SPRK
schools parents robots kids

Next Generation Robots
Teacher Guide

Overview

Students will begin the activity as two individual "parents" of a Sphero. They will select from two options for three different traits to create their own profiles (or these may be randomly assigned) and then determine which traits their Sphero would inherit, based on which traits are dominant or recessive.

They will then adjust the variables on a Macro template to show which traits their Sphero has inherited, before aligning with another "family." Each pair will run the Macros for their Sphero robots, document the traits represented, and complete the same activity to determine what a third generation would inherit.

This can be repeated for several "generations" of robots and the resulting population of Sphero robots and represent statistics about the different generations of robots in a variety of ways.

Estimated Time: 1-1.5 hours

Student Organization:

Objectives

- Think critically about genetic variation across generations.
- Create tangible models of inherited characteristics that can be observed and documented.
- Create MacroLab programs for two or more generations of robots.
- Compare statistical samples from within a population and analyze the data gathered in different ways.

Materials Needed

- Sample Program
- Student Worksheet

FAQs:

Q: How can robots have phenotypes (expressed alleles)?

While the robots will not actually "inherit" the alleles, they can be used to visually demonstrate the most likely expressed traits as a result of Punnet square calculations with alleles, when a trait has only two alleles and one is dominant (more likely to be expressed), while the other is recessive (not less common, but less likely to be expressed).

Students can also observe the expressed traits of a robot as a Macro is played. They can then complete different Punnet squares to trace the robot's genetic inheritance backwards as they could for likelihood of certain allele combinations after observing their own parents' eye or hair color.
It is important to note that in biological organisms, many physical traits are actually polygenic, meaning that several genes work together to determine what is expressed.

Q: Where can students learn more about Punnet squares and what they represent?

There are many tutorials about how to use a Punnet square online. Below is one example that students or teachers may find helpful.

- How to Draw a Punnet Square from Mahalo.com
- https://www.youtube.com/watch?v=prkHKjfUmMs&noredirect=1

Q: How can students decide which phenotype is expressed?

While Punnet squares can provide information about which phenotypes are most likely to be represented, they are not a guarantee. To simulate the random expression from likely traits in real life, students can select phenotypes from the Punnet squares using a 6-sided die and disregard numbers 5 and 6.

Q: How can different generations of robots be tracked?

Depending on class time and focus, parents and robots can be given names and family trees can be created to note which Sphero robots are siblings, cousins, parents, or other extended family members. This can lead to a valuable discussion of heredity in small verses larger populations.

Q: How can statistics be gathered about the robots?

After each generation of robots has been created, complete a poll of the class, or use a large piece of chart paper to create a tally chart on which groups can independently note their robot's phenotype. This method can be used to create samples of the population by dividing the class into groups when phenotypes are tallied.
The resulting statistics can be compared between generations, between classes, or even between schools who are also completing the activity.

Extension:

- Programs and tasks can be made more complex by introducing additional traits or “mutations” that include more sophisticated programming challenges. (e.g., an inherited ability to jump or flip).

- Have another class in the school or community complete the same activity and compare the evolution of robots between the two isolated communities. Investigate isolated populations of animals in the wild and discuss similarities or differences in the development of different traits.