he ideas of genotype and phenotype and their intricate relationship are often initially presented simply as terms to be memorized. Many times the volume of material to be taught leaves little time to revisit their true meaning, and how an organism’s genetic makeup (genotype) generates its phenotype. The idea that a gene encodes a protein establishes the fundamental relationship, but it is often presented as an idea that the student memorizes. The student may also memorize that a mutant gene can generate a mutant phenotype. Further, the student may memorize that changing the sequence of the gene changes the amino acid sequence of the protein. The extra step of melding these memorized passages into a coherent model that incorporates the connection of protein activity and phenotype is rarely achieved without additional assistance. It is truly important that students grasp these abstract concepts, because they are core ideas that are important in a number of biological disciplines, including genetics, biochemistry, molecular and cellular biology, and physiology. It is because these concepts are so abstract that an active learning approach that is visual, concrete, and includes role-playing and modeling is most likely to be effective (Anderson, 1996; Rutledge, 2001).

Several hands-on and wet laboratory activities have been proposed to model similar genetic concepts (Lanza & Cress, 2001; Heim, 1991; Guilfoile & Plum, 2000; Pigage, 1991; Bio-Rad Laboratories pGLO Bacterial Transformation Kit). The exercise presented here is a novel, time effective, student-centered, role-playing activity in which students learn about the intricate connection between genotype and phenotype by exploring the fundamental effect of mutation on protein function beginning with a very real and human phenotype, albinism. This exercise is based on a long established role-playing model of enzyme kinetics (author unknown) by allowing students to act out the role of enzyme (Oreo-ase). However, in this model exercise, instead of learning only about the enzyme, students learn about the genes and mutations, bringing this model to its full genetic extension.

Classroom Logistics

This exercise can be done within a 50-minute class period with students in groups of four or five around small tables or with chairs arranged in circles. It is recommended for students in grades nine and above and has been performed in situations where class size ranges from seven to 24.

The Activity

Students learn about the gene and enzyme (see Figure 1 and the Albinism Background Section) responsible for