

Biology and the Investigative Process



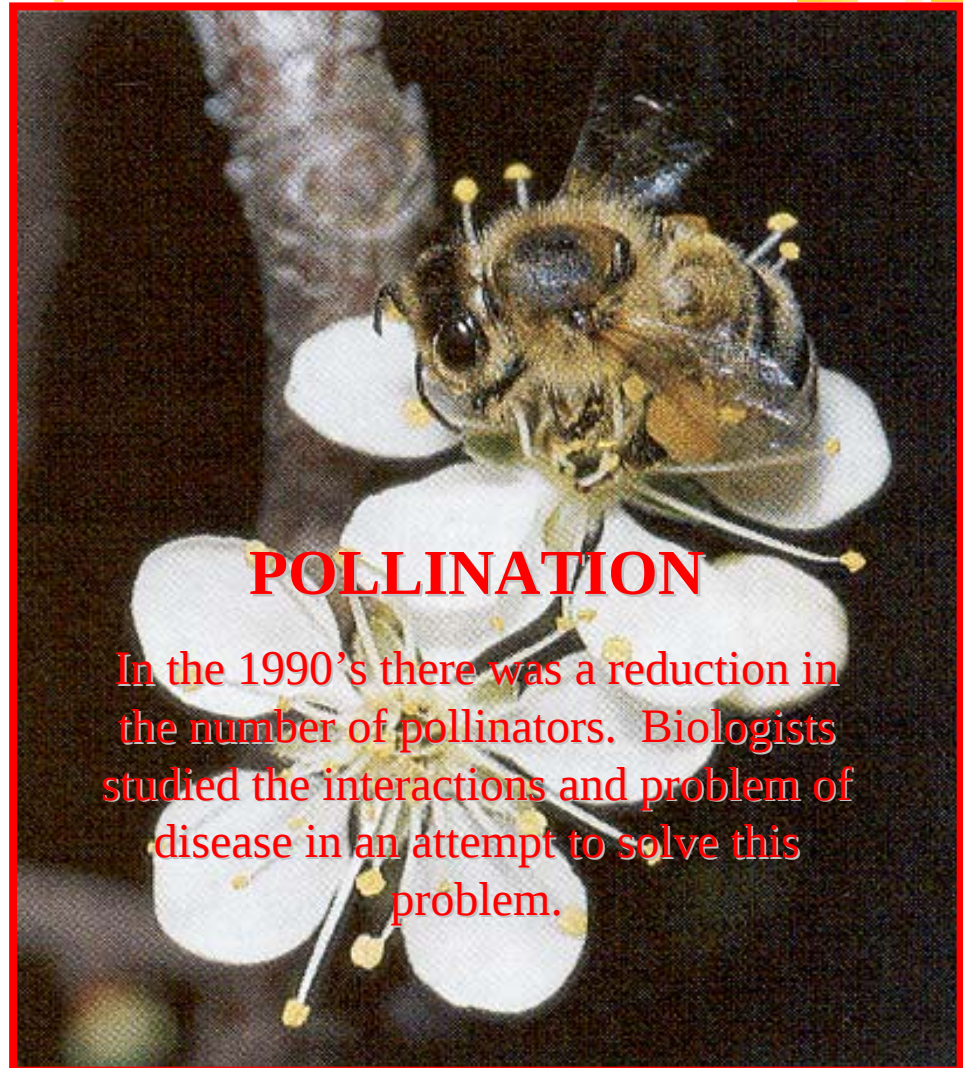
Unit 1: Concepts and Questions



- What is Biology?
- How is the Scientific Method applied in the study of Biology?
- How do we collect information and resources through the internet?
- How do we complete an inquiry project?
- Why is it important to have our peers work with us on research?

The Science of Biology

- **BIOLOGY-**
the study of life
- Millions of life forms have not been studied yet
- Study interactions among organisms (whole living things)
- Study of problems and solutions



POLLINATION

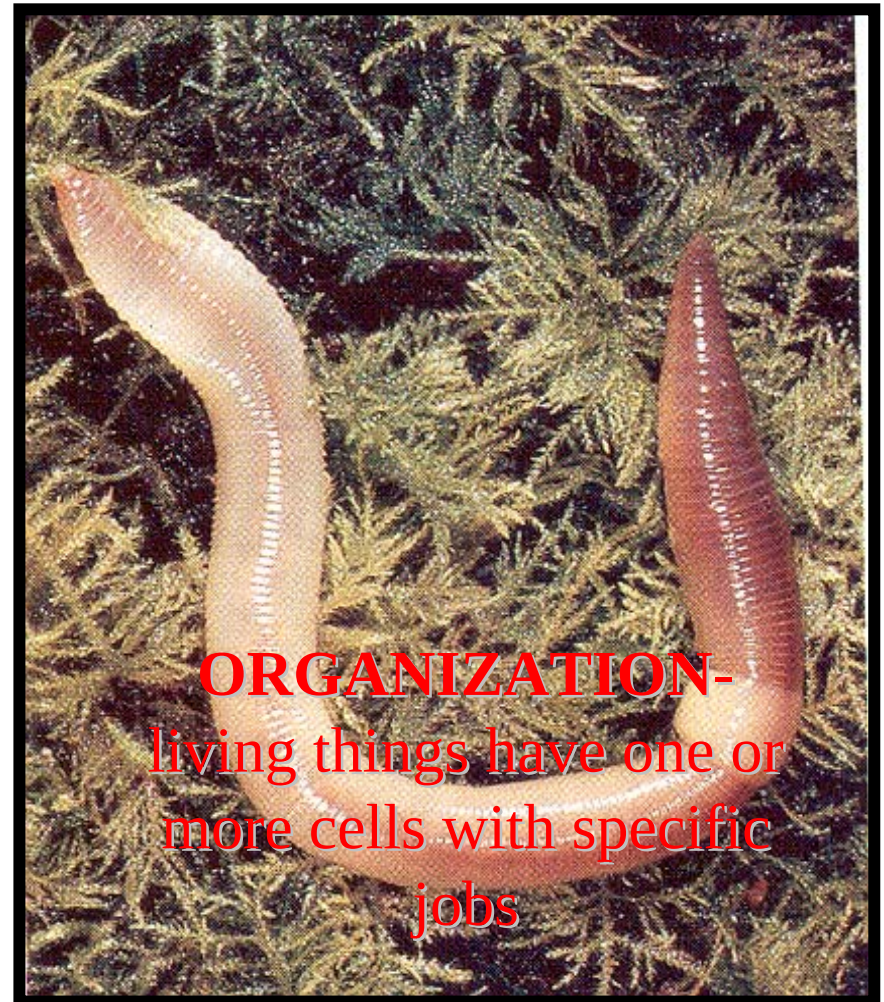
In the 1990's there was a reduction in the number of pollinators. Biologists studied the interactions and problem of disease in an attempt to solve this problem.

