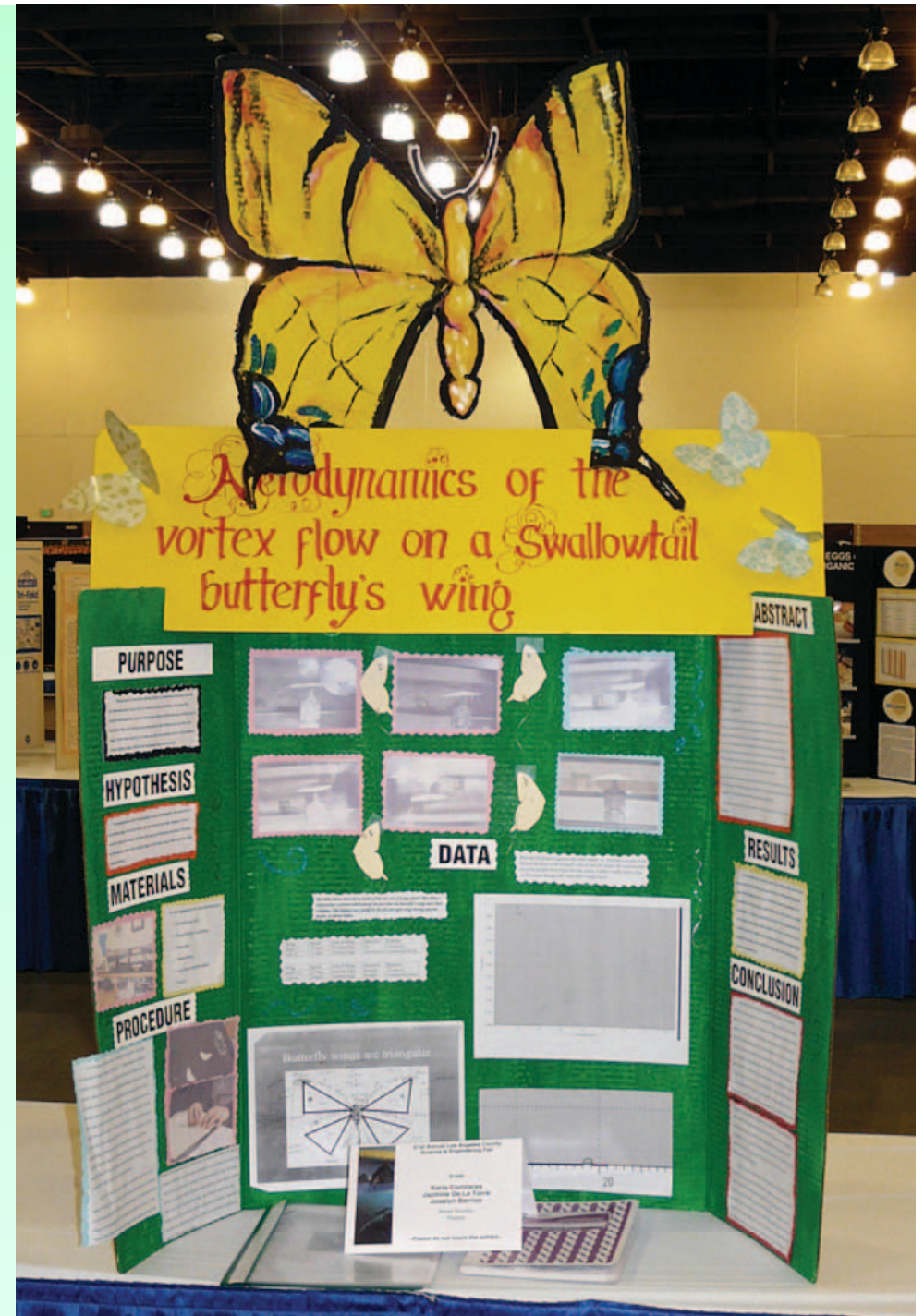


# Boggled by Bugs?



# Experiment in **Animal Biology**



# Constant Competitor?




# Work on **Animal Physiology!**

## Copepod Culturing: Conditions for Maximum Yield per Generation



### Statement of Problem

Could produce the most copepods per generation? How do temperature and light intensity affect the population? How long would they reach sexual maturity?



### Results

After experimentation, it became clear that the highest copepod yield occurred in the first trial, with a 200% increase in the first trial and a 100% increase in the second. In addition, copepods taken from the culture only fed with algae had a higher sex ratio, and were much larger in size when compared to those taken from the culture fed only with fish food.

	CONTROL	10 DEGREES F	15 DEGREES F	20 DEGREES F
INITIAL	100	100	100	100
1 WEEK	200	170	150	100
2 WEEK	400	300	200	100

First Trial Population Count

The temperature that allowed that anything above 15 degrees Fahrenheit resulted in a steep decline with all of the copepods dead. The ideal temperature for the copepods California seemed to be a mean temperature of about 10 degrees Fahrenheit.

	CONTROL	10 DEGREES F	15 DEGREES F	20 DEGREES F
INITIAL	100	100	100	100
1 WEEK	100	170	150	0
2 WEEK	400	300	200	0

Temperature That Mean Population Count

Finally, for the light trial, it was concluded that there is no strong correlation between light intensity and copepod population. However, there was an overall positive trend when exposed to the higher light intensity of 75 watts.

	CONTROL	75 WATT	40 WATT
INITIAL	100	100	100
1 WEEK	200	170	150
2 WEEK	400	300	200

Light Trial Population Count

### Introduction

Copepods are an extremely diverse family of crustaceans, with over 10,000 different species. Although the majority of copepods are parasitic, some are considered to be free-living. The free-living copepods can be divided into two groups: the planktonic and the benthic. The planktonic copepods are the most common and are found in all aquatic environments. They are important for many marine species that depend on them for food. They are also important for many species that depend on them for food.

### Methods and Materials

#### Culture Set-Up

- Four gallon buckets were used as the culture containers.
- Each bucket of the copepods was set up in a party with just enough time to keep the water from becoming stagnant, and each set of with 100 gravid female copepods of the species *Tigraea californica*.

#### Temperature Trial Cultures

- Four buckets per used in this trial, and temperature are regulated through heaters.
- Additionally, three cultures will have a glass-glass top to reduce large amount of evaporation that could affect the quality of the culture.
- The temperatures tested are room temperature (68 degrees Fahrenheit), 70 degrees Fahrenheit, 75 degrees Fahrenheit, and 80 degrees Fahrenheit.

#### Light Trial Cultures

- Four buckets per used in this trial, and light intensity are regulated through heaters.
- Additionally, three cultures will have a glass-glass top to reduce large amount of evaporation that could affect the quality of the culture.

#### Culture Sampling

- Every ten weeks, conduct 200 samples are taken through a net.
- The water is applied to large cylinders in even distribution throughout the culture.
- These random samples are taken from each culture, and the average of three samples are used to estimate the culture population.
- Copepods are sorted out with a fine glass jar and are counted with a tally counter.
- Random size samples are taken, the copepods from the bucket are placed back into the original culture to maintain the population.

### Hypothesis

That higher light intensity will result in a higher population of copepods. That higher temperature will result in a higher population of copepods. That higher light intensity will result in a higher population of copepods.

### Data





Time	Control	10 Degrees F	15 Degrees F	20 Degrees F	75 Watt	40 Watt
Initial	100	100	100	100	100	100
1 Week	200	170	150	100	170	150
2 Week	400	300	200	100	300	200

### Conclusions

After experimentation, it became clear that the highest copepod yield occurred in the first trial, with a 200% increase in the first trial and a 100% increase in the second. In addition, copepods taken from the culture only fed with algae had a higher sex ratio, and were much larger in size when compared to those taken from the culture fed only with fish food.

