

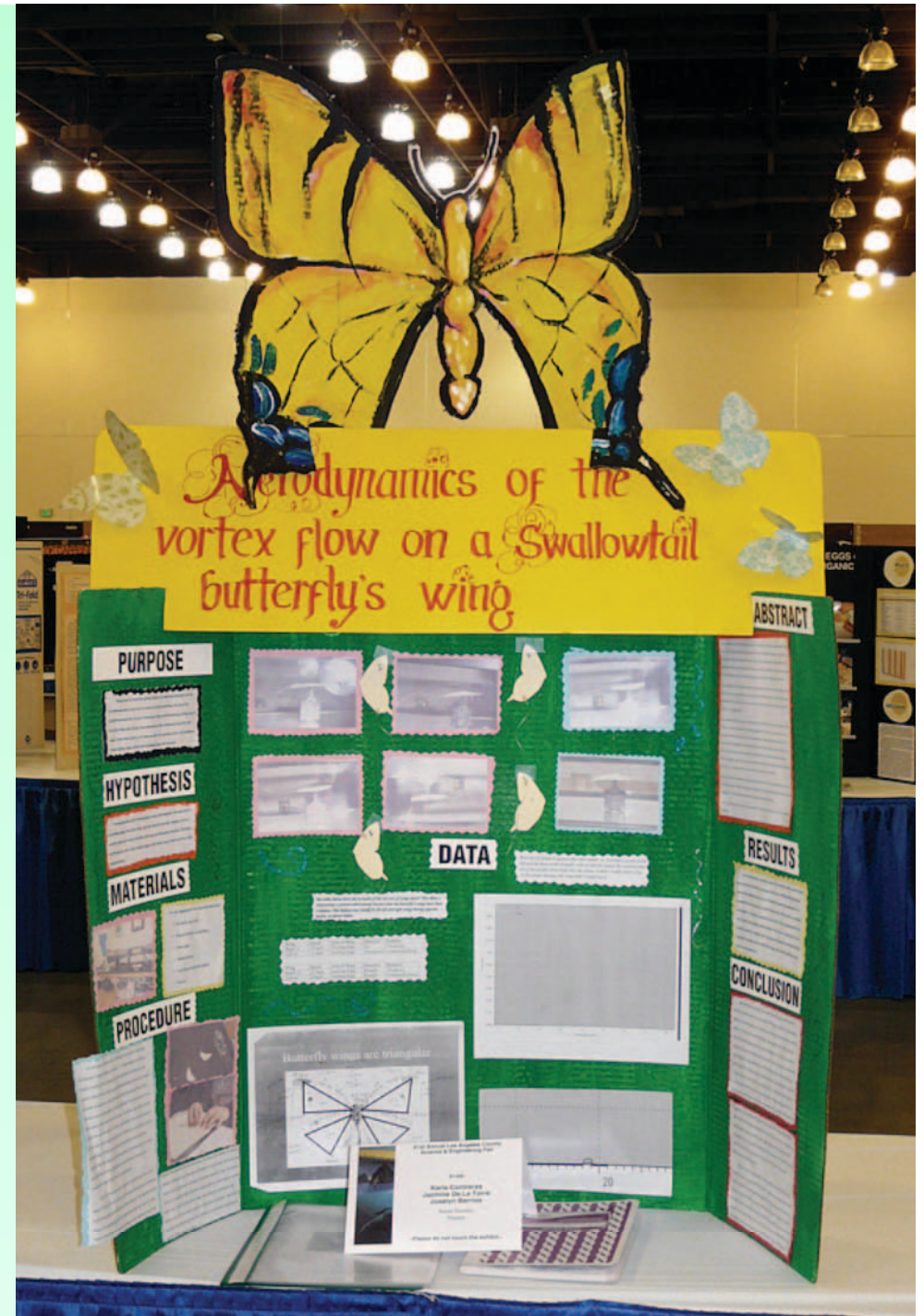
# Choosing a Topic from Your Own Interests: Examples



# 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 light 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.

Generation	Temperature	Light Intensity	Sex Ratio	Mean Population
1	20°C	High	1.5	100
2	20°C	High	1.5	200
3	20°C	High	1.5	300

And the Mean Population (mean)

The temperature that showed that anything above 15 degrees Fahrenheit resulted in a mean population of all of the copepods dead. The above temperature for the species Tigraea Calanoides seemed to be a mean temperature of about 20 degrees Fahrenheit.

CONTROL	15 DEGREES F	20 DEGREES F	25 DEGREES F
INITIAL	100	100	100
1 WEEK	100	170	0
2 WEEK	0	200	0

Temperature That Mean Population (mean)

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
1 WEEK	200	110
2 WEEK	300	100

Light That Mean Population (mean)

### 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 important. The best known copepods are those that parasitize fish and other aquatic animals. In the primary consumer, many of the copepods are the entire aquatic food chain. They are also important that many species are used as experimental fish or invertebrate organisms.

### Methods and Materials

#### Culture Set-Up

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

#### Temperature Trial Cultures

- Four buckets per used in the 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 variety 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 the 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 variety of the culture.
- The light intensities tested are 40 watts, 75 watts, and 100 watts.

#### Culture Sampling

- Every ten weeks, conduct 2000 samples, are taken through a syringe.
- The water is applied to large syringe 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 counted out with a glass pipette and are recorded with a tally counter.
- Random size samples are taken, the copepods from the bucket are placed back into the original culture to be used in the next trial.

### Hypothesis

Most likely the different light of food on the copepods, the control feeding schedule of all three copepod groups in three parts should show in the highest yield due to the control and that the copepods will be consuming.

As for the water temperature, warmer water should result in a higher population because heat speeds metabolism and that result in faster growth and development.

Finally, cultures that are exposed to higher light intensities and produce more individuals due to the increased algae growth that can be obtained on supplemental food for the copepods.

### Conclusions

After experimentation, it became clear that the highest copepod yield occurred in the light 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.

The temperature that showed that anything above 15 degrees Fahrenheit resulted in a mean population of all of the copepods dead. The above temperature for the species Tigraea Calanoides seemed to be a mean temperature of about 20 degrees Fahrenheit.

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.