Characteristics of Living Things

■ ORGANISM-

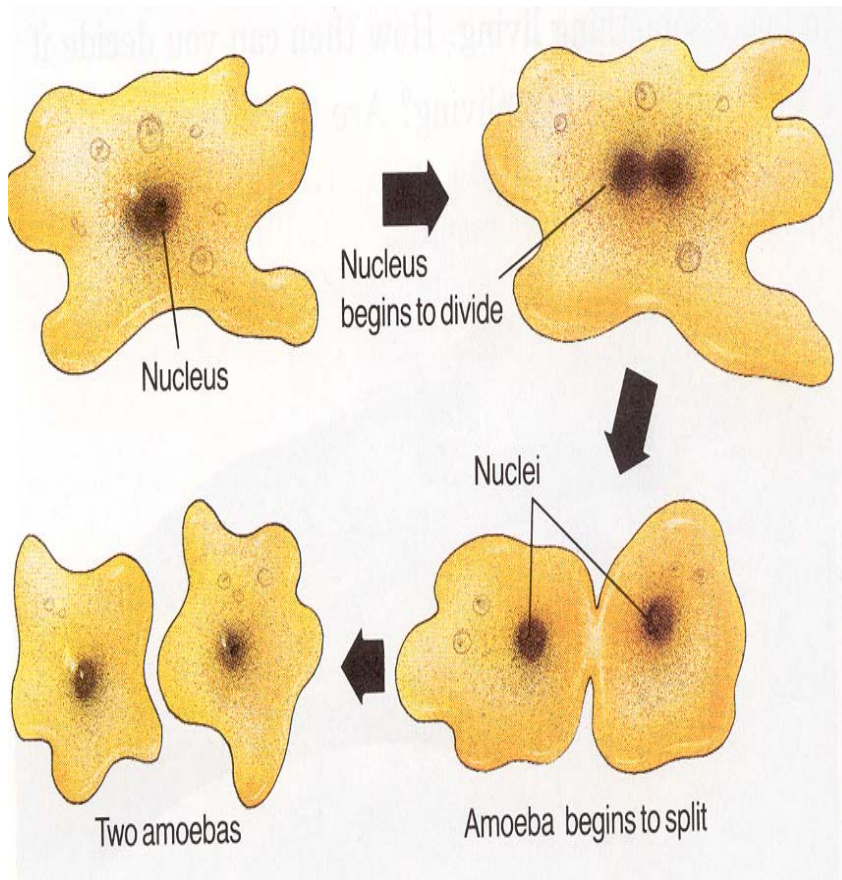
A whole and living thing

- In order for something to be considered alive it must have ALL the characteristics of a living organism



ORGANIZATION-
living things have one or
more cells with specific
jobs

Characteristics of Living Things



- **REPRODUCTION:**
Each species must be able to produce new organisms like themselves
- **Ex. Amoeba**
undergo *asexual reproduction*