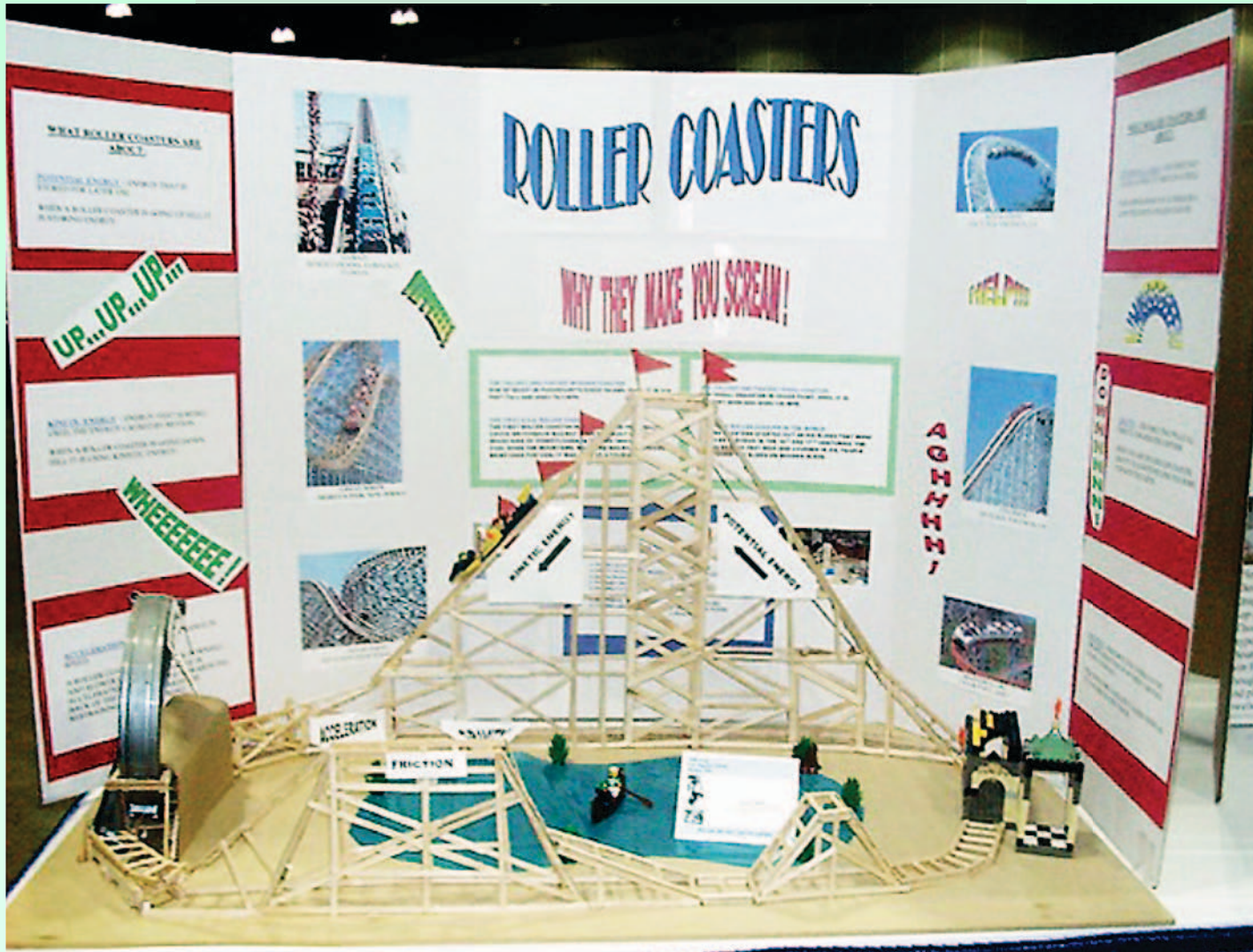
### Further Research

Some other factors that can be tested in the future include the amount of water circulation, the amount of light intensity, and the amount of food. Future research could also include testing the effect of different light intensities and temperatures on the copepods' growth and development.

# Coaster Crazy?



# Try Behavioral Science- Human Study



# Avid About Animals?



# Work in Behavioral Science- Non- Human





# Love Labwork?



# Try a Biochemistry/Molecular Biology Project

## A Single Amino Acid Substitution Switches a Protein Specificity

### Abstract

As one of the six Tumor Necrosis Factor Receptor Associated Factor (TRAF) family members, TRAF3 plays a critical role in regulating the non-canonical NF- $\kappa$ B pathway. TRAF3 mutations are associated with both human disease and experimental disease. The amino acid of TRAF3 that is able to specifically bind to I $\kappa$ B $\alpha$ . Based on the sequence information and crystal structure studies, we found that amino acid of TRAF3 that is able to specifically bind to I $\kappa$ B $\alpha$  is Y441. We have shown that Y441 is a critical residue for TRAF3 to bind to I $\kappa$ B $\alpha$  and that a single amino acid substitution can switch the binding specificity of TRAF3 to that of TRAF5. Our studies may provide insight for drug design on TRAF proteins in both cancer and inflammatory diseases.

### TRAF3 is a critical regulator for the non-canonical NF- $\kappa$ B activation pathway

TRAF3 is an essential molecule involved in non-canonical NF- $\kappa$ B activation, which plays an important role in regulating normal immune responses. Mutations of TRAF3 in humans are associated with cancer such as multiple myeloma and auto-immune diseases such as lupus.

### TRAF3 but not TRAF5 can specifically bind to I $\kappa$ B $\alpha$ and regulate p100 processing to p62

### TRAF3 electrostatic surface map with I $\kappa$ B $\alpha$ peptide

### Y441 plays a critical role in TRAF3 binding to I $\kappa$ B $\alpha$

### Sequence alignment among 6 TRAF proteins

Protein	TRAF1	TRAF2	TRAF3	TRAF4	TRAF5	TRAF6
TRAF1	1-200	1-200	1-200	1-200	1-200	1-200
TRAF2	1-200	1-200	1-200	1-200	1-200	1-200
TRAF3	1-200	1-200	1-200	1-200	1-200	1-200
TRAF4	1-200	1-200	1-200	1-200	1-200	1-200
TRAF5	1-200	1-200	1-200	1-200	1-200	1-200
TRAF6	1-200	1-200	1-200	1-200	1-200	1-200

### Create cDNA clones with a point mutation in TRAF3

### A single amino acid substitution switches the binding specificity of TRAF proteins

### Conclusion

Based on the sequence alignment and crystal structural studies, we found that amino acid of TRAF3 that is able to specifically bind to I $\kappa$ B $\alpha$  is Y441. We have shown that Y441 is a critical residue for TRAF3 to bind to I $\kappa$ B $\alpha$  and that a single amino acid substitution can switch the binding specificity of TRAF3 to that of TRAF5. Our studies may provide insight for drug design on TRAF proteins in both cancer and inflammatory diseases.

