Measuring Human Phenotypic Variation

This lab will investigate some of the variation of genetic traits in a population. Thumb length and bending ability will be examined and then statistically analyzed. The thumb bending trait is determined by a pair of alleles. The two thumb alleles include the more common dominant allele for straight thumbs (H) and a recessive allele for hitchhiker thumb (h). Those people with two recessive alleles for hitchhiker's thumb are able to bend the distal joint of the thumb at an angle of 45 degrees or more. This is also called hyperextension of the thumb. People possessing at least one dominant H allele for a thumb that is straight, or close to being straight, express the dominant phenotype.

Purpose

You will examine the thumb phenotype of each member of your class. Once you have determined everyone's thumb type, you will measure and record each person's thumb length. The data will then be analyzed using the spreadsheet program, Excel.

Materials

thumb	metric ruler
paper	computer with MS Excel

Procedure

1. In the section labeled hypothesis on your student answer sheet record the percentage of people in your class that you expect to display the hitchhiker thumb phenotype.

2. In the space provided on your student answer page, draw a data table with three columns and as many rows as there are students in your class. The columns should be titled: Initials, straight thumb length (mm) and hitchhiker thumb length (mm).

3. Determine whether or not you have a hitchhiker's thumb by comparing to the diagram below.

4. By using the picture below, measure your thumb in millimeters from joint 2 to the tip of your finger. Do not include the measurement of your fingernail. Be as accurate as you can in your measurement, to the nearest 0.1 millimeter. Your answer might be 80.1 millimeters but not 80 millimeters.

Hitchhiker's Thumb

Joint 2   Joint 1   Tip
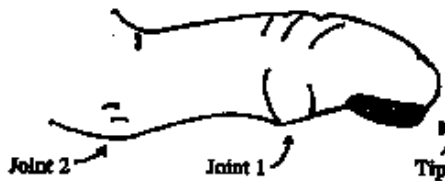
(Use this picture when determining what to measure.)

5. Record the measurement of your own thumb in millimeters in the appropriate thumb type column. Record your initials in the first column.

6. Record the measurements of your classmates' thumbs in the appropriate columns. Be sure you have the same number of rows as there are students in your class. If you have difficulty determining the thumb type, ask your teacher for help.

7. If your teacher instructs, repeat step 6 for another group of people. Use a separate piece of paper for this second data table.

8. Working with a partner, use a computer to start the program, MS Excel (Start>Programs>Microsoft Excel), to create a spreadsheet of your data from the two classes.

9. Save the empty spreadsheet onto your hard drive or into a network folder if you have that capability. Record the file name on your student answer page.

10. Transfer the data from your data table into columns A, B, and C on the Excel worksheet. If you measured a second group of people use a different sheet in the same workbook.

11. Once your values are entered, skip a row and title a new row AVERAGE and the following row STANDARD. DEVIATION. Then, use the spreadsheet to calculate the following: (Your teacher will demonstrate how to start this.)
   a. The mean (average) thumb lengths of H_ individuals in your class.
   The command for averaging a column is =AVERAGE(B2:Bx), where B or C is the column of numbers you wish to average and where x is the number of your last row on the spreadsheet.
   b. The mean (average) thumb lengths of hh individuals in your class.
   c. The mean (average) thumb lengths of H_ individuals in the second test group.
   d. The mean (average) thumb lengths of hh individuals in the second test group.
   e. The standard deviation in thumb lengths of H_ individuals in your class
   The command for calculating the standard deviation is =STDEV(B2:Bx) where x is the number of your last row on the spreadsheet.
   Standard deviation is a statistic showing how much variation from the mean exists in your sample.
   f. The standard deviation in thumb lengths of hh individuals in your class
   g. The standard deviation in thumb lengths of H_ individuals in the second test group.
   h. The standard deviation in thumb lengths of hh individuals in the second test group.
   i. If your teacher allows, determine how you would calculate the standard deviation for the H_ and hh trait for BOTH classes on your spreadsheet. Extra credit may be awarded for successful completion.