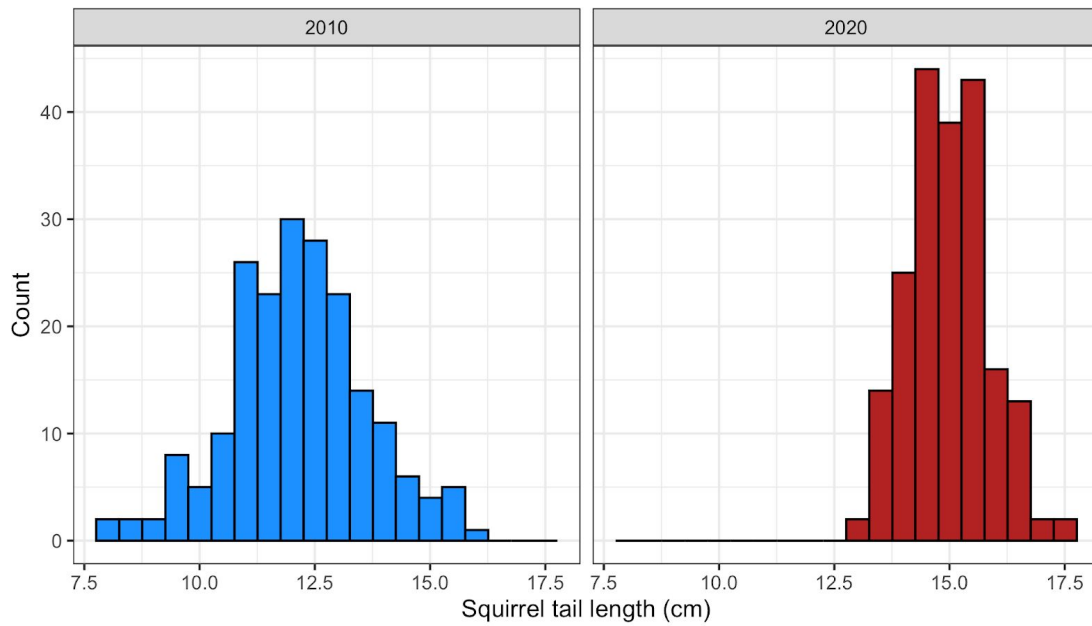


You are studying a population of squirrels in the Pine Barrens. In 2010, you randomly collected 200 squirrels and measured the length of their tails in centimeters, and you returned in the first week of 2020 to again measure 200 randomly sampled squirrels. You obtained these results:



1. Is the trait "tail length" discrete or continuous?
2. Based on the measurements from 2010 and 2020, is there evidence that tail length is evolving? For your answer, consider whether the data satisfies the entire definition of evolution. *Hint: Evolutionary change of traits over time can manifest as changes in mean and/or standard deviation of trait values.*
3. To test if tail length *can be* evolving by natural selection, three conditions must be satisfied. Below, we will test (or figure out how to test!) if these conditions are indeed met.
 - a. The trait is variable
 - b. The trait is heritable
 - c. The trait gives a fitness advantage

Condition One: Trait is variable

Based on the claw measurements you took, is there variation in the trait "tail length"? Consider 2010 and 2020 distributions individually; this question is NOT asking you to compare years.

Condition Two: Trait is heritable

To determine if the trait is heritable, you randomly select 10 mating pairs of squirrels and measure their tail lengths as well as their childrens' tail lengths, in centimeters. Using this information, draw a midparent-midoffspring regression and "ballpark" the line of best fit.

Mom's tail length	Dad's tail length	Midparent tail length? (calculate and fill in the column)	Mean offspring tail length
14	15		15
12	16		14
12	12		11
13	11		12
16	13		14
13	14		14
14	16		15
11	15		12
15	12		14
10	12		11

Continue to next page...

In the space below, draw your midparent-midoffspring regression plot in the space below to (roughly) determine if the trait is heritable. Include all axis labels, points, and draw an *approximate* line of best fit. Based on THE SLOPE of your plot, is the trait likely heritable? If so, weakly? Strongly?

Condition Three: Trait gives a fitness advantage

You have *observed* that squirrels with longer tails tend to be more successful storing nuts for the winter, and therefore more likely to eat and survive to reproductive age. You wish to test this observation. With your group, design an experiment to test this observation:

1. What are your alternative and null hypotheses?

2. Design an experiment with appropriate control/treatment groups, randomization, and replication that can address your hypothesis. Be sure to have clearly define your independent and dependent variables.
3. Below, *draw two graphs* (depending on your experiment, there are many options for what kind of graph) of what your results might look like if there were evidence for the alternative hypothesis, or NO evidence for the alternative hypothesis.