MODULE 1
Objective 1.7 Lesson A

Training Your New Lab Techs!

Safety to Lab Prep

Course
Advanced Biotechnology

Unit
Advanced Biotechnology

Essential Question
How do scientists maintain a safe and organized lab?

TEKS
130.364 1A-K, 2F, 2G, 2J

TAKS
Science 1A, 2B, 2C

Prior Student Learning
NONE

Estimated Time
120 minutes

Rationale

Biotechnology labs can be very time consuming to prep by yourself especially if you have multiple classes. Train your students on lab safety and lab set up. Create a company name. Give grades based on performance and semester reviews. It will save you time and train students in workforce skills that so many students often lack.

Objectives

Students will:

- Demonstrate proficiency in lab safety.
- Identify potential lab hazards.
- Identify location of all lab equipment/reagents/materials.
- Use a lab protocol to identify pre-lab set up of equipment and reagents.
- Demonstrate lab clean up and glassware washing.

Engage

- *Congratulations!*

  You have been hired as an entry level lab technician in Room _____under the guidance of _____. Please complete the training activities below. Once you are finished, you will be given a lab tech exam to obtain your entry certification. In the future, you will have opportunities to obtain higher level certifications in your field.

Key Points

I. Refer to Bio-Link Equipment for examples and SOPs of some common biotechnology equipment

Pre-Activity

1. Label all drawers, cabinets or anywhere that biotechnology equipment/materials/reagents may be stored with a numbering or letter system.

Activity

1. Introduce students to the task. They are now your employees and must receive entry level training.

2. Vote on a company name for your class.

3. Students complete "Entry Level Lab Tech Training" Activity.
    a. Use rubric found in activity for a formative assessment.

4. For Part A:
    a. Contract, videos, policies will vary depending on your district requirements. Examples used in AISD/ACC district are provided at the end of this lesson for your reference.
    b. For #7 in this activity, assign students various chemicals that will be used throughout the year.
    c. Display the MSDS Forms around the classroom grouped by lab.
    d. Refer to these forms as lab exercises are performed.

5. For Part B:
    a. Edit list to fit your classroom.
    b. If a student does cannot identify a piece of equipment, have them find an image on the Internet. A good site for reference is http://www.bio-link.org/home/how-equip-biotechnology-lab.

6. Once complete, assign student to create an digital inventory for a drawers, cabinets, and so on. Inventory can be printed and placed in a classroom binder for reference or posted in a digital form.

7. In the future, create other training opportunities for certification (EX: how to set up and run a horizontal gel.)

Assessment

- Safety Training Performance List
- Equipment Training Performance List

Materials

- Activity: "Entry Level Lab Tech Training"
- MSDS Form and Internet Access for MSDS information
- Worksheet: "Mandatory Laboratory Safety Rules"
- Worksheet: "Biology Lab Safety Rules"
- "Safety Contract" from http://www2.austincc.edu/sci_safe/

Accommodations for Learning Differences

- Visit the **Special Populations** section of the CTE Career and Technology Education Website: http://cte.unt.edu/special-pops

National and State Education Standards

Science Standards

Texas College and Career Readiness Standards

I. C2, C3, E1, E2

III. B3, C1, D1

Entry Level Lab Tech Training Activity

Part A: Lab Safety

1. View the Science Safety Video: http://www.austincc.edu/biology/safetyvid.html.

2. Read the Science Safety Policy.

3. Fill out the Biology Safety Rules and Information sheet for this laboratory classroom.

4. Sign the Safety Contract.

5. Create Map (graph paper or computer generate) of the laboratory and clearly identify the following:
   - Eyewash stations
   - Shower
   - Glass disposal box
   - Closest phone
   - Chemical cabinet
   - Gas valves
   - Sinks
   - Lab benches
   - Fume hoods
   - Fire extinguisher
   - Windows
   - Exits
   - Fire blanket
   - Emergency evacuation rally point (outside) and route to it

6. Finding MSDS and Safety Information on the Internet

   Use the Internet to search for chemical company websites, university departments, or other databases containing MSDS information. Locate information for the following 3 chemicals:

   a. Nicotine, an addictive substance found in tobacco.
   b. Ethidium bromide, a stain commonly used for marking DNA.
   c. Sodium chloride, table salt.