# Photography Fan?



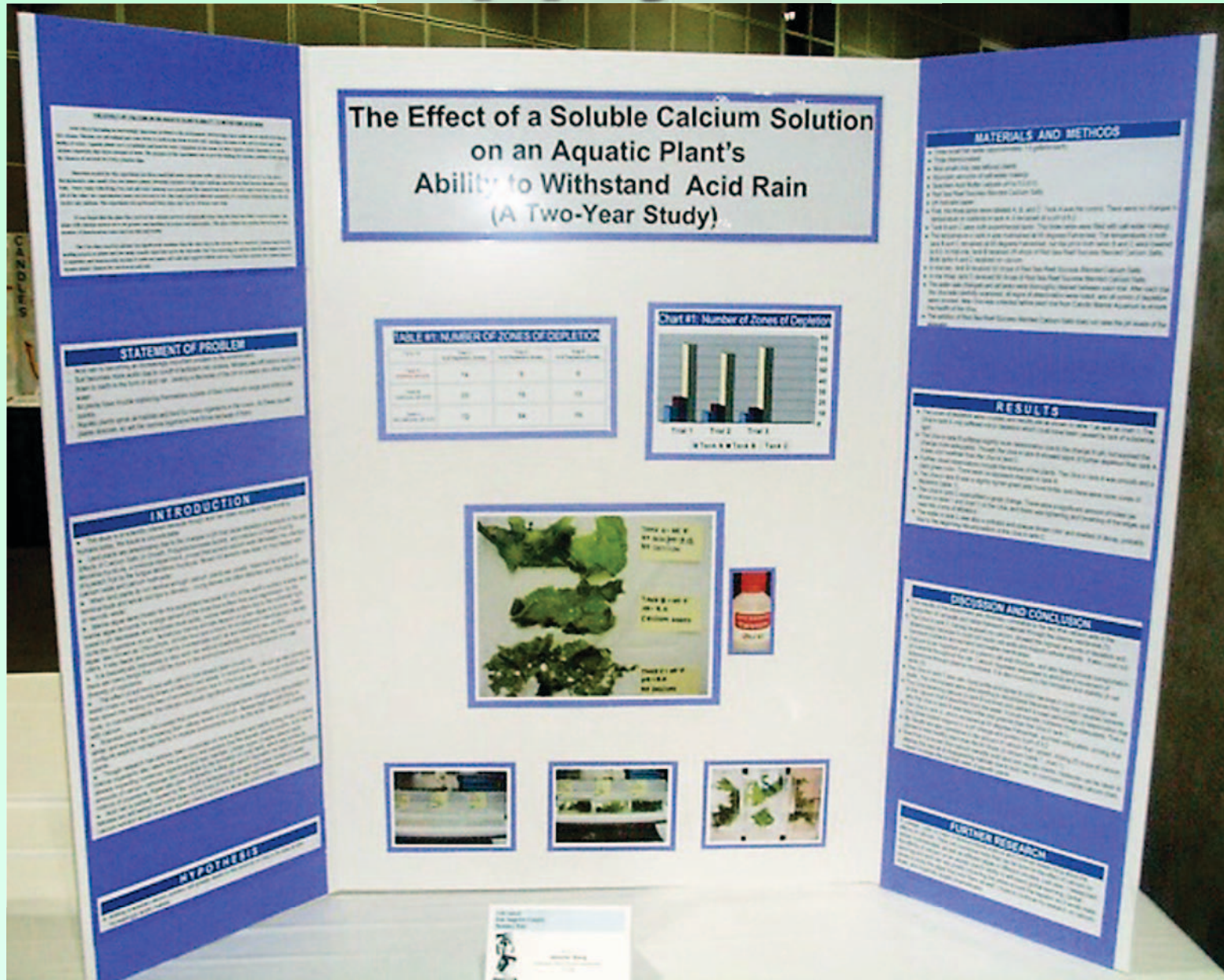
# Study the Chemistry Behind it



# Crazy about Chemistry?



# Apply It!

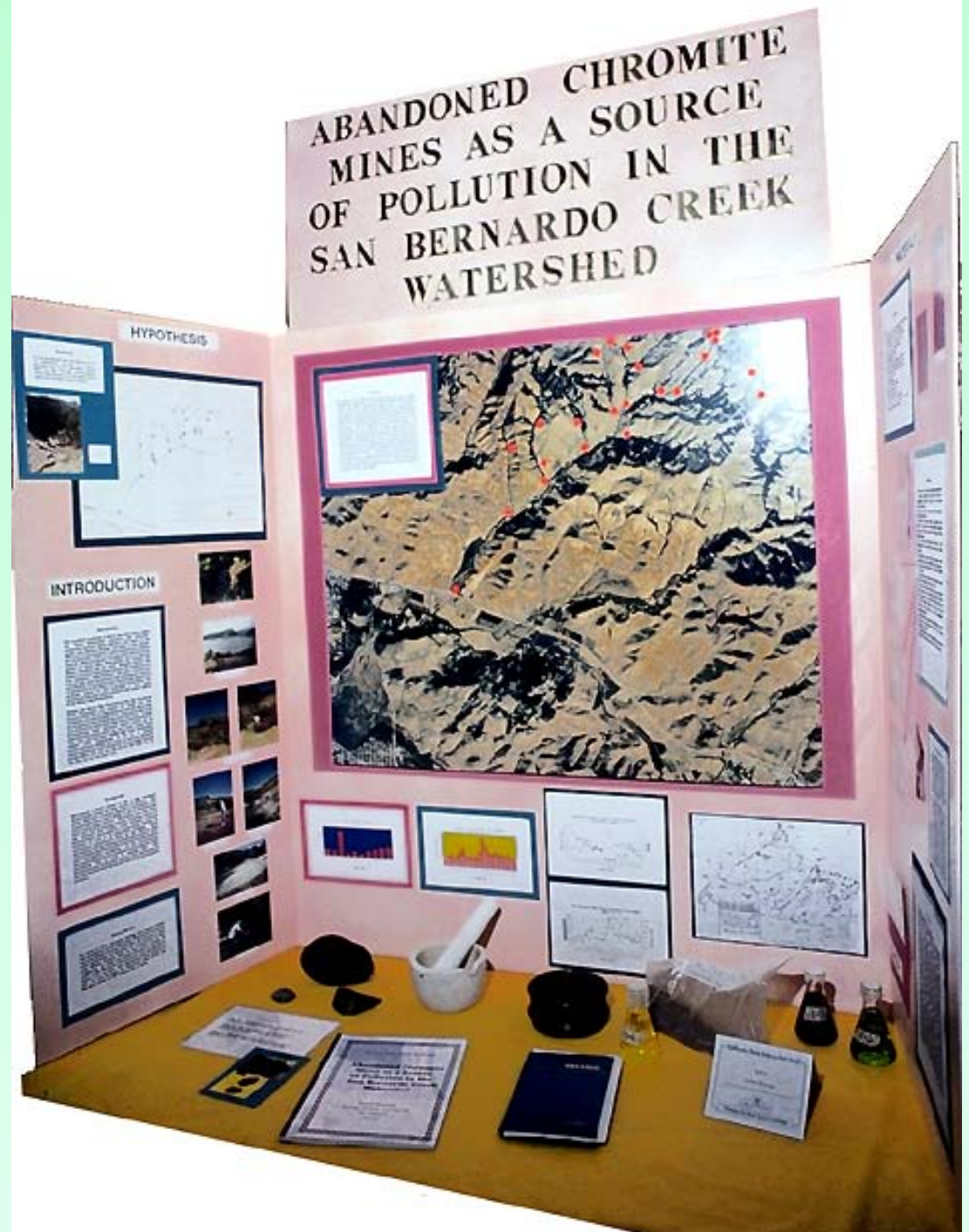


# Rocks Knock Your Socks?



**Delve into**

**Earth/  
Space  
Science**

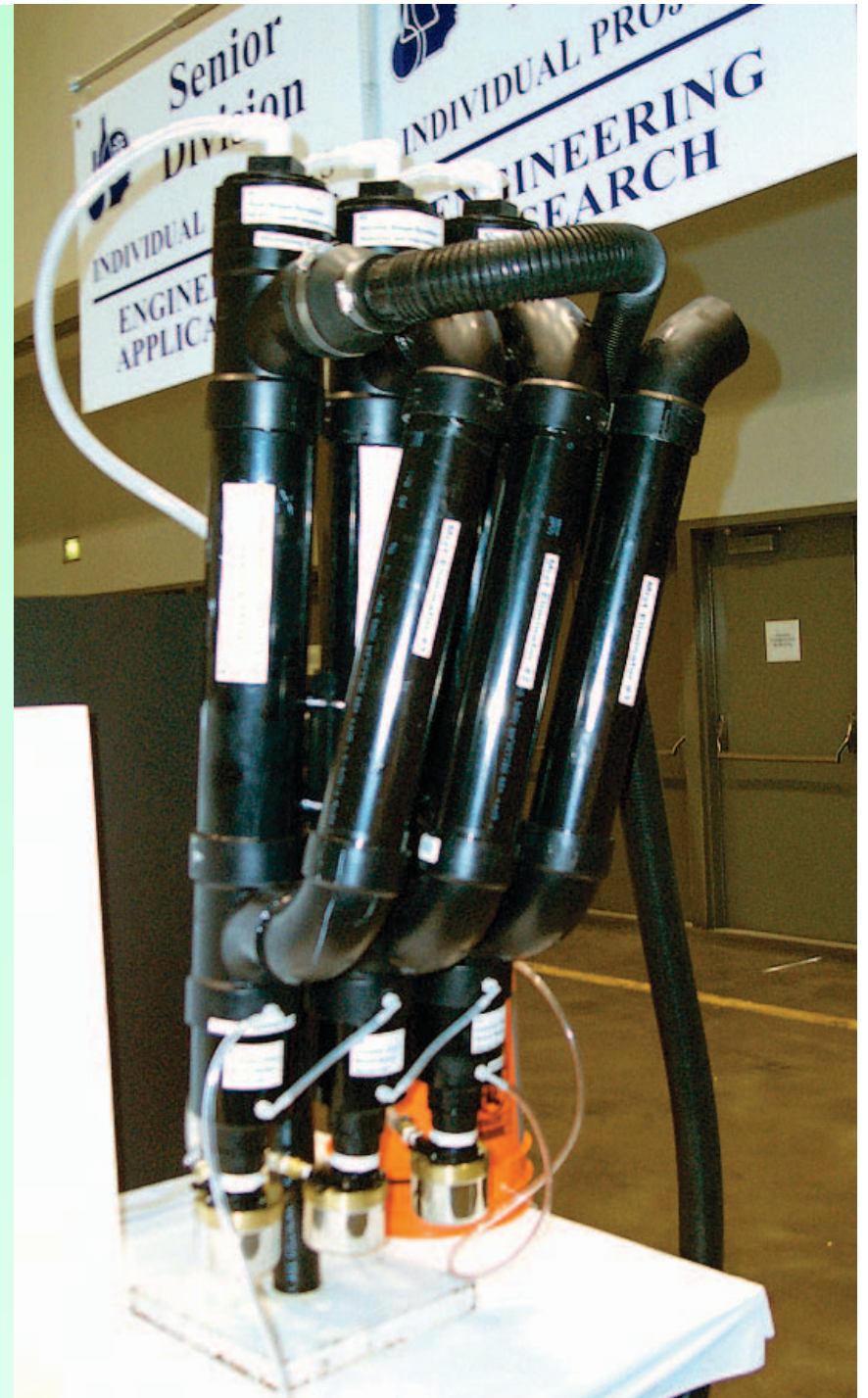




***Always  
Asking  
WHY???***



**Try**  
**Engineering**  
**Research**



# Care for Mother Nature?



# Can Aquatic Plants Improve the Water Quality of Polliwog Pond?

## Do Environmental Management

**Figure 2. Storm Drain**

**Figure 3a. Water Collection**

**Figure 4a. Internal Structure of Water Hyacinth Bulb**

**Figure 4b. Illustration of Water Hyacinth**

**Figure 3b. Test Tub With Plants**

**Control Tub**

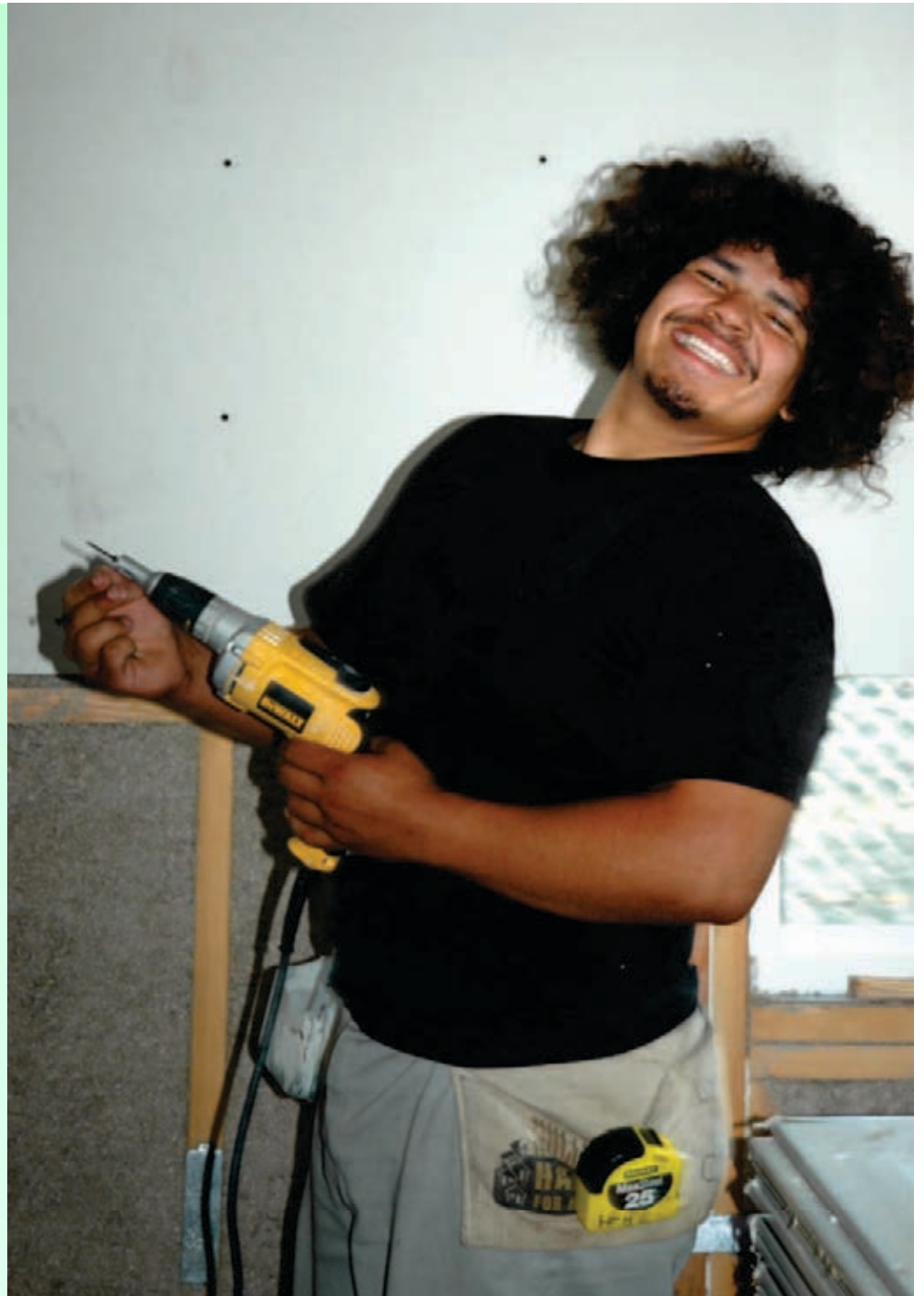
**Colorimetric Water Test**

**Figure 5. Algae Comparison**

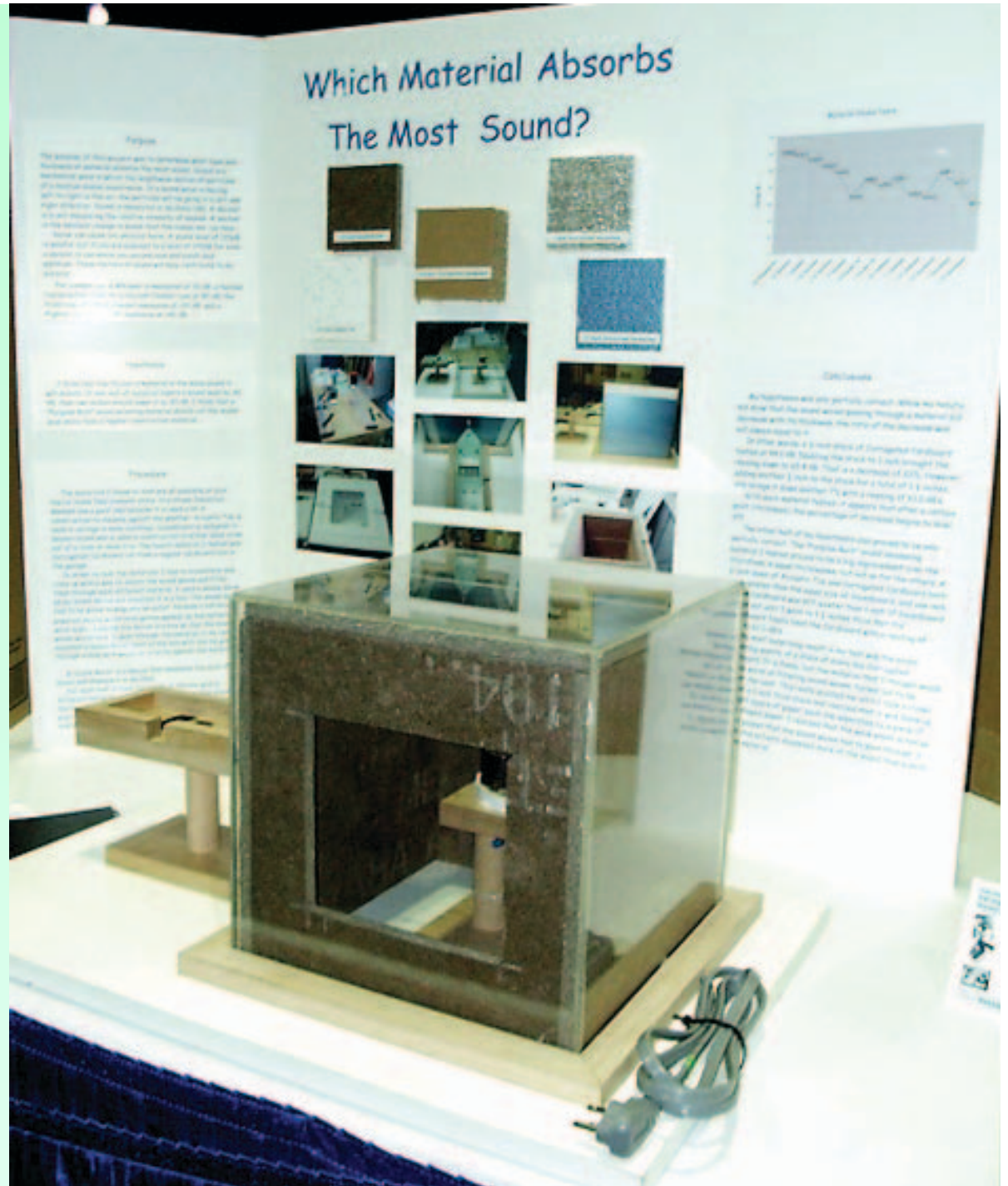
**Conclusion**

After conducting this experiment I agree my hypothesis of "I believe the test tube will be able to measure more nitrogen levels of comparison than the test tube of pond water than from the control