Characteristics of Living Things

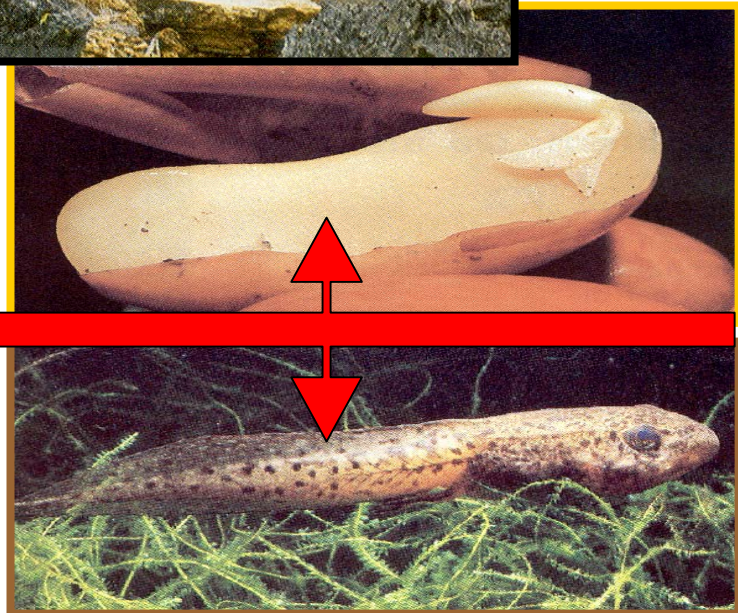
■ GROWTH

Increase in size or
number of cells



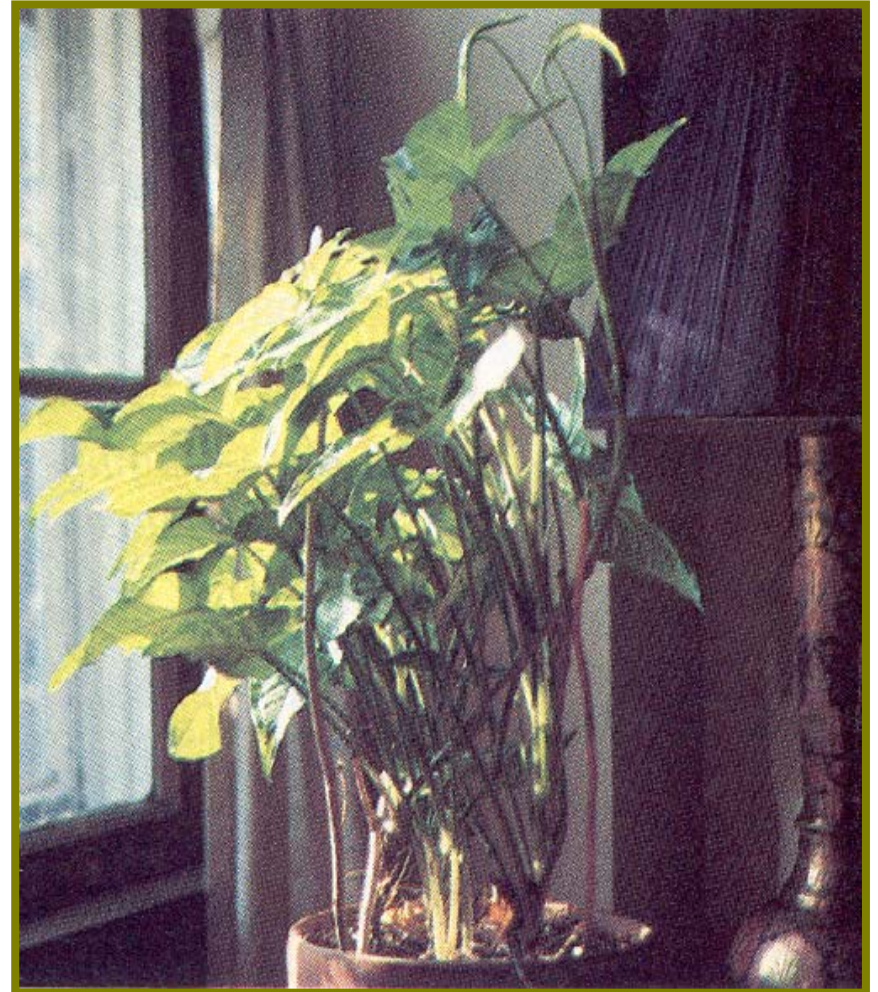
■ DEVELOPMENT

Change in shape and
form of the organism



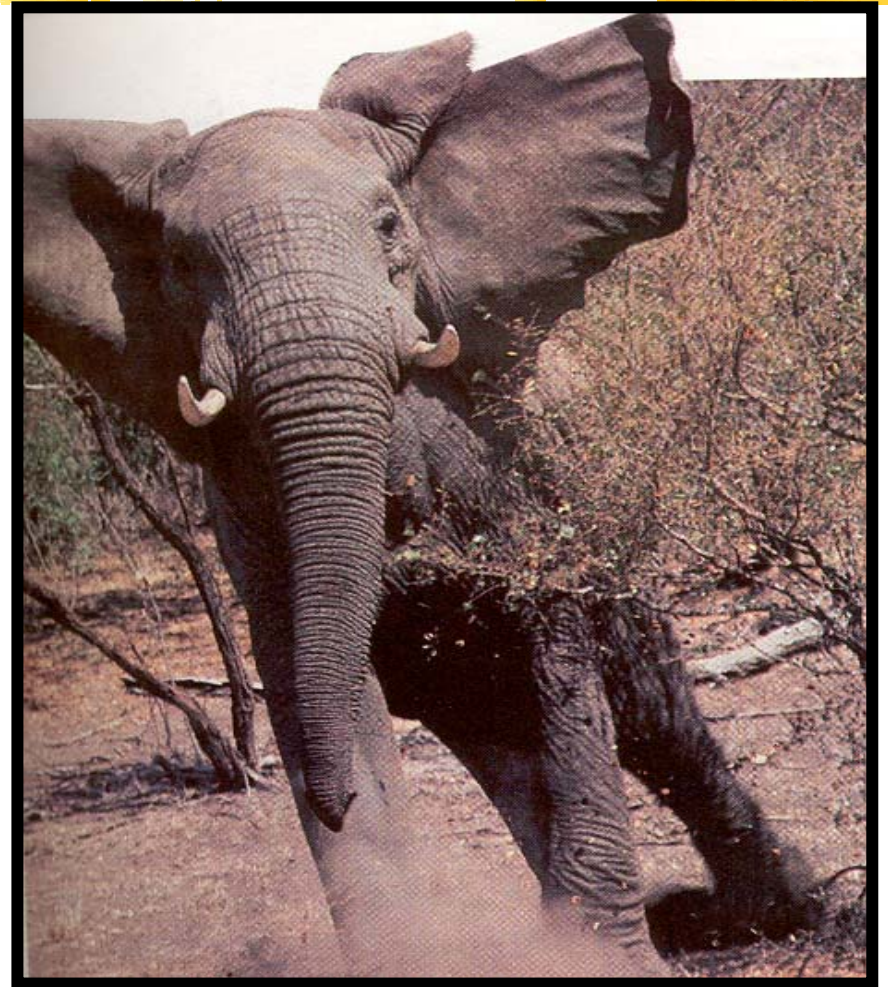
Characteristics of Living Things

- Living things need food
- Living things use energy
- Living things respond to their environment
- Living things adapt



