Environmental Science

TOPIC CATALOG

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About Environmental Science

Environmental science is an integrated scientific field consisting of biology, ecology, environmental toxicology, and much more. Today, scientists from a range of backgrounds work to determine the safety of different chemicals, water quality testing methods, and genetically modified foods, to name a few. Bring all of these techniques directly into your classroom with environmental science kits from Edvotek®!

Our present day understanding of genetics was largely unraveled by Gregor Mendel's study of pea plants over one hundred years ago. In recent years, molecular biology techniques have widened our understanding of how plants evolve, develop, and can be used as crops and even as pharmaceutical factories. The first plant genome to be sequenced in 2000 was the humblest member of the Brassicaceae family, *Arabidopsis thaliana*. As with its animal counterpart, the fruit fly *Drosophila melanogaster*, Arabidopsis has been used to decipher the molecular genetics of the plant kingdom.

Similar to *Drosophila*, many thousands of *Arabidopsis* mutants are available for scientists to study and are used to understand how plant genes function. These studies have not only contributed to the controversial developments of GM plants for food, but also to plants for producing medicines, and plants to supplement people's diets in the developing world.

Additionally, model organisms like these allow us to study environmental toxicology. Environmental toxicology is the study of the effects of harmful chemicals on human health and the environment. Scientists work together to determine where a toxicant will end up in an ecosystem and how long it will remain. Scientists can do this by using a series of bioassays - tests that measure the potency of a substance by observing its effects on molecules, cells, tissues, or organisms. Toxicologists also predict safe exposure limits that will keep the environment and us healthy.

Engage your students with some of the key techniques of molecular biology that are changing our view of environmental science. From growing mutants to tissue culture to PCR, we have something for you to try out in your classroom.

Water Quality Testing

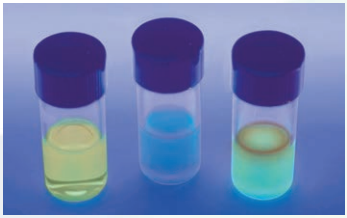
How Clean is the Water We Drink and the Air We Breathe?

Your class will make the invisible, visible! With this kit, your students will sample water and air and then grow any microbes present overnight. A safe and simple way to teach about everyday pollution.

Cat# S-30 *For 10 groups*

Chromogenic Analysis of Water Contaminants

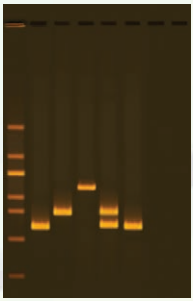
Testing drinking water for every possible type of pathogenic bacteria is slow and costly. Thus, drinking water is tested for coliforms - including the familiar *E. coli*. Presence of coliforms is an indicator of fecal contamination. In this experiment, students will test for coliforms in simulated contaminated water using color and fluorescent reagents. These same reagents can be used to test water samples from your local environment. As an extension activity, a Gram Stain test can be performed on the collected samples.



Cat# 951 *For 10 groups*

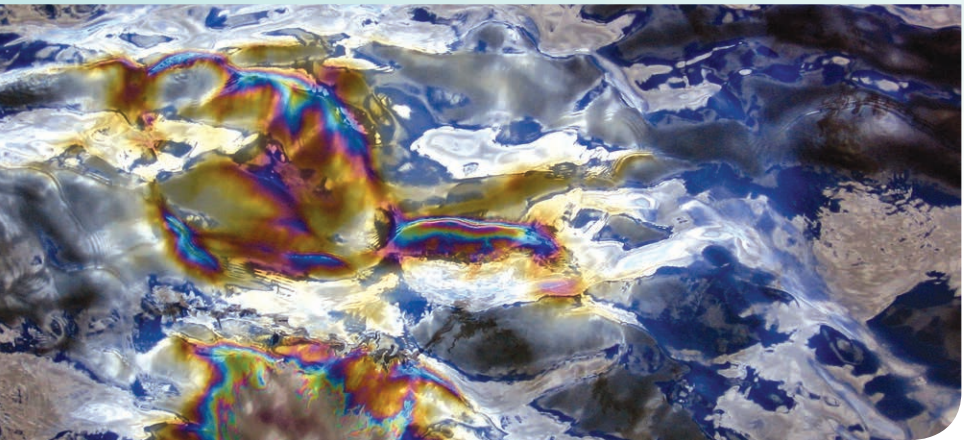
Multiplex PCR Testing of Water contaminants