   For each, find the LD_{50} (oral, rat, mg/kg) and whether it is a mutagen or carcinogen. Record this information on the back of your lab map.

7. Special Safety Precautions for Individual Lab Exercises

   Find a partner to work with, and select a laboratory exercise together from this lab manual that has a list of chemicals and materials that will be used. Your teacher may also assign you a chemical. Ask! Using information from MSDS, find the following information:

   - chemical name (trade name)
   - physical data (appearance, etc.)
   - NFPA rating
   - any health hazards/first aid measures
   - LD_{50} (mg/kg, oral, rat) or LC_{50} (ppm)
   - Toxicity data (carcinogen, mutagen, teratogen, neurotoxin, nephrotoxin, or hepatotoxin)
   - waste disposal method/spill procedures
   - any PPE needed

   Enter the information in the form provided in the MSDS Form. Your group will be required post the table in the lab room during that particular exercise, and explain to the class what special precautions should be taken for that experiment. The simplified categories of hazardous materials found in the appendix of this manual will help you to prepare your class presentation.

8. Once complete, please have your instructor check your work before you move on to the next training activity.

SAFETY TRAINING PERFORMANCE LIST

Safety Training	**Instructor Initials for acceptable**
Oral Quiz on Safety Video, Policies and Information Sheet	
Safety Contract signed by Student and Parent	
Safety Map	
MSDS Information	
MSDS Form	

_____ has complete Safety Training _____

Student Name **Teacher Signature**

MSDS Form for Lab Exercise

Chemical Name: _____

Chemical Formula: _____

Physical Data (appearance, etc.)	
NFPA Rating	
Health Hazards/First Aid Measures	
LD_{50} (mg/kg, oral, rat) or LC_{50} (ppm)	
Toxicity Data (carcinogen, mutagen, teratogen, neurotoxin, nephrotoxin, or hepatotoxin)	
Waste Disposal Method/Spill Procedures	
PPE Needed	

Part B: Equipment Training

1. You will be responsible for gathering materials you need for each lab exercise during the semester. You will need to know the location of the equipment/materials below. Using the Safety Map generated in Part A, identify all cabinets, drawers, etc. that are labeled with numbers indicating they contain materials/equipment.
2. Create a key to identify the location of all materials/equipment below on your map:

glassware	broken glass disposal	microscopes
gloves	freezer (-20˚C)	microscope slides
hotplate/stirrers	refrigerator (4˚C)	5ml/10ml pipettes
micropipetters	37 ˚C incubators	magnetic stirrers
micropipetter tips	microcentrifuge tubes	test tubes
microfuges	microscopes	electric balances
ring stands and clamps	test tube racks	microcentrifuge
Eppendorf tube racks	marking tape	Sharpies
analytical balance	chemical cabinet contents	TEA buffer
Di water	beakers	graduated cylinders
paper towels	power supply	casting trays
water bath	pipette pump	Edvocycler
UV Phot Doc	color printer	black and white printer
hot gloves	nitrile gloves	microwave
spatula	scissors	parafilm
flask	thermometer	pH meter
enzymes	buffers	lab bench outlet

You should also know the use of all of the materials above.

