Teacher's Guide
ACTIVITY 4 – GENETICS AND INHERITANCE

OVERVIEW: Students will learn about probability, by tossing a coin, and about basic Mendelian genetics by conducting simulated "genetic crosses" with mice that differ in eye color. Puppets will be used to illustrate the transfer of genes for eye color from parents to offspring, allowing students to visualize the inheritance of a single trait (eye color) in their simulated mice.

TERMS WE WILL BE USING:

- **Content related**—cell, chance, characteristic, chromosomes, DNA, gamete, gene, genetics, inheritance, meiosis, mitosis, offspring, traits (dominant and recessive)
- **Process related**—observation, hypothesis, comparison, classification, prediction, inference, data, random sampling, probability

OUTLINE OF WORKSHOP:

During the first few minutes we will briefly review some of the concepts from the previous workshop. We will then introduce the topic for this workshop—Genetics and Inheritance. We will use the genetics research conducted by SREL researcher Travis Glenn to draw the students into this important (but potentially difficult) topic. Travis does some state-of-the-art genetics research, which can admittedly be very complex, but some of the organisms he studies (e.g., ALLIGATORS!) are so fascinating to kids that it makes a good hook.

The slide presentation is content heavy, but the terms and concepts introduced are essential to the hands-on activity. The more that the students can be exposed to some of the terms before the workshop the better. If they come to the workshop with an understanding of **organs → tissues → cells → nucleus → chromosomes → genes → DNA** that would be great.

After the slides we will have a couple of demonstrations, first about probability (using coin-flipping) and then about "genetic crosses" (using the students to act out a hypothetical cross to produce a litter of mice). Students will then work in pairs (within their group of four) to do their own probability exercise and a mouse breeding "experiment." The most difficult concept to get across to them seems to be the difference between what they would **predict** would happen when two mice with a given set of traits breed (the "expected results") versus the **actual results** that they get when they sample. We will be stressing this point over and over.

The students will be introduced to a term that is probability foreign to most folks—the Punnet square. The name is not necessarily important, but it is a very useful tool for generating a prediction about what the results of a genetic gross will be.

Punnet Square		
Genes	**B**	**b**
B	?	?
B	?	?

If you have the opportunity to go over this sort of chart with them, or even just the idea that a chart of any sort can be a very useful way to organize data, that would be helpful.

After the experiment the students will discuss their results in the science seminar. If time permits we will survey the class for common human traits that illustrate dominant and recessive characters.

STANDARDS COVERED:

Sci	Life Sci	Cells and systems	Structure and function--cells, cell structure
Sci	Life Sci	Cells and systems	Structure and function--respiratory and circulatory systems
Sci	Life Sci	Ecosystems	Populations and population interactions
Sci	Life Sci	Ecosystems	Functions and roles of organisms/niche concept
Sci	Inquiry	Process skills	observe, classify, measure, communicate, infer, predict, hypothesize
Sci	Inquiry	Inquiry skills	Plan and conduct simple investigations
Math	Alg-S1	Understand patterns, relations, and functions	Describe, extend, and make generalizations about geometric and numeric patterns
Math	Alg-S1	Understand patterns, relations, and functions	Represent and analyze functions, using words, tables, and graphs
Math	Alg-S2	Represent and analyze mathematical structures	Use variables
Math	Alg-S2	Represent and analyze mathematical structures	Use equations
Math	Alg-S3	Use models to represent and understand quantitative relationships	
Math	Alg-S4	Analyze change	Compare varying rates of change

SUGGESTED FOLLOW-UP ACTIVITIES:

Science and Math

- **Follow up sheet**—Do the science follow-up sheet on the Activity 4 genetics workshop.
- **Poster/Chart**— Conduct a survey of your classmates using the "genetic traits list" (available from us). Calculate the total numbers of each genetic trait and construct a pie chart for the results. **Example**: How many students have attached ear lobes? Suppose three out of twenty-two do. What percentage is that? Divide 3 by 22 and multiply by 100 and you get 13.6%. Create a poster for the classroom with all your results.
- **Science Fiction Story**—A science fiction story is an imaginary tale based on scientific information and sometimes includes the possibilities of future events. Research the topic of "cloning" and use science facts to write a science fiction story.

Language Arts

- **Research (Reading and Writing)**—Go to the library and check out a book that will expand on your knowledge on genetics. This could include topics such as using genetic information in crime solving (forensic genetics), Gregor Mendel and the history of the discovery of inherited traits, or other related topics. Read the book, and then write a book report or do an oral presentation for your class.

Technology

- **Internet Research**—Use the Internet to do research on how scientists use genetics to alter crops that are grown, such as corn, soybeans, and others. Use the information you learn to create a chart on the good things (pros) and the bad things (cons) about genetically modified foods.

Physical Education

- **Game**—develop a rainy day game using pretend "genetic traits" that you assign to members of opposing teams. Examples could include a running game with traits such as the "jump-on-2-feet" trait, the "hop-on-1-foot" trait, the "walk backwards" trait, etc. Divide your class into teams, each with a different trait, and see which "trait" is better adapted to different conditions. Who wins the race?

Art

- **DNA Sculpture**—Construct a three dimensional model of the double helix structure of DNA using popsicle sticks and glue, or straws and glue, or cut out paper. Be creative, use lots of color and have fun discovering just how complex and amazing DNA really is. Think about the fact that every cell in your entire body has enough DNA to stretch form from the moon and back 6,000 times!