

Unit Summary

The hands-on activities in Frey's Inquiry Investigations™ *Biotechnology Applications* Module link to core science concepts, making them an excellent complement to existing curricula. Students investigate DNA structure, bioremediation, DNA paternity testing, DNA fingerprinting, transgenic plants, biotechnology and the impact on the production of cheese, the Human Genome Project, and how gene defects are detected.

The Inquiry Investigations™ *Biotechnology Applications* Module consists of four investigative units featuring fifteen hands-on laboratory activities. Each unit begins with a thorough introduction of the science skills and concepts presented in the lab activities that follow. The lab investigations can be performed in sequence (see pacing chart) or separately based upon the time available.

Suggested *Going Further* investigations allow students to design and carry out their own investigations, expanding their knowledge and understanding of biotechnology applications.

Unit 1: Biotechnology in Agriculture and the Environment

Lab 1: Genetically Modified Crops

In **Activity 1**, students grow two types of soybean seeds (traditional and genetically modified). They study the effects of a herbicide on the seeds.

Suggested *Going Further* investigations direct students to investigate how herbicides are used to increase crop yields.

Lab 2: Biotechnology and Food

In **Activity 1**, students use genetically engineered chymosin to produce curds and whey. They observe the curdling effect of chymosin and collect data during the cheese-making process.

Suggested *Going Further* investigations encourage students to study the effect temperature has on curdling.

Lab 3: Bioremediation

In **Activity 1**, students observe the effect of oil-hungry bacteria on a simulated oil slick.

In **Activity 2**, students model various shore environments and observe how they impact oil spill clean up. Students also investigate porosity.

In **Activity 3**, students use a microscope to examine and compare two oil samples—a degraded oil sample and an untreated oil sample.

Suggested *Going Further* investigations encourage students to research the techniques that are used to clean up oil spills.

Unit 2: Biotechnology in Medicine

Lab 4: Genetic Detectives

In **Activity 1**, students learn about Down Syndrome and determine if the case information provided is convincing enough to diagnose baby Mike with the disorder.

In **Activity 2**, students attempt to confirm or disprove a pediatrician's suspicions that baby Mike has Down Syndrome by analyzing the chromosomes (karyotyping).

In **Activity 3**, students learn about cyanosis.

In **Activity 4**, students construct a pedigree to help uncover the secret of baby Mike's ancestors.

In **Activity 5**, students collect data from members of their family to determine if they can taste PTC. They use this information to create their own family pedigree and determine the mode of inheritance for PTC tasting ability.

Suggested *Going Further* investigations encourage students to learn about other inheritable traits such as ability to roll your tongue or having a widow's peak. Students are asked to collect and analyze data from their own families.

Lab 5: Gene Quest

In **Activity 1**, students learn about the causes of sickle cell anemia and how it is inherited. They simulate a DNA testing procedure to determine the genotypes of various family members for the sickle cell anemia disease.

Suggested *Going Further* investigations encourage students to investigate further how DNA fingerprints are used to diagnose inherited disorders, develop cures for inherited disorders, and identify missing/unidentified people.

Unit 3: Biotechnology in Forensic Science

Lab 6: Modeling DNA Profiles

In **Activity 1**, students simulate the procedure for making a DNA fingerprint.

Suggested *Going Further* investigations allow students to learn about short tandem repeats (STRs) and Combined DNA Index System (CODIS) technology.

Lab 7: Forensics and DNA

In **Activity 1**, students electrophorese DNA samples and analyze their results to attempt to solve a crime.

Suggested *Going Further* investigations encourage students to design and test their own battery powered electrophoresis system.

Unit 4: Comprehensive Inquiry Investigation

Lab 8: Culminating Lab

In **Activity 1**, students separate DNA molecules using electrophoresis and analyze their results to try to establish family relationships.

In **Activity 2**, students analyze an autoradiogram to determine several individual's susceptibility to the SARS virus.

Suggested *Going Further* investigations encourage students to research various genetic diseases and disorders along with learning more about the anatomy of chromosomes.