Jelly Bean Genes

Materials
- 10 paper cups for each small group
- 4 different colors of jelly beans or other “counters” - 6 of each color
- Data collecting sheets (pages 2-4)
- Marker pen to identify cups

Directions
1. Label the ten paper cups as follows:
   Grandfather 1   Grandfather 2   Andrew   Emily
   Grandmother 1   Grandmother 2   Michael
   Father       Mother       Madeleine

   Place the cups on the table in an arrangement like that shown on page 2.

2. Place six red beans in the Grandfather 1 cup and six green beans in the Grandmother 1 cup. Put six yellow beans in the Grandfather 2 cup and six blue beans in the Grandmother 2 cup. The beans represent the genes of each of the grandparents - the hereditary information that the grandparents will pass on to their children. Color the diagram on page 2 to show the colors used for each grandparent.

3. Without looking, select three beans (genes) from the Grandfather 1 cup and three from the Grandmother 1 cup. These genes represent the daughter of the first grandparents - the daughter who will grow up to become a mother herself. Place them in the cup marked Mother. The Mother now has six genes, just as did each of her parents.

4. Without looking, take three genes each from the Grandfather 2 and Grandmother 2 cups. Place them in the cup marked Father. The Father should now have six genes, just as did each of his parents. Color the diagram to show the genes for the Mother and the Father.

5. Assume that the Mother and Father have four children - Andrew, Emily, Michael, and Madeleine - as shown in the diagram. To find Andrew’s genes, draw (without looking) three genes each from the Mother and Father cups. Color the blanks in the space for Andrew to match the colors of the genes you chose.

6. Return all genes to the cups. (Return red and green genes to the cup labeled Mother. Put the yellow and blue genes in the cup marked Father.) Now select Emily’s genes. Close your eyes when you select the genes. Continue for Michael and Madeleine.

7. Summarize your data in the following table. In each box, write the number of genes each child received from each grandparent. (The total should always be six.)

<table>
<thead>
<tr>
<th></th>
<th>Andrew</th>
<th>Emily</th>
<th>Michael</th>
<th>Madeleine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grandfather 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandmother 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandfather 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandmother 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
Going Further
Part 1

1. Repeat the process described in Steps 5 and 6 of the Directions 20 times. Record the colors of the beans selected each time on this tally list.

<table>
<thead>
<tr>
<th>Color</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
</tr>
</tbody>
</table>

Complete the bar graph. What do you notice about the heights of the bars?

2. Complete the phrase that BEST completes the following statement. The chance that a red bean will be selected is...

A. About one in four
B. About 30 out of 120
C. About the same as the chance that a yellow bean will be selected.
D. About the same as the chance for any other bean.

Justify your answer. ______________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

3. Do you think your results would have been the same if you had started out with twice as many red beans as any other color?

Why or why not? ______________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
Jelly Bean Genes (Questions for Discussion)

Directions: Discuss the following questions with other students. Record your answers in the space provided.

1. Were any of the four children exactly alike? ___________________________________
   What do you think would have happened if you had been working with many hundreds of genes, instead of only six?
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

2. Why was it necessary to take three genes (beans) from the Mother cup and three genes (beans) from the Father cup to “create” a child?
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

3. Why was it necessary to return the genes (beans) to the cup each time? ______________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

4. Suppose the beans were actually genes that controlled some very obvious traits. Which of the children would look most alike?
   Justify your answer. ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

5. Which of the children would most resemble a parent or grandparent? ______________
   Justify your answer. ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________
Jelly Bean Genes (Answer Key)

Answers will vary, suggested answers:

Page 3

2.  D  The beans were selected randomly

3.  The results would probably change because the chance of picking red would increase.

Page 4

1.  Were any children alike?  Answers will vary depending on the group.  
    With hundreds of genes there may have been some that were alike because there would be many 
    more opportunities to roll the same combination by chance.

2.  Because the parents each contribute the same number of traits

3.  Because each opportunity requires the same chances

4.  The children who received the controlling genes.  
    Justification: The controlling gene would mask the recessive trait

5.  Those whose dominant or controlling genes came from that parent or grandparent  
    Justification: Dominant genes control the observable traits