

- For enrichment, students could experiment with other DNA sources to determine which sources provide the most DNA. Students could also experiment with different soaps and detergents. Do powdered soaps work as well as liquid detergents? How about shampoo or body scrub? Students could experiment with leaving out or changing steps and determine if they change the amount of DNA extracted.

### What Did You Find Out? Answers

- (a) DNA will appear white and stringy and will feel slimy.  
(b) Students may say they are surprised that DNA is white even though the strawberries are red.
- Students should say that the DNA from another organism would look similar, since the DNA in all living organisms has the same structure of sugar phosphate backbones and bases.
- It is necessary to crush the strawberries to break through the cell wall, since strawberries contain plant cells. Also, the crushing helps break the cell membrane and nuclear membrane.
- The DNA became visible when the alcohol was added. (This is because DNA stays dissolved in water but precipitates out or forms a solid in alcohol).
- If you add more alcohol, you will get more DNA precipitating out. Adding more salt will make more of the DNA clump together and will add to the amount of DNA as well. (The grinding and mixing with detergent breaks the cell membrane and nuclear membrane. Ethanol makes DNA uncoil and precipitate out. In water, DNA is soluble, so it stays dissolved. Salt is used because the sodium ions clump together with the negatively charged DNA and help it stick together.)

### ■ USING THE FEATURE

#### www science: **Glowing Genes**, p. 134

Ask students to read the feature independently, record what they think is important about glowing genes, and then pair up with another student to discuss and share their thoughts. An alternative is to have students write three things they learned about glowing genes and write down one thing they still wonder about. Check for student understanding on

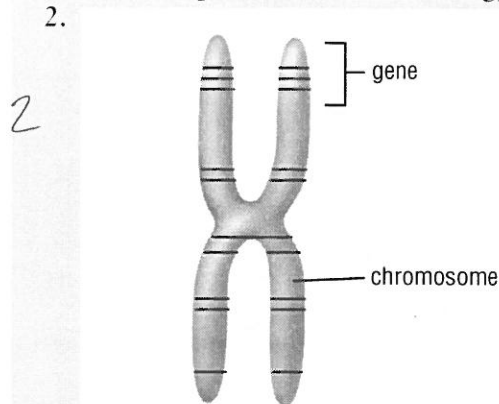
the future use of glowing genes and the advantages of using glowing genes over other tracing methods.

### ■ SECTION 4.1 ASSESSMENT, p. 143

#### Check Your Understanding Answers

##### Checking Concepts

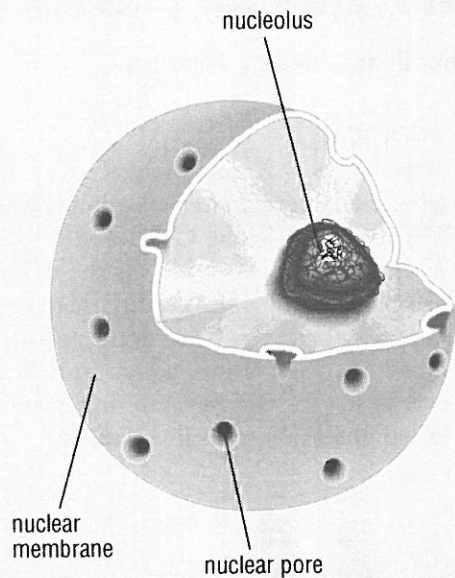
- (a) The answer is A, the nucleus, since it contains the genetic material to make proteins.  
(b) The answer is B, the Golgi body.  
(c) The structure shown in C is the chloroplast, which traps the energy from the Sun to make glucose. The structure shown in D is a mitochondrion, which provides energy for the cell by changing a sugar called glucose into usable energy.



- The function of genes is to store the information to make a specific protein.
- To transport the information for a gene out of the nucleus, the DNA message for a specific protein is copied into a small molecule called ribonucleic acid (RNA), which is small enough to leave through the nuclear pore of the nucleus.
- The ribosomes that manufacture proteins for transport out of the cell are located on the endoplasmic reticulum.
- The function of the Golgi body is to repackage the protein for transport out of the cell.
- A. sugar; B. base; C. phosphate

## Understanding Key Ideas

8.



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9. The nucleus contains the information on the genes to make different proteins. These different proteins help the cell carry out life functions by functioning as enzymes and hormones or forming structures within the cell.
10. A skin cell is different than a nerve cell because different proteins are made within each type of cell. Different proteins are made because different genes are read on the DNA molecule.
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11. Even though all cells in our body contain the genes that code for the protein hemoglobin, only signals received by red blood cells will cause the reading of these genes from the DNA and the copying of these genes into RNA.
12. If a protein was not made within a cell or the protein was not made correctly within that cell, there may be no effect on the individual. But if there were many of the same type of cells unable to make that protein, the individual might develop a disease since that protein is not functioning to do its job.
13. The sequence on the other side of the molecule would be TGGACGATA.
14. A strand could lack thymine because there was none available in the cell when the DNA was being made. The gene message would now be different, and the proteins made would be different and probably not useful to the cell.
15. A change in the bases of A, G, C, and T would be most damaging because this would change the information carried in the genes to make a

specific protein, so that protein would not be made correctly.

16. DNA cannot leave the nucleus because the DNA molecule is too large to go through the nuclear pores.

### Pause and Reflect Answer

Answers will vary but should include the idea that DNA contains the information in the genes to make proteins. Proteins direct the activities of the cell and therefore direct the life of the cell and the life of the organism.

### Other Assessment Opportunities

- Assessment Checklist 1, Making Observations and Inferences
- Assessment Checklist 2, Asking Questions
- Assessment Checklist 3, Designing an Experiment
- Assessment Checklist 6, Developing Models
- Assessment Checklist 7, Scientific Drawing
- Assessment Checklist 11, Poster
- Assessment Checklist 13, Concept Map
- Assessment Checklist 14, Events Chain or Flowchart
- Assessment Checklist 20, Assessment Record Form
- Assessment Checklist 23, Learning Skills
- Assessment Checklist 24, K-W-L Assessment Checklist
- Process Skills Rubric 1, Developing Models
- Process Skills Rubric 2, Hypothesizing
- Process Skills Rubric 3, Controlling Variables
- Process Skills Rubric 4, Problem Solving
- Process Skills Rubric 7, Predicting
- Process Skills Rubric 8, Interpreting Data
- Process Skills Rubric 9, Questioning
- Assessment Rubric 1, Concept Rubric
- Assessment Rubric 2, Science Notebook Rubric
- Assessment Rubric 3, Co-operative Group Work Rubric
- Assessment Rubric 6, Design Your Own Investigation Rubric

## 4.2 MUTATION

### ■ BACKGROUND INFORMATION

There are two main categories of mutation: gene mutations and chromosome mutations. This section talks about gene mutations. Gene mutations occur in the base sequence of DNA. There are three types of mutations that may occur in the sequence: addition, loss, or substitution of a base. Substitution of a base is the least damaging. The effects of mutations can be