test". The rapid decline of nitrate levels in the water shows that the plants were filtering them out in the cubic and absorbing the nitrate. The declining levels of the other nitrate substances probably showed that they either evaporated into the air or that they were processed along the nitrogen cycle by the surviving bacteria in the water. The ammonia/nitrite levels in the test tube decreased to a consistent level of 0.10 ppm after the first 24 hours of the experiment, which suggests that during clear cells were feeding the nitrogen into a stable level. The bacteria could also have come in the sediment attached to the roots of the plants. These plants could probably be used to clean the water in Polliwog Pond. Another plant that could be used is water hyacinth. This technique may also be used in low developed countries as an alternative form of sewage treatment, which would greatly improve water quality. In these areas I got the idea I did by comparing the results of untreated tests to tests with control and comparing nitrate to them. This experiment would measure their rate constant monitoring of the water. Just while comparing the nitrate in the water, I found that it is possible to measure the corresponding nitrate and nitrite. Thus the increase in the chemical levels in the graph could be either from nitrogen already existing in the water or from the decomposition of the color reagent. The absolute nitrate reading of 0.10 ppm is an alternative form of sewage treatment. Throughout the experiment, the water drops were always high enough to indicate that they were monitoring with the nitrate measurement, which is much more precise and reliable. I had conducted a similar experiment for environmental science I report nitrate readings on the report as a regular basis. This experiment could be improved by possibly comparing the results of the test to water quality parameters, or by comparing the results of the test to the water quality parameters, or by comparing the results of the test to the water quality parameters. This experiment is a good one to do about the nitrogen cycle and how aquatic plants can be used to treat water.

