

# Mouse Genetics

Grades: 4<sup>th</sup>-8<sup>th</sup>

Duration: 55 minutes

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## Program Description

Using eye color in mice, discover how traits are passed from parent to offspring and the mathematical probability associated with the expression of genetic characteristics.

## Louisiana GLEs

### Science

#### Grade 4

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)
12. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
49. Compare similarities and differences between parents and offspring in plants and animals (LS-E-B3)

### Math

39. Identify categories and sort objects based on qualitative (categorical) and quantitative (numerical) characteristics (D-1-E)
40. Read, describe, and organize a two-circle Venn diagram (D-1-E) (D-2-E)
41. Explain the word *average* and use it appropriately in discussing what is "typical" of a data set (D-1-E)

### English Language Arts

#### *Speaking and Listening*

#### *Standard 4*

34. Adjust pacing to suit purpose, audience, and setting when speaking
35. Interpret, follow, and give multi-step directions
37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
38. Adjust speaking content according to the needs of the audience

## Grade 5<sup>th</sup> –8<sup>th</sup> Science as Inquiry

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
13. Identify patterns in data to explain natural events (SI-M-A4)
14. Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
40. Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)

## English Language Arts

### Grade 5

#### *Speaking and Listening*

#### *Standard 4*

32. Adjust diction and enunciation to suit the purpose for speaking
33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

## Science

### Grade 5

16. Observe, identify, and describe the basic components of cells and their functions (e.g., cell wall, cell membrane, cytoplasm, nucleus) (LS-M-A1)

### Grade 7

15. Identify the cell as the basic unit of living things (LS-M-A1)
16. Observe, identify, and describe the basic components of cells and their functions (e.g., cell wall, cell membrane, cytoplasm, nucleus) (LS-M-A1)
20. Describe the levels of structural organization in living things (e.g., cells, tissues, organs, organ systems) (LS-M-A5)

## Math

### Grade 5

5. Read, explain, and write a numerical representation for positive improper fractions, mixed numbers, and decimals from a pictorial representation and vice versa (N-3-M)
8. Use mental math and estimation strategies to predict the results of computations (i.e., whole numbers, addition and subtraction of fractions) and to test the reasonableness of solutions (N-6-M) (N-2-M)
11. Explain concepts of ratios and equivalent ratios using models and pictures in real-life problems (e.g., understand that  $\frac{2}{3}$  means 2 divided by 3) (N-8-M) (N-5-M)
32. Represent probabilities as common fractions and recognize that probabilities fall between 0 and 1, inclusive (D-5-M)

Grade 6

13. Use models and pictures to explain concepts or solve problems involving ratio, proportion, and percent with whole numbers (N-8-M)

Grade 7

10. Determine and apply rates and ratios (N-8-M)

37. Determine probability from experiments and from data displayed in tables and graphs (D-5-M)

38. Compare theoretical and experimental probability in real-life situations (D-5-M)

Grade 8

45. Calculate, illustrate, and apply single- and multiple-event probabilities, including mutually exclusive, independent events and non-mutually exclusive, dependent events (D-5-M)

## Key Terms

**Allele** — Alternative forms of a gene for each variation of a trait of an organism

**Diploid** — Cell with two of each kind of chromosome; is said to contain a diploid, or  $2n$ , number of chromosomes

**Dominant** — Observed trait of an organism that mask the recessive form of a trait

**Egg** — Haploid female sex cell produced by meiosis

**Fertilization** — Fusion of male and female gametes

**Gamete** — Male and female sex cells, sperm and eggs

**Gene** — The fundamental physical and functional unit of heredity which is made up of a sequence of nitrogenous bases that code for a specific protein structure.

**Genetics** — Branch of biology that studies heredity

**Genotype** — Combination of genes in an organism

**Gregor Mendel** — An Augustinian abbot who is often called the "father of genetics" for his study of the inheritance of traits in pea plants. Mendel showed that the inheritance of traits follows particular laws, which were later named after him.

