

What is Your Pedigree?



Introduction

Lesson Introduction

Pedigree charts are an indispensable tool for genetic counselors, in animal husbandry and hybridization of plants. More than just a family tree, a pedigree chart allows genetic traits (diseases and otherwise) to be traced back through families as well as to predict the occurrence of specific traits in potential future offspring. This activity is designed to allow students to trace specific traits through their own family or a fictitious one.



Grades: 8-10

Time Needed: Three to five 45 minute class periods

Learning Objectives:

After completing this lesson, students will be able to:

1. Construct a pedigree chart
2. Determine genotypes and phenotypes for members of a fictitious (or real) family
3. Describe the mechanisms at work in the passing of traits from parents to offspring
4. Recognize traits that are genetic

Materials:

- Blank Paper
- Ruler
- List of commonly used pedigree chart symbols available at [pedigree chart symbols](#) or [pedigree chart symbols 2](#)
- Alternatively, the pedigree may be constructed using the iPad /iPhone apps **Heredis** or **Family Trees**
- Fictitious family information (on student pages)**
- List of traits

Next Generation Science Standards (NGSS)

As a result of activities in grades 8-10, all students should develop:

Topics

- **MS-LS2:** Growth, Development & Reproduction of Organisms
- **HS-LS2:** Inheritance and Variation of Traits

Performance Expectations

- **MS-LS3-2:** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation
- **HS-LS3-3:** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Dimensions

Practices:

- Developing and Using Models

Disciplinary Core Ideas:

- **LS3.A:** Inheritance of Traits
- **LS3.B:** Variation of Traits

Cross-Cutting Concepts:

- Patterns



Instructional Process

Day 1 - Day 3

1. This activity assumes students are familiar with the basics of Mendelian Inheritance and vocabulary of such. Depending upon the extent and detail that you desire in the finished product, you may also wish to include explanations and discussions of sex-linked inheritance, incomplete dominance, and codominance.
2. As each mode of inheritance is discussed, sample Punnett square problems may be assigned to help students understand the process. Comparisons of genotype and phenotype ratios to observe differences in the mechanisms are useful at this point.

Day 4

1. Explain the purpose of a pedigree chart.
2. Describe the basic symbols used in a pedigree chart.
3. Explain how to work backwards through the chart to determine genotypes for all individuals using a few known phenotypes.
4. Work with students to complete sample pedigree charts.

Day 5

1. Give students the assignment parameters and answer any questions they may have regarding the project.

It is useful to assign this project near an extended break so that students have time to gather family information regarding specific traits. For students who do not wish to create a pedigree chart for their own family, provide the fictitious family information.

This project could easily be modified to trace traits through multiple generations of plants or fruit flies.



Format

1. All lines are drawn with a straight edge 1 _____
2. Circles/Squares are the same size 1 _____
3. Each generation is lined up and marked I, II or III 1 _____
4. The student is indicated 1 _____
5. Overall document is neat and easy to read 1 _____
6. Each page is labeled with the trait 1 _____
7. Pedigree drawn correctly 1 _____
8. Appropriate letters selected for alleles 1 _____

Genetics

1. All genotypes are accurately represented.
 - a. Parents 2 _____
 - b. Grandparents 4 _____
 - c. Siblings 2 _____
 - d. Student 2 _____
2. All phenotypes are accurately represented.
 - a. Parents 2 _____
 - b. Grandparents 4 _____
 - c. Siblings 2 _____
 - d. Student 2 _____
3. All chart symbols are accurately represented.
 - a. Parents 2 _____
 - b. Grandparents 4 _____
 - c. Siblings 2 _____
 - d. Student 2 _____

Sources

National Human Genome Research Institute. (May, 1 2012). Your family health history: A DNA day activity. Retrieved from <http://www.genome.gov/Pages/Education/Modules/YourFamilyHealthHistory.pdf>

Dr. Robert Tissot. (2012, July 26). Human genetics for 1st year students. Retrieved from <http://www.uic.edu/classes/bms/bms655/lesson3.html>

University of Utah. (2008). Inherited human traits: a quick reference. Retrieved from http://learn.genetics.utah.edu/content/inheritance/activities/pdfs/Inherited%20Human%20Traits%20Quick%20Reference_Public.pdf



What's Your Pedigree?

Student Sheet

Introduction

Pedigree charts are an indispensable tool for genetic counselors, in animal husbandry and hybridization of plants. More than just a family tree, a pedigree chart allows genetic traits (diseases and otherwise) to be traced back through families as well as to predict the occurrence of specific traits in potential future offspring.

Your task for this project is to create a family **pedigree chart** that traces the occurrence of three genetic traits over three generations. You may complete the family pedigree using your own family, or by using the hypothetical family (included).