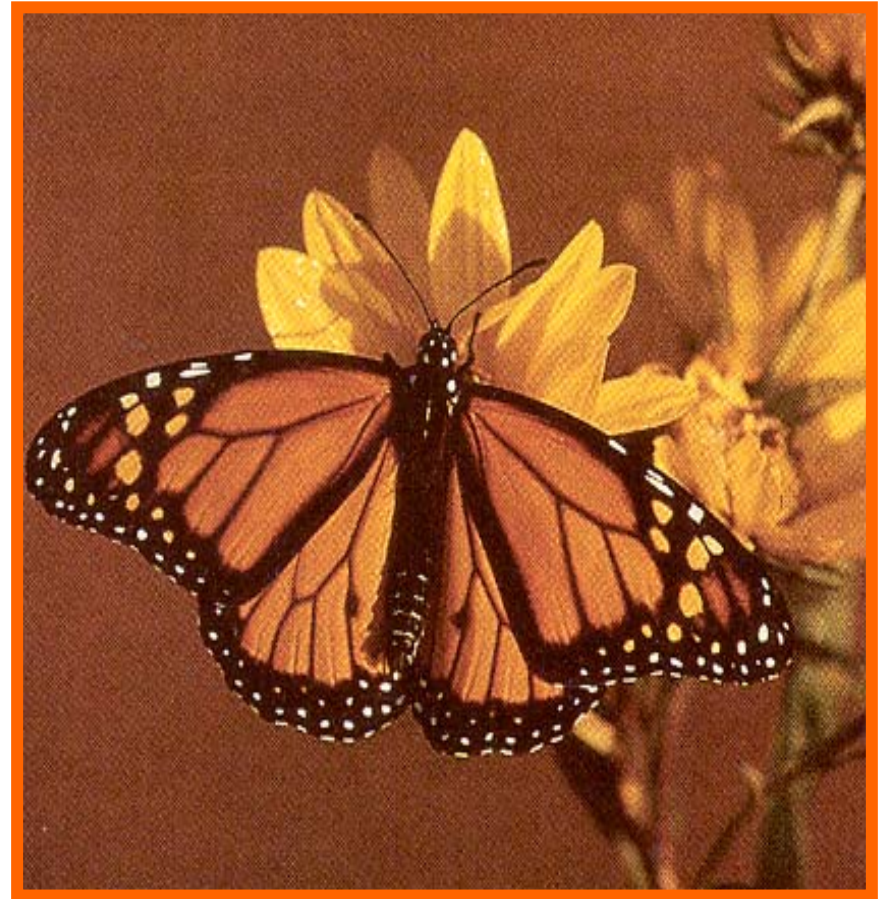
The Methods of Studying Biology

- How do elephants communicate?
- Why do mosses grow in wet, shady areas?
- Why do earthworms crawl onto sidewalks after it rains?



The Study of Biology

- How far do Monarch Butterflies fly during their annual migration?
- You will be able to determine this through a long term investigation in which you raise and tag Monarch Butterflies

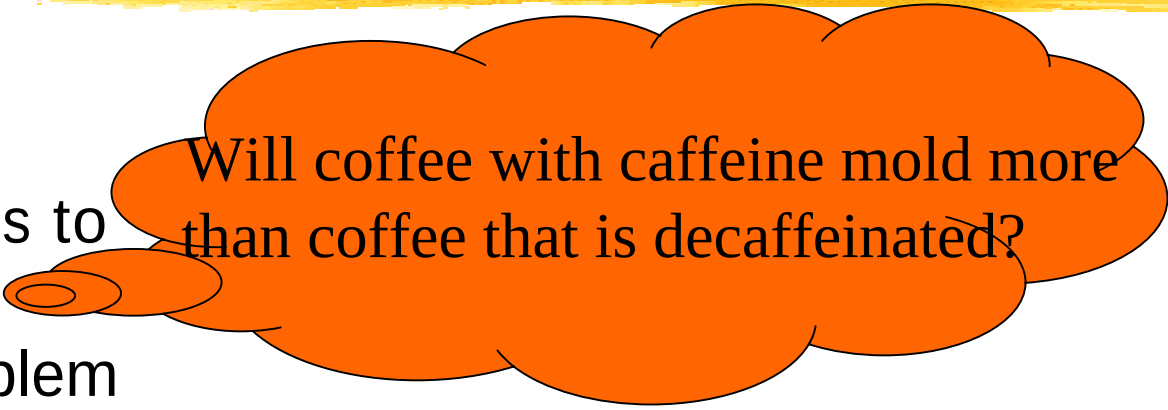


Steps of the Scientific Method



■ Question

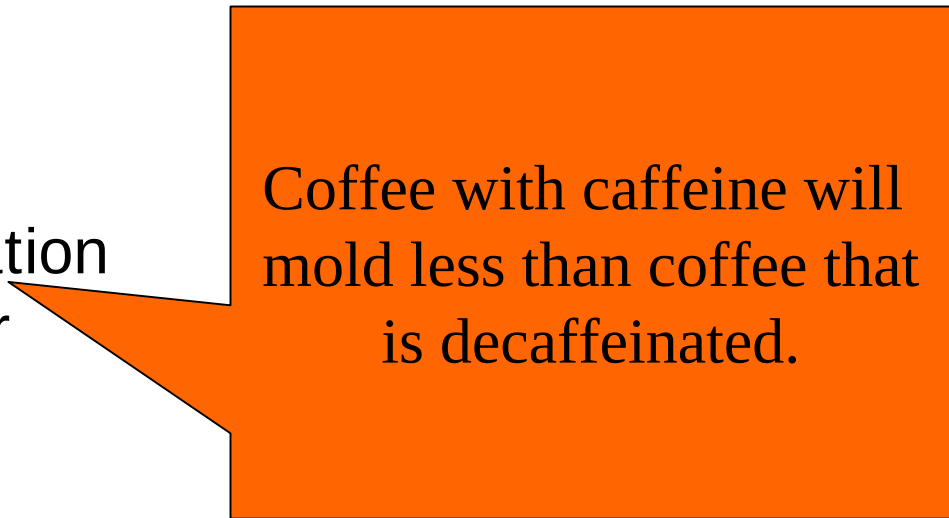
- Use observations to come up with a question or problem



Will coffee with caffeine mold more than coffee that is decaffeinated?

■ Hypothesis

- testable explanation for a question or problem



Coffee with caffeine will mold less than coffee that is decaffeinated.

After the Hypothesis

■ Experiment

- A procedure for an experiment must be developed including:

- Control (comparison)

- Constants (things that stay the same throughout)

- Independent Variable (what is being tested)

- Dependent Variable (end result)

1. Place 50 ml. of coffee with caffeine into a 100 ml. glass beaker. (Independent Var.)
2. Place 50 ml. of decaffeinated coffee into a 100 ml. glass beaker.
3. Keep both beakers at room temperature under the same amount of light.
4. Observe the beakers each day and mass the amount of mold that grows on days 2, 4 and 6.

