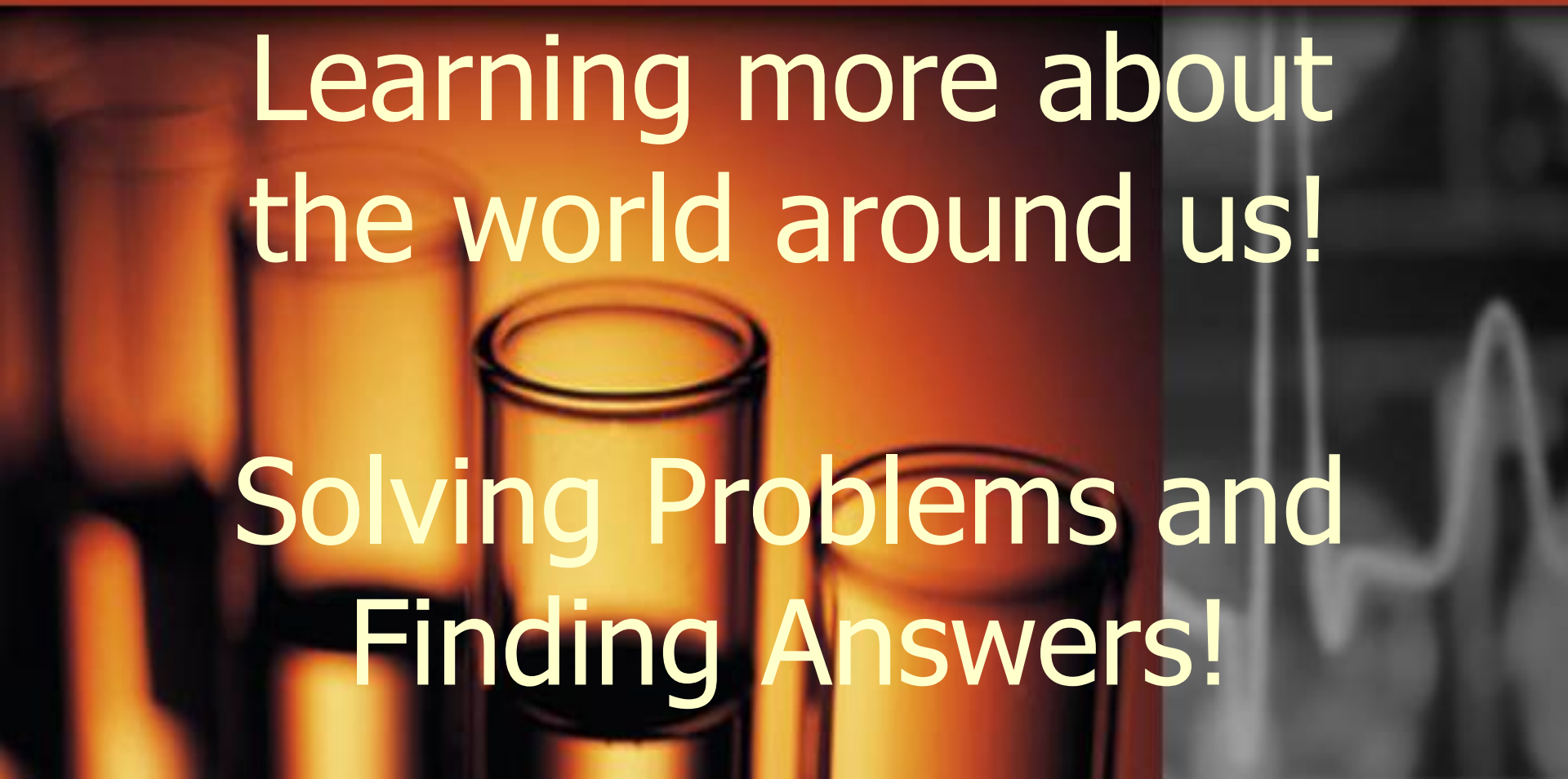
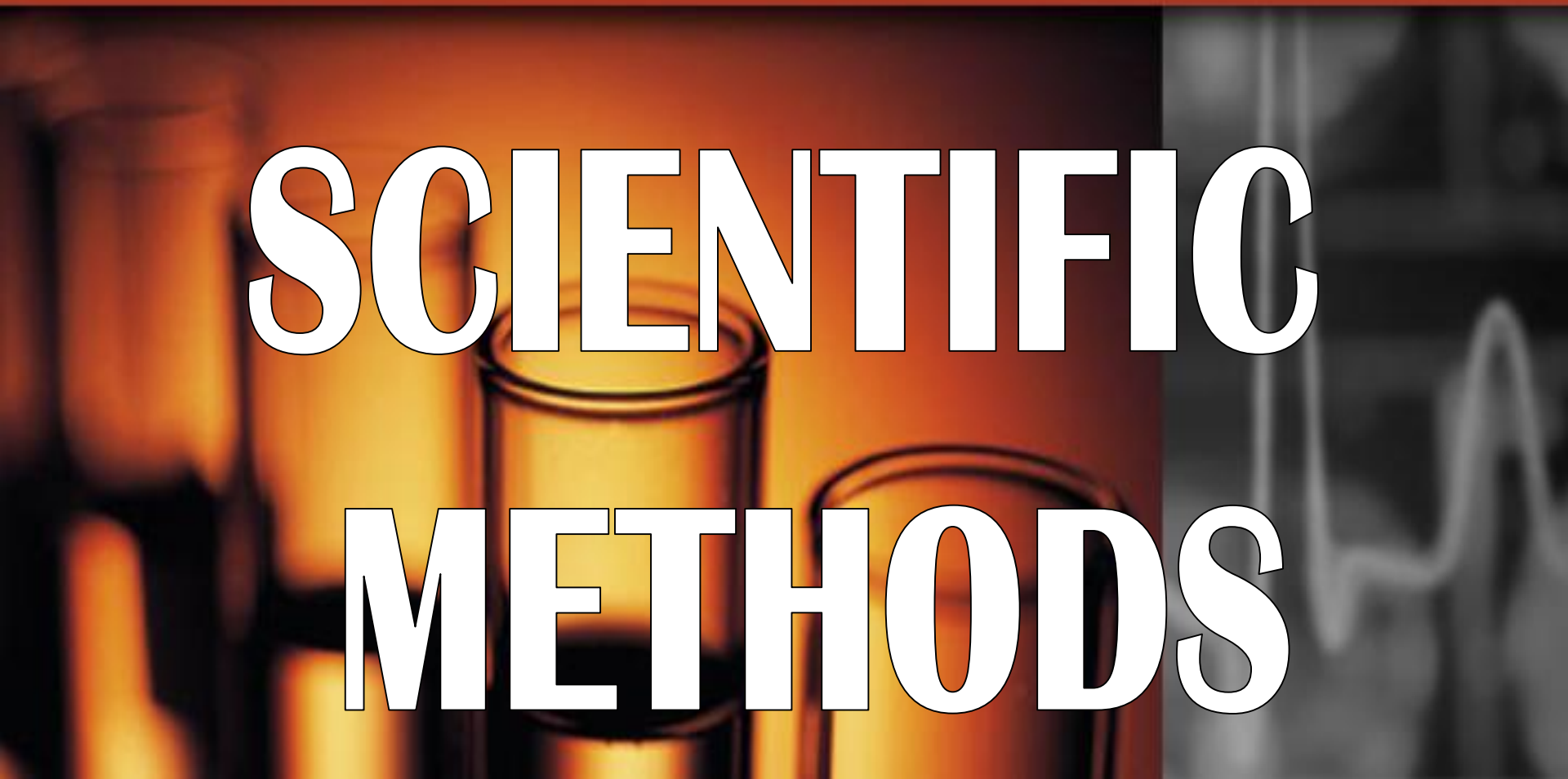
What does "Doing Science" mean?