### Data



Time	15°C	20°C	25°C
0	100	100	100
1 Week	100	170	0
2 Week	0	200	0

Time	40W	75W	100W
0	100	100	100
1 Week	200	110	100
2 Week	300	100	100

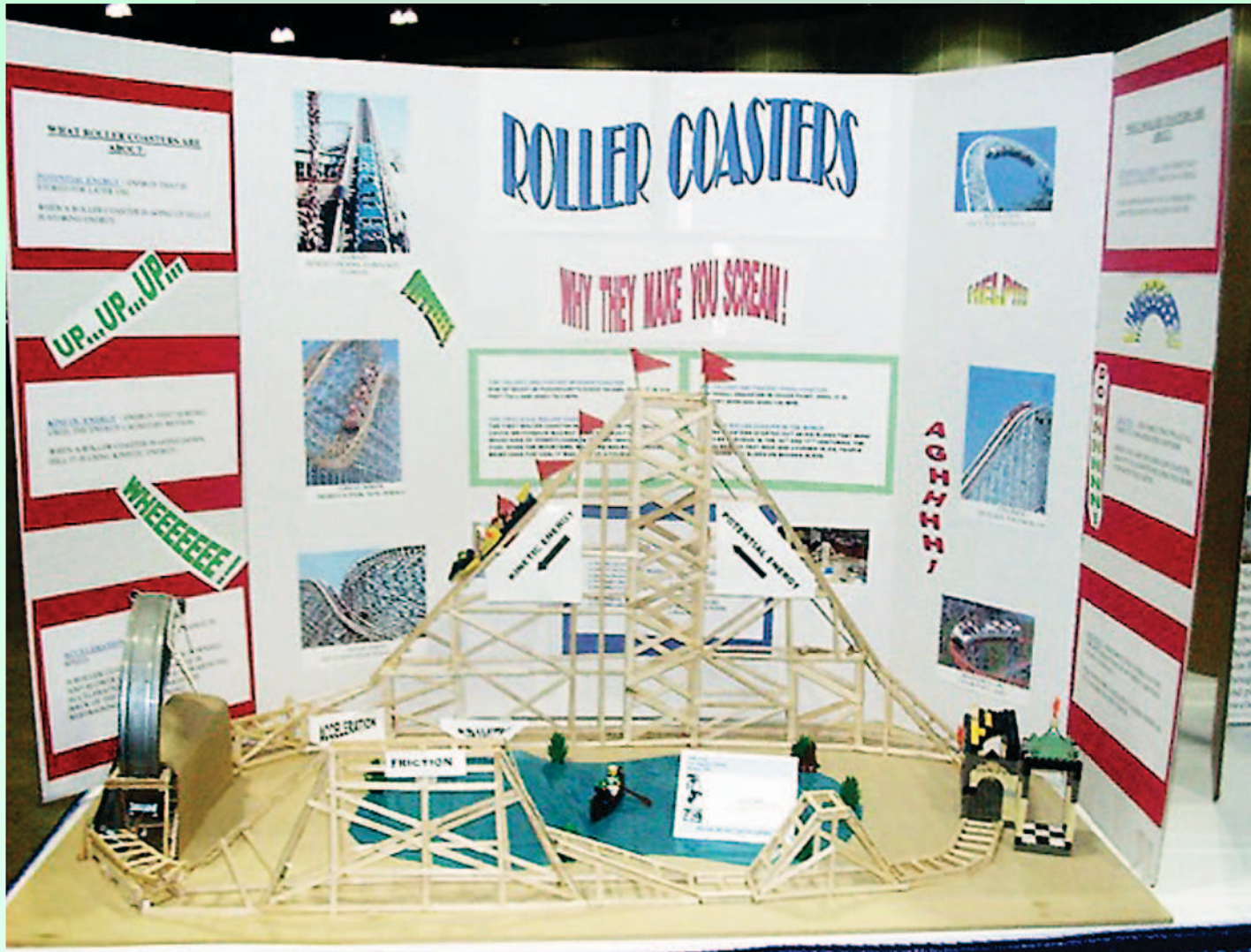
### Further Research

Some other factors that can be tested in the future would be longer control of the amount of water circulation. Another test that could be conducted is a higher pH of the water. It is also possible to test the effect of different water temperatures such as the Celsius, Fahrenheit, and Kelvin. Future research using this study would be to test the effect of different water temperatures and pH levels on the growth and development of the copepods. It is also possible to test the effect of different light intensities and water temperatures on the growth and development of the copepods. It is also possible to test the effect of different light intensities and water temperatures on the growth and development of the copepods.

# 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 serine 441 of TRAF3 is the only amino acid residue that has a conserved interaction with I $\kappa$ B $\alpha$ . To test this hypothesis, we created a point mutation at TRAF3, by changing it to threonine, which mimicked the amino acid of TRAF5, which is known to bind to I $\kappa$ B $\alpha$  in the position 441 of TRAF5. We found that the mutant TRAF3 did not bind to I $\kappa$ B $\alpha$ , but TRAF5 mutant bound to I $\kappa$ B $\alpha$  as strongly as TRAF3. Thus, we have demonstrated 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

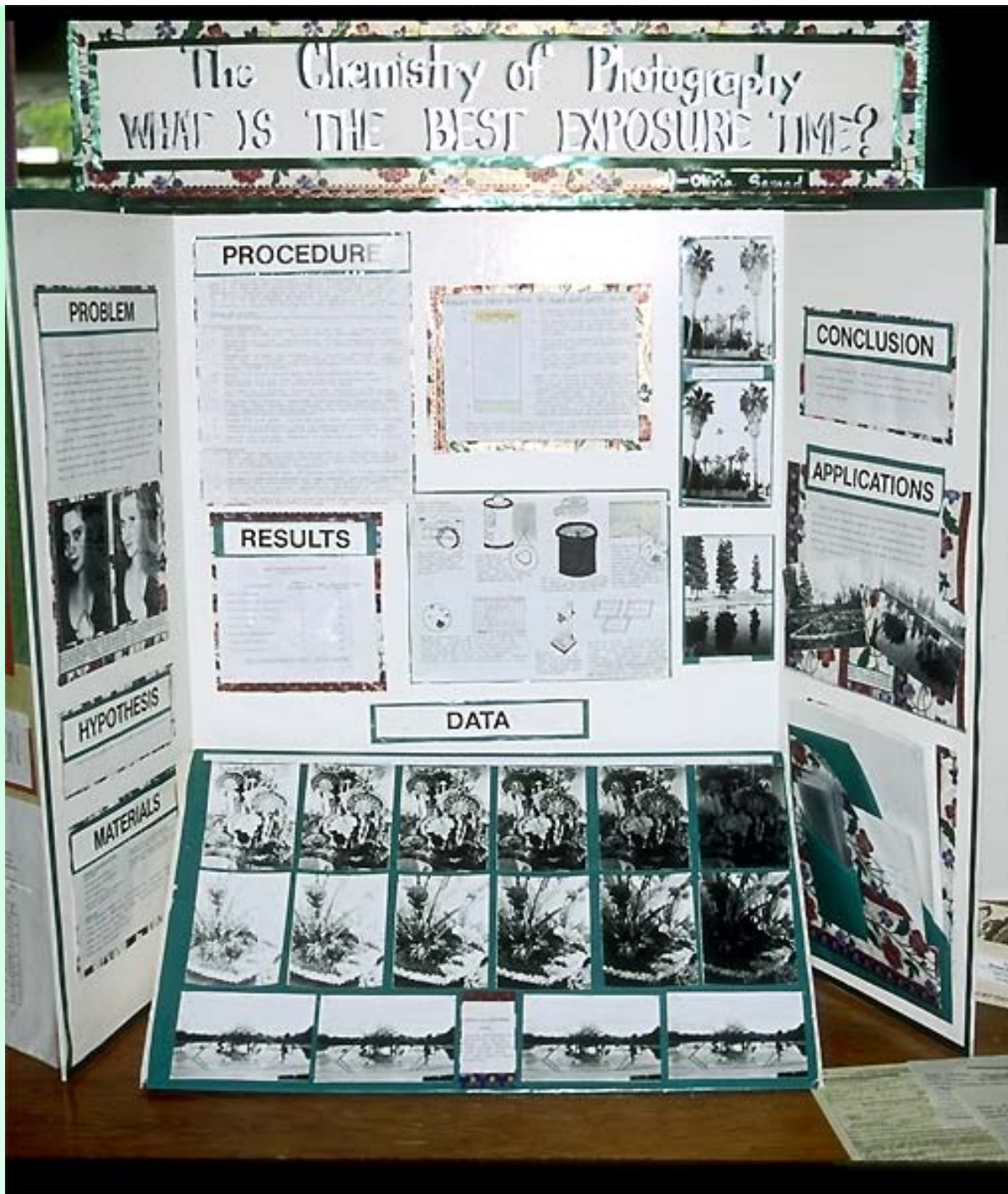
### Conclusion

Based on the sequence alignment and crystal structural studies, we found that serine 441 of TRAF3 not only directly contacts with I $\kappa$ B $\alpha$ , but is also different in sequence from all other TRAF family members at the corresponding position. By using a PCR mutagenesis strategy, we have successfully created a TRAF3 mutant, TRAF3(Y441E), which mimicked the amino acid of TRAF5, which is known to bind to I $\kappa$ B $\alpha$  in the position 441 of TRAF5. The Y441E mutant did not bind to I $\kappa$ B $\alpha$  as strongly as TRAF3, but TRAF5(Y441E) did bind to I $\kappa$ B $\alpha$  as strongly as TRAF5. Our studies may provide insight for drug design of TRAF proteins in both cancer and auto-immune diseases.

