

Principles of Experimental Design

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Experimental Design

- Many interesting questions in biology involve relationships between *response variables* and one or more *explanatory variables*.
- Biology is complex, and typically, many potential variables, both those measured and included in an analysis and those not measured, may influence the response variable of interest.
- A statistical analysis may reveal *an association* between an explanatory variable and the response variable.
- It is very difficult to attribute causal effects to observational variables, because the true causal influence may affect both the response and explanatory variable.
- However, properly designed experiments *can reveal causes of statistical associations*.
- The key idea is to reduce the potential effects of other variables by designing methods to gather data that *reduce bias and sampling variation*.

Case Studies

We will introduce aspects of experimental design on the basis of these case studies:

- An education example;
- An *Arabidopsis* fruit length example;
- A starling song length example;
- A dairy cow nutrition study;
- A weight loss study.