Following the Experiment, Collect Data

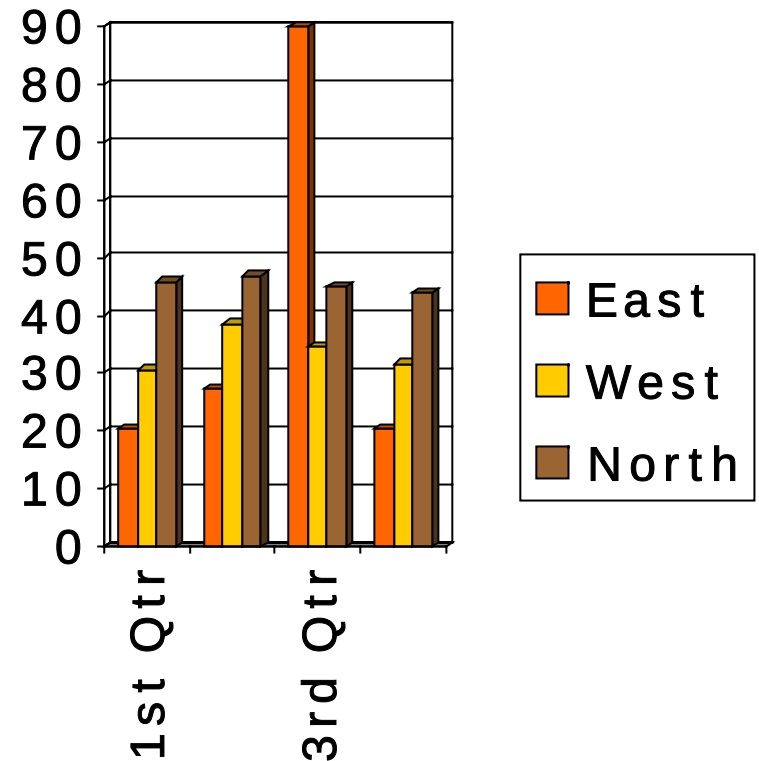
■ Observations

■ Qualitative Analysis

- description of what you see, hear or feel

■ Quantitative Analysis

- collection of data using actual measurements (numbers)



Analyze Your Data

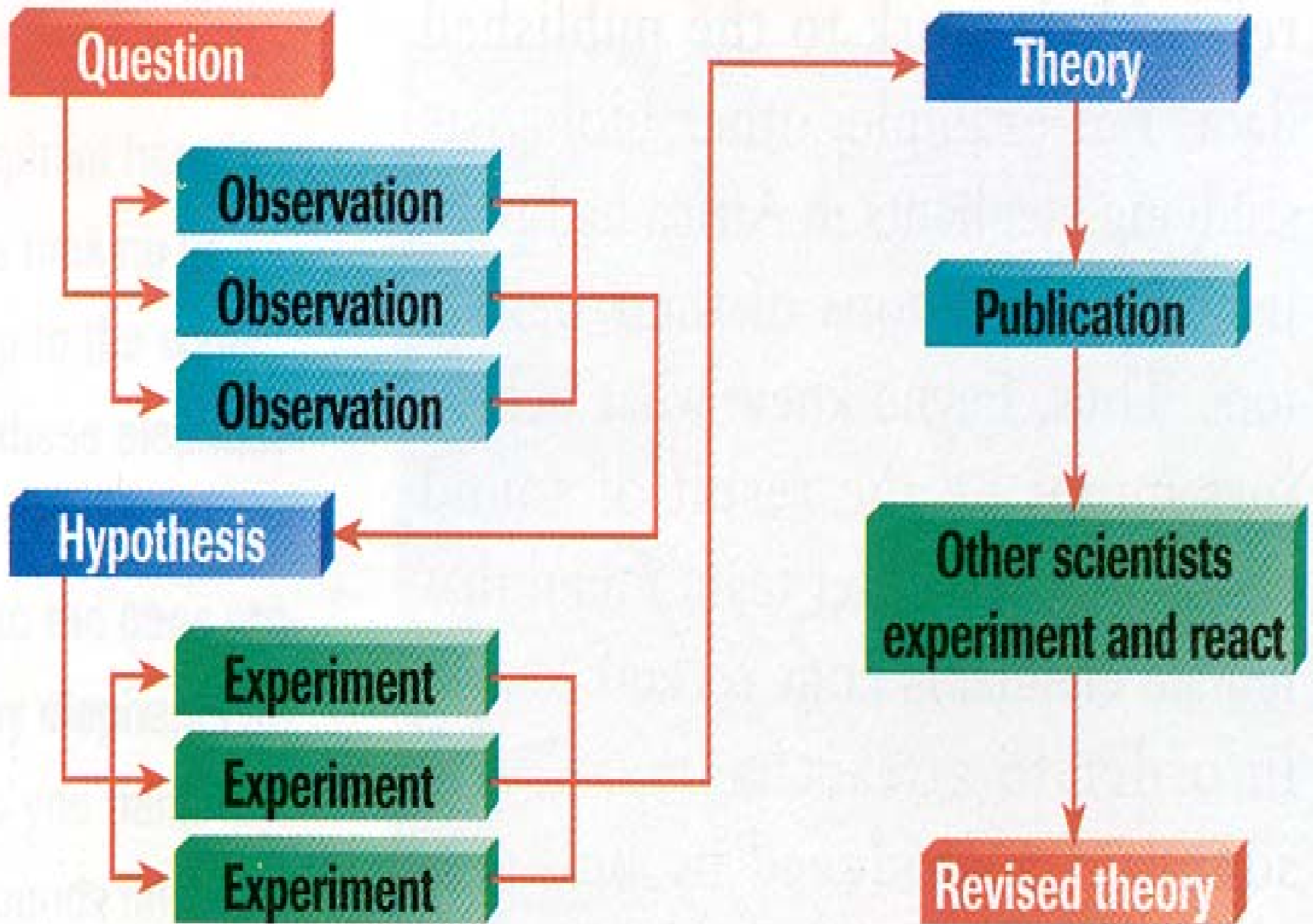


■ Conclusion

- Summarize past studies
- Support or Deny your Hypothesis after analyzing your data
- Identify experimental error
- Describe new studies that could be developed as a result of your research

Past studies demonstrated that there is no effect of caffeine on mold growth. Our data agreed with these past studies.