# Photography Fan?



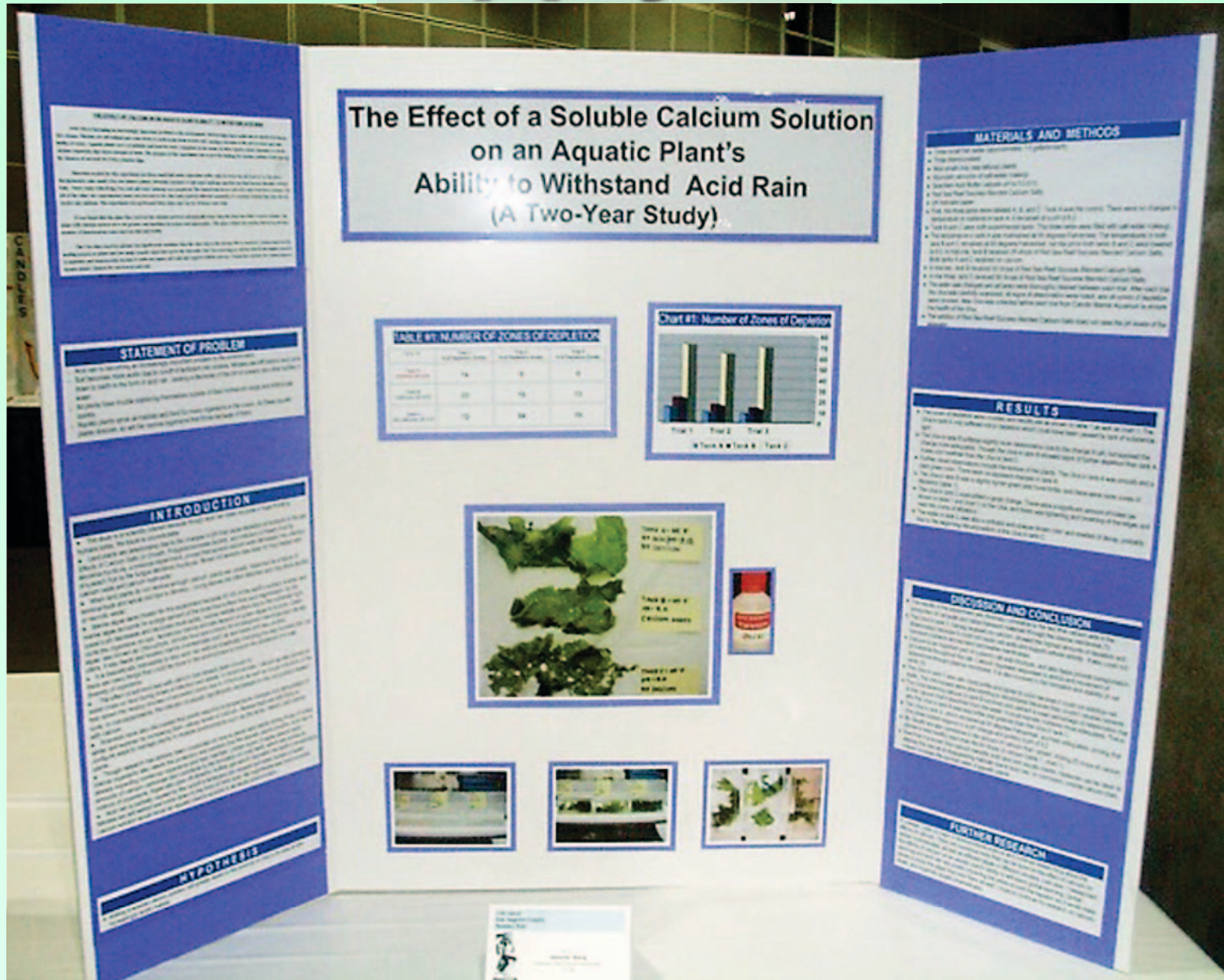
# Study the Chemistry Behind it



# Crazy about Chemistry?



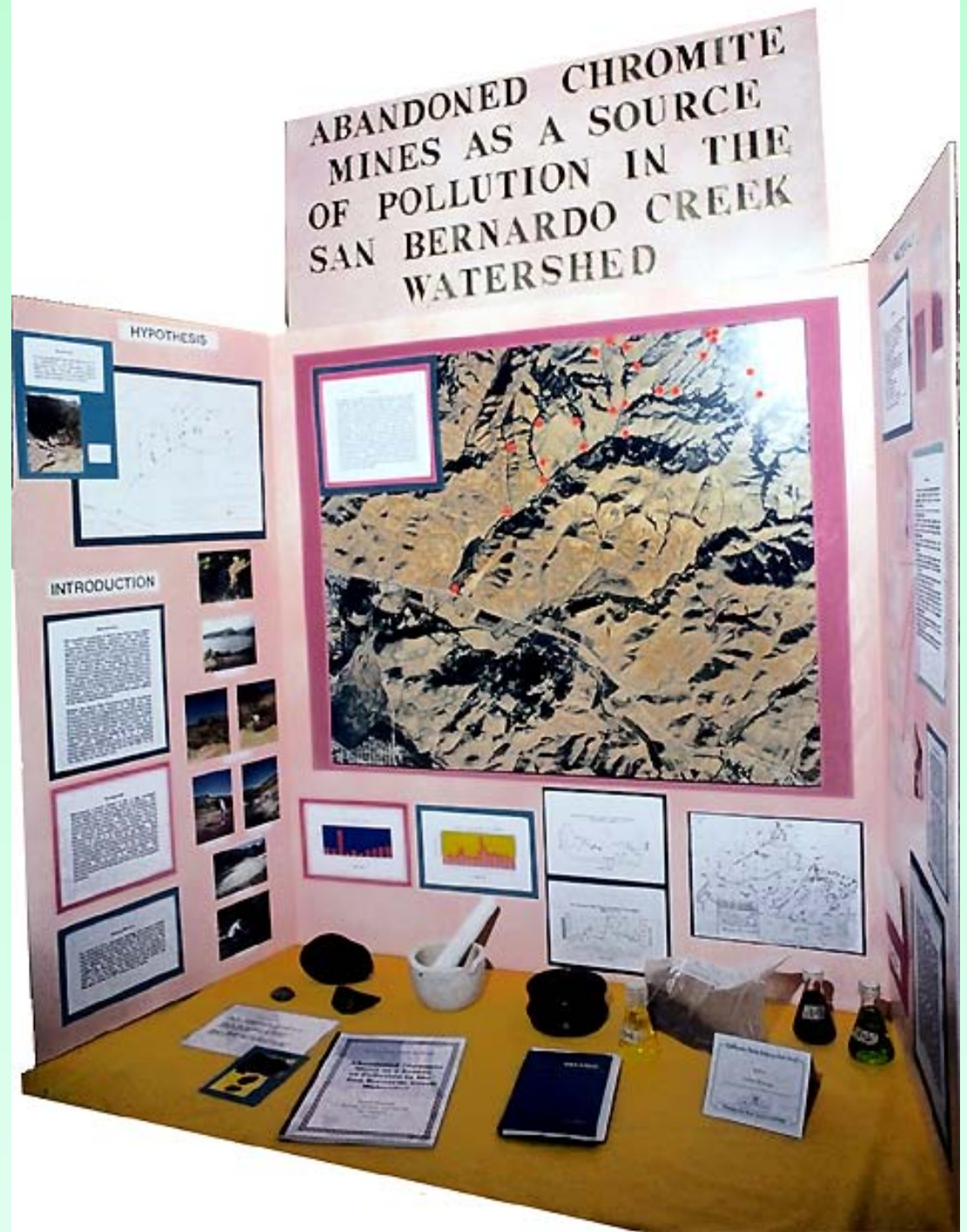
# Apply It!