Learning more about the world around us!

Solving Problems and Finding Answers!

What processes can scientists use to learn about the world, solve problems, and find answers?



SCIENTIFIC METHODS

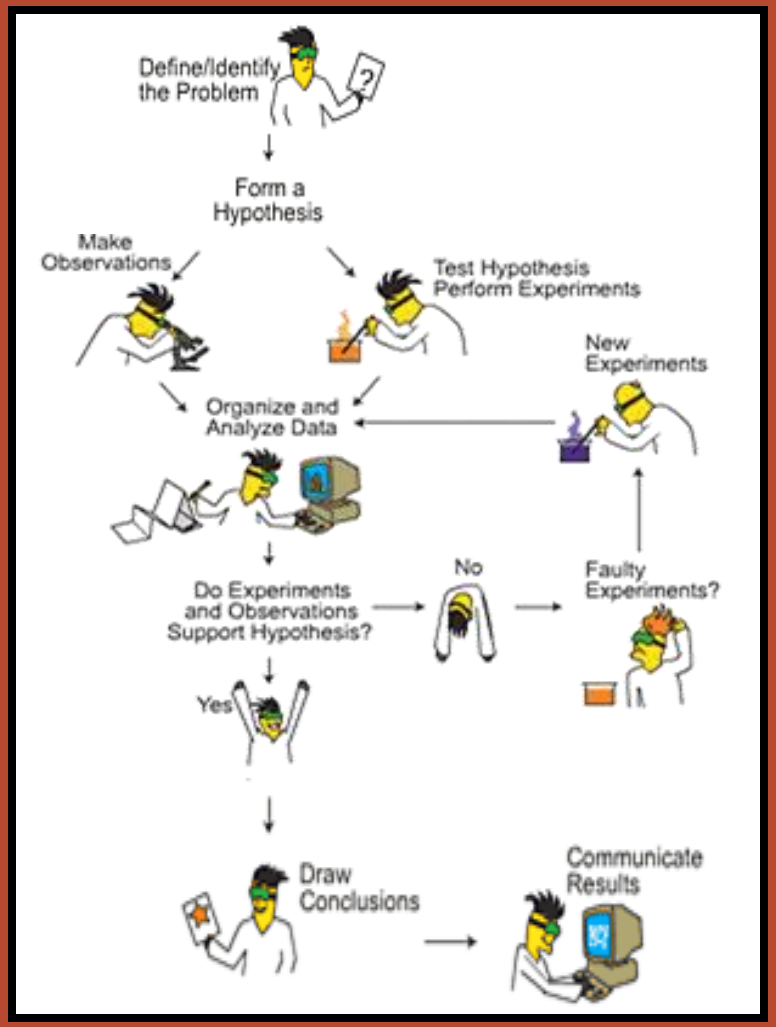
What are the Scientific Methods?

- A Descriptive Design GO
- A Correlational Design GO
- An Experimental Design GO

DESCRIPTIVE DESIGN

What are the Basic Parts of a Descriptive Design Investigation?

- Asking Questions
- Making a Hypothesis
- Making a Prediction
- Planning a Procedure
- Making Observations
- Analyzing Observations
- Making a Conclusion
- Communicating



Getting Started

How do we start Descriptive Design?

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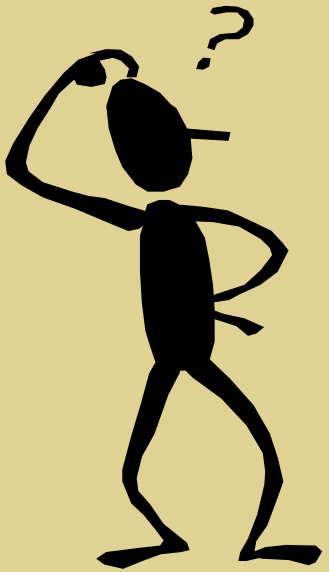
- We ask Scientific Questions!



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A SCIENTIFIC QUESTION is…

…a problem, matter, or point that needs to be considered.

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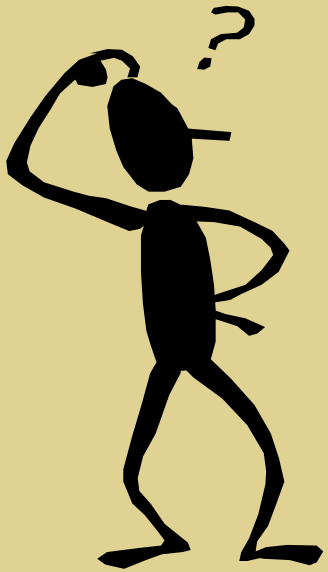
What good is a question if we don't do anything with it?

Scientists take their questions and make hypotheses and predictions.

- What is a hypothesis?
- What is a prediction?



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OBSERVATIONS

What do we do with our hypothesis and prediction?

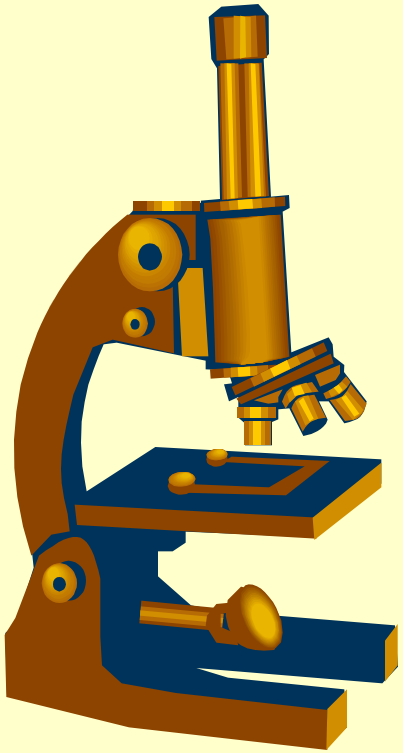
WE PLAN AND MAKE OBSERVATIONS!

What is the PROCEDURE?

A procedure is the steps that will be followed in an investigation.

We make sure that we have a plan for what we will do and then we make notes of any changes as we go through the procedure when we do the investigation!

What are MATERIALS?



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- ✓ Observations can include:
  - Measurements
  - Descriptions of what happened
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What is DATA?

Data are bits or pieces of information that you collect in an investigation.

Data can be observations or measurements.

And, how do we RECORD DATA?

Data is recorded in tables and charts.

What are DATA TABLES?

