Malaria, Lyme disease, Epstein-Barr syndrome, meningitis, syphilis, hepatitis B and HIV/AIDS—what do all of these diseases have in common? These belong to a group of over 100 microorganisms categorized as bloodborne pathogens. Until the advent of AIDS, the general public tended to be unconcerned about these pathogens. With the HIV epidemic and public awareness of Hepatitis B, coupled with confidentiality legislation, bloodborne pathogens came front and center on the public’s radar. Bloodborne pathogens also got the attention of middle and high school science teachers, due to hands-on activities such as cheek cell staining/observation and blood typing, along with general exposure to dried blood or fresh blood and more.

What are bloodborne pathogens?
A bloodborne pathogen is a microorganism such as a bacteria or virus that is carried, replicated, and/or transmitted in blood or blood products and is capable of causing disease in people. The Occupational Safety and Health Administration (OSHA) rang the alarm relative to the seriousness of these microbes by issuing the Required Occupational Exposure to Bloodborne Pathogens standard (29 CFR 1910.1030) in 1992, which was updated and revised in 2001. The standard mandates that employers institute a comprehensive program to prevent or reduce worker exposure to blood and other infectious materials. This standard applies to all employees, including science teachers, who may come in contact with blood and other potentially infectious materials as part of their job. In the case of the science teacher, the standard requires that the employer (the board of education) develop a written Bloodborne Pathogens Plan, train personnel annually, develop prudent work practices, provide personal protective equipment, foster safe workplace behaviors, and use engineering controls.

How does exposure occur?
Exposure or transfer of bloodborne pathogens can occur in four different ways: direct, indirect, airborne, and vector-borne:

- **Direct**—Touching body fluids from an infected person. This includes contact with lesions, open wounds, or sores on the skin. Skin lining of the mouth, nose, or throat, and eye contact/invasion, are additional avenues.
- **Indirect**—Touching objects that have touched the blood or another body fluid of an infected person. This includes touching broken glass with blood on it, clothes with blood stains, or other items.
- **Airborne**—Coming in contact with spores or other pathogen transfer mechanisms that are traveling through the air.
- **Vector-borne**—Receiving a bite from an insect that is serving as an incubator for the pathogen.

The vehicles of transfer include:
- Needlesticks;
- Cuts from contaminated sharps (scalpels, broken glass, and so on),
• Sharing of needles during drug use,
• Contact of mucous membranes (for example the eye, nose, mouth) or broken (cut or abraded) skin with contaminated blood,
• Sexual contact, and
• Mother to baby during pregnancy or during breast feeding.

Using universal or standard precautions
All human blood and potentially infectious body fluids should be treated as infected. Because of confidentiality legislation, a science teacher will not know if his/her student has a bloodborne pathogen.

All body fluids containing visible blood and certain other body fluids such as saliva, cerebrospinal fluid, semen, vaginal fluids, amniotic fluid, etc., are to be considered contaminated. Other more common body fluids are not normally considered contaminated, but may be. These include nasal secretions, sputum, urine, and vomitus.

OSHA requires a written exposure control plan that is accessible to employees. The plan must include an annual review and employee training, amongst other things. It also requires the employer to provide engineering controls (sharps disposal containers, retracting lancets with safety features), work practice controls (no food in work areas, washing hands with soap after removing gloves), personal protective equipment (e.g. gloves, chemical splash goggles), and good housekeeping practices.

Remember that human skin normally provides an excellent barrier to bloodborne pathogens. However, open sores, cuts, abrasions, acne or any kind of damaged or broken skin such as sunburn or blisters can provide access for bloodborne pathogens.

What are the applications in the middle school science laboratory/classroom?

There are direct ramifications for the science teacher relative to dealing with bloodborne pathogens. Examples include, but are not limited, to the following:

• Blood typing: Blood typing activities used to be done in both middle and high school science laboratories. With the advent of OSHA’s Bloodborne Pathogen Standard, schools have dropped this activity, given the potential risk of exposure to students and employees. In addition, synthetic blood typing kits provide a viable alternative. It is not prudent practice for a middle school science class to be doing human blood typing.

• Cheek cells: Middle school life science classes also used to do cheek cell staining and observation as an introduction to body systems. Again, the risk is too high at this point. It is prudent practice to use alternative preserved slides which are available and inexpensive to use.

• Glassware/plasticware: With use of glassware in the middle school science laboratory, there is increased risk of glass shattering and students getting cut. The prudent practice is to use plasticware where possible. Should a student get cut, have first-aid materials available such as wipes, sterile gauze pads, bandages, and so on. Try to have the student address their own needs to stop the bleeding if possible. The teacher’s job is to keep other students away from the area. Depending on the employer’s practice, the teacher may help the student, if necessary, but should wear protective gloves as a minimum. Never handle broken glass with an unprotected hand.

• Sharps: Have students use extra caution if using utility knives or other sharps while doing laboratory work. Training and demonstrations are the best defense! Never handle a sharp with an unprotected hand.

• Dried blood: Use caution when dried blood is discovered in the laboratory. HIV can survive five plus days and Hepatitis viruses can survive over ten days in dried blood. Most schools have trained custodial help to clean up dried blood. The teacher’s job should be to keep others away from it.

• Vomitus: Although this happens more often in the elementary school level, students get sick and teachers have been known to be the unintentional recipient of projectile vomitus. Remember that bloodborne pathogens may be transmitted through the mucous membranes of the eyes (tear ducts), nose, and mouth.

• Physical fighting: Realistically, teachers are exposed to one or more fights between students during their careers. Use utmost caution in stopping the fight. Do not put yourself in harm’s way relative to splashing of blood or biting.

• Field experiences: Field experiences are great opportunities for students to work directly in nature’s laboratory. However, precautions and preparations must be taken to protect students and science teachers from bloodborne pathogen vectors such as ticks and mosquitoes. Long pants, long-sleeved shirts, hats, and so on, should be worn to protect against ticks and mosquito bites. Also, a post-field experience check for these insects on clothing and skin are a prudent practice.

If any blood or potential blood product gets on clothing, the clothing should be removed and placed
in a Biohazard regulated waste bag for proper disposal. Teachers may decide to have their clothing laundered. If this is the case, the employer is normally responsible for the cost, providing the incident occurred at the worksite.

What is the bottom line?
Any exposure incident should be treated immediately by first washing the exposed areas with soap and water. In the meantime secure the assistance of the school medical support person. Also be familiar with the basic first aid response in the school’s Bloodborne Pathogen Plan. Students should also be trained as part of the prelaboratory primer. No matter how large or small, report any suspected exposures to the school medical support person!

Resources
Centers for Disease Control
- Bloodborne pathogens—www.cdc.gov/niosh/topics/bbp


Question of the month
Should I allow students to drink in the science lab?

Answer
Drinking in school science labs depends on school rules and practices. OSHA housekeeping rules and Hazard Communication Standard rule discourages food and drink in the laboratory. Prudent practice certainly enforces the same behaviors. Realistically, although no food or eating should be allowed, students might be allowed to use water bottles with secured sports caps. Regular screw-cap bottles should not be permitted.

Do you have a question?
Submit questions relative to safety in the middle school science laboratory to Ken Roy at Royk@glastonburyus.org.

Ken Roy (Royk@glastonburyus.org) is an NSTA Science Safety consultant and principal NSTA contact to the Science Safety Advisory Board. He is also Director of Environmental Health and Safety for Glastonbury Public Schools in Connecticut.