Introduction to Design

BIOE 498/598

2/5/2020

Definitions

- **Experiment** or **Run**. A single action with the change of at least one variable followed by an observation.
- **Experimental Unit**. An instance of the item under study that is changed.
- **Observational Unit**. *We'll come back to this.*
- **Independent Variable** or **Factor**. The thing under study that can be controlled or changed.
- **Background** or **Lurking Variable**. A thing we are unaware of or cannot control.
- **Dependent Variable** or **Response**. The things we measure. Depends on the settings of the independent and lurking variables.

Definitions (continued)

- **Effect**. The change in response due to a change in independent or lurking variable.
  - **Calculated effects** come from the model.
  - **Practical effects** come from our knowledge of the system.
- **Replicate**. Two or more experiments conducted with the same settings on different experimental units.
  - The respones of replicates vary due to differences inherent in experimental units or the lurking variables.
- **Duplicates**. Multiple measurements on the same experimental unit.
  - Duplicates should always be averaged before analysis.

Definitions (continued)

- **Experimental Design**. Collection of experiments planned in advance.
- **Confounded Factors**. When a change in factor corresponds with an identical change in another factor.
- **Biased Factors**. When a change in a factor coincides to a change in a lurking variable.
- **Experimental Error**. Difference between observed response and long run average of all experiments with the same settings.
  - There is nothing wrong with error.
  - **Bias error** remains constant or changes consistently.
  - **Random error** changes unpredictably *and averages to zero*.

Overall experiment design

- Use a proper experimental design.
- Randomize as much as you can.

Designs we will study

- Completely Randomized Design
- Factorial Designs
- Fractional Factorial Designs
- Response Surface Designs
- Crossover Designs
- Screening and Sequential Designs