Clean Up Protocol

1. Wash all regular glassware:
    a. Pour contents into an approved container (Ask your instructor if you are unsure of how to discard a particular chemical.)
    b. Rinse with tap water.
    c. Scrub with soapy water and a test tube brush.
    d. Rinse 3 times with tap water.
    e. Rinse 3 times with distilled water.
    f. Store inverted over absorbent towels until dry.
2. All disposable glassware goes into the special glass disposal receptacle.
3. All instruments should be turned off and unplugged.
4. Wipe off your workspace with a damp paper towel.
5. Make sure everything that you have used is clean, put away, or discarded.
6. Leave your work area in the same order that you found it in.
7. Ask your instructor to check your work area before you leave.

EQUIPMENT TRAINING PERFORMANCE LIST

Equipment Training	Instructor Initials for acceptable
Equipment Map Complete	
Set Up a Sample Lab	
Oral Quiz over use of Equipment	
Clean Glassware	

Mandatory Laboratory Safety Rules Worksheet

Modern laboratories are equipped with supplies and equipment that may pose a hazard if used carelessly. Following safety rules, paying attention to what you are doing, and using common sense is the best way to make your experience in this course a safe one. Health and safety are paramount values in science classrooms, laboratories and field activities. You are expected to learn, understand and comply with ACC environmental, health and safety procedures and agree to follow the ACC science safety policy. You are expected to conduct yourself professionally with respect and courtesy to all. Anyone who thoughtlessly or intentionally jeopardizes the health or safety of another individual will be immediately dismissed from the day's activity, may be withdrawn from the class, and/or prohibited from participating in future activities. Specific safety training will take place before most activities. If you are late and miss this training, you will not be able to participate in the activity. You can read the complete ACC science safety policy at http://www2.austincc.edu/sci_safe/

General Laboratory Safety Rules

1. Never eat or drink in the lab. Do not bring food or drinks into the lab.
2. Avoid wearing contact lenses in the laboratory. Chemical vapors can permeate lenses or become trapped behind them, potentially damaging your lenses or eyes.
3. Do not come into contact with another's body fluids (blood, saliva, urine). Assume all body fluids are infectious.
4. Wear UV-rated safety glasses or goggles and gloves at all times while in the lab. Change your gloves often, and while wearing gloves, do not touch door handles, water taps, computers, telephones or other objects that may be touched by people not wearing gloves. Gloves will be provided, but students should provide their own UV-rated safety glasses.
5. Remove your gloves and wash your hands immediately after handling animals or body fluids.
6. Keep book bags and other personal items off the tables and floor during lab. You can store your personal items in the labeled cupboards or on empty chairs so that they are out of the way.
7. Do not wear loose or flowing clothing or dangling jewelry in the laboratory. Pin up long hair or confine it under a hat. Some of the substances used in the lab may stain or damage clothing. You may wish to wear a lab coat or apron for protection, or wear clothing that you don't mind being stained or damaged.
8. Do not wear sandals or open-toed shoes. Flat-heeled, full-coverage shoes of leather or other impermeable material are best.
9. Report broken glass immediately to your instructor, and always dispose of broken glass in its designated container. Do not place non-glass items in these containers.
10. Clean up your work stations, wipe your lab bench and wash your hands before leaving the lab room.

General Safety Procedures

1. Each student should know the location and proper use of each of the following: gloves, goggles, safety shower, eyewash station, biohazard container, broken glass disposal box, fire extinguisher, first aid kit, and hazardous material spill cleanup kit.
2. If you have any doubt about a proper safety procedure in a specific instance, ask your instructor.

Handling Chemicals

1. Wear gloves and goggles when handling potentially hazardous chemicals.
2. Read the label completely before opening a chemical bottle (pay special attention to warning labels).
3. Open volatile organic solvents only in a fume hood.
4. Close all containers immediately after using.
5. Always handle chemicals with care to avoid spills. Clean up and dispose of if not hazardous.
6. Report any spills of a potentially hazardous chemical immediately to your instructor.
7. Follow your instructor's directions on how and when to mix chemicals.