**Want to  
Change the  
World?**



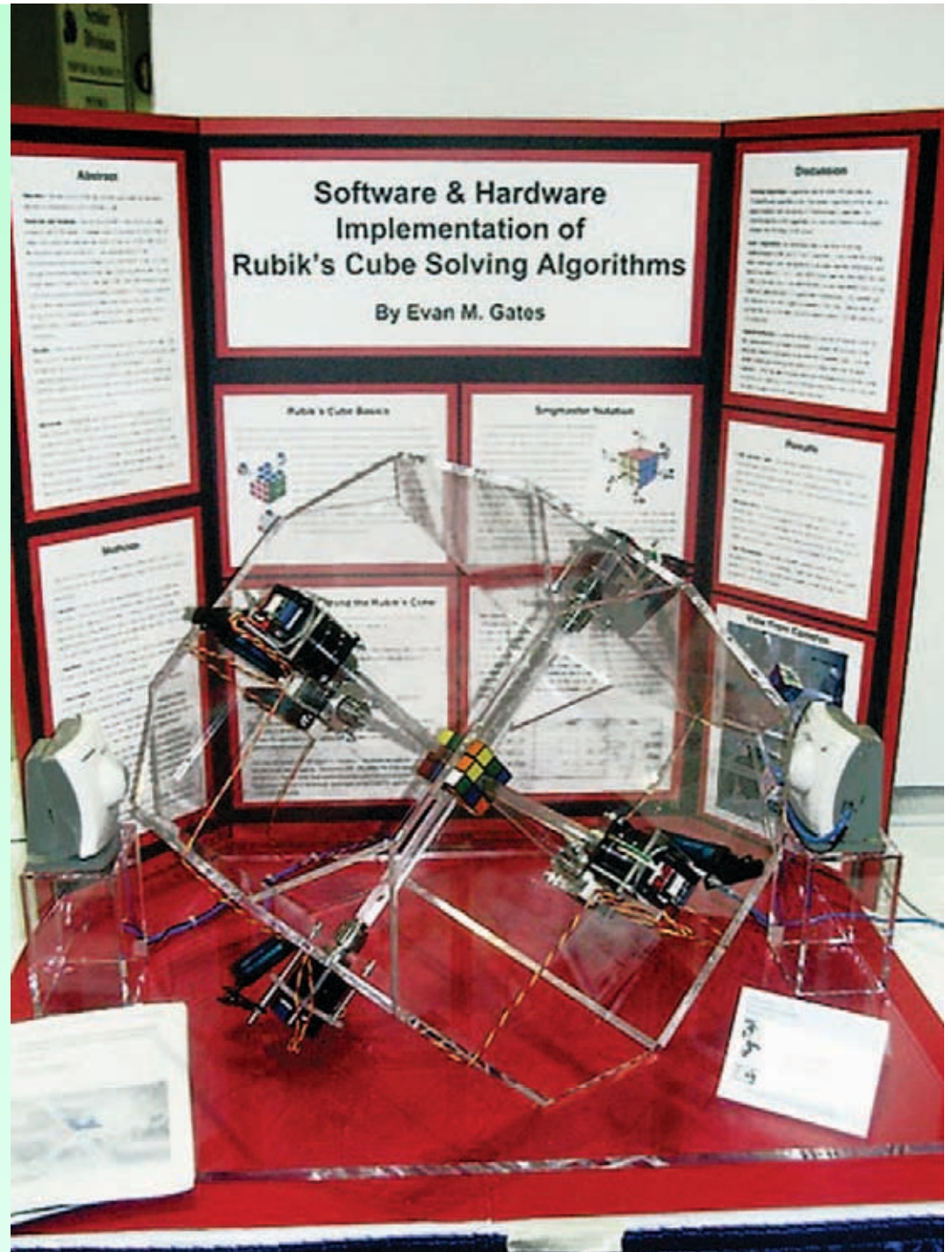
# Do Materials Science



# A Computer Whiz?



# Do Math/ Computer Science





# Keen to Crunching #'s?



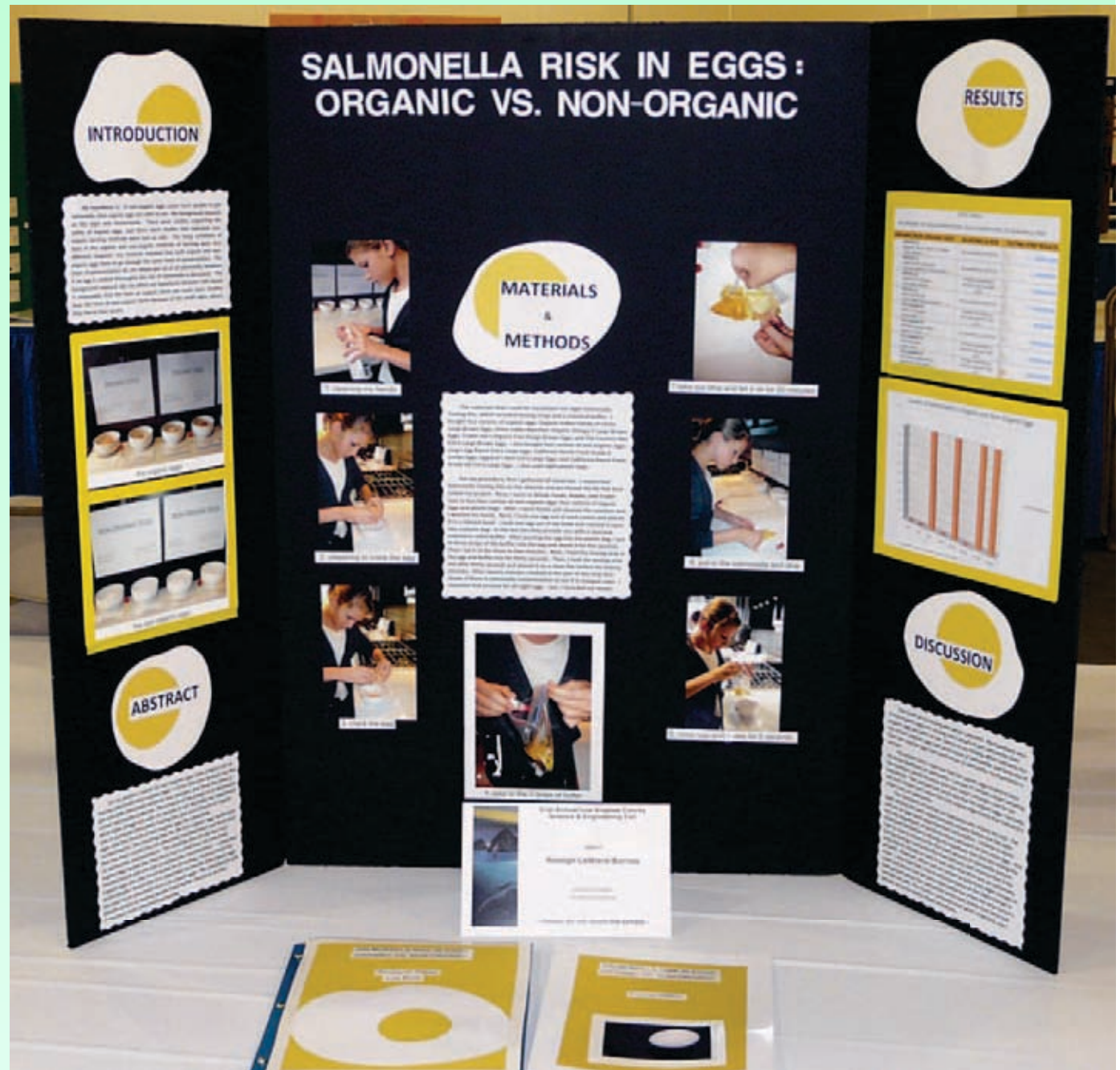
**Make a  
Math/  
Computer  
Science  
Project**



**Love to  
Look at  
Little  
Stuff?**



# Design a Micro- biology Study



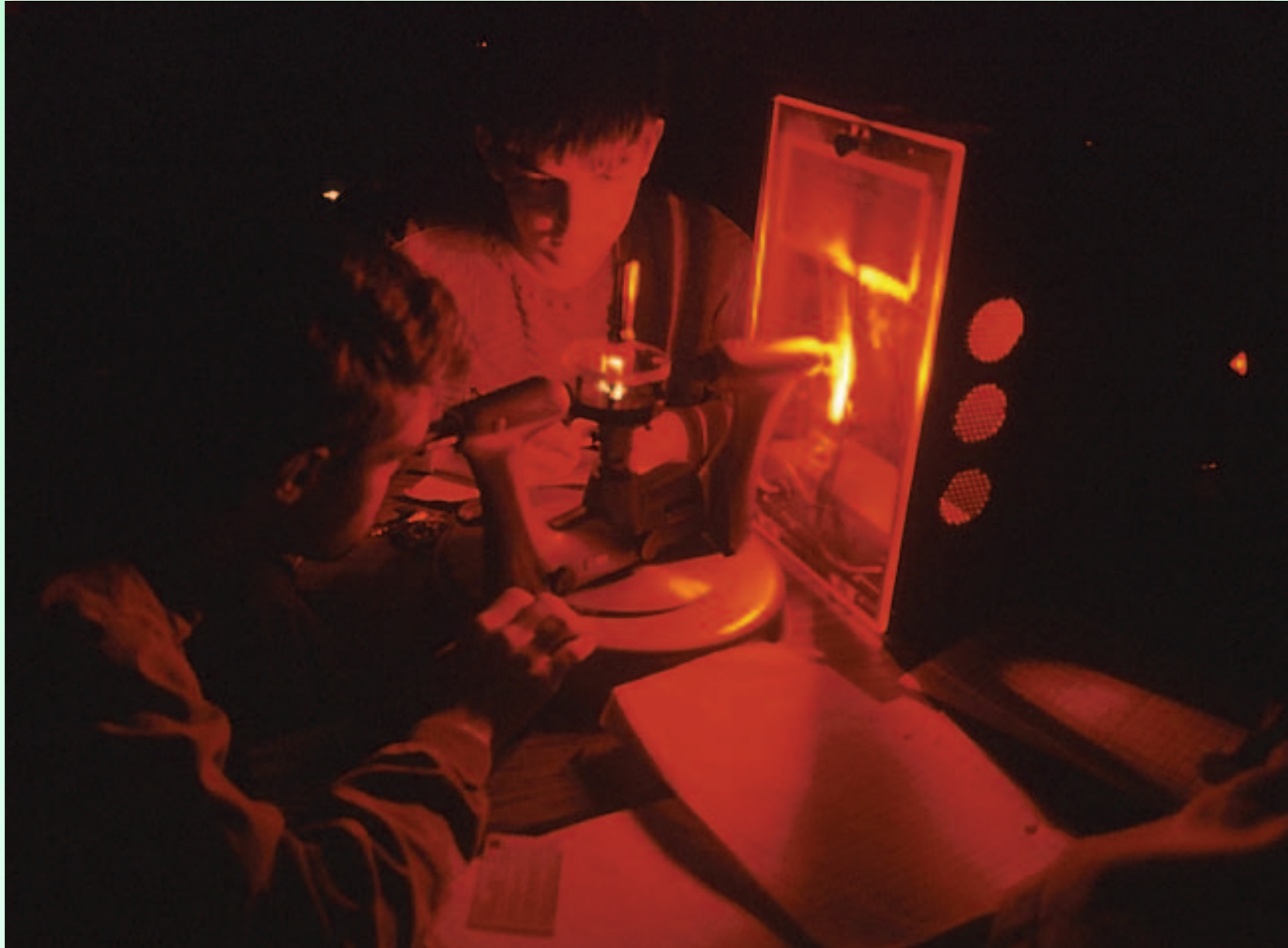
# Curious About WHY Drugs Work the Way They Do?