Drinking water is routinely tested for contamination. If a screening tests positive, more sophisticated tests are required. One such test uses PCR in multiplex format. In this experiment, students will extract DNA from contaminated water to test for the presence of three separate, classroom-safe organisms using a single PCR reaction.



Cat# 953 *For 25 students*

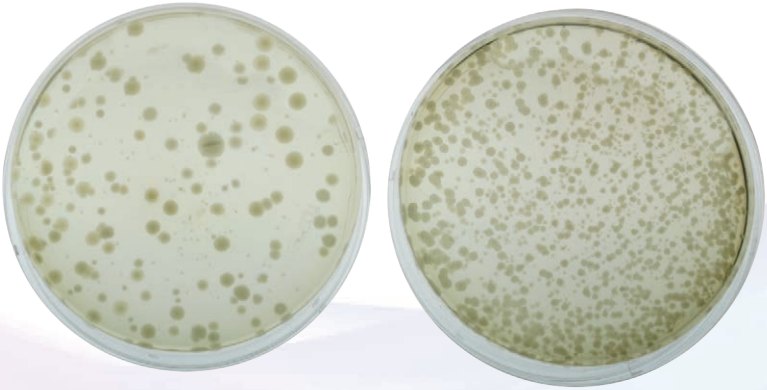
Bioremediation



Bioremediation by Oil Eating Bacteria

Oil spills cause devastation to the environment, killing sea life, birds, and coastal plants. Spraying areas of contamination with oil-eating microbes accelerates the degradation of the oil. This process is known as bioremediation. In this open-ended experiment, students will grow a mixture of oil-eating bacteria and observe their effectiveness at degrading a variety of oils.

Cat# 956 ***For 10 groups***



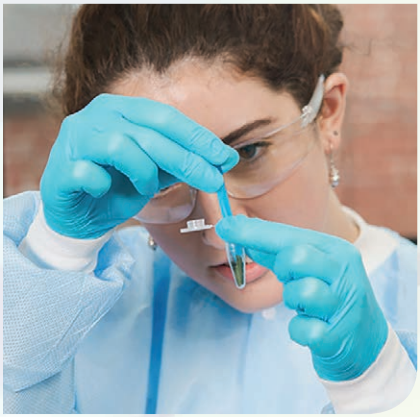
Genetically Modified Organisms

Detection of Genetically Modified Organisms

For centuries, humans have used selective breeding and conventional hybridization to produce desirable qualities and to increase crop yields. Today, scientists use genetic engineering to directly manipulate the DNA, quickly producing desirable traits. In this experiment, students will use agarose gel electrophoresis to explore the molecular methods used by scientists to identify genetically modified organisms. No thermal cycler is required. Students are also encouraged to explore the controversy surrounding the use of genetically modified organisms.

Cat# 121 *For 8 gels*

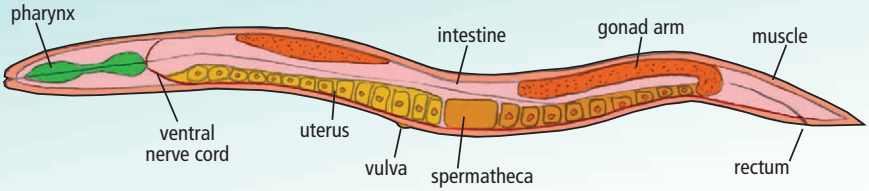
Identification of Genetically Modified Foods Using PCR



Some foods contain raw materials from genetically modified organisms (GMO). Examples include tofu, corn flakes and corn meal. In this experiment, your students will extract DNA from food or plant material and perform PCR to determine if any GM indicator genes are present. Amplified DNA is separated and sized by agarose gel electrophoresis.