8. Don't taste chemicals or smell fumes directly.
9. Don't use your mouth to pull liquid into a pipette.
10. Always use clean glassware to prevent contamination.
11. Don't pour unused chemicals back into storage containers where it may contaminate the rest of the reagent. Dispose of unused chemicals in proper waste containers.
12. Do not flush chemicals or cleanup materials down the drain without instructor's consent.
13. Consult with your doctor about any special health conditions that you may have, such as asthma, allergies, or pregnancy.
14. Clean up work areas thoroughly when you are finished. Always clean up shared areas such as balances and stir plates. Never leave spilled chemicals sitting on a balance, even if you did not spill it. They can corrode the instrument.
15. Wash hands prior to leaving the laboratory.

Handling Biohazards

1. When working with microbes, always assume they are infectious. Avoid touching contaminated objects to any other objects, even the floor and counters, and avoid direct contact, especially around broken skin.
2. Always wear gloves and goggles when working with microbes or body fluids.
3. Dispose of all potentially contaminated objects in a biohazard bag or a container filled with a 10% bleach solution, or follow your instructor's directions.
4. Spray and wipe the work areas with 10% chlorine bleach solution before and after lab.
5. Wash hands immediately after handling a biohazard.

Handling Mechanical Hazards

1. Never touch a rapidly moving machine, such as a centrifuge, while it is moving.
2. Distribute weights evenly in a centrifuge to prevent vibrations and breakage.
3. Do not leave a running centrifuge unsupervised.
4. If the centrifuge is vibrating excessively or "walking" across the tabletop, turn it off immediately.

Handling Electrical Hazards

1. Do not use equipment that has any frayed or damaged wiring or plugs. Report any uninsulated wires to your instructor.
2. Always make sure the area around all electrically powered equipment is dry before turning on the power.
3. Gel electrophoresis poses a high risk for electrocution. When assembling or disassembling the gel apparatus, always be sure that it is unplugged. Connect the power supply and turn on the power supply only under the supervision of your instructor.

Handling Glassware

1. Dispose of disposable glass items such as capillary tubes and cover slips in a hard-sided box labeled "Glass Disposal".
2. Do not use broken or cracked glassware. If you break a glass item, report the incident to your instructor and dispose of it in the "Glass Disposal" box.
3. NEVER put broken glass or disposable glass items with sharp edges in the ordinary trash can. This poses a serious hazard to the person who must empty the trash.
4. Avoid rapid temperature changes of any glassware, as this will often cause the glass to break. Do not place a cool glass container on a hot surface (such as a hot plate), and do not place a hot glass container on a cold surface or in a cold environment (such as a refrigerator).
5. Report any cuts immediately to your instructor, and wash the wound thoroughly in running water. Check for glass in the wound, remove if necessary, dry the skin, and apply a bandage.
6. Do not shake glass thermometers, and lay thermometers away from the edge of a bench on a towel or screen to avoid dropping it on the floor. If a thermometer breaks, immediately inform your instructor.

Handling Bunsen Burners

1. Check gas hose for cracks every time before using.
2. Make sure hose fits securely.
3. Make sure the striker produces sparks before turning on the gas.
4. Stand back, open gas, use striker, and adjust flame.
5. Flame should be blue. Adjust oxygen intake if you have a yellow flame.
6. If the flame sputters or goes out, immediately turn off gas and inform instructor.
7. If you smell gas, turn off gas and immediately inform instructor.
8. If you are going to heat a glass container, check container closely for cracks or stars. Do not use glass that is cracked or starred.
9. Glass containers must have an opening for vapors and heat to escape when heated.
10. Use beaker tongs, hot hands, insulated gloves or test tube holders when handling hot glass.
11. Remember: hot metal and glassware can look just like cool metal and glassware. Be aware of hot materials and make sure no one handles them. Don't leave a hot object unattended without notifying every person in the room.
12. When heating test tubes over a flame, move the tube back and forth at an angle to avoid splattering, and point it away from others and yourself to avoid being burned by splattered liquids.

