Basic Experimental Design

PSCI 4442
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Fundamental Types of Research

• Basic (Pure) Research

• Applied Research
Attributes of a Basic Science Problem

• Interests investigator strongly
• Connections with other science
• Fits into a larger picture
• Well-laid out hypotheses
• Why me?
• Know when to hold, know when to fold
Attributes of an Applied Science Problem

• Careful statement of problem
• Know background of problem
• Information sharing important
• Balancing applied and fundamental
Elementary Scientific Method

• Be objective
• Observation and description
  • Write in notebook immediately
  • Avoid bias
• Analyze
  • Break into multiple parts
  • Simplify
• Synthesis (not chemical term)
  • Approximate real solution from simple parts
  • Simple parts must be the correct ones
  • Effects of parts considered
• Create hypothesis – tentative suggestion
• Test hypotheses
Elementary Scientific Method (cont.)

- Can a model be constructed?
- Search for causes
  - Method of agreement
  - Method of difference
  - Method of concomitant variation
- Fallacies
Experimental Design

• Break into simple parts
• Identify variables
• Carefully select sample(s)
• Controls and/or standards
• Replication
• Design of apparatus
Analysis of Data

• If possible, apply rigorous statistical methods
• Identify uncertainties and sources of error
Reporting of Results

- Typically in a journal format
  - Letter to the editor
  - Communication
  - Full-length paper
- Could be presentation
  - Some publish abstracts and papers
- Work needs to be original
Reference