# Rocks Knock Your Socks?



# Delve into Earth/ Space Science



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



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

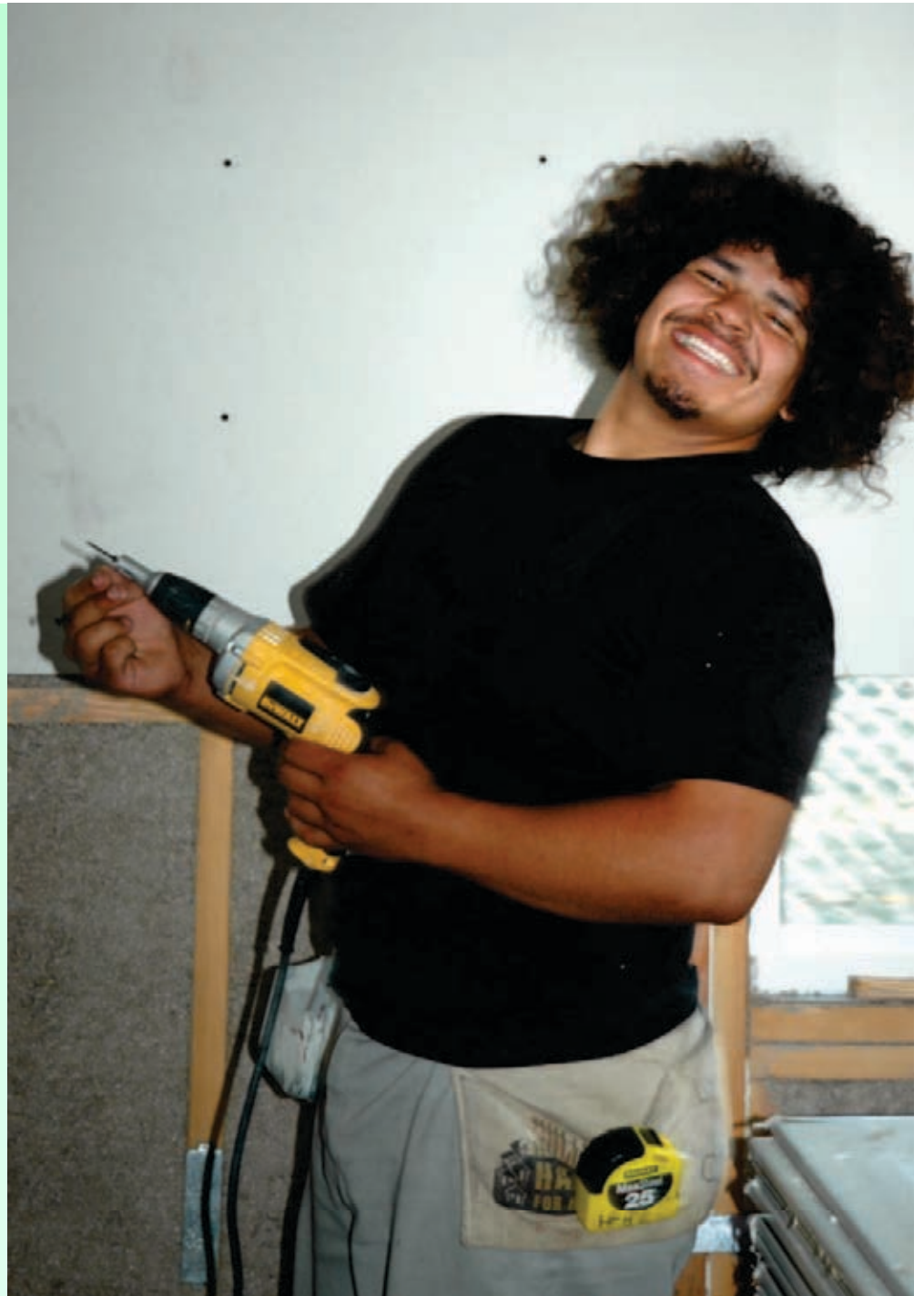


# Care for Mother Nature?

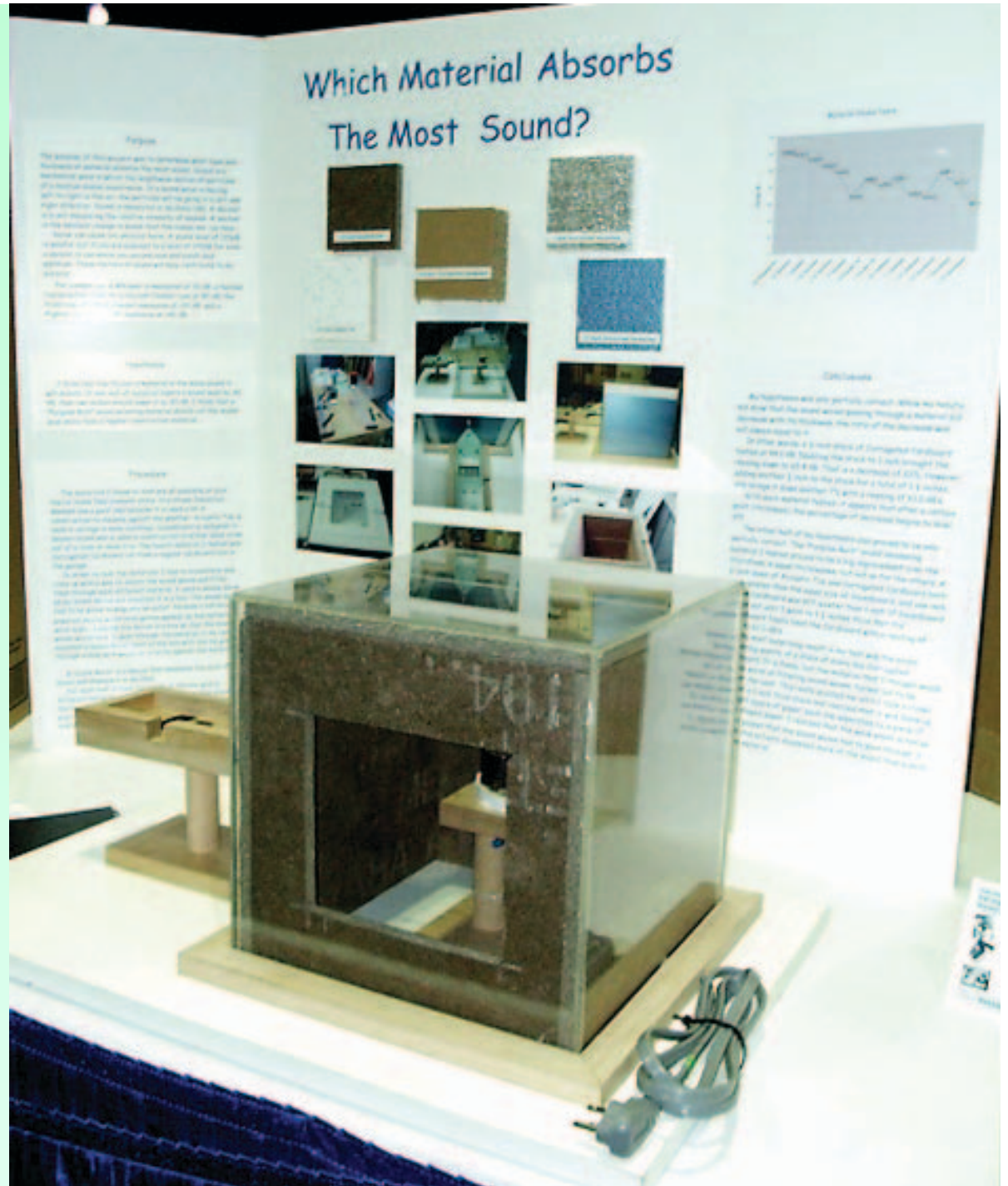