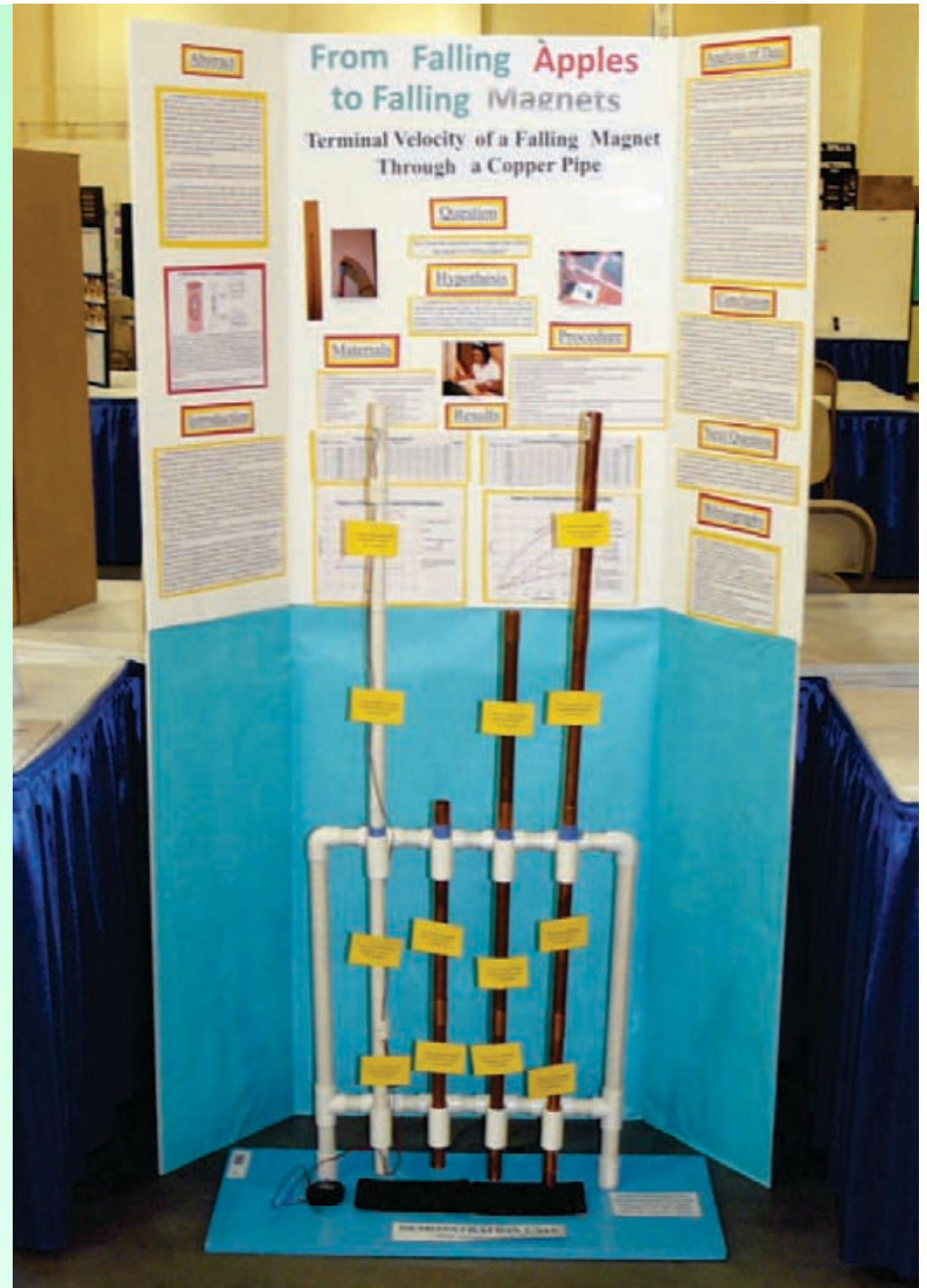
# Work in Pharmacology



# Love Physical Science?



# General Physics Studies are for You

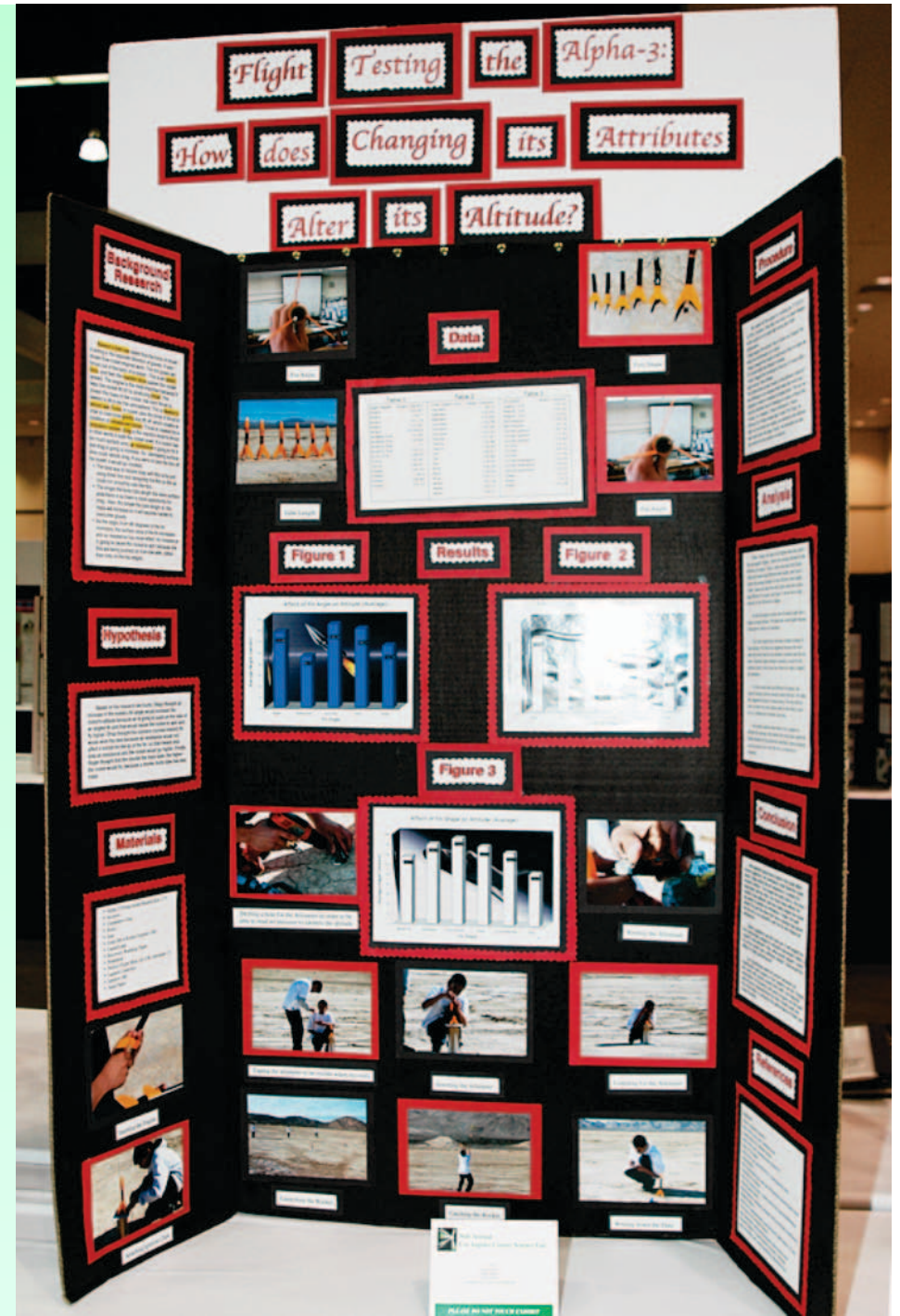




# Love “Flying” in Water?



# Physics: Aerodynamics/ Hydrodynamics are for *YOU!*



**Electricity  
Give You a  
Charge?**



# Physics: Electricity/Magnetism

## May be Your Bag

**ABSTRACT**

The objective of this project was to determine the optimum orientation and tilt angle of solar panels for maximum energy production. The project was conducted over a period of two weeks, during which the solar panels were oriented in various directions and tilt angles. The results of the experiment are presented in the following sections.

**INTRODUCTION**

Solar energy is a renewable source of energy that is becoming increasingly important. The amount of solar energy that can be captured by solar panels is dependent on the orientation and tilt angle of the panels. The objective of this project was to determine the optimum orientation and tilt angle of solar panels for maximum energy production.

**MATERIALS & METHODS**

The materials used in this project were a solar panel, a digital multimeter, and a protractor. The method used was to measure the energy production of the solar panel at different orientations and tilt angles. The data was then analyzed to determine the optimum orientation and tilt angle.

**THE OPTIMUM ORIENTATION AND TILT ANGLE OF SOLAR PANELS**

**DATA ANALYSIS**

**Table 1: Average Energy Production (Wh/m<sup>2</sup>) from Solar Panel by Orientation and Tilt Angle**

Orientation	10:00 AM		1:00 PM		4:00 PM	
	0°	15°	0°	15°	0°	15°
NORTH	10.20	10.20	10.20	10.20	10.20	10.20
EAST	9.80	9.80	9.80	9.80	9.80	9.80
WEST	9.50	9.50	9.50	9.50	9.50	9.50

**Table 2: Average Energy Production (Wh/m<sup>2</sup>) from Solar Panel by Orientation and Tilt Angle**

Orientation	10:00 AM		1:00 PM		4:00 PM	
	0°	15°	0°	15°	0°	15°
NORTH	10.20	10.20	10.20	10.20	10.20	10.20
EAST	9.80	9.80	9.80	9.80	9.80	9.80
WEST	9.50	9.50	9.50	9.50	9.50	9.50

**Table 3: Average Energy Production (Wh/m<sup>2</sup>) from Solar Panel by Orientation and Tilt Angle**

Orientation	10:00 AM		1:00 PM		4:00 PM	
	0°	15°	0°	15°	0°	15°
NORTH	10.20	10.20	10.20	10.20	10.20	10.20
EAST	9.80	9.80	9.80	9.80	9.80	9.80
WEST	9.50	9.50	9.50	9.50	9.50	9.50

**RESULTS**

The results of the experiment show that the optimum orientation and tilt angle for maximum energy production is 0° tilt and North orientation. The energy production was highest at 10:00 AM and lowest at 4:00 PM.