Data Tables are…

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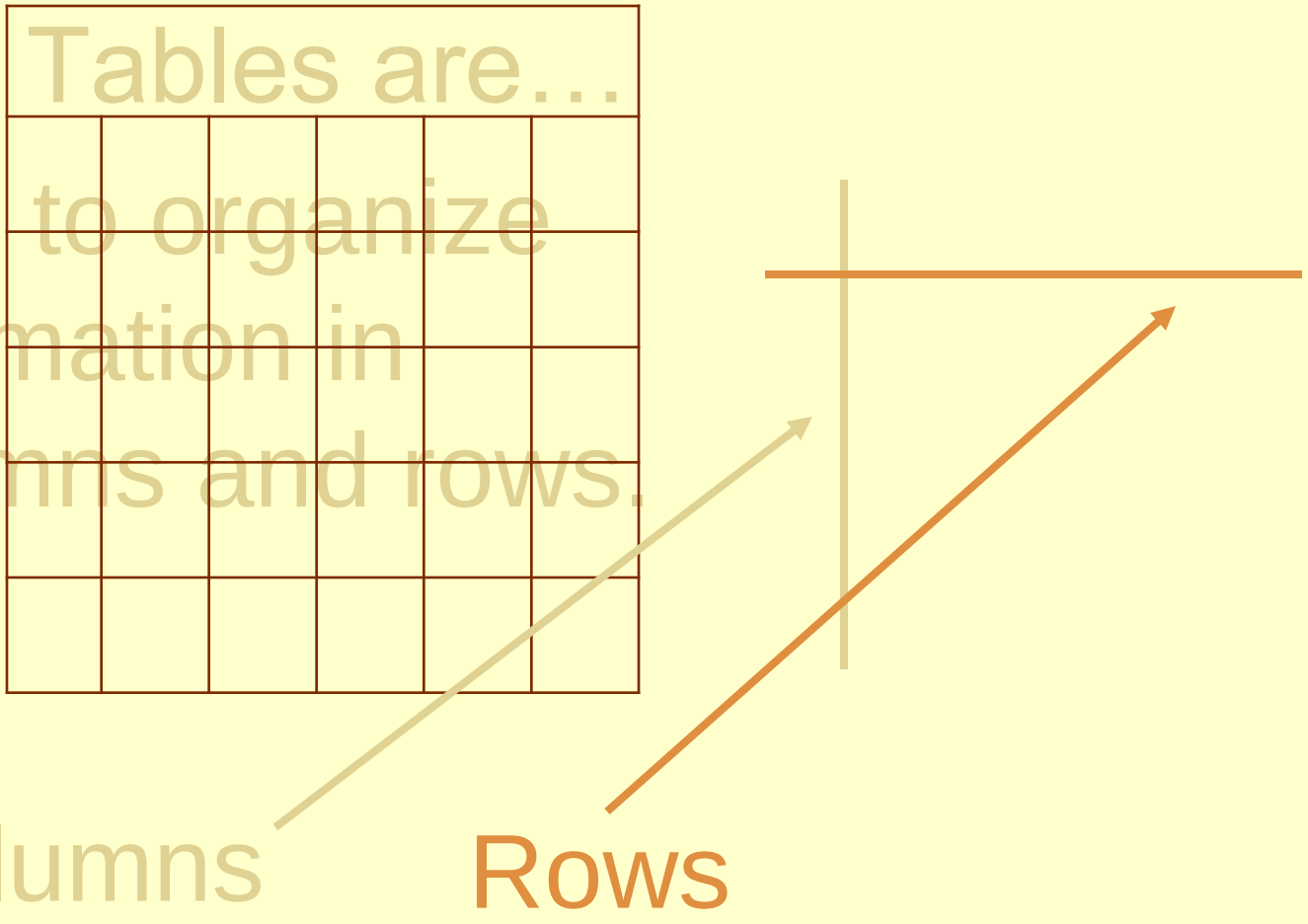

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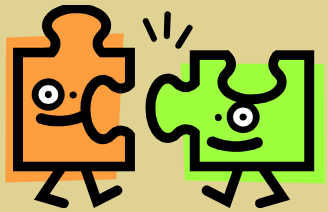

The investigation is done, what do we do with our data?

- We ANALYZE our DATA!
- We make CONCLUSIONS!
- We ASK NEW QUESTIONS!
- We COMMUNICATE!

How do you ANALYZE?

Analyze…

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ana means to "break apart"

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How do we ANALYZE RESULTS?

- Make graphs or tables and use other tools to better understand the information that has been gathered.
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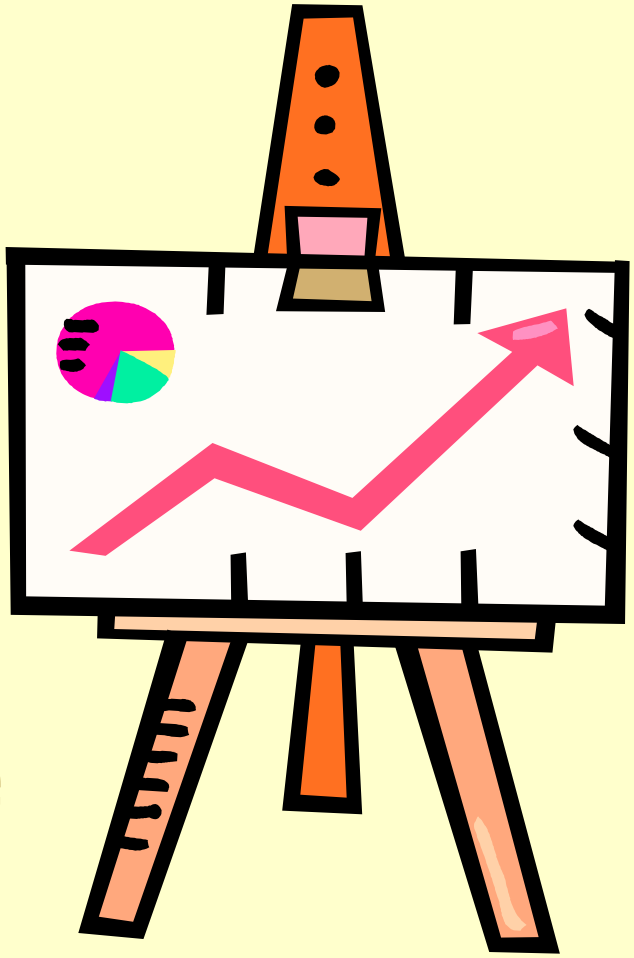

How do we MAKE CONCLUSIONS?

- We make a **conclusion** by making a decision based on the observations of the investigation.
- We review our hypothesis and determine if it was *supported* or *not supported*.
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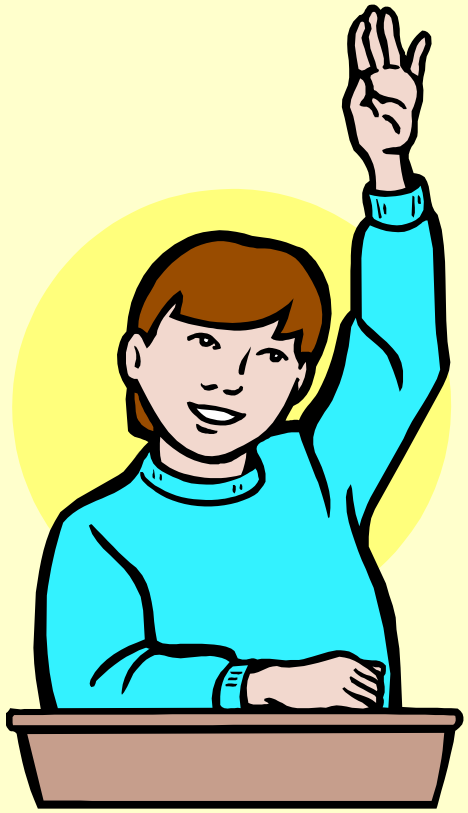