**Haploid** — Cell with one of each kind of chromosome; is said to contain a haploid or  $n$ , number of chromosomes.

**Heredity** — Passing on of characteristics from parents to offspring

**Heterozygous** — When there are two different alleles for a trait

**Homologous chromosome** — Paired chromosomes with genes for the same traits arranged in the same order.

**Homozygous** — When there are two identical alleles for a trait

**Hybrid** — Offspring formed by parents having different forms of a specific trait.

**Law of Independent Assortment** — Mendelian principle stating genes for different traits are inherited independently of each other.

**Law of Segregation** — Mendelian principle explaining because each plant has two different alleles, it can produce two different types of gametes. During fertilization, male and female gametes randomly pair to produce four combinations of alleles

**Meiosis** — Type of cell division where one body cell produces four gametes, each containing half the number of chromosomes in a parent's body.

**Phenotype** — Outward appearance of an organism, regardless of its genes

**Punnett square**—Chart which shows/predicts all possible gene combinations in a cross of parents (whose genes are known). Punnett squares are named for an English geneticist, Reginald Punnett.

**Recessive** — Trait of an organism that can be masked by the dominant form of a trait

**Sexual Reproduction** — Pattern of reproduction that involves the production of subsequent fusion of haploid cells.

**Sperm** — Haploid male sex cells produced by meiosis

**Trait** — Characteristic that is inherited; can be either dominant or recessive

**Zygote** — Diploid cell formed when a sperm fertilizes an egg.

Connections to Permanent Exhibits: These exhibits are found on second floor in Body Works.

**Genetic Traits:** This exhibit describes nine genetic traits. What form of each of these traits do you have?

**Check Your Prints:** Examine your fingerprints under a microscope and compare them to common forms.

**DNA-The Language of Life:** Where is DNA found and what shape does it have?

Resources!

Activity Exchange/Activities-To-Go

Access Excellence

<http://www.accessexcellence.org/AE/ATG/>

Activities-To-Go is a place for all science teachers to share innovative, successful teaching strategies and activities to help students learn the concepts and processes of the life sciences. You may UPLOAD an activity, or do a search by Keyword, Grade Level, Subject and Special Categories, or National Science Education Standards (NSES)

DNA from the Beginning

Cold Spring Harbor Laboratory & Dolan Learning Center

<http://www.dnafb.org/dnafb/>

This website is organized around the key concepts of classical genetics, molecules of genetics and genetic organization and control . The science behind each concept is explained by: animation, image gallery, video interviews, problems, biographies, and links to topics.

Easter Egg Genetics

Access Excellence

<http://www.accessexcellence.org/AE/ATG/data/released/0256-AnneBuchanan/index.html>

This is an example of an activity found on the Access Excellence site. This activity reinforces using Punnett squares to determine genotype and phenotype.

National Human Genome Research Institute

National Institutes of Health

<http://www.genome.gov/Education/>

This website has a multitude of resources including downloadable videos, pamphlets and activities about the human genome project.

Reproduction and Heredity

State of Utah Office of Education

<http://www.usoe.k12.ut.us/curr/science/sciber00/7th/genetics/sciber/intro.htm>

This site has a number of genetic activities including genetic terminology, animations on mitosis and meiosis, and a DNA quiz.

The Biology Project>Human Biology

The University of Arizona

[http://www.biology.arizona.edu/Human\\_Bio/human\\_bio.html](http://www.biology.arizona.edu/Human_Bio/human_bio.html)

On this website there is a genetic counseling activity, information about spectral karyotypes, and an activity where students use a family study to learn the concepts and techniques behind DNA profiling , interpret DNA autoradiograms,

Learn.Genetics-Genetic Sciences Learning Center      The University of Utah  
<http://learn.genetics.utah.edu/units/basics/index.cfm>

This website provides students and teachers a tour of the basic information about genetics on a cellular level. It also has activities for building DNA and understands the processes of transcription and translation. There is an activity where students use a DNA to solve a mystery and Explore RNA's roles as an information molecule and biological catalyst. This unit contains an online introduction and detailed PDF monograph.