

TEACHER NOTES: Gene Pool Simulation – Frequency of Alleles in Gene Pools

MATERIALS:

1. Set of 2 cups per lab group, one each marked:



NOTE: “Cups” need to be large enough for student hands to reach in and pull out beans, and sturdy enough so they don’t easily break with use. Cut-down ½ gallon milk cartons work well.

2. If you have students carry out the procedures they design to simulate selection in sickle cell disease, you may need a 3rd cup (a “cemetery”) where students can put the beans of those individuals who don’t survive to reproduce. Let them tell you their plan before you give it to them. “So you’re telling me some of these individuals aren’t going to survive and go back in the gene pool...sounds like you’ll need a place to put them.”☺
3. Beans: one bag each—red kidney beans and white beans
4. Class data tables

PREPARATION:

Count 40 red and 60 white beans into each cup. Have a container at the front of the room with lots of extra beans of each color so students can adjust counts as needed.

MAIN NOTES:

1. If you didn’t teach probability in the genetics model, you will need to teach students how to figure out the probability of drawing a red or white bean from each cup, and use that information to figure out the chances of getting each combination. There is a slide for that purpose. Even if you did cover probability students often forget to use it!! A lot of students will do their mathematically expected calculations as if there were an equal chance of picking a R or a W bean. You’ll need to talk them through why, even though there are 2 possibilities, the chances aren’t 50/50.
2. Emphasize the importance of arranging pairs in an orderly way. If they don’t do this, they will have trouble getting accurate numbers, and especially, with correctly returning beans to the gene pools for the second generation.
3. Make sure students understand that this simulation assumes two important conditions:
 - a. Mating is random with regard to the trait (you may need to explain that this does not mean everyone randomly mates with everyone else!)
 - b. Everyone born lives to reproduce (in other words, no selection) and all of their alleles go back into the gene pool.
4. The biggest “aha” – and the biggest reason for doing this demonstration – is that the gene pool (# of R and W beans/cup) doesn’t change between the first and second generations. Students really need to see this to believe it. In fact, they often think they’ve made a mistake once they realize what has happened! Of course, if they are sloppy in carrying out the procedure their data is likely to be off and they may not see this. This is why it is very important to discuss this idea in debriefing the lab.

OTHER NOTES:

Your students may end up with an odd number of bean pairs in the RR or WW categories. (If they get an odd number of RW pairs, it means they did something wrong! Usually their initial count of beans in the cups wasn't accurate.) Tell students the simulation is imperfect... that we wouldn't end up with "half persons" in the real world. It's just an artifact of how we draw things. (Of course there are a lot of approximations in this simulation, e.g. that everyone gets to mate and all alleles are passed along. But that's part of the "aha" anyway.)