**Math, Genes, and You**

Week 3, Day 2: Intro to Pedigrees

**Plan for today**

Genetics news

Class activity: Finish problem set 2

Lecture: Pedigrees

Group activity: Pedigree Kahoot

Group project introduction

**Definitions**

**Pedigree** – A record of individuals’ descent and genetic relationships. Also called a **family tree**.

**Relationship coefficient *r*** – The proportion of identical alleles inherited between relatives

**Male** – square



**Female** – circle



**Unspecified sex** – diamond



**Parent-child relationship** – *r* = 1/2



**Full Siblings** – A pair of siblings that share both parents. *r* = 1/2



**Nuclear family** – A family consisting of parents, children, and siblings



**Half siblings** – A pair of siblings that share only one parent. *r* = 1/4



**Step siblings** – A pair of siblings who do not share a biological parent. *r* = 0



**Identical twins** – Twins who have an exact copy of each other’s DNA. *r* = 1



**Fraternal twins** – Twins who share as much DNA as full siblings. *r* = 1/2



**First cousins** – Relatives who share a pair of grandparents. *r* = 1/8



**Grandparent-grandchild relationship** – *r* = 1/4



**Avuncular relationship** – Uncle-nephew, uncle-niece, aunt-nephew, aunt-niece. *r* = 1/4



**Examples**

**Example 1:** How many sibling pairs are in the following pedigree? **4**



**Example 2:** What is the relatedness coefficient of the pictured relationship? ***r* = 1/8**



**Example 3:** What is the relatedness coefficient of the pictured relationship? ***r* = 1/4**



**Group projects**

* We will form groups of 3-4 students. Each will be assigned an instructor or TA to help them
* Groups will get 10-20 minutes during each class to work on projects and can also use open math time
* Students will present their work on the last day of class
* Possible projects
  + Construct the pedigree for your family and follow the inheritance of a trait
  + Calculate how much DNA you share with a distant relative
  + Predict the results of a cross between two individuals using Punnett squares and different inheritance models
  + Infer allele frequencies from trait frequencies using an inheritance model
  + Generalize Hardy-Weinberg equilibrium for polyploid organisms
  + Describe a real genetic variant and determine whether it is in Hardy-Weinberg equilibrium
  + Propose your own projects!

**Problem Set 3:**

1. Count the number of nuclear families in this pedigree and state how many individuals are in each.



1. Draw a pedigree and indicate two individuals with *r* = 1/4.
2. Calculate *r* for the indicated individuals.



1. Bonus problem: A family has a pair of identical twins. If each of them has a child, what will be the relationship coefficient of those two children? How would that change if the twins were fraternal and not identical?