To complete this task, you will need to find out which traits your family members exhibit. Using these **phenotypes** and what you learn in class, you will then determine the genotypes of each family member.

The complete pedigree chart should be labeled neatly according to the format we will use in class. Each individual on the pedigree should be labeled with their genotype and phenotype and the appropriate symbol should be used to represent them. In any case, where more than one genotype is possible, the pedigree should be labeled as such.

Purpose

1. To construct a pedigree chart.
2. To study the patterns of inheritance in a real family.

Materials:

- Blank Paper
- Ruler
- List of commonly used pedigree chart symbols available at [pedigree chart symbols](#) or [pedigree chart symbols 2](#)
- Alternatively, the pedigree may be constructed using the iPad /iPhone apps **Heredis** or **Family Trees**
- Fictitious family information**
- List of genetic traits

Background Information

- Refer to [pedigree chart symbols](#) for a review of how to construct and complete a pedigree chart.
- If applicable, load the following apps on your device: **Heredis, Family Trees**



Timeline:

Day 1 - 4

1. We will spend several days discussing patterns of inheritance and completing practice problems to prepare you for the final project in this unit.
2. Be sure to read the materials assigned, take appropriate notes and complete the practice problems.

Day 5

1. Begin gathering information from your family for the project. Use the list below to get an idea of traits that you might trace through you family or choose 3 traits from the fictitious family.
2. Come to class with your information and materials ready to work by _____ so that you may use class that day to work on your charts.

List of Genetic Traits [images of phenotypes](#)

<i>Dominant</i>	<i>Recessive</i>
Widow's Peak	No Widow's Peak
Free Earlobes	Attached Earlobes
Tongue Roller	Non tongue Roller
Cleft Chin	Smooth Chin
Dimples	No Dimples
Freckles	No Freckles



Fictitious Family: The Mendelians

1st Generation:

Greg

Tongue Roller
Widow's Peak
Attached lobes
Cleft Chin
No dimples
Hair above knuckle
Freckles
Not albino
B + blood type

Sweet Pea

Nonroller
Widow's Peak
Free lobes
Cleft Chin
No dimples
Hairless fingers
Freckles
Not albino
A - blood type

2nd Generation:

Children of Greg & Sweet Pea

Austria	(married Violet)	Monk	(married Genny)	Gene	(Married Al)
Roller	Tongue Roller	Roller	Tongue Roller	Nonroller	Tongue Roller
No Widow's peak	No widow's peak	No Widow's Peak	No Widow's Peak	Widow's Peak	No Widow's Peak
Free lobes	Attached lobes	Free lobes	Attached lobes	Free lobes	Attached lobes
Cleft chin	Bo cleft	Cleft chin	No cleft	No cleft	No cleft
No dimples	Dimples	No dimples	Dimples	No dimples	Dimples
Hairless fingers	Hair above knuckle	Hairless fingers	Hairless fingers	Hairless fingers	Hair above knuckle
Freckles	Freckles	No freckles	No freckles	Freckles	Freckles
Not albino	Not albino	Not albino	not albino	Not albino	Not albino
O + blood	AB+ blood type	AB – blood type	O- blood type	A + blood type	AB+ blood type



3rd Generation

Austria & Violet had no children

Monk & Genny had one child:

Phil

Nonroller
No Widow's Peak
Free lobes
Cleft
Dimples
Hairless
No freckles
Not albino
A – blood type

Gene & Al had two children:

Polly

Roller
Widow's Peak
attached lobes
No cleft
Dimples
Hairless
Freckles
Not albino
A+ blood type

Nate

Nonroller
Widow's Peak
Attached lobes
No cleft
No dimples
Hairless
No freckles
Albino
AB+ blood type

Procedure

1. Use the pedigree chart symbols to map out 3 generations (you, your siblings, your parents, your maternal and paternal grandparents) of your family or the fictitious family.
 - a. Remember that only your *biological* parents, grandparents may pass traits to you.
 - b. In case of large families, you may limit the number of individuals included in your pedigree to 10.
 - c. Make 3 copies of the chart. (1 for each trait and a spare in case you goof up!)
2. Label each pedigree chart with your name (identify yourself on the pedigree) and the trait represented on that chart.
3. Include a key indicating the colors used for each phenotype and letters/symbols used for ***dominant*** and ***recessive alleles***.
4. Label each “person” on the pedigree with the observed ***phenotype*** and shade the symbols according to the pedigree chart symbols references and the key.
5. Using your knowledge of inheritance patterns, determine the ***genotypes*** of each individual on your pedigree chart. In cases where there is more than one possibility, include both.

Complete your pedigree charts and turn them in no later than the due date.