Science in Motion - Ursinus College

https://www.ursinus.edu/offices/science-in-motion/

Biology Activities – High School

Artificial Selection

Students grow *Arabidopsis* plants and induce artificial selection. (This lab takes multiple weeks.)

Blood typing

Students use simulated blood to learn about blood typing and Rh factors

CCR5-HIV lab

Students will analyze a gel using LoggerPro software to determine that people that are homozygous for a CCR5 gene mutation lack the binding cite for HIV which makes them resistant to HIV infection. Recently, Chinese scientist, He Jiankui, used CRISPR to attempt to edit the CCR5 gene in twin girls.

Cell cycle

Students use our digital microscopes to view and identify the stages of the cell cycle in onion and whitefish cells

Cellular Respiration

Students measure the cellular respiration of crickets, peas, and parsley using Vernier CO_2 probes

Climate Change

CO_2 levels: Students measure the air temperature inside a flask exposed to light, then introduce high levels of CO_2 and re-measure the air temperature while the flask is again exposed to light. (45 minutes, can be combined with one other study in this time period)

Albedo: Students compare the air temperature change inside a flask with black gravel and another flask with white/tan gravel while exposed to light. (30 minutes)

Water vapor: Students compare the air temperature change inside a flask exposed to light, then introduce high levels of water vapor and re-measure the air temperature while exposed to light. (30 minutes)

Cloud cover: Students compare the air temperature change inside a flask exposed to light with and without "cloud" cover (white covering on one of the flasks). (30 minutes)

Solar output: Students compare the air temperature change inside a flask exposed to two different light outputs. (30 minutes)

DNA Fingerprinting

Students use provided images of DNA fingerprinting gels to determine paternity and to match a crime scene sample to a suspect. This is a good follow-up activity after completing the gel-electrophoresis lab.

DNA model kits

We have K'nex DNA model kits available to borrow.

DNA sequencing

Students read autoradiographs to determine the nucleotide sequence of sample DNA. Then students conduct a BLAST search to identify the gene associated with the nucleotide sequence.

Enzyme (catalase) lab

Students measure the rate of the catalase enzymatic activity using a gas pressure sensor under various conditions (concentrations, pH, temperature)

Evidence of Evolution

Students learn about evolution by studying fossils, comparing the anatomy of different organisms, comparing the stages of embryonic development in mammalian species and chick embryos, comparing blood sera of different species, and comparing DNA sequences of primates.

Faces / Forensic art

Students act as "eyewitnesses" and use a forensic art program to draw faces of suspects

Fingerprinting

Students learn to take, read, and match fingerprints.

Gel electrophoresis: An introduction using food coloring

Students pour their own gels, load the gels with food coloring solutions, run the gels, and analyze the results

Investigating Your Sense of Balance

This activity demonstrates that visual cues are important to the sense of balance. Students stand on a Vernier force plate and try to balance on one foot first with their eyes open, then with their eyes closed. The force plate measures how much they shift back and forth to keep their balance. Students then design a hypothesis to test, such as comparing dancers to non-dancers, etc.

Live pond specimens

Students study live pond specimens using digital microscopes (subject to season and organism availability)

Physiology Labs

Students can use EKG, respiration, heart rate, and blood pressure monitors in a variety of experiments

Population Genetics

Students study population genetics by collecting class data on who can taste the bitter flavor of P.T.C paper

Protein Identification through immunoassay

Students use an immunoassay to show how forensic scientists can determine if blood on a bumper is from a human or another animal.

Review / Test prep activities

We can design fun, unique review sessions for nearly any topic using our programmable Spheros. (No prior programming experience needed.) Ask us for suggestions for your next review session!

Rewiring the Brain

Students discover the plasticity of the brain in this activity. They use special goggles while attempting to pitch bean bags at a target to investigate how the brain adapts to changing sensory cues.

Sherlock Bones

Students study properties of bones to determine sex, race, height, and age.

Soil Analysis

Comparison of potting soil to ground soil: students use probes to measure temperature, moisture, pH, conductivity/salinity, calcium, chloride, ammonium, and nitrate in potting soil and ground soil. An add-on is to compare plants grown in potting soil to those grown in ground soil. (45 minutes)

Soil temperature: Students measure the temperature changes in soil from differing depths, daytime, and nighttime. (45-60 minutes)

Spheros

Spheros are paired with a Kindle Fire (provided) through the SpheroEdu app. Beginners can draw a path for the Sphero robot to follow, intermediate users can drag and drop blocks of code, and advanced users can write text programs using JavaScript. Provide your own activities, or use one of the SpheroEdu prepared modules aligned to NGSS, CCSS, and various state standards.

Sphero of Influence – Vaccines

Students use Spheros (programmable robots) that are programmed to spread a fake disease throughout the Sphero population. Students are given a budget, and make decisions about improving the vaccine efficacy and/or the number of Spheros who receive a vaccine to the fake disease. We then run the program to see which student plans work better than others in preventing the spread of this fake disease. (This activity does not need any prior programming experience.)

Stream ecology:

Stream study (physical parameters): Students study and measure the flow rate, temperature, dissolved oxygen, pH, and turbidity of a stream. This lab requires a field trip to a local stream.

Stream study (biology): Students use digital microscopes to observe live pond organisms. (90 minutes; 1-2 class periods; subject to season and organism availability)

Survival of a Sea Turtle – a Sphero activity

This activity models a sea turtle ecosystem and the challenges sea turtles face in surviving to reproductive age (predators, environmental factors, pollution). Students drive Spheros (programmable robots) and act as the various parts of this ecosystem. (This activity does not need any prior programming experience.)

Trace Evidence Lab

Students use microscopes to examine a variety of animal hairs and fibers. This kit also includes materials to make your own wet mount slides of trace evidence such as pollen or human hair. A vial of diatoms and a diatom identification book are also provided.

Whale Lab / Mislabeling Food

Students are given DNA sequences of common seafood, then use BLAST to identify which fish it is and whether or not it has been mislabeled.

Other equipment:

- Blood spatter kit
- Fingerprinting kit
- Flex cams
- Hair and fiber materials
- Heart model
- Human bone sets (genders, age, ethnicity)
- Kidney model
- Microscopes:
  - Digital microscopes
  - Stereomicroscopes
- Model kits:
  - DNA (K'nex)
  - Chemistry of fats
  - Chemistry of proteins
- pH meters
- Spectrometers (Spec 20s, UV/Vis, FTIR, etc)
- Vernier LabQuests
- Vernier LabPros
- Vernier probes:
  - CO_2
  - O_2
  - Chloride ion
  - Calcium ion
  - Gas Chromatography
  - Nitrate ion
  - Ammonium ion
  - Turbidity
  - Dissolved oxygen
  - Light sensors
  - Soil moisture
  - UVA & UVB sensors
  - Conductivity
  - Temperature

We are always working on new activities to bring to your classroom. If you have any curriculum for which you do not see an activity, please let us know! We may be able to design one for you.