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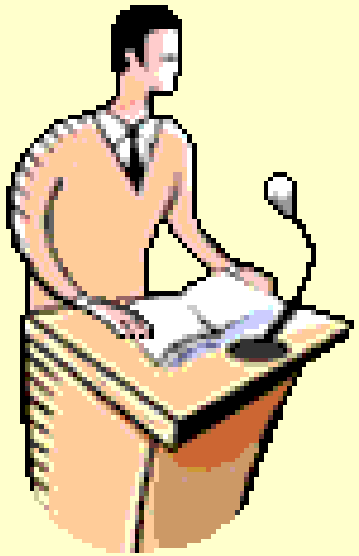
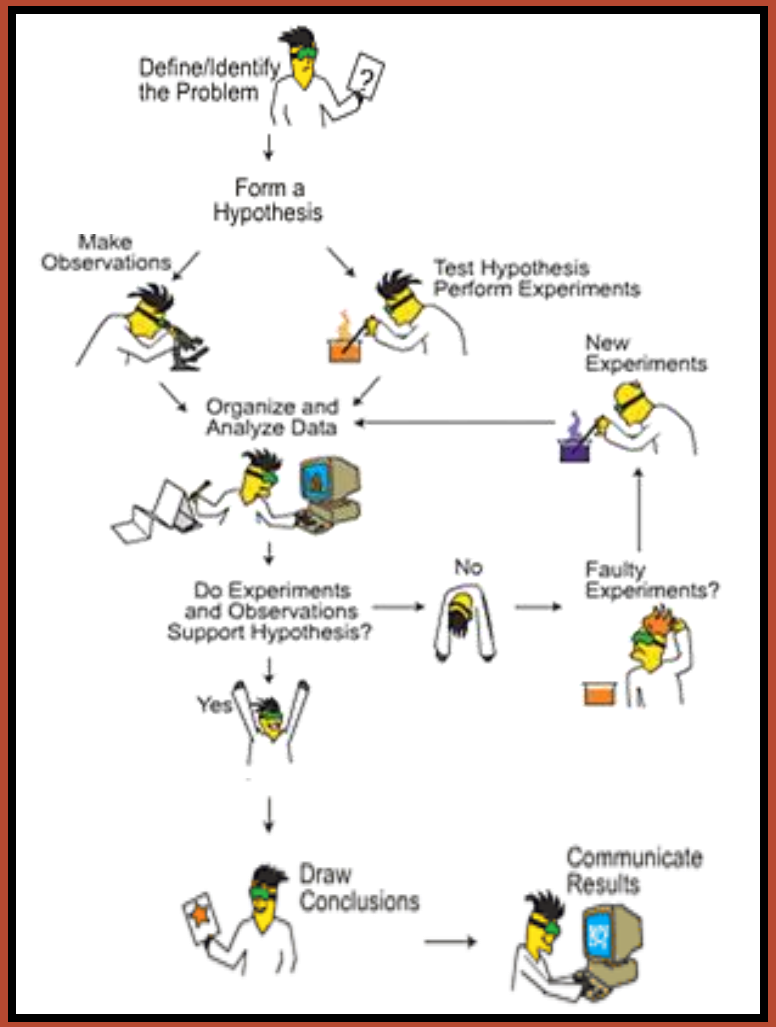


CORRELATIONAL DESIGN

What are the Basic Parts of a Correlational Design Investigation?

- Asking Questions
- Making a Hypothesis
- Making a Prediction
- Planning a Procedure
- Gathering Data
- Analyzing Data
- Making a Conclusion
- Communicating

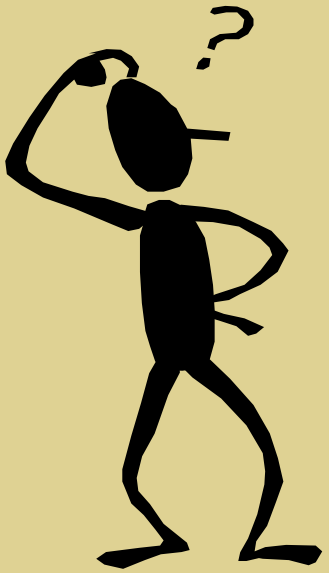


Getting Started

How do we start Correlational Design?

Like all scientists, humans are curious! Our curious minds are always ready to ask questions!

- We ask Scientific Questions!



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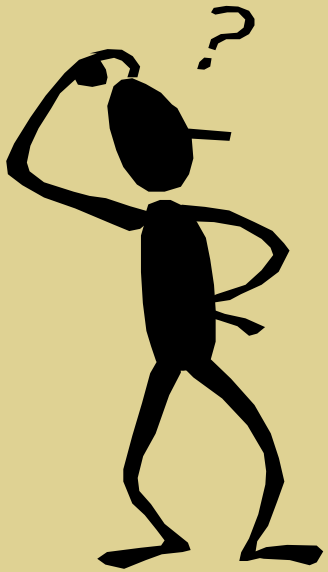

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DATA

What do we do with our hypothesis and prediction?

WE PLAN

AND

GATHER DATA!

What is a PROCEDURE?

A procedure is the steps that will be followed in an investigation.

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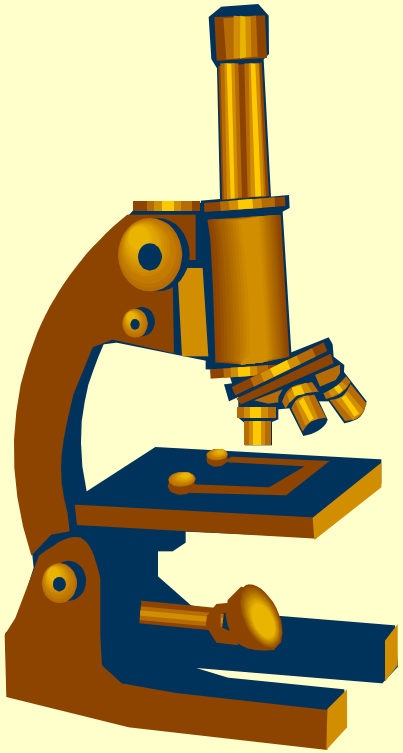

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What is DATA?

Data are bits or pieces of information that you collect in an investigation.

Data can be observations or measurements.

How do we COLLECT DATA?

In a Correlational Design, we may need to create a survey or we may need to develop questions that will be asked of each participant.

How do we RECORD DATA?

Data is recorded in tables and charts.

What are DATA TABLES?

Data Tables are…

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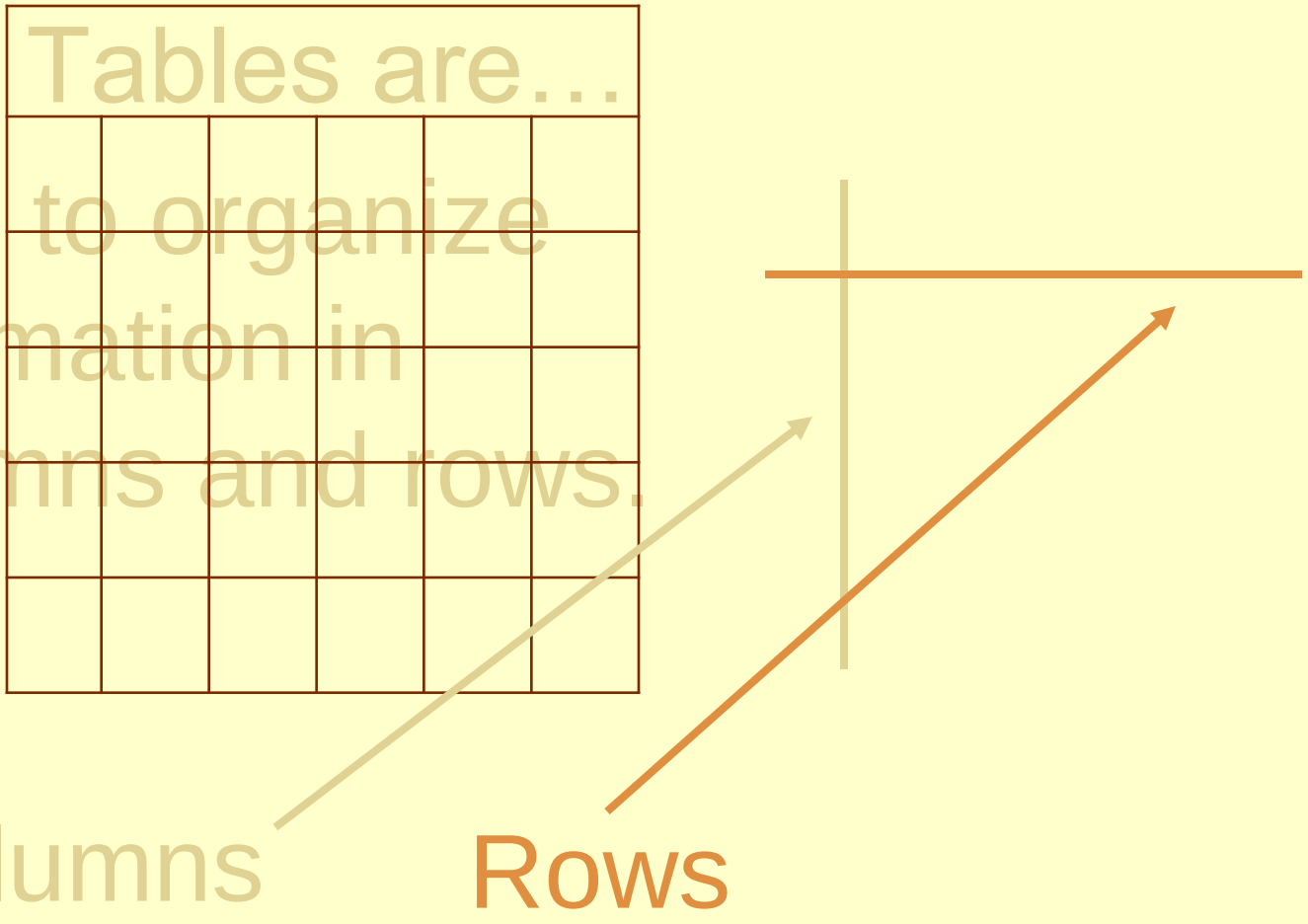

