PLS205: Experimental Design and Analysis

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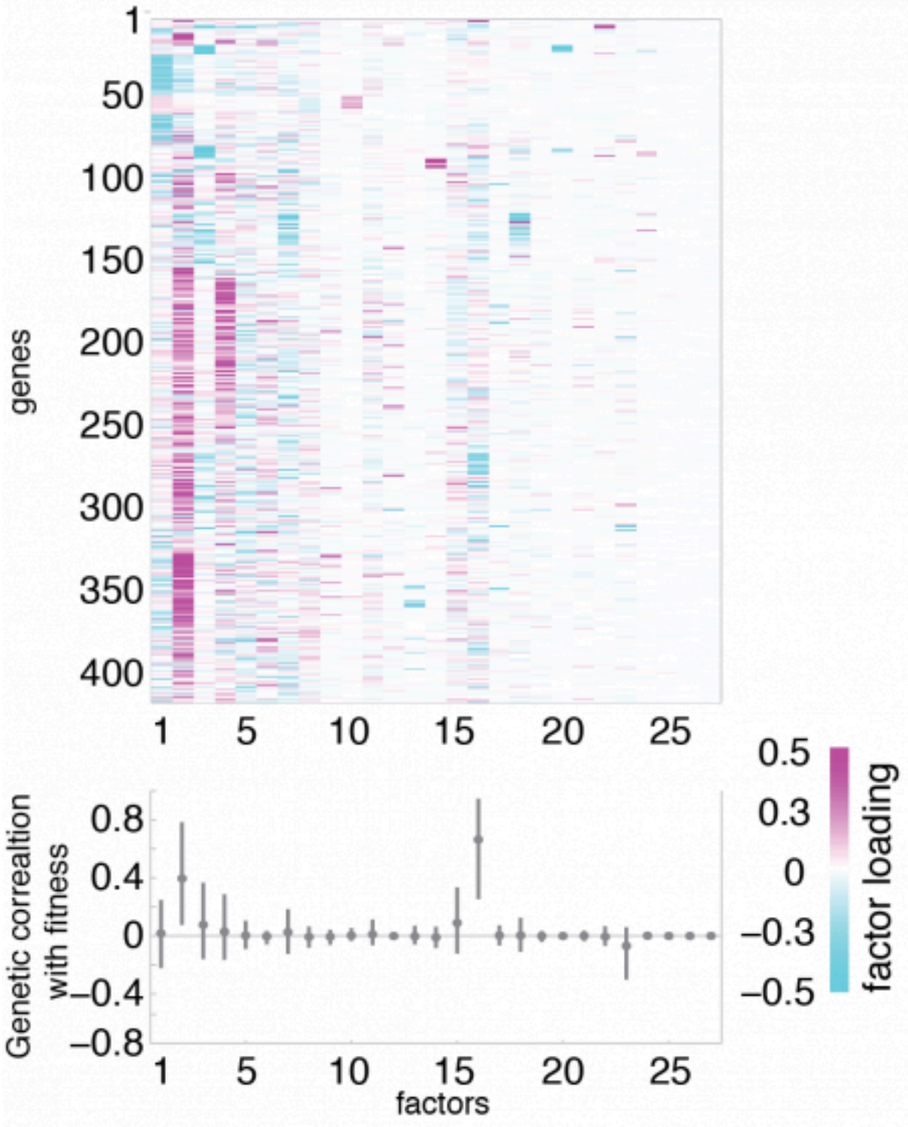
Robbins 278

Runcie lab: Plant Genetics and Evolution

maize

Mimulus guttatus

Arabidopsis thaliana



Myrna Cadena

James Ta

Experimental Design and Analysis

How do you design a good experiment?

Once you've run an experiment, how do you analyze and communicate your results?

Course Objectives

Be able to choose an appropriate experimental design for a range of experiments

- treatments, replication, randomization, blocking

Identify and evaluate experimental designs in the literature

- scope, goals, efficiency
- Problems? bias, confounding, pseudo-replication

Analyze data from a range of standard experiments with **R**, and communicate results clearly

- parameter estimation, hypothesis testing
- Produce reports using R Markdown

See Canvas . . .

Course Structure

Lectures Theory of designed experiments
primarily on the chalkboard

	A01	A02, A03
Discussions	Tu: 4:10-5:00	Tu: 5:10-6:00

Misc topics, HW help, R programming

Asmundson 242 Bring your laptop if you can

Labs	Th: 4:10-5:00	Th: 5:20-6:10 or Th 6:10-7:00

Demonstrate analysis of experiments using R

Hutchinson 73 Seats are limited

HW, Exams Weekly problem sets, 2 exams

Apply skills from lab, practice using R

	% of total	Date
Homework (9)	35%	Due Thursdays before class
In-class Quiz	5%	Tuesday 1/28
Midterm exam	30%	2/13 (Due 2/18)
Final exam	30%	3/12 (Due 3/17)

Resources

Textbook (not required): Statistical Methods in Biology: Design and Analysis of Experiments and Regression S. J. Welham, S. A. Gezan, S. J. Clark and A. Mead. CRC Press

Online courses for experimental design

PSU Stat 503

3Rs- Reduction.co.uk

Office hours

Monday	Tuesday	Wednesday	Friday
4:00-5:00	3:00-4:00	10:00-11:00	11:00-12:00
Robbins 289	Asmundson 242		Robbins 289
Runcie	TAs		Runcie

Prereq's

STAT 100 or PLS 120 or equivalent

- t-test
- ANOVA
- Distributions (normal, Student's t)
- Hypothesis test

Experience with R (or another programing language) is not required

- Make use of online resources for R help
  - Intro R tutorials
  - R Markdown

How to do well

Take advantage of Discussion sections and office hours

- Come to me or TAs **early** in the quarter if you're having problems
- Slack channel: pls205-2020

Ask questions!

Use online resources for learning **R** and **R Markdown**

Readings from past years are available on Canvas

Work together on homework (but turn in your own work)

Grade your own homework!

Practice, practice, practice

Let’s run an experiment ...

Question: Does standing up increase a person's pulse?

I assigned each of you to one of two treatments (sitting / standing).

Let’s run an experiment ...

Question: Does standing up increase a person's pulse?

I assigned each of you to one of two treatments (sitting / standing).

Count your pulse for 30 seconds:

Ready . . . Set . . . Go!

Stop!

Pulse (beats per minute) = count x 2

Record your pulse in the form I just emailed through Canvas.

Experiment

An exercise designed to determine the **effects** of one or more variables (**treatments**) on one or more characteristics (**response variables**) of some well-defined system (**experimental unit**).

Hurlbert 2004

Goal of Experimentation

Draw conclusions about treatment effects

Generalize results to a broader population

Experimental Unit

The **smallest** unit of experimental material to which a **single treatment** (or treatment combination) is assigned by the experimenter and which is dealt with **independently** of other such systems **under that treatment** at **all stages in the experiment** at which important variation may enter.

Kozlov and Hurlbert 2006

Experimental Unit

Each experimental unit get its treatment **independently**

Each experimental unit is **equally likely** to be assigned each treatment

Experimental units shouldn’t **interfere** with each other

Experimental units should be **randomly** selected from a **reference population**