**CONCLUSION**

The optimum orientation and tilt angle for maximum energy production is 0° tilt and North orientation. The energy production was highest at 10:00 AM and lowest at 4:00 PM.

**FUTURE STUDIES**

Future studies could include measuring the energy production of solar panels at different times of the day and in different locations.

# Born with a Green Thumb?



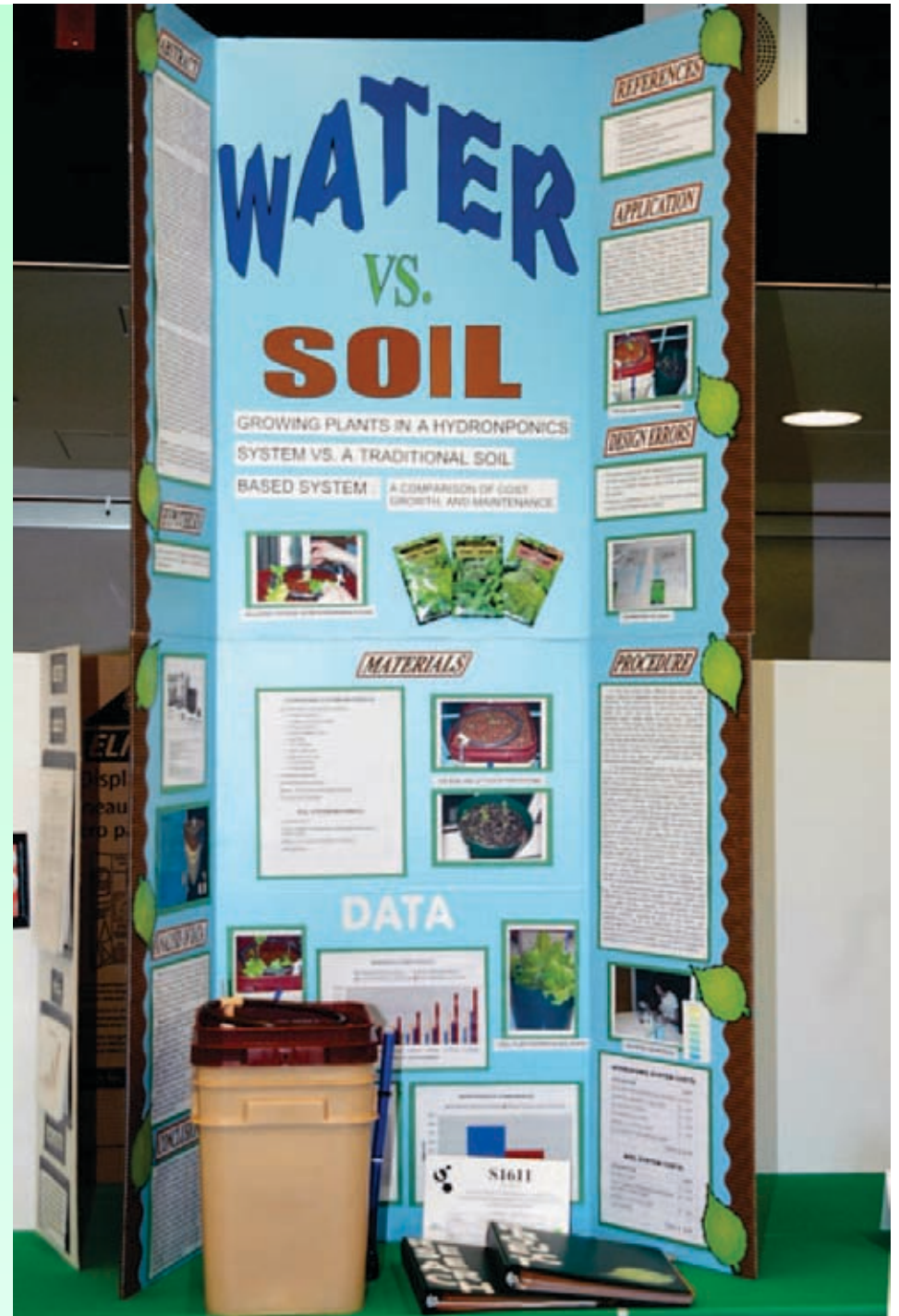
# Investigate Plant Biology



# Want to Feed the World?



# Do Plant Physiology

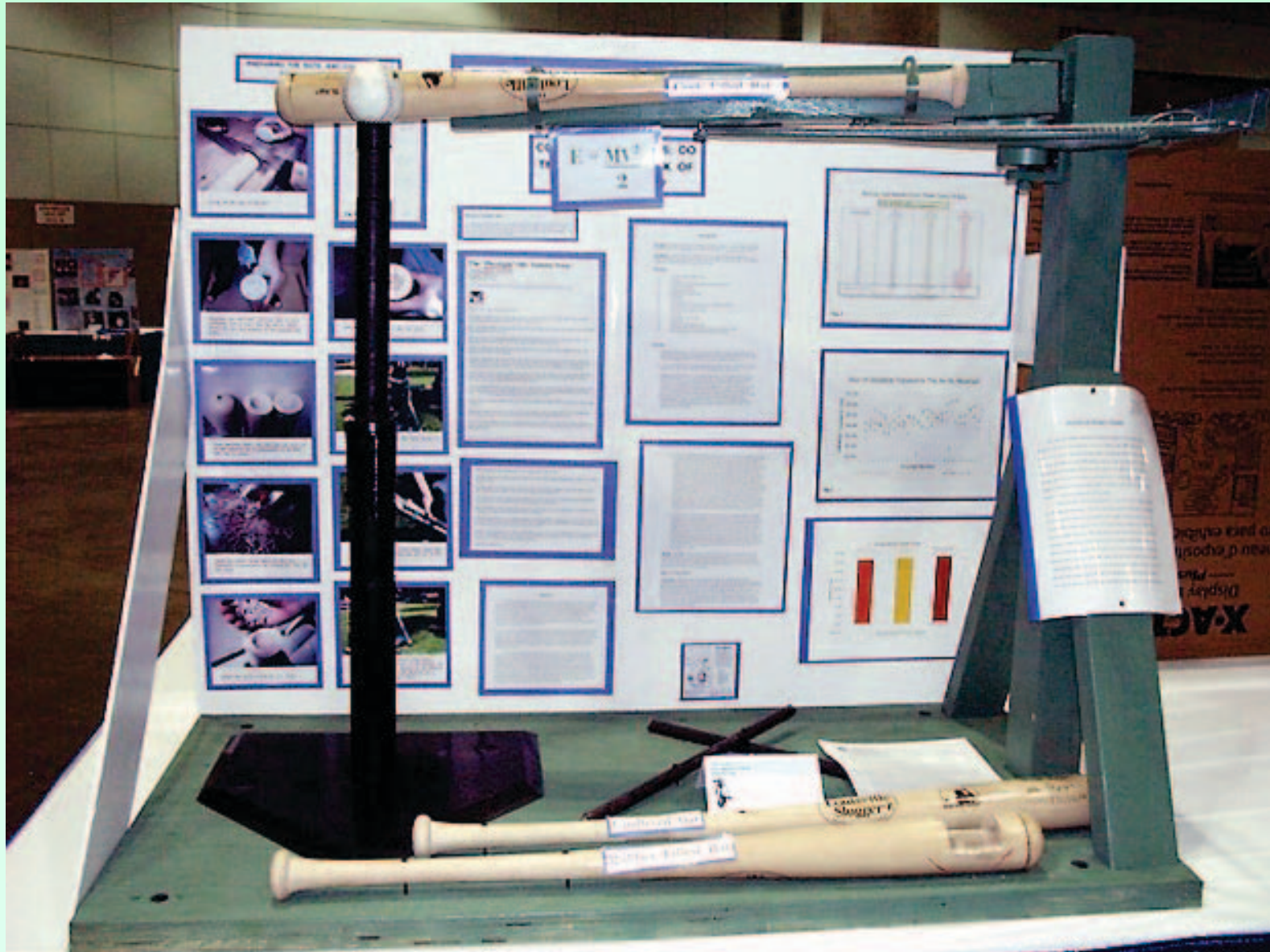




# Like to Compare Things?



# Try Product Science!



**Designed & Photographed by**

***Anne F. Maben***

**Former AP Science Coach, LACOE**

**for the**

**Los Angeles County Science Fair**

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