According to our data, the coffee with caffeine resulted in 5% more mold than the decaffeinated coffee. Additional studies could be performed using larger concentrations of caffeine.

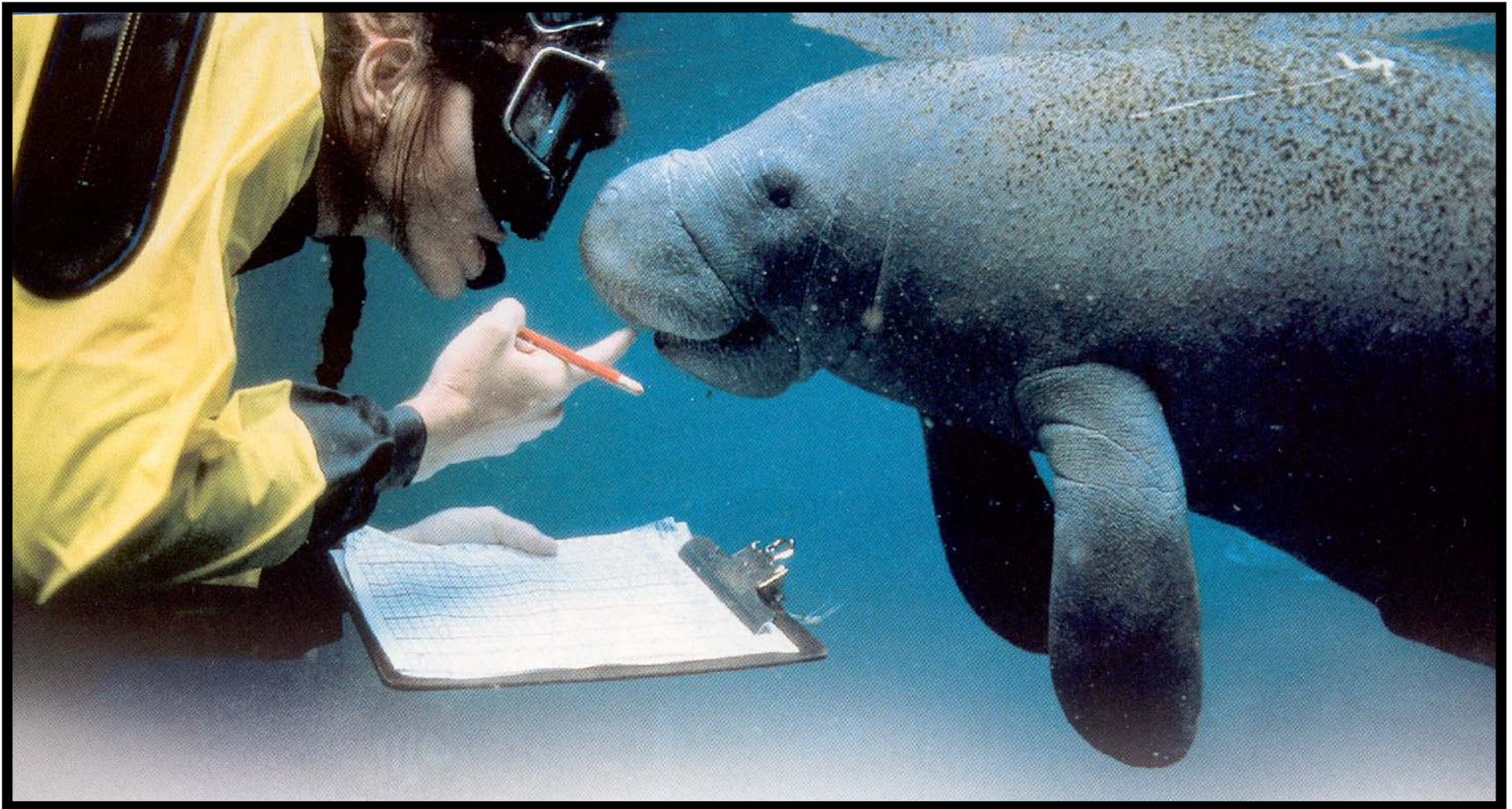


Curiosity and Questions



- Questions lead to studies
- Questions come from everyday observations
- The ***Scientific Method*** is an approach used by all scientists in order to answer questions

What type of Research might be going on in the photo below?



