Activity Guide
Title: Pedigree analysis through genetic hypothesis testing
Chapter 17, Inheritance of Sex Chromosomes, Linked Genes, and Organelles

Introduction
This activity guides students through a series of simple pedigree problems in order to practice the skills required to solve a complex pedigree problem, an example of which is given at the end of the exercise. Students are first exposed to a complex pedigree with a real-world look and feel. They then are provided with a method of genetic hypothesis testing that they practice by solving a series very simple pedigree problems. Finally, they apply their skills to the original complex pedigree.

The instructor guides students through the activity in class, lab, or a discussion setting by working through each step with clicker questions. Experience teaching with this activity suggests that guidance from the instructor while students are working improves student learning considerably.

Learning Objectives
After this activity, students should be able to:
determine whether traits shown in human pedigrees are dominant or recessive, and autosomal or *X*-linked.

- make hypotheses for possible patterns of inheritance, and then test those hypotheses to determine whether the predictions they make are consistent with the inheritance pattern seen in pedigrees presented.

- calculate simple probabilities of inheritance.

Context and Connections
Chapter 16, Mendelian Inheritance
	16.3 Segregation: Mendel's key discovery
		Fig. 16.8 A testcross
	16.5 Patterns of inheritance observed in family histories
Chapter 17, Inheritance of Sex Chromosomes, Linked Genes, and Organelles
	17.1 The *X* and *Y* sex chromosomes
	17.2 Inheritance of genes in the *X* chromosome
The activity relates to basic Mendelian inheritance presented in Section 16.3, Mendel's principle of segregation, the use of the Punnett square described in Section 16.3 and Figure 16.8, human pedigrees presented in Section 16.5, and principles of *X*-linkage in Section 17.2.

List of Materials:
1. Activity Guide (file name: 1_ActivityGuide_Ch17PedigreeAnalysis)
2. In-class Presentation (file name: 2_In-classPresentation_Ch17Pedigree Analysis)
3. Handout (file name: 3_Handout_Ch17PedigreeAnalysis)

Class Size and Timing
This activity has been used for many years in a large introductory biology course for majors and has been successfully used as an in-class set of clicker problems. This set of problems has also been used successfully in a laboratory setting guided by graduate teaching assistants. The exercise could be done in a single 2-3 hour lab period, or in two one-hour lecture periods.

Activity Description
This is an activity that is set in the context of a relatively complex pedigree problem. It presents a method for solving the problem based in Mendelian genetics and uses an approach of hypothesis testing of possible patterns of inheritance.

Through the use of a handout (3 pages, item #3 in the list of materials), students are first shown a complex pedigree of a large family affected by two traits caused by mutations in two unlinked genes. Their ultimate task is to determine the pattern of inheritance of the two traits, and then to determine whether the next child born to a couple in the family will be affected by both traits.

To guide students, and help them develop the basic skills required for the complex problem, the activity poses a series of simple pedigree problems. This series of problems will show students the basic approach to pedigree problem-solving through hypothesis testing and give them practice calculating probabilities of inheritance.

After practice with simpler problems, students return to the complex pedigree and are guided through a set of questions designed to help them solve the final problem.

Instructors can guide students through the activity using the In-class Presentation (item #2 in the list of materials). This file includes slides for use with students as well as hidden slides with thoroughly stepped-through solutions for use by the instructor to prepare or use in class.

Connection to Vision and Change:
This activity is aimed specifically at the Core Competency, Ability to Apply the Process of Science, in which a hypothesis is proposed, then predictions from that hypothesis are developed and compared to observations. Hypotheses are then rejected or not based on the comparison.