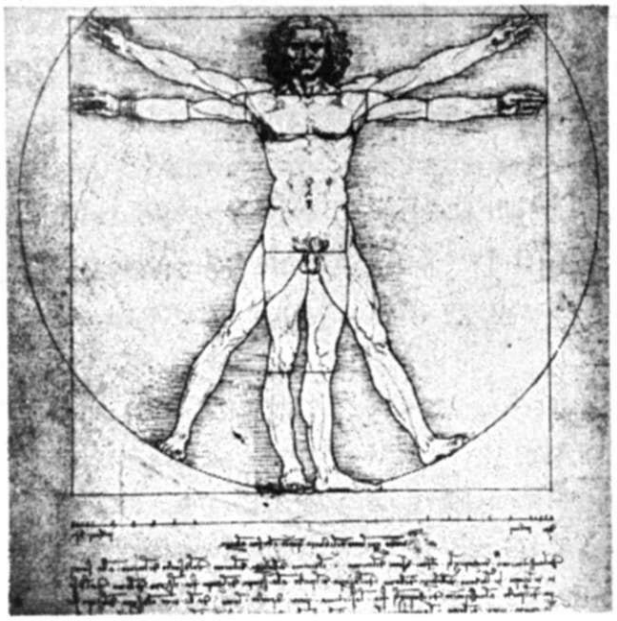
Vitruvian Man Meets the Scientific Method
Writing and Testing Appropriate Hypotheses

Leonardo da Vinici's drawing *Vitruvian Man* shows how the proportions of the human body fit perfectly into a circle or a square. This diagram by Leonardo da Vinci is an illustration of Vitruvius' theory. According to Vitruvius's theory the distance from fingertip to fingertip (arm span) should be equal to the distance from head to heel (height). In this activity you will explore the legitimacy of Vitruvius' theory by developing a hypothesis regarding the Vitruvian Man.



A hypothesis is a possible explanation for a set of observations or an answer to a scientific question. A hypothesis is useful only if it can be tested. Testable hypothesis are generally written in a formalized format using an *if/then* statement.

- If my car does not start because the battery is dead, then when I replace the old battery with a new one it will start.
- If increasing physical activity causes a person to burn calories and lose weight, then I should lose weight if I run 2 miles a day.

Formalized hypotheses contain both a dependent and an independent variable. The independent variable is the one that you change and the dependent variable is the one you observe and measure to collect data. Using the *if-then* format, if I change temperature, then what will happen to movement. Temperature is the independent variable because I change it and movement is the dependent variable because it is the one that is observed to look for change. Using the *if-then* format forces the scientist to think about what results are expected.

PURPOSE

In this activity you will devise and test a hypothesis regarding Vitruvius' theory on human proportions. In Part II, you will devise and test a hypothesis concerning the relationship between foot and arm span lengths.

MATERIALS

14 metric measuring tapes

PROCEDURE

PART I

1. Write an *if-then* hypothesis based on Vitruvius' theory relating arm span and height. Record your hypothesis on the student answer page.

2. Working with a partner, measure your arm span by standing against a flat surface and spreading your arms out as far as possible. Have your partner measure the distance from the longest finger on one hand to the tip of the longest finger on the other hand. Record your measurements in Data Table 1.

3. Repeat step two on your partner.

4. Remove your shoes and have your partner measure your height as you stand against a flat surface. Measure the distance from the top of your head to the floor. Record your measurements in Data Table 1.

5. Repeat step 4 on your partner.

6. Calculate the difference between your arm span and your height (arm span-height). Record your calculations in Data Table 1.

7. Gather data from 10 additional students in the classroom. Record the student's name, sex and data in Data Table 2.

PART II

1. Some people have observed that the length of their foot is the same as the length of their forearm. Others disagree saying there is no relationship between the two. You have been assigned to investigate this phenomenon. As a good scientist, you know that first thing you need to do is write a hypothesis. Is there a direct relationship between the length of a person's foot and the length of their forearm? Write an *if-then* hypothesis for this relationship on the student answer page in the space labeled Hypothesis #2.

2. Collect foot-forearm data from five people and record the measurements in Data Table 3.

Name _____

Period _____

Vitruvian Man Meets the Scientific Method
Writing and Testing Appropriate Hypotheses

HYPOTHESIS #1

HYPOTHESIS #2

DATA AND OBSERVATIONS

Data Table 1: Lab Partner Data			
Measured in cm	Arm Span	Height	Difference
Your measurements			
Your Partners measurements			

Data Table 2: Class Data in cm			
Person M/F	Arm Span	Height	Difference

Data Table #3: Foot Size/Arm Length Comparison			
Person M/F	Length of foot	Length of forearm	Difference

CONCLUSION QUESTIONS

1. Does your individual data for height and arm span lead you to accept or reject Vitruvius' hypothesis? Why or why not?

2. How do your height and arm span results compare to other groups in the class? Explain.

3. Does the class height and arm span data support Vitruvius' hypothesis? Why or why not?

4. When comparing males and females, does one group fit Vitruvius' hypothesis more closely than the other? Explain your answer.

5. Write a conclusion statement based on the data that you have collected.

6. Based on the data that you have collected is there a correlation between the length of the forearm and the length of the foot? Explain your answer.

7. Why was it necessary to collect data from other students in the class?

8. Write a conclusion statement based on the data that you have collected for Hypothesis #2.