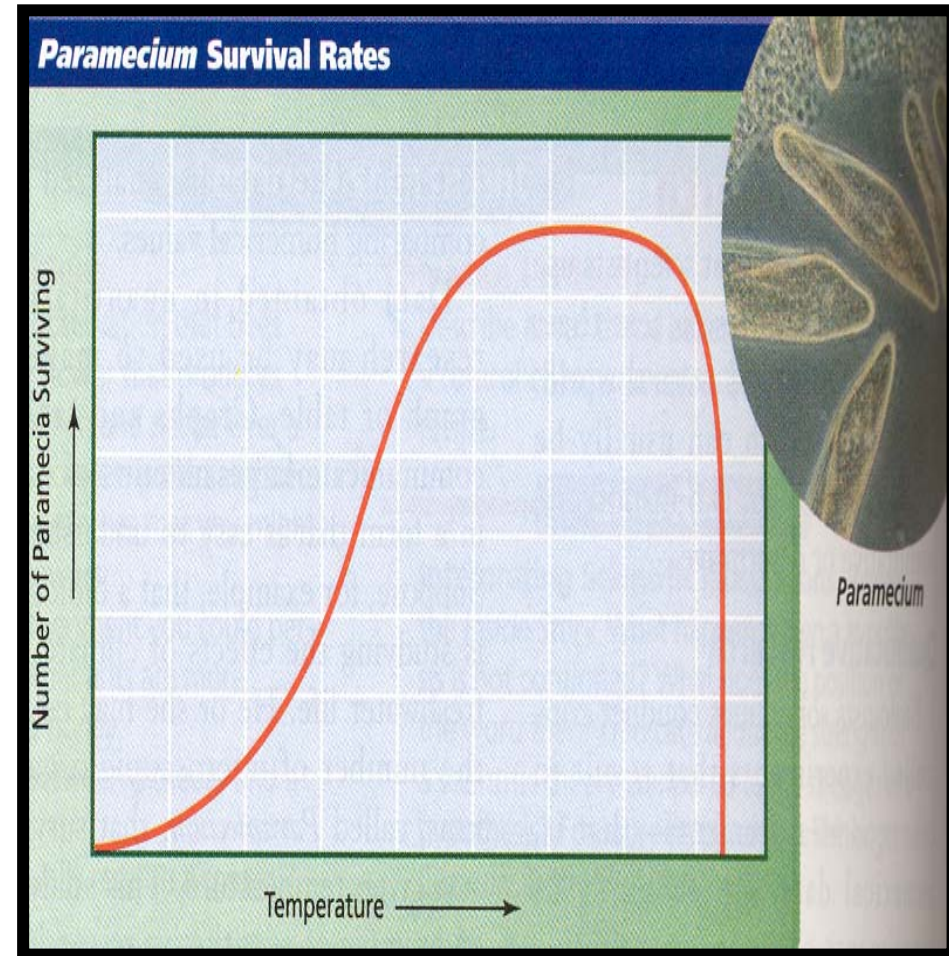
Write a “pretend” research plan



- Ask a question
- Define a problem
- Write a hypothesis
- Briefly describe a procedure to test your hypothesis
- Identify the data you would collect
- How would you analyze and summarize your data?

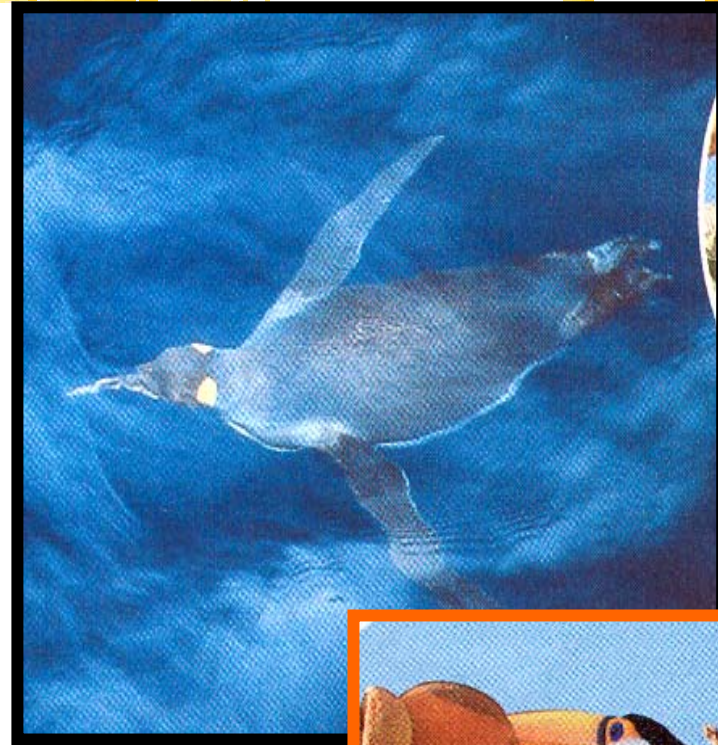
Types of Biological Research

- Quantitative Research
 - Data may be collected in the form of numbers
 - Graphs and data tables are used in the analysis of research

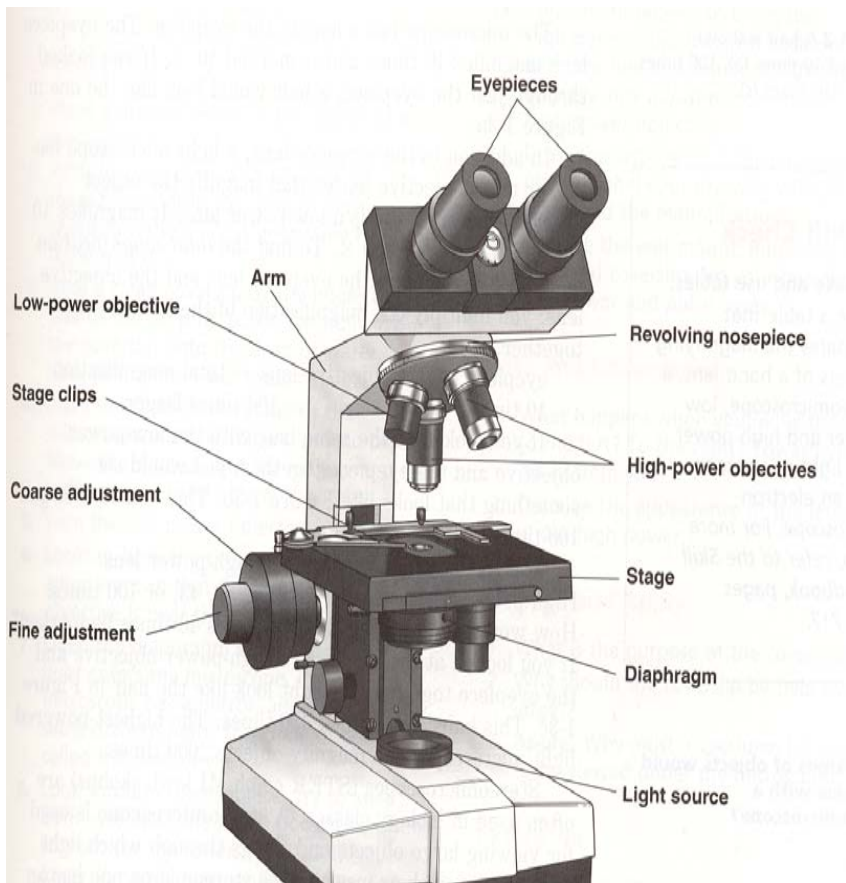


Types of Biological Research

- Descriptive Research
 - Field Studies
 - Research on how animals react in response to their environment
 - Migration Patterns and other behaviors in animals