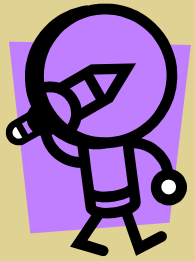

Now that the investigation is planned, let's get started!

Gather Data:

- Test our Hypothesis
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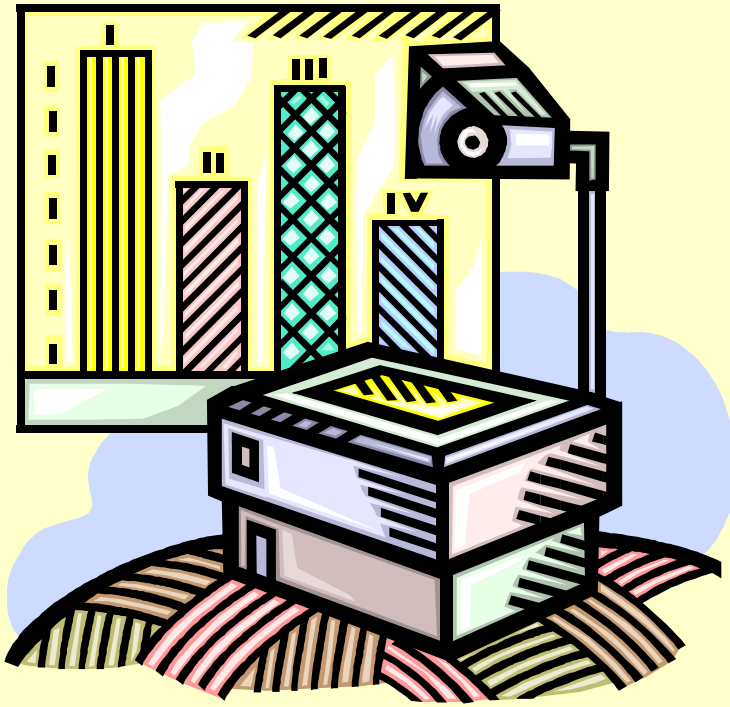

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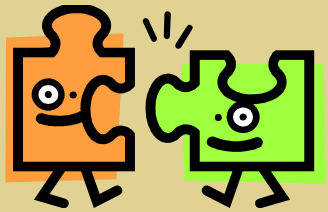

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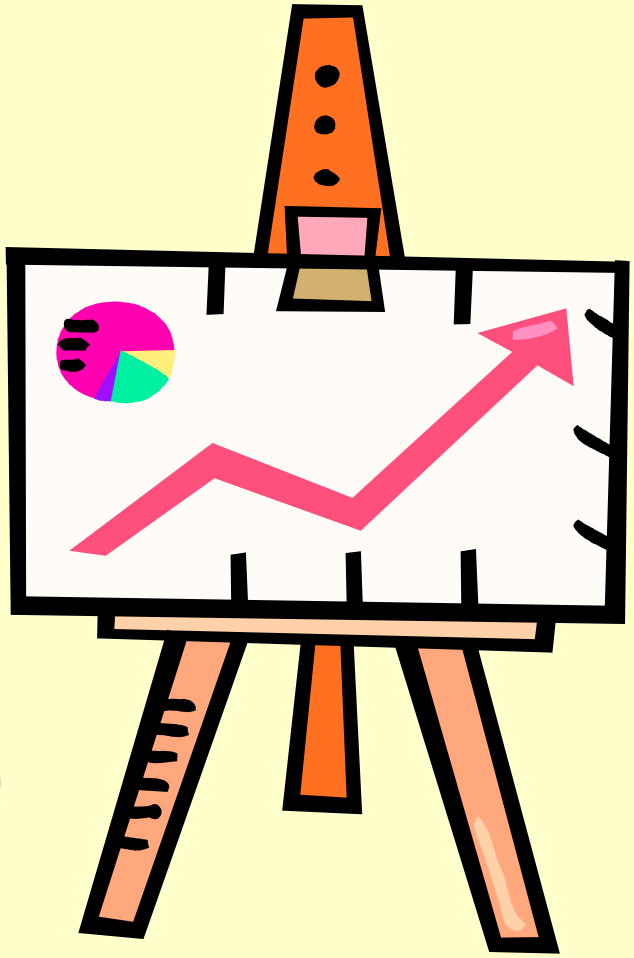

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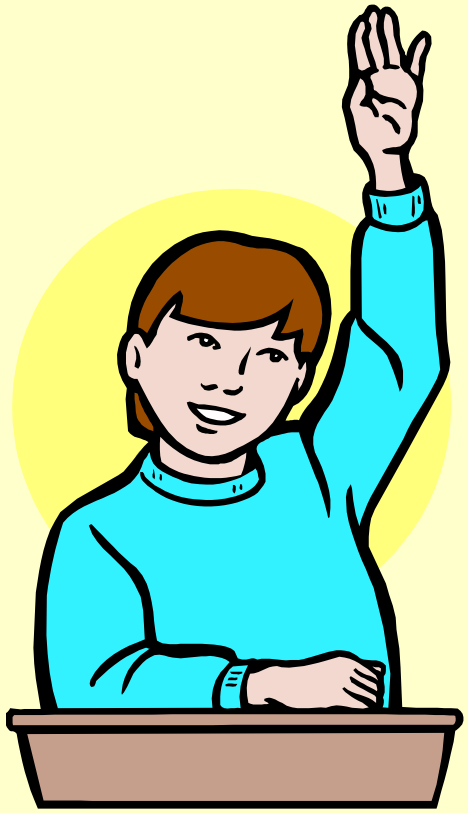

