1. Some types of "questions" involve comparisons

Statistics can help us make rigorous and systematic comparisons of groups, their treatment, and responses and help us avoid arbitrary comparisons that cannot be generalized beyond the particular subjects being studied.

2. Investigative Studies

Last chapter we examined sample surveys. There are additional ways to gather information

- The observational study: the researcher collects data as they currently are ("in the wild").
- The retrospective study the researcher collects data from the past. Backward looking.
- The prospective study the researcher collects data as events unfold. Forward looking.

All three of these suffer from the same problem. The research is not "in charge" of assignment. In other words, the researcher cannot RANDOMLY assign a condition (e.g. race, gender, major, musical education) so for these kinds of studies it is NOT possible to demonstrate "cause and effect" but one can demonstrate ASSOCIATION.

It is possible to demonstrate "cause and effect" in an investigative study by using:

The Randomized Controlled Experiment and its features

- At least one Factor (with multiple levels) the combination of specific levels of different factors (a factor if there is only one) in an experiment is a treatment.
- A comparable Control (what if we never intervened)
- Random assignment to either treatment or control
- A measurable response (a real outcome)
- Subject/participant/experimental unit
- Replication an experiment should be repeatable

Your textbook mentions "blocking", don't worry about being tested on it in Stat 10.

3. Beneficial aspects of experiments

- Randomization(vocabulary) -- eliminates bias (vocabulary)
- Control Group (vocabulary) allows a clear comparison
- Placebo (vocabulary) -- eliminates the "placebo effect" (vocabulary)
- Double Blind (vocabulary) -- eliminates bias
- Single Blind (vocabulary) -- may eliminate bias
- Replication (vocabulary) -- validate results

4. What can go wrong?

Confounding (vocabulary) -- the effect of an unforeseen characteristic, behavior, event or procedure on the response that cannot be distinguished from the proposed treatment.

5. Statistical Significance

When an observed difference between two or more groups is too large for us to believe that it occurred "by chance". We consider the difference to be "statistically significant". Just know the verbal definition for now, later, there are way to calculate it.