Data Analysis 21 **Molecular Homology in Hoxc8**

**Goal**
Infer relationships among animals by comparing DNA nucleotides of homologous genes.

**Skills Focus**
Calculate, Analyze Data, Draw Conclusions

**Build Connections**
Homologous parts of organisms share certain characteristics that point to their descent from a common ancestor. Forelimbs are a good example. For example, a mouse, a whale, and a chicken appear very different. Yet their forelimbs share similarities in the shape and positions of the bones.

The evidence of homology in evolution is not just limited to parts of the body. Some proteins and genes are also homologous. Like homologous structures, these molecules can be used to infer relationships among species. The diagram shows a small portion of the DNA for the gene, Hoxc8, for three animals—a mouse, a baleen whale, and a chicken.

<table>
<thead>
<tr>
<th>Sequence of Bases in Section of Hoxc8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mouse</strong></td>
</tr>
<tr>
<td>CAGAATGCCACTTTATGGCTCCTGTTCCTCTCTC</td>
</tr>
<tr>
<td><strong>Baleen whale</strong></td>
</tr>
<tr>
<td>CGAAATGGCTCTTTATGGCGCTGTTTCTCTGCCG</td>
</tr>
<tr>
<td><strong>Chicken</strong></td>
</tr>
<tr>
<td>AAAAAATGCGCTTTTACAGCTCTGTTCCTCTGTA</td>
</tr>
</tbody>
</table>

**Analyze and Conclude**

1. **Calculate** What percentage of the nucleotides in a baleen whale’s DNA are different from those of a mouse? First, count the nucleotides in one entire sequence. Then, count the nucleotides in the whale DNA that differ from those in the mouse DNA. Finally, divide the number of nucleotides that are different by the total number of nucleotides, and multiply the result by 100.
2. **Calculate** What percentage of the nucleotides of a chicken are different from those of a mouse?

3. **Draw Conclusions** Do you think a mouse is more closely related to a baleen whale or to a chicken? Explain.

4. **Evaluate** It is not unusual for a gene to have thousands of bases in its sequence. Would you expect that scientists typically use small sections of DNA, like the one in the table, or larger sections to infer evolutionary relationships? Explain.

5. **Infer** What modern piece of technology plays an important role in the ability of scientists to study genes?

**Build Science Skills**

Hox genes are a group of genes that control the development of an organism. How might the similarity of Hox genes in a mouse, whale, and chicken be related to their homologous forelimbs?