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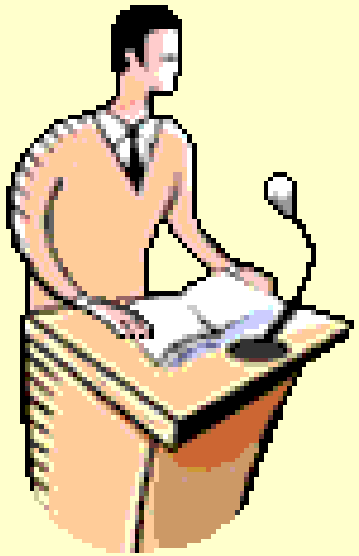
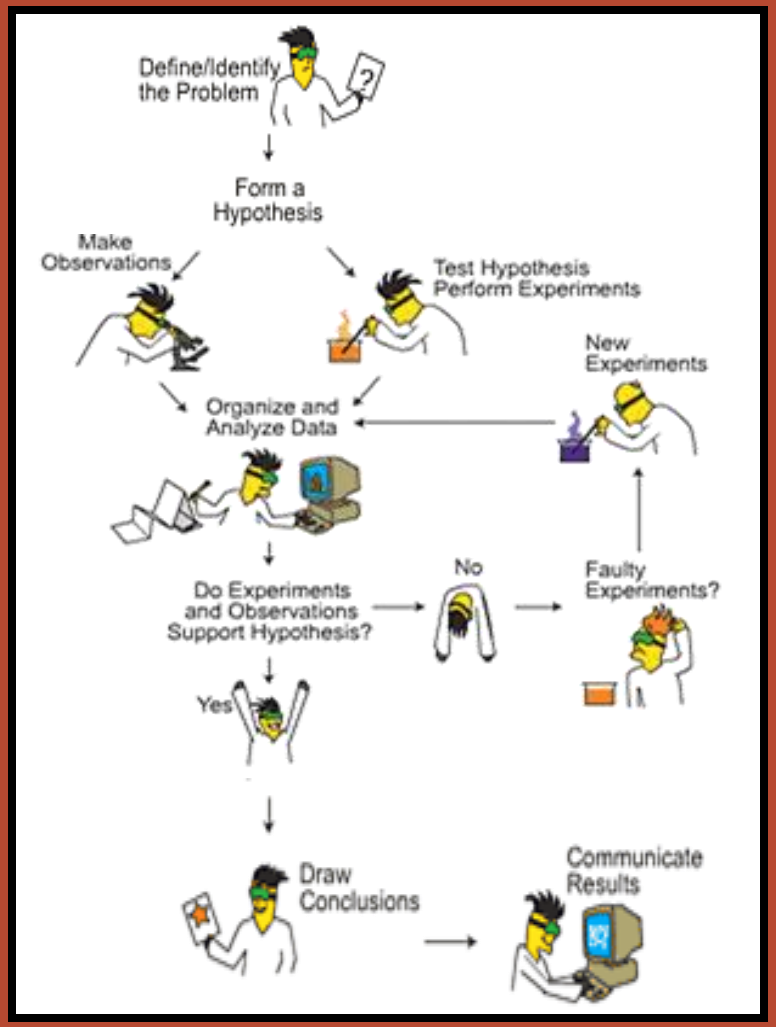


EXPERIMENTAL DESIGN

What are the Basic Parts of an Experimental Design Investigation?

- Observations
- Asking Questions
- Making a Hypothesis
- Making a Prediction
- Experimenting and Gathering Data
- Studying or Analyzing the Results of the Experiment.
- Making a Conclusion
- Communicating



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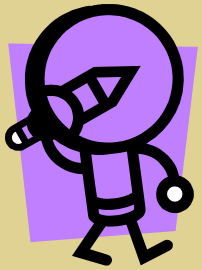
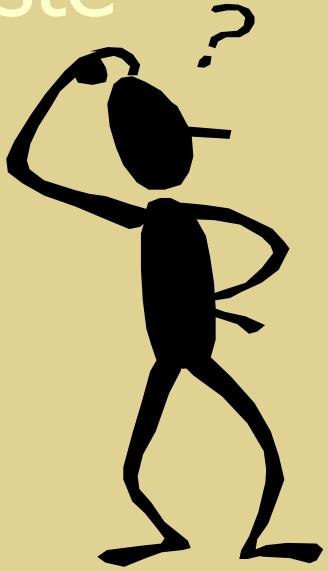


How do we start Experimental Design?

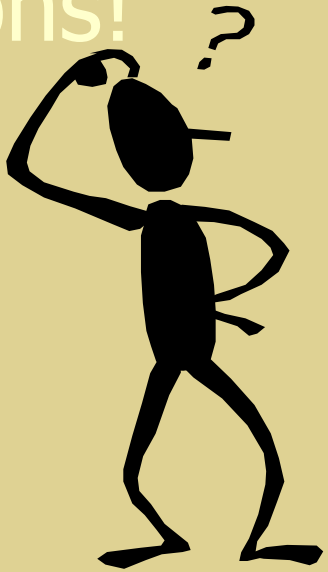
- We make observations!
- Observations should come from what you see, hear, smell, touch, and taste (But only taste or smell if safe – BE Smart!)
- We look at the world around us and make observations with all of our senses!



What do we do with our observations?

Like all scientists, humans are curious! After making observations, our curious minds with be ready to ask questions!

- We use our observations to ask Scientific Questions!



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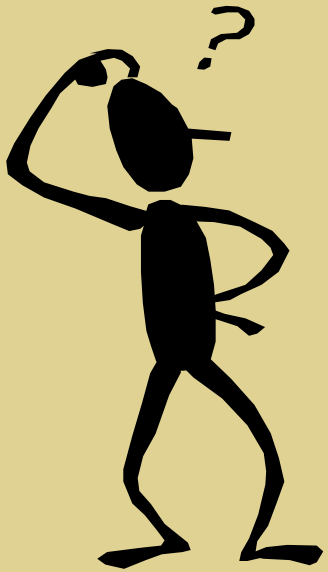

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Experimenting

What do we do with our hypothesis and prediction?

WE MAKE DECISIONS AND CREATE AN EXPERIMENT TO TEST OUR HYPOTHESIS!

What is an EXPERIMENT?

An experiment is…

…a scientific investigation that tests a hypothesis in order to discover what happens to something in particular conditions.

When we create an experiment what do we need to consider?

WHAT IS THE ONE THING WE ARE TESTING?

WHAT MATERIALS DO WE NEED?

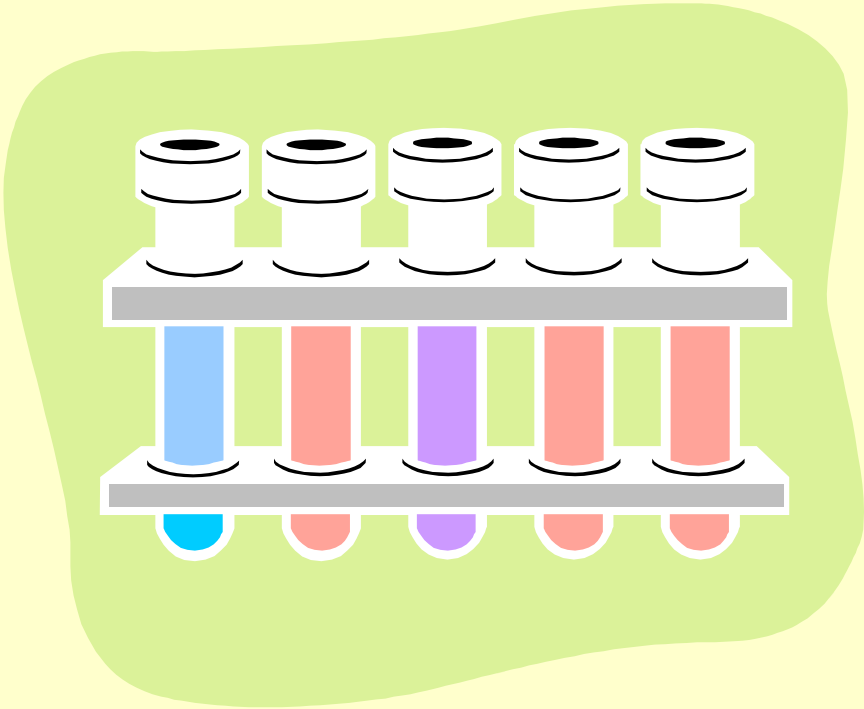
WHAT DATA WILL WE COLLECT?