Disposal Procedures

1. Treat all biological and chemical materials as if it were hazardous waste, unless notified otherwise by your instructor.
2. Do not pour chemicals, solutions, or biologicals down the drain without permission by your instructor.
3. Dispose of wastes in the proper labeled waste containers, as indicated by your instructor. Chemicals should be poured by funnel into a labeled chemical waste bottle. Biohazards should be placed into a biohazard bag (do not overfill), sealed with autoclave tape, and autoclaved until sterile. Glass should go into a labeled glass disposal box.

Accident Procedures

1. Try to contain any spills without endangering yourself and others. Spill socks and pillows, or paper towels if necessary, can be used to contain a spill and keep it from spreading. Notify the instructor immediately when a spill has occurred.
2. If a caustic chemical is splashed into your eyes, notify the instructor or another student immediately so that you can be assisted to the nearest eyewash station as quickly as possible. Continue to wash your eyes for at least 20 minutes while emergency personnel are being called.
3. If caustic chemicals are spilled on your skin, wash the contaminated area for at least 15 minutes. If it is a major spill, immediately remove contaminated clothing and wash for at least 15 minutes in a safety shower.
4. Quickly shout an immediate warning to all your neighbors in case of a fire. It is very important that everyone in the room know as quickly as possible when there is a fire.
5. All students should exit a lab in case of a fire. The lab instructor will call the Campus Police Dispatch at 222 (from any ACC phone) or 223-7999 (from an outside or mobile phone).
6. Speed is the most important aspect of helping a person who is on fire. Your nearest neighbors must respond quickly by smothering the fire with a fire blanket as soon as it appears.
7. Do not allow a person whose clothing or hair is on fire to move. Stop the person and quickly push them to the floor and smother the flames immediately with a fire blanket.
8. The student nearest a fire blanket should bring the blanket to a person who is on fire, and once the flames are quenched, that person should be taken immediately to the safety shower.

Violations of Safety Rules

Failure to follow the lab safety procedures may have consequences for your grade in this course.

Biology Lab Safety Rules Worksheet

Review the safety rules listed above, and answer the following questions for your laboratory room. You can read the complete ACC science safety policy at http://www2.austincc.edu/sci_safe/

Emergencies

- If there is a fire, major chemical spill or other emergency call the ACC Police Dispatch as soon as possible. Tell the officer your campus and exact location in the building.

  Location of nearest ACC phone: _____

  ACC POLICE DISPATCH: **222** (from an ACC phone)
  223-7999 (from a mobile or other phone)

- If evacuation is necessary, go to the designated rally point away from this building.

  Directions to nearest exit: _____

  Location of rally point: _____

Safety Equipment and Information

- Information about chemicals used in this laboratory can be found in Material Safety Data Sheets (MSDSs) and in a chemical inventory located

  _____

- The emergency gas shut-off for this lab is located _____
  Shut off the gas immediately if gas nozzles or valves are damaged, or if there is a fire.

- Fire extinguishers are located (1) _____

  (2) _____

  To use a fire extinguisher, pull the pin in the handle and squeeze the handle while pointing the nozzle at the base of the flame.

- Fire blankets are located (1)_____

  (2)_____

  If you are on fire, stop, drop and roll. Let someone else get the fire blanket.

- A safety shower is located _____
  If you spill a significant quantity of chemical, especially an acid or base, on yourself, immediately stand under the shower and pull the handle. Disrobe. The instructor will evacuate the room and close the doors for your privacy. Someone of your gender will stay to help you. Stand under the shower for at least 20 minutes. You will be given clothing after the shower.

- An eyewash is located _____
  If a chemical is splashed or rubbed into your eyes, you must use the eyewash for at least 20 minutes. Put your face close to the basin with your eyes held open and press the lever to start the spray. Someone will help you with this.

- If a person is experiencing electrical shock from touching wires or equipment, use a belt, apron, lab coat or other non-conducting material to pull them away from the electrical source.