**Want to  
Change the  
World?**



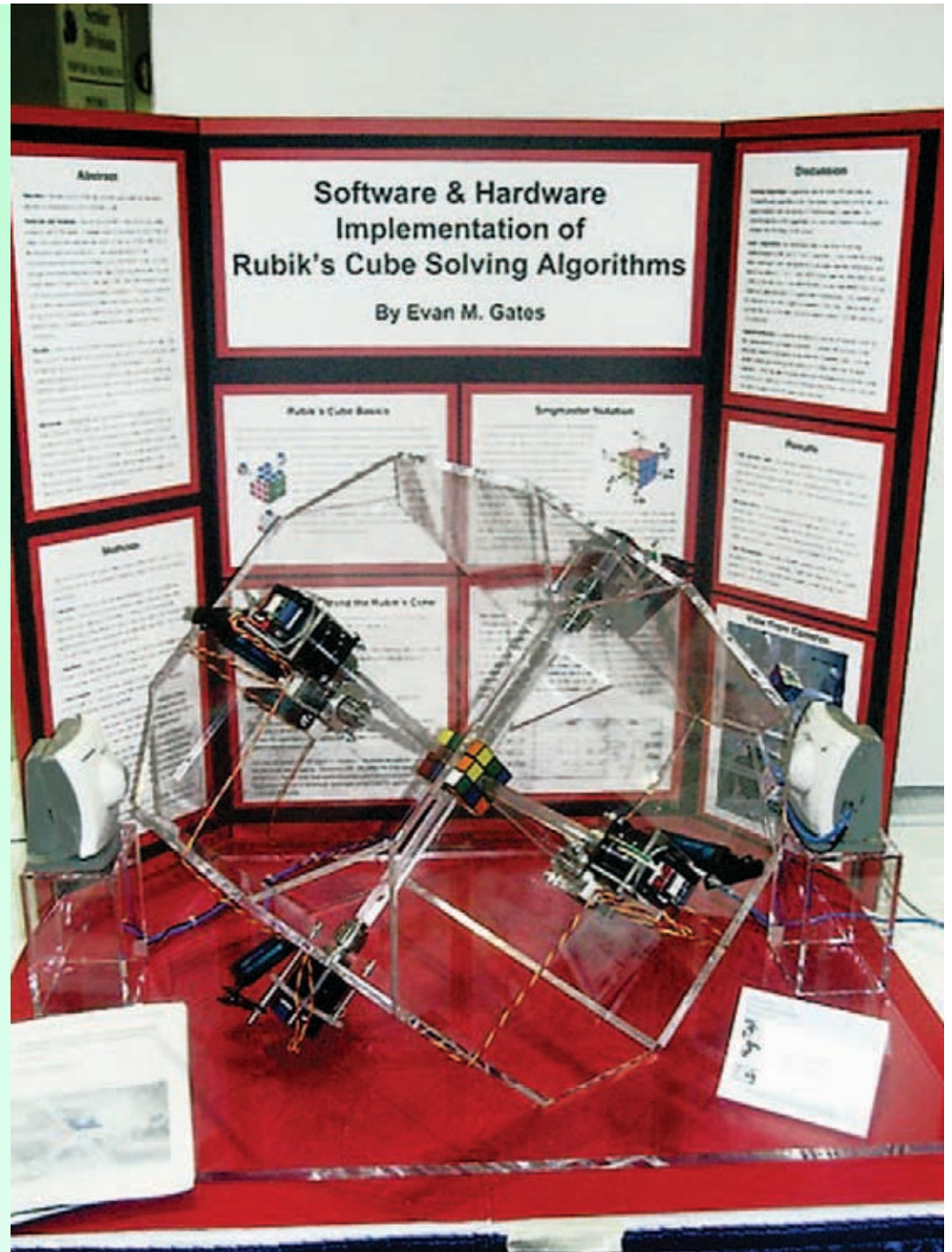
# Do Materials Science



# A Computer Whiz?



# Do Math/ Computer Science



# Keen to Crunching #'s?



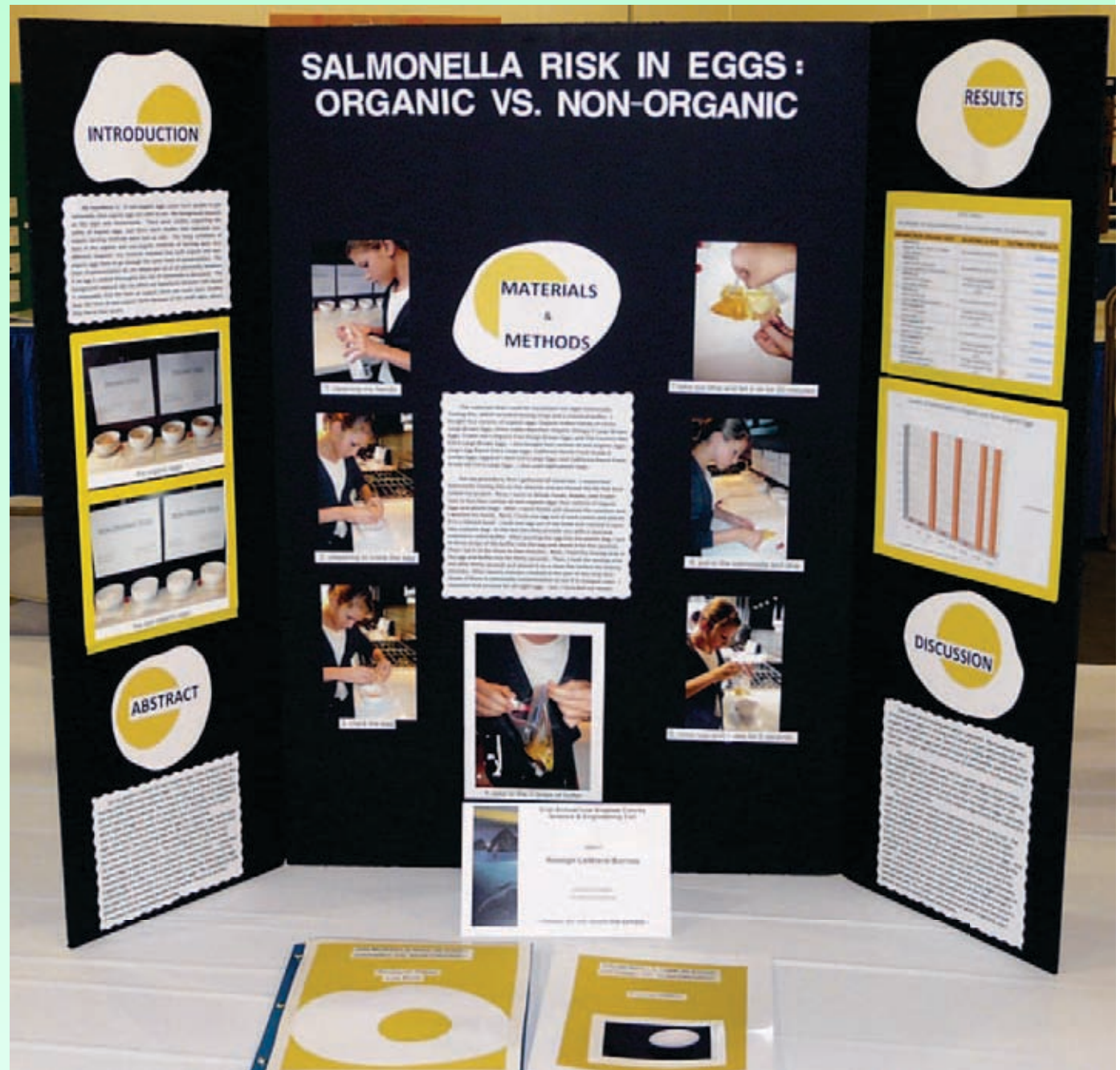
**Make a  
Math/  
Computer  
Science  
Project**



