EXPERIMENTAL DESIGN

PART 1: MODEL SYSTEMS AND CONTROLS

MODEL SYSTEMS

- Are extremely important
- Most investigations become _____ if you must use a ***complete, existing system*** to do experiments
- May be impossible to conduct on the complete system.

Example

- Want to study the mechanism by which sulfuric acid affects human eyeballs
- Can’t find volunteers

MODEL SYSTEMS – CONTD.

- Develop a model system which
  - _____
  - Allows the non-key behaviors/attributes to be _____
- Sulfuric acid example
  - Eyeball model may consist of two parts
    - A model aqueous solution
    - A model lipid layer on a substrate

KEY CONSIDERATIONS FOR MODEL SYSTEMS

Model systems are:

- Controllable relatively easily
- Parameters of interest are adjustable
- Easy to analyze
- Realistic (i.e., ***captures and mimics the key attributes***)
- Safe
- Inexpensive

EXAMPLES OF MODEL SYSTEMS

- Various animal models in the study of diseases
- Certain thiols as models for nerve agents in perfecting detection mechanisms
- Use of TNT for simulating seismic events
- Computational chemistry for studying the reactions of methylmercury

Carefully choosing and properly justifying a particular model is a critical part of a research proposal!

CONTROL EXPERIMENTS

- Control or background results are necessary in order _____
- Try to _____ of the parameter of interest.

- Example: Drug development
  - A new treatment for heart disease is developed in your lab
  - The drug is given to heart patients who are then monitored over six months
  - None of the patients has a heart attack
  - Conclusion: the new drug successfully prevents heart attacks!
  - **What's wrong????**

CONTROL EXPERIMENTS

- Example: H_2O hydrolysis by Silica
  - A new surface cleaning procedure was hypothesized to enhance the activity of clean Silica particles to catalyze H_2O hydrolysis to hydrogen and oxygen.
  - The experiment was repeated several times.
  - H_2O hydrolysis was observed every time.
  - Conclusion: The new cleaning procedure enhanced catalytic activity.
  - **What is wrong???**

CONTROL EXPERIMENTS

- There are occasions where a suitable control experiment is not possible
- Examples:
  - Event rarity or uniqueness (e.g., large meteor strikes)
  - Ethical considerations (e.g., infecting humans with a disease to see if a treatment works)
  - Analysis of a non-manipulable system (e.g., almost all economic “experiments”)
  - Analysis of historical data

The End