- First aid kits are located (1) _____

  (2) _____

  Only minor cuts and burns will be treated in the lab. Serious injuries must be treated in a medical facility. Emergency Medical Services (EMS) will be called if you are injured and are unable to take yourself to a medical facility.

Dress Code and Personal Protective Equipment (PPE)

- While in the lab you must wear closed-toed shoes.
- In lab activities involving chemicals, you must wear long pants or skirts (below the knee) or a lab apron/coat (provided).
- You must wear goggles or safety glasses marked ANSI Z87.1 when directed to do so by the lab instructor or lab safety instructions. You must bring your protective eyewear with you to every lab class. If you forget your eyewear and the lab room does not have a pair to loan to you, you will not be able to participate in the lab and may forfeit your lab grade for that day. ACC cannot guarantee that loaned safety glasses or safety goggles are uncontaminated by microbes or chemicals.
- Wearing contact lenses in the lab is strongly discouraged. Students wearing contact lenses must wear safety goggles instead of safety glasses.
- You must tie back any long hair in labs involving open flames, and it is recommended you do so for any lab.
- Gloves are provided and should be worn for any lab activity. Your instructor will inform you when gloves are required rather than optional.
- For your safety, we recommend that you:
  - avoid wearing very loose clothing, especially long, loose sleeves.
  - wear natural fiber clothing (such as cotton or wool) because synthetic material (such as polyester) can melt onto skin in a fire.
  - remove watches, rings, and bracelets during lab activities involving chemicals.

Waste Disposal

- For chemical wastes, there are (i) flammable organic, (ii) inorganic, and (iii) organic waste containers located

  _____

- For other wastes, there are containers for
  - biohazards – located _____
  - glass – located _____
  - other trash – located _____
- You must precisely follow the waste disposal procedures. Never dispose of anything in lab without prior direction from the instructor.

Lab Conduct

- DO NOT
  - horse around or perform unauthorized experiments

- eat, drink, or chew (tobacco or gum)
- bring drinks or food (even in closed containers) into the lab
- pipet by mouth
- taste chemicals, or directly smell chemical fumes

- You must follow all procedures in manuals, in handouts, and as given by the instructor.
- You must store backpacks, coats, and other personal items _____. We recommend that you bring as few items to lab as possible.

- Report broken glass and chemical spills to your instructor immediately.

Lab Hygiene

- You must clean up your individual work area/equipment and community work areas/equipment (such as sinks and balances).
- You must put lids back on bottles and containers immediately after use.
- Do not put excess chemicals back into original containers.
- Only dispose of chemicals and waste as directed by the instructor.
- Wash hands prior to leaving lab.
- Always assume the chemicals used in lab are corrosive or irritating. Any time chemicals come in contact with your skin, wash the affected area immediately.

Labeling

- You must label containers/test tubes if you are using more than one container per lab.
- Inform your instructor immediately if a label is damaged in any way.
- Read all labels and pay special attention to hazard information.

Disease

Blood-borne diseases, such as HIV and hepatitis, can be transmitted from person to person through contact with human blood. Follow the Universal Precautions whenever exposure to human body fluids is possible.

- Consider all body fluids (saliva, blood, urine, feces, vomit) as potentially infected.

Do not come into contact with anyone else's body fluids.

Safety Contract by Austin Community College Biology Department

Course # / Name	Course Synonym and Section #s
Instructor	
Campus and Room	Semester

By signing below, I acknowledge that I have received a copy of and have reviewed and understand the Biology Lab Safety Rules. I agree to abide by all ACC safety policies as stated in the Biology Lab Safety Rules and as directed by my instructor.

Print Name	Signature	Date	Optional Emergency Contact Name	Optional Emergency Contact Phone #
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Print Name	Signature	Date	Optional Emergency Contact Name	Optional Emergency Contact Phone #
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