**Love to  
Look at  
Little  
Stuff?**



# Design a Micro- biology Study



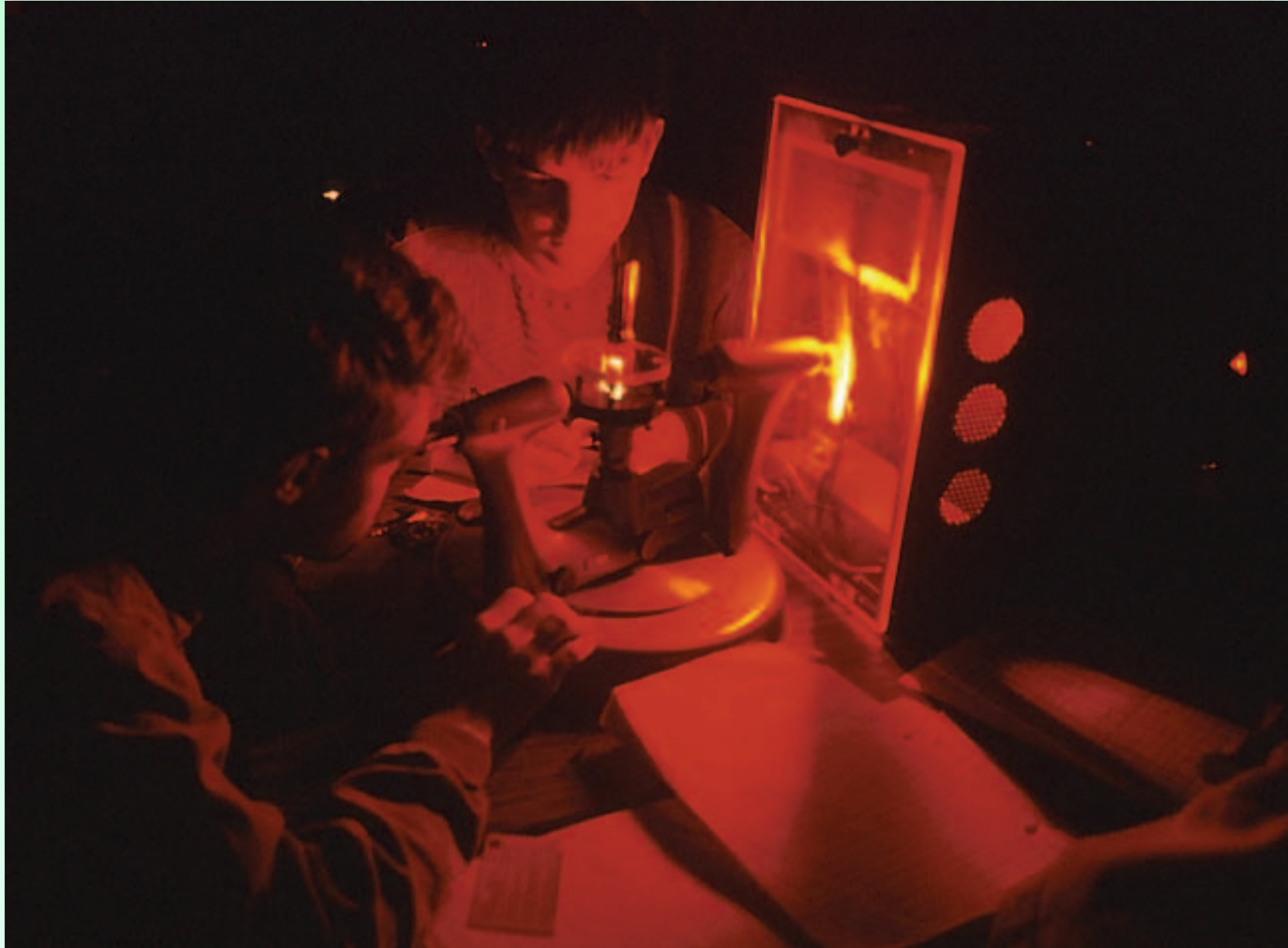
# Curious About WHY Drugs Work the Way They Do?