WHAT STEPS WILL WE FOLLOW?

What are VARIABLES?

A variable is any factor that can change in an experiment.

In an experiment, we make sure that to keep all the variables the same except the one you are testing.



What is a TRIAL?

Trials are repeats of a test or an observation. And, the more trials you do, the more you can trust the data that you collect.

- ✓Can we do more than one trial?
- ✓How many trials?

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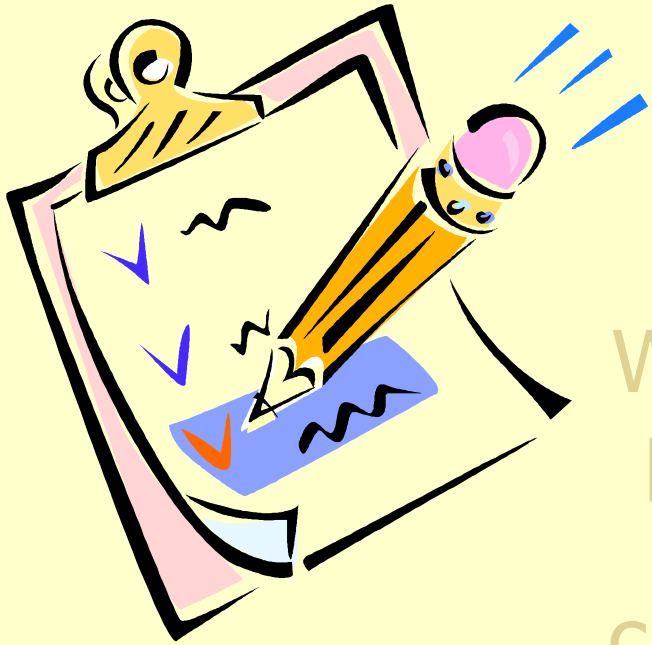

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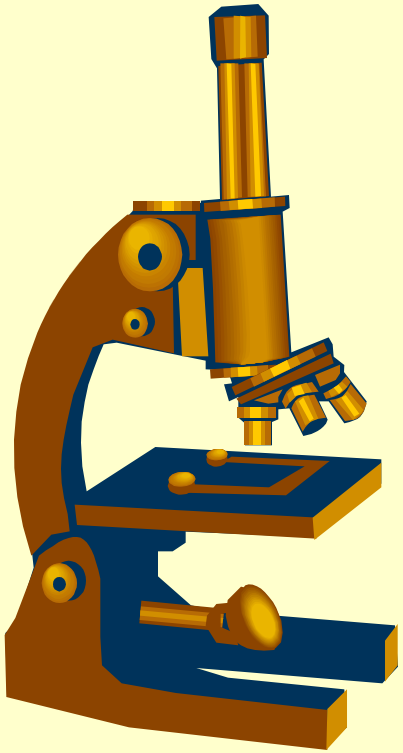

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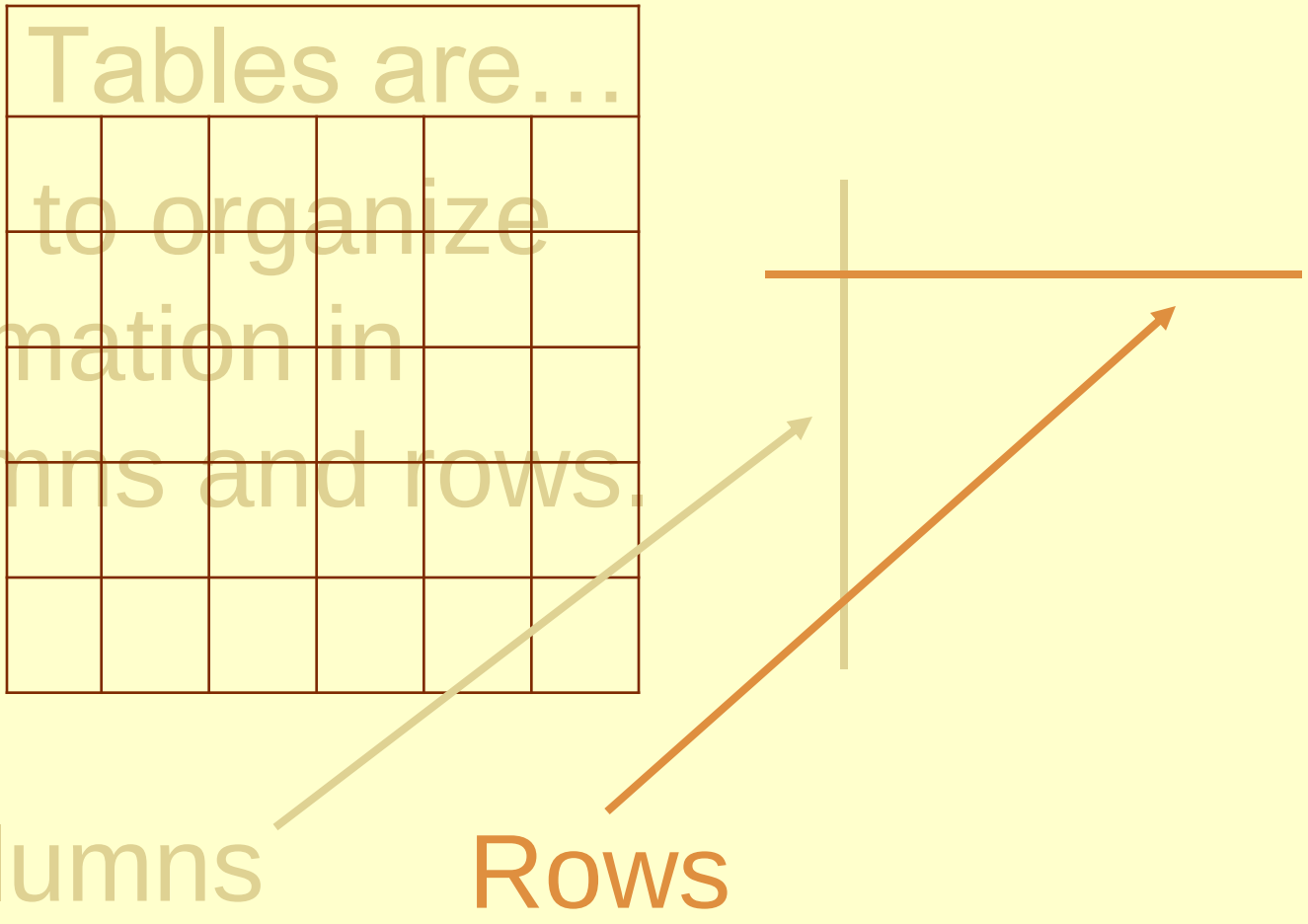
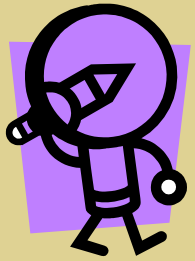




Now that the experiment is planned, let's get started!

Gather Data:

- Test our Hypothesis
- Make Observations
- Record Data or Results

How do we TEST our Hypothesis?

- WITH TEACHER APPROVAL
- By Being Safe!
- By following the Procedure!

