

PERSONAL PEDIGREE LESSON [REV.12.07]

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SYNOPSIS: A most engaging activity in which students connect their own family to the principles of Mendelian genetics. Students are asked to survey their family (or a neighbor or friend's family), looking for a trait that shows different phenotypes. They diagram the family using pedigree symbols, add the phenotypes where known, then look for the discriminating pattern that tells us which phenotype is dominant. (Students learn that it's not necessarily the most common one). From there, genotypes are inserted for each person, and even possible phenotypes/genotypes for persons whose phenotypes are unknown can be indicated. An exercise in recognizing patterns.

CONCEPTS:

1. Dominant/Recessive phenotypes are determined from a particular pattern of inheritance (especially useful in humans, as breeding programs are generally frowned upon!), not from the relative frequency in the population.
2. Mendelian genetics applies to human inheritance, too.

ASSESSABLE OBJECTIVES:

1. recognize the pattern in family trees that tells us which phenotypes are dominant and which are recessive.
2. identify the dominant and recessive phenotypes in a pedigree showing that pattern.
3. determine genotypes (and phenotypes) of individuals for whom phenotypes have not been identified (based on known phenotypes and genotypes).

MATERIALS:

Personal Pedigree Lesson (Teacher Guide)
Examples of Student Pedigrees done
Handout: Personal Pedigree Assignment
PTC taste test paper (optional)

CONTEXT: As early in your genetics unit as possible, introduce a number of human hereditary traits (see list on the student handout). This can be a most engaging way to introduce genetics. Then introduce basic Mendelian inheritance patterns, along with the usual terminology of trait, phenotype, genotype, allele, and the usual letter symbols used for genotypes and what they mean. Before continuing with dihybrid crosses, multiple alleles, chromosomal inheritance and karyotypes, introduce the Personal Pedigree Assignment, so they will have enough time, about 2 weeks minimum) to survey their families and prepare their pedigrees by the due date, and before they finish the genetics unit.

Need for caution: You should caution students that what are often treated as simple Mendelian traits are coming to be realized as being more complex than initially thought. Part of this is the growing knowledge of regulatory genes that control penetrance and other aspects of expression. Consequently, tell your students that if they find inheritance patterns that seem impossible or inconsistent with the usual pattern (e.g., having brown eyes with both parents having blue eyes), they should NOT jump to conclusion that they are not related (adopted, etc.); it could well be other genetic factors that are operating.

You could also let parents know earlier in the year (letter home, announcing your rules and course content), that you plan to have your students do a family pedigree to see how some genetic traits are inherited, and if they have a problem with that, they should contact you and/or encourage their student to do another family (friend, neighbor, etc.), perhaps because that family is larger, more likely to show an informative pattern. The letter should be signed by parent and either mailed back to you or returned by the student. This could save some embarrassment later on.

PRESENTATION:

Hand out the **Personal Pedigree Assignment** sheet, and show them some examples of pedigrees done by previous students (on the overhead or PowerPoint). Do this before getting into chromosomal inheritance and karyotypes, etc., so they can be working on their pedigrees while you finish your genetics unit, and their unit test can include questions about pedigree analysis (for sample questions, contact **webmaster** using your school email address).

Students may resist and find excuses, but point to the footnote! I would allow as much time as you can (at least two weeks) so they can mail PTC taste strips to relatives and ask them about other traits. Urge them to get started right away, talking to relatives and using e-mail if possible, so they can get information ASAP. Meanwhile, they can lay out their pedigree (using proper symbols and connectors, as you demonstrate), so when they get the information from relatives, they can just select the most interesting (useful) trait, and plug in the phenotypes, genotypes, etc. I always enjoyed developing my own pedigree on the overhead as I describe my crazy family tree (with all its divorces and remarriages and all my relatives!) Lots of fun.

ASSESSMENT: I usually collect the pedigrees on the assigned due date. This is a firm due date, whether they are in class or not! I tell them that if they anticipate being absent that day, for any reason, they should hand it in earlier, or arrange for a parent or other trusted person to get it to me on or before the due date. If an accident, or other family emergency prevents that, I expect a detailed note from the parent. If it's late, I may knock off 5 points per day (out of the 20 points possible for the finished pedigree). They know this the day the assignment is given.

I may grade each pedigree myself (rubric below), or I may just check them with a plus, check, or minus, depending on the apparent quality and completeness with a quick glance (which I record). I may follow that by returning the pedigrees after a few days, and either have them grade their own pedigree in class (as I go over the rubric with them), or exchange pedigrees (within the class, or between classes). It depends on the kids and the time available.

RUBRIC: Assign values (perhaps 2 points) to each criterion. Note these criteria are designated in the directions.

1. Proper pedigree symbols and connecting lines used (mating lines, descent lines, and sibling lines).
2. Phenotypes shown by shading/non-shading, or different colors.
3. Genotypes shown wherever (and as complete as) possible, given the known phenotypes and relationships shown, and for those with unknown phenotypes, where possible.
4. Specific pattern circled that shows the dominant and recessive phenotypes, OR a statement saying that pattern is not in this pedigree.
5. Letters for each allele defined, with upper case letter for the dominant allele, small case for the recessive allele.
6. Symbols for each phenotype defined.
7. Proper title (as directed in directions).
8. Student's symbol clearly identified.