Cat# 962 *For 10 groups*

C. elegans

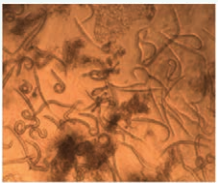


Chemotaxis: The Science of Attraction in *C. elegans*

All organisms are affected by "scent" molecules in the environment, including a multicellular organism called *Caenorhabditis elegans*. These worms are composed of 959 somatic cells, of which 300 are neurons comprising organs for taste, smell, temperature and touch. In this experiment, your students will observe and record the phenomenon by which normal and mutant strains of *C. elegans* can direct their movement in response to certain chemicals in the environment.

Cat# 852 ***For 10 groups***

Environmental Toxicity Response in *C. elegans*



Caenorhabditis elegans is a soil nematode with great potential for educational research, partly because of its rapid (3-day) life cycle, small size (1.0-mm-long adult), and ease of laboratory growth cultivation. In this experiment, students will observe and compare the effects of heavy metals found in the environment on normal and mutant strains of *C. elegans*.

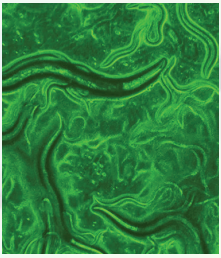
Cat# 856 ***For 10 groups***

Effects of Alcohol on *C. elegans*

You will not believe how similar we are to worms! The genome of *Caenorhabditis elegans* was sequenced and is a 40% match with humans. It is now used as a model system by researchers to address fundamental questions in developmental biology, neurobiology and behavioral biology. The objective of this experiment is to observe and record the effects of alcohol on normal and alcohol mutant strains of *C. elegans*.

Cat# 851 ***For 10 groups***

Lighting Up Life: Expression of GFP in *C. elegans*



Scientists can directly manipulate an organism's genome to produce a phenotype using engineered genes called transgenes. In this experiment, students will use fluorescence microscopy and PCR to analyze *C. elegans* (nematodes) that have been engineered to express the Green Fluorescent Protein (GFP).

Cat# 858 ***For 10 lab groups***

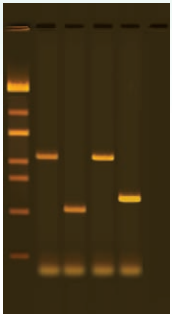
Plants and Cell Culture

Introduction to Cell Culture

Stem cells are cells that are able to differentiate into different types of cells. Even plants have stem cells! In this experiment, your students will establish cell cultures of African Violets from leaves and de-differentiate them to produce stem cells. They will then use plant growth regulators to encourage root growth from the cultured cells, and produce a mature plant.

Cat# 908 *For 10 groups*

Exploring Plant Diversity with DNA Barcoding



In this inquiry-based lab, your class will explore the genetic diversity of ten selected plants. Students will isolate plant DNA and use PCR to amplify two polymorphic regions of the chloroplast genome. Digestion of PCR products and analysis by agarose gel electrophoresis will then be used to generate unique identification profiles for each plant.

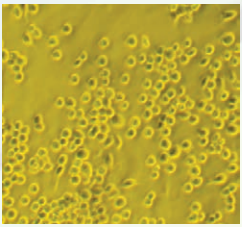
Cat# 338 *For 10 groups*

The Dose Makes the Poison: Testing the Environmental Impacts of Pollution

Biological assays, or bioassays, are powerful tools that allow scientists to determine the effects of a given substance on living organisms. In this inquiry-based lab students plan and perform a plant bioassay to determine the environmental hazard of common point and non-point source pollutants. The results are analyzed using averages, standard deviations, and TC50 calculations, integrating STEM.

Cat# 905 *For 10 groups*

Cell Culture Toxicity Screening



Toxicity screening is a powerful technique that allows scientists to determine the effect of potentially harmful substances on living cells. In this inquiry-based lab, students will plan and implement a toxicity screening experiment using insect cell culture. The results will be analyzed to determine cell viability and to estimate the LD50 of the toxic solution.

Cat# 1002 *For 6 groups*

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