples of _____.

5. Mutations that are harmful to an organism are called _____.

6. Mutations that are helpful to an organism are called _____. For instance, some plants carry a mutated gene that protects them from disease.

7. Mutations that have no effect on an organism are called _____.

8. New techniques for treating gene mutations are called _____ and may involve replacing a _____ with a _____.

Use with textbook pages 136–143.

Mutation

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ gene mutation	**A.** techniques developed to replace mutated genes
2. _____ gene therapy	**B.** a mutation that does not affect the organism
3. _____ mutagens	**C.** a mutation that harms an organism
4. _____ negative mutation	**D.** a change in the genetic material
5. _____ neutral mutation	**E.** a mutation that benefits an organism
6. _____ positive mutation	**F.** a healthy gene
	G. substance or factor that can cause mutations in DNA

Circle the letter of the best answer.

7. The coat colour of the Spirit Bear is due to

A. change of the seasons

B. global warming

C. a mutated gene

D. environmental stresses

8. Most mutations

A. are helpful to the organism

B. are harmful to the organism

C. have no effect on the organism

D. can be treated in an organism

9. Which of the following is an example of a neutral mutation?

I.	white fur instead of black fur
II.	a mutated gene protects a plant from a disease
III.	curved red blood cells instead of disc-shaped cells

A. I

B. II

C. III

D. none of the above

10. Which type of mutation is beneficial to an organism and, therefore, aids in the organism's ability to survive?

A. neutral

B. positive

C. negative

D. deletion

11. Errors in the DNA that appear to neither harm nor help an organism are called

A. neutral

B. positive

C. negative

D. substitutions

12. Which of the following can cause mutated genes?

I.	cigarette smoke
II.	radiation
III.	pesticides

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III