The end of the year is always an exciting time in a biology classroom. Hopefully, at this point in time, the students have successfully followed the safety procedures throughout the year and can be trusted enough to perform the much-anticipated dissection event. Fetal pig, frog and cat dissections require a lot of patience and a tremendous amount of trust. Ensuring student safety at this time is largely dependent upon their adherence to established safety protocols.

Biology labs are platforms for further inquiry—a place where students can investigate, analyze and present their findings. Laboratory activities can range anywhere from dissections, to animals, to field study. It is of utmost importance that all students are aware of inherent risks associated with participating in labs. All students must understand and demonstrate appropriate lab behavior to ensure that accidents (should they occur) will be very rare.

Proper "equipment" usage of animals, dissections, electrophoresis, field activities, Bunsen burners, hot plates, microwaves and plants will all be discussed in detail prior to the lab. Following this discussion we will review proper storage, disposal and responses to common accidents in the rare case that an accident does occur. This is certainly not a comprehensive list of the safety protocols for everything involved in a biology laboratory, but I will be highlighting the most impactful safety protocols of which all teachers and students should be well aware. If there are any further questions or concerns, the comprehensive list of safety standards from the Connecticut Department of Education is available. All of the protocols discussed here are directly from the Connecticut science safety standards.

Animals in a classroom are engaging components of any biology laboratory. Adequately sized cages must be provided for animals. As part of personal protective equipment (PPE), gloves must be used when handling vertebrates. Before starting any lab, check with the school nurse for any student allergies—have a differentiated instruction lesson plan readily available for the student so he or she understand the objective of the lesson. Animals should only be secured from reputable suppliers. As a general precaution, enforce strict hand washing hygiene in your classroom before and after laboratory work (especially when handling animals).

Mouth pipetting techniques, although used in experienced laboratories, is very dangerous in a biology classroom. Have materials available for mechanical pipetting only. In order to decontaminate all glassware, soak materials in a 10 percent bleach solution for several hours.

Dissections can be a very educational experience if executed correctly. Students will be naturally curious—some may wish to rip apart the organism without any scientific intent. As a teacher, be sure to enforce the rules of respect in your classroom. Contact the school nurse prior to the experiment for student allergies, and prepare students for expectations during the dissection. Review emergency eye-wash procedures for chemical exposure prior to beginning the lab. To reduce risk, always have the specimen completely rinsed prior to dissection to avoid student contact with preservative chemicals. Continually reinforce throughout the experiment that students must cut *away* from the body—*never* toward the body.

An electrophoresis apparatus has a thin layer of moisture that acts as an electrical conductor. Advise students to approach the apparatus with extreme caution. If you are working with an electrophoresis device that has a cooling component, do not contact any cooling apparatus with a gel as the tubing. It can also act as a current conductor. Teacher supervision during equipment usage should be implemented at all times. After finishing all work, wait a minimum of 15 seconds for the capacitor to discharge after shutting the power down.

Field activities are a great way to get students to work with "hands-on" science. However, West Nile virus, Lyme disease and other insect-borne diseases are real threats. Instruct students before fieldwork to dress appropriately (long sleeved shirts, pants, closed-toed shoes)

and repellents. Parents should be informed about class activity. Students should be aware of, and subsequently sign, a behavior contract with consequences for not abiding by rules. When working in a field with river, pond or lake water, students should wear chemical splash goggles if water testing chemicals and other activities prove to be hazardous to the eyes. Be sure to remember the sun—students should wear light clothing that covers exposed skin to minimize sun exposure. Sunscreen should be provided on the trip.

Bunsen burners and hot plates have very specific guidelines supported by the Connecticut Department of Education. Safety protocols for Bunsen burners are as follows: make sure hair is tied back, always wear chemical splash goggles, light the burner at arm's length using an igniter or splint, do not operate the burner with acrylic nails, never leave the burner unattended, do not touch the burner until it has had time to cool off and never operate the burner while igniting it. Students may be curious about fire, but be sure to continually reinforce the fire safety rules in addition to the negative consequences associated with not abiding by the protocols. In case of a fire, activate the nearest fire alarm pull station, notify all lab personnel and evacuate the building (WPI, 2014).

As with all glassware, be sure to inspect the wiring on hot plates before use. Insulation should be in place with all the prongs on the plug. Wait until the hot plate has completely cooled before touching it. Never tie the cord around a heated hot plate, and similar to the Bunsen burner protocols, *never* leave a hot plate unattended. Leaving experiments unattended increases the risk for accidents and creates an unsafe environment that is potentially a fire hazard.

Microwaves are common household appliances. When used in a laboratory setting, remind students to never place metal objects such as aluminum foil in the oven. Never put a face near the oven door while in operation.

When introducing plants into a biology laboratory, check ahead of time for any potential allergies. Do not burn parts of plants that have allergen-type oils such as poison ivy and poison oak. Inform the students about the difference between edible and non-edible plants. Provide specific procedures on the lab day that covers safety protocols for the plants in use.

Proper storage or containers placed in a refrigerator or freezer should be completely sealed or capped and securely placed and labeled. All liquid chemicals should be stored in plastic trays while all specimens should be stored in labeled plastic bags. Never use graduated cylinders or volumetric flasks to store materials. Chemicals should only be stored in amounts needed over a reasonable period of time. It is important to remember that each chemical has shelf-life and decomposition products that could be harmful. Power outages and technology failure can have an impact on stored contents. A teacher should investigate any unusual odors or vapors promptly. Place appropriate "Danger—High Voltage" warning signs on all power supply and buffer tanks.

All classrooms should be equipped with proper waste disposal containers. All dissected parts must be labeled and disposed of in this way. For contaminated equipment such as pipettes, petri dishes and more, be sure to have a disinfectant tray available. It is necessary to autoclave or microwave all bacteria cultures and petri dishes prior to disposal. If animal waste is present, dispose of feces and cage materials in a hygienic manner.

Due to the nature of science, accidents do occur. As a teacher, it is your responsibility to properly handle reactions to common accidents. If potentially infectious material is spilled, clean the area immediately with a disinfectant agent (70 percent isopropyl alcohol) and wipe down the region with soap and water. If there is an accidental spill of microbial organisms, be sure to immediately contain it with dry paper towels. Sterilize the paper towels and disinfect the area of the spill. If the autoclave begins to leak for an unknown reason, shut it down immediately. The

teacher should be conscious of any student health concerns and allergies prior to a student's involvement involving any animal, plant or fieldwork activity. In the case of an animal bite, be sure to immediately report the bite and have a medical examination scheduled. Should an animal die unexpectedly, a veterinarian should be contacted to evaluate the animal.

Biology laboratories can be very exciting at times, but it is important that student health and safety are never put at risk. Constantly reinforcing and reviewing laboratory safety procedures will serve to mitigate the risk of accidents. For many students, these experiences in their high school biology labs create memories that last a lifetime, for no other means of inquiry is quite as immediate and integral to their studies as is the first-hand understanding they glean of the living world through this very personal form of instruction. The lab provides students with a keener understanding of the living world by providing opportunities where they are actively engaged in student-centered, hands-on, minds-on activities, resulting in an enhanced respect for life as well as the environment—and *that's* a lesson that can last a lifetime.

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