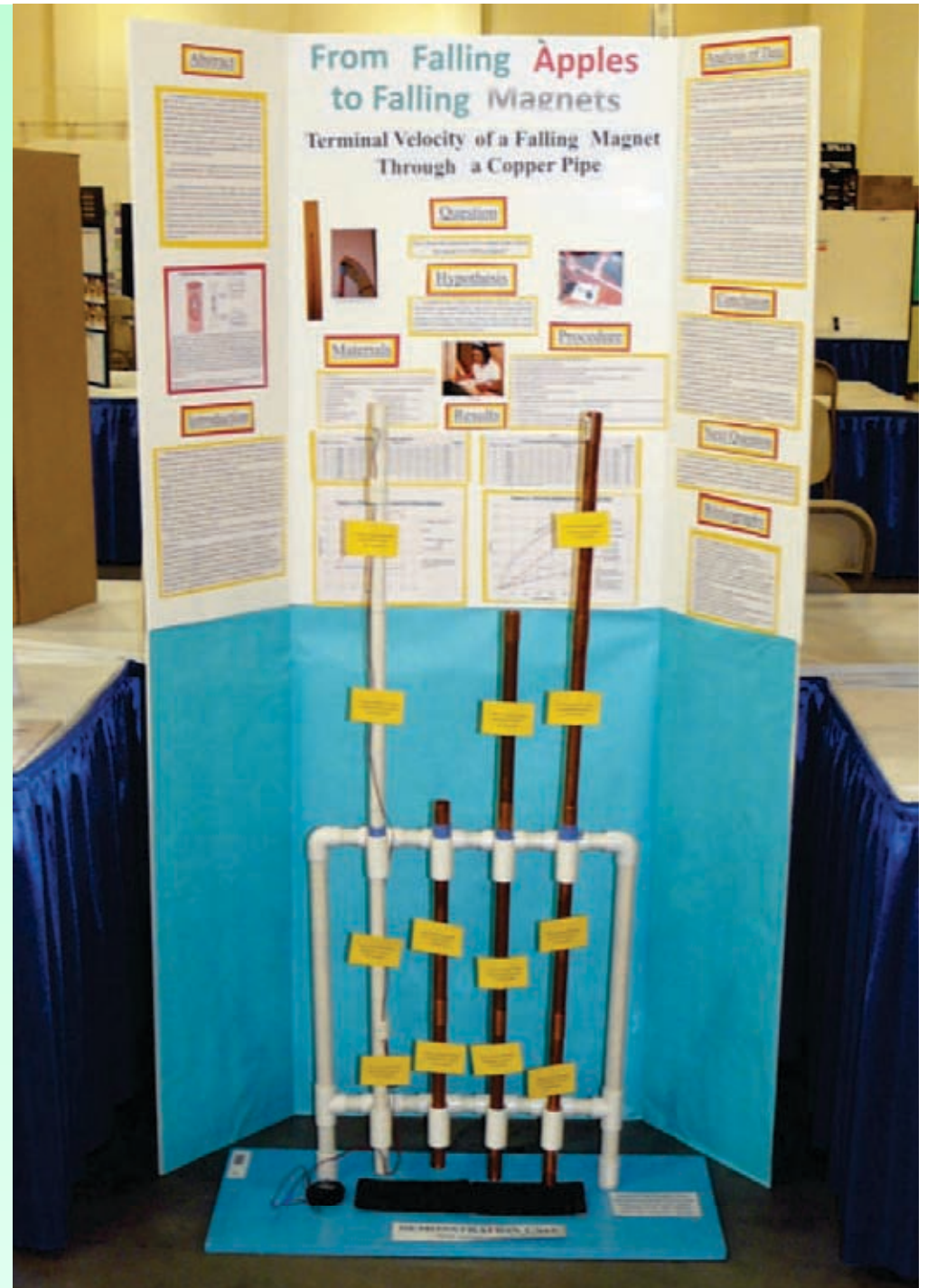
# Work in Pharmacology



# Love Physical Science?



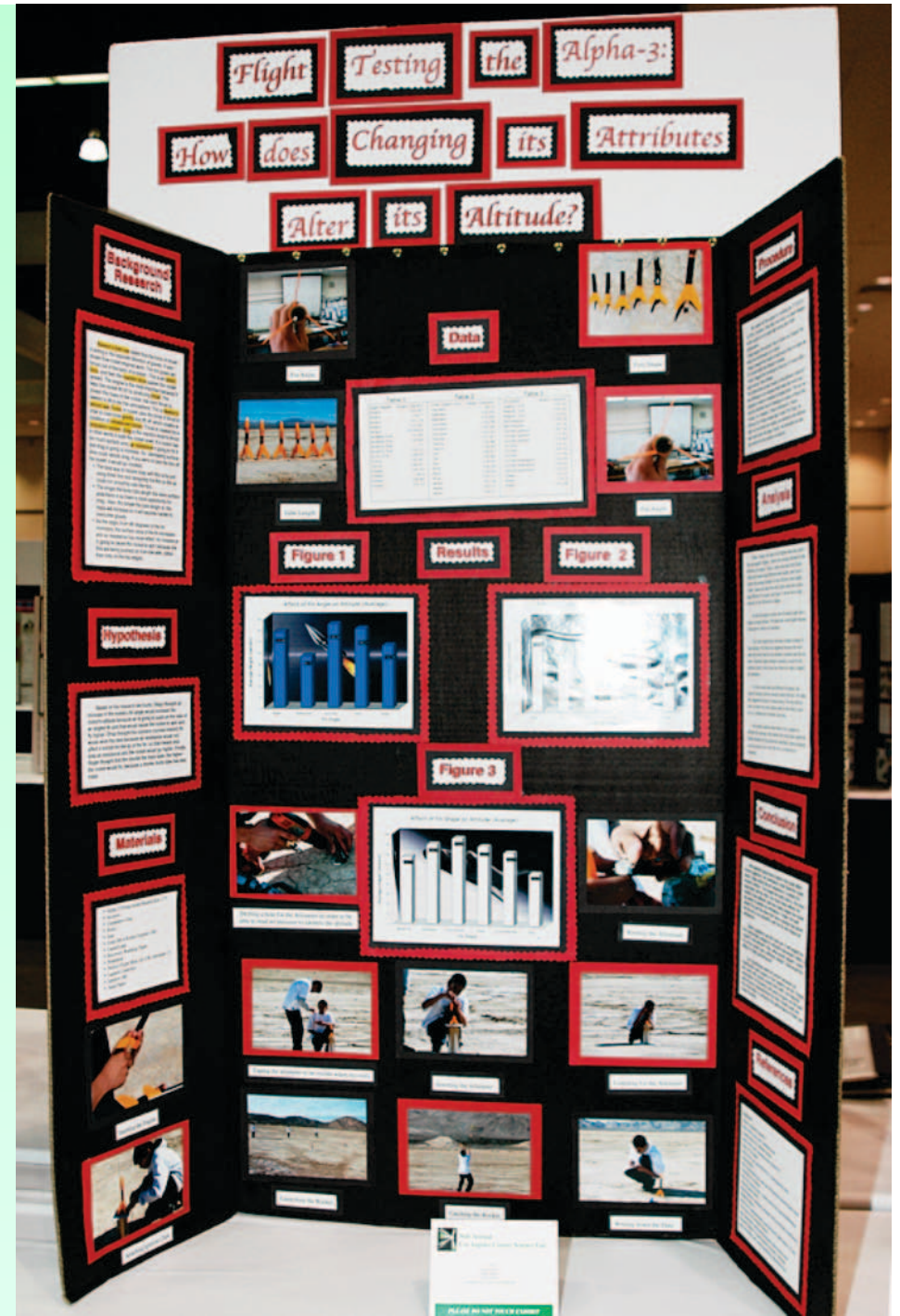
# General Physics Studies are for You



# 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. The results show that the optimum orientation is facing south and the optimum tilt angle is 30 degrees. The project was conducted over a period of two weeks. The results show that the optimum orientation is facing south and the optimum tilt angle is 30 degrees.

### INTRODUCTION

The introduction section discusses the importance of solar energy and the need for efficient solar panel orientation. It mentions that the project was conducted over a period of two weeks. The results show that the optimum orientation is facing south and the optimum tilt angle is 30 degrees.

### MATERIALS & METHODS

The materials and methods section describes the equipment used, including a solar panel, a digital multimeter, and a protractor. It also details the experimental procedure, which involved measuring the energy production of the solar panel at different orientations and tilt angles.

### 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	Tilt Angle		
	10.00 AM	1.00 PM	4.00 PM
NORTH	0.00	0.00	0.00
EAST	0.00	0.00	0.00
SOUTH	10.00	10.00	10.00
WEST	0.00	0.00	0.00

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

Orientation	Tilt Angle		
	10.00 AM	1.00 PM	4.00 PM
NORTH	0.00	0.00	0.00
EAST	0.00	0.00	0.00
SOUTH	10.00	10.00	10.00
WEST	0.00	0.00	0.00

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

Orientation	Tilt Angle		
	10.00 AM	1.00 PM	4.00 PM
NORTH	0.00	0.00	0.00
EAST	0.00	0.00	0.00
SOUTH	10.00	10.00	10.00
WEST	0.00	0.00	0.00

#### RESULTS

The results section discusses the findings of the experiment, including the optimum orientation and tilt angle. It states that the optimum orientation is facing south and the optimum tilt angle is 30 degrees.

#### CONCLUSION

The conclusion section summarizes the findings of the experiment and provides recommendations for future studies. It states that the optimum orientation is facing south and the optimum tilt angle is 30 degrees.

#### FUTURE STUDIES

The future studies section discusses potential areas for further research, such as the effect of different weather conditions on solar panel performance.