Tools of the Biologist



■ Microscope

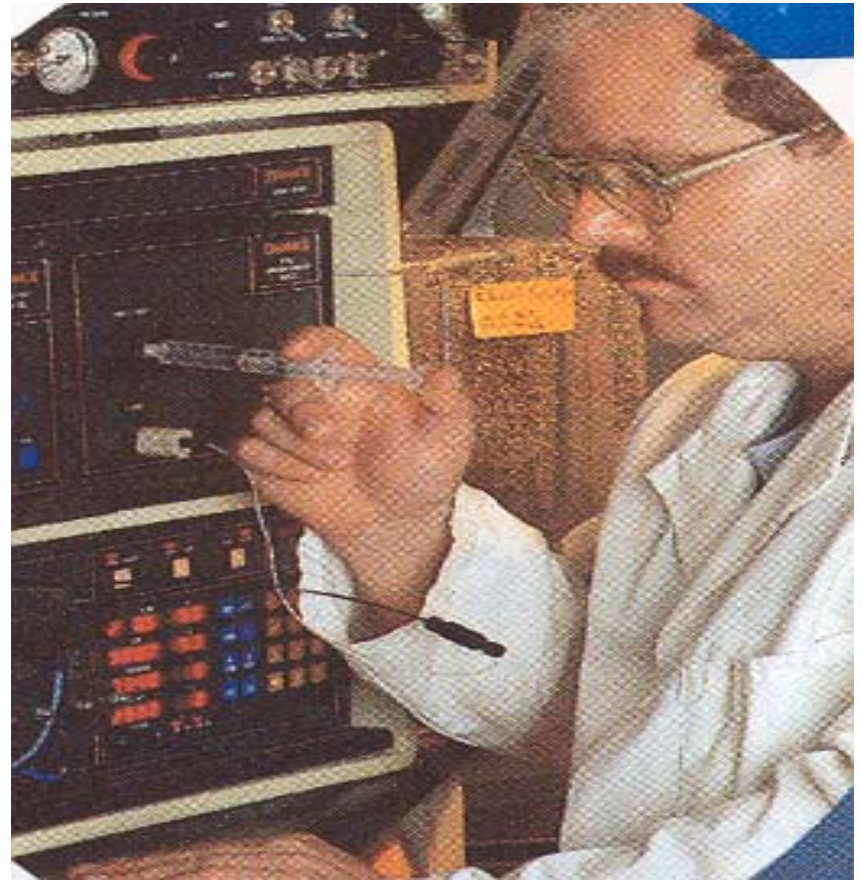
- Basic tool of Biology
- Magnifies using the eyepiece (usually 10X) and the Objective lens (4X, 10X or 40X)

■ Electron Microscope is much higher power

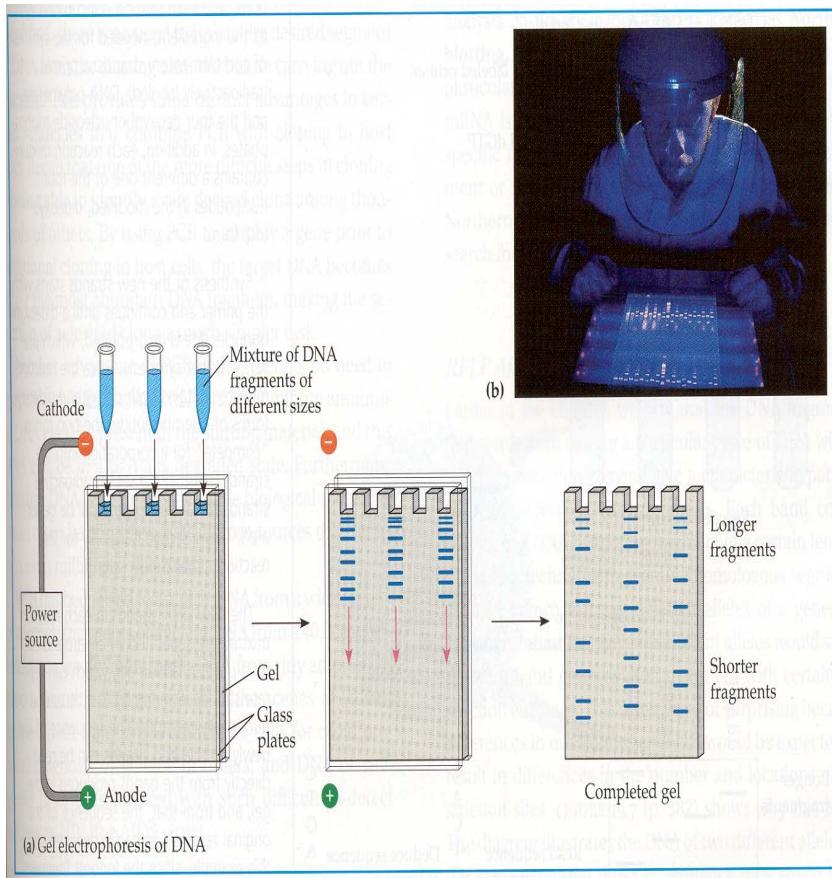
- up to 1,000,000X
- uses beams of electrons rather than lenses

Tools (Con't)

- Gas Chromatograph
 - Used in Scientific Laboratories to identify pesticides or chemicals that might be present in plants or fish.
 - Ex. Levels of DDT in fish of Lake Ontario



Tools (Con't)



■ Gel Electrophoresis

- Method used to separate DNA into different fragments
- May be used for:
 - identification of disease
 - criminal identification
 - paternity
 - unknown person identification