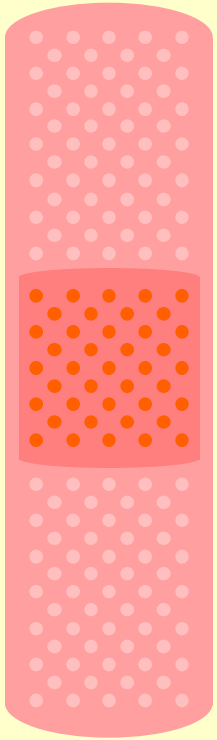
What is TEACHER APPROVAL?

Don’t forget...

…before you begin your experiment, you must get teacher approval of your plan.

How are we SAFE?

- ✓ Follow all safety instructions!
- ✓ Never eat or drink in the lab!
- ✓ Never inhale chemicals!
- ✓ Report *any* accident or injury to your teacher.
- ✓ When cleaning up, get rid of materials as directed by your teacher
- ✓ Wash your hands after working in the lab.



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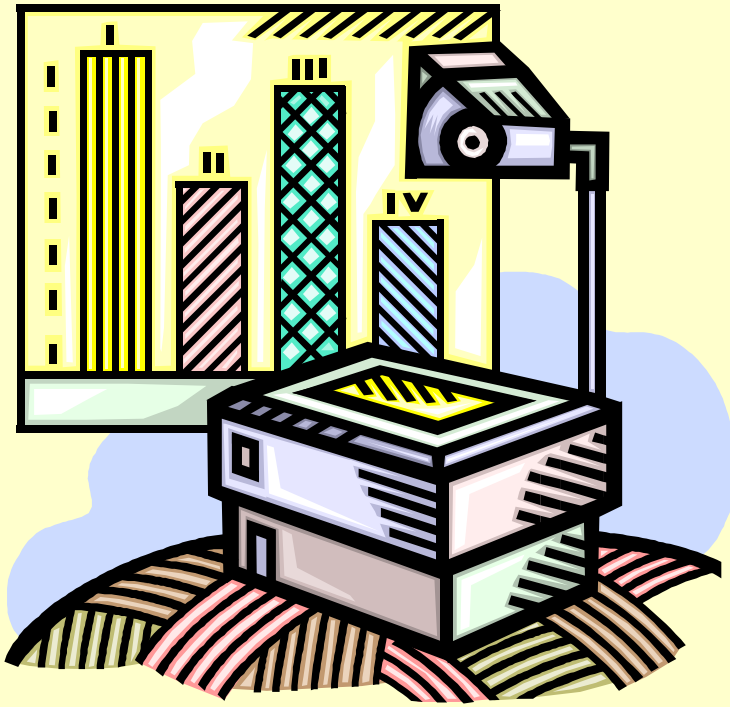
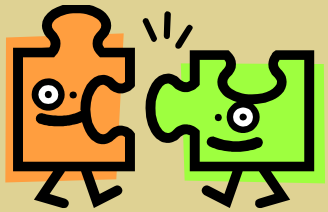


WRAPPING UP



The investigation is done, what do we do with our data?

- We ANALYZE our DATA!
- We make CONCLUSIONS!
- We ASK NEW QUESTIONS!
- We COMMUNICATE!

How do you ANALYZE?

Analyze…

…comes from Greek:

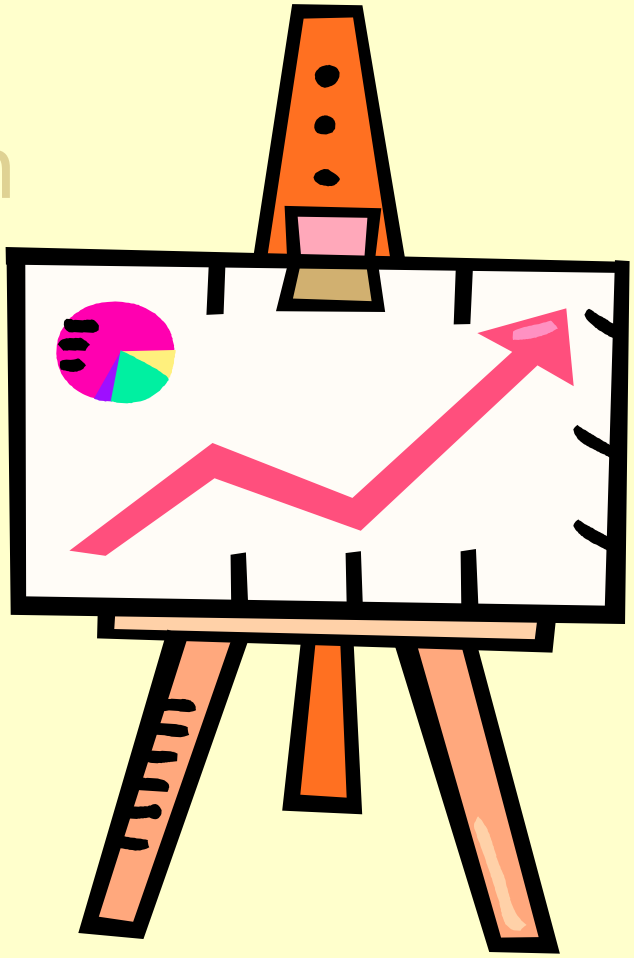
ana means to "break apart"

lyze means "to loosen"

…look closely at each detail to find out what it means.

How do we ANALYZE RESULTS?

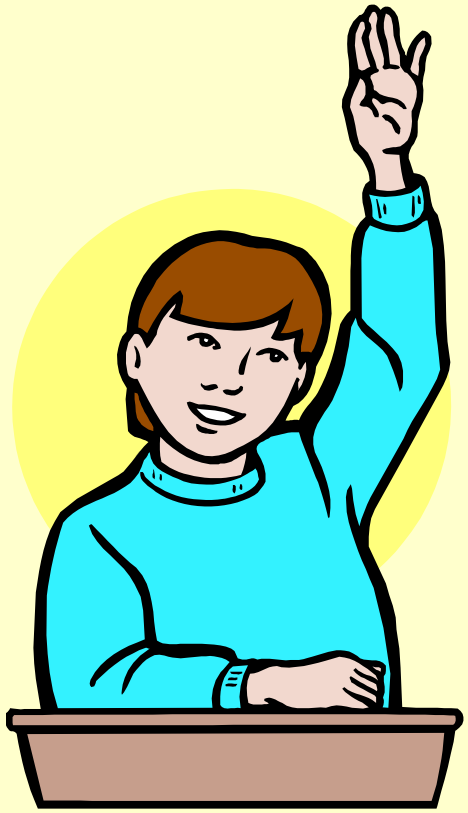
- Make graphs or tables and use other tools to better understand the information that has been gathered.
- We ask ourselves:
  - What do the data tell us?
  - Is the data accurate?
- We look for patterns in the data.
- We compare our data to our hypothesis.



How do we MAKE CONCLUSIONS?

- We make a **conclusion** by making a decision based on the results of the experiment.
- We review our hypothesis and determine if it was *supported* or *not supported*.
- We review our predictions and determine if they were *accurate* or *not accurate*.
- We also may make **inferences** which means we explain what we think the results mean based on our experience and observations.
- We also may make **predictions** which means we share ideas about what will happen in the future.

How do we ASK NEW QUESTIONS?



- Scientist investigation to answer questions.
- The results of one investigation can lead a scientist to think of new questions.
- And, sometimes the results from one experiment will lead us to ask questions that can be answered by other methods of scientific investigations or other experiments!

How do we COMMUNICATE?

- **In Science, we share our results so that one person's discoveries can lead to more discoveries!**
- **We can share our results by communicating in many ways:**
  - Talking: Presentations and Discussions
  - Writing: Reports and Journals
  - Showing: Sketches and Models