# Born with a Green Thumb?



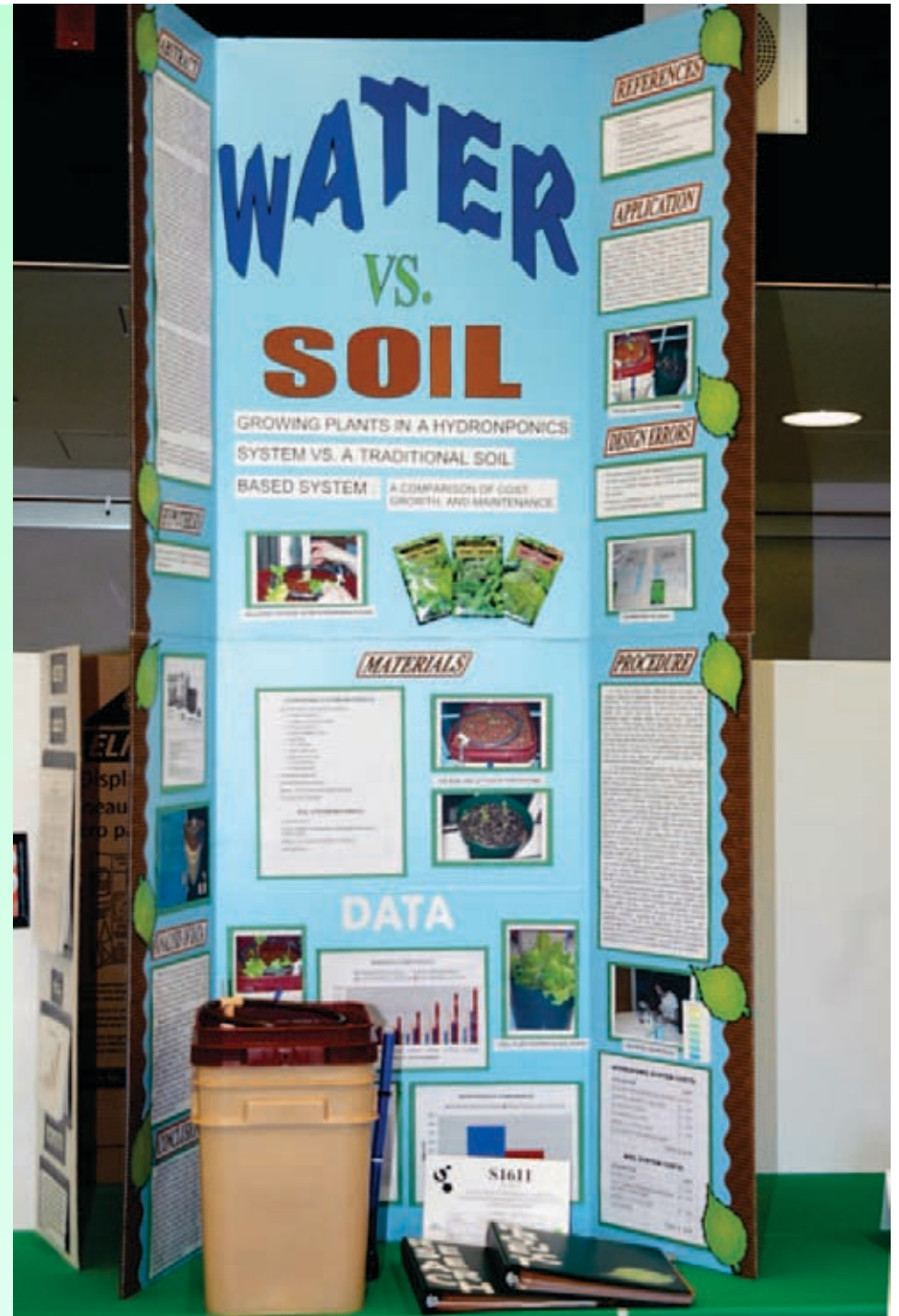
# Investigate Plant Biology



# Want to Feed the World?



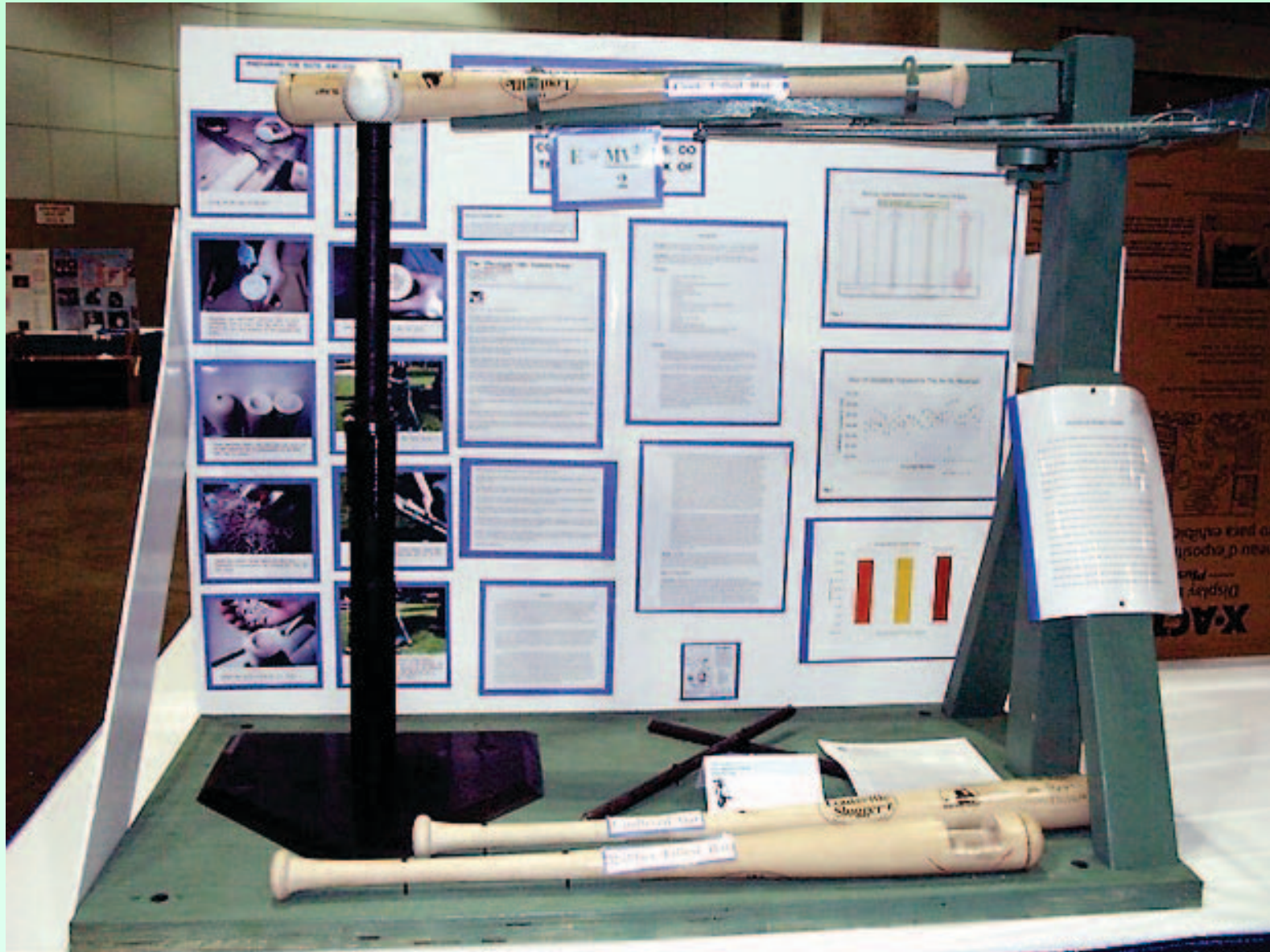
# Do Plant Physiology



# 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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