Guide for Working Safe in a Clinical Laboratory

Education of Biomedical laboratory Scientists

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Introduction

This guide is for you who are about to start working in a clinical lab. This guide is intended to familiarize you with operating safely in a laboratory environment. Safe practices are the foundation of laboratory work, and the first step in developing your professional skills.

The clinical laboratory provides a variety of laboratory services needed to monitor the health status of patients. The results of laboratory tests can be used to diagnose diseases and monitor the progress of treatment. Special fields in laboratory medicine include clinical chemistry, clinical microbiology, hematology, pathology, genetics, clinical physiology, and clinical neurophysiology.

Occupational safety covers physical, mental and social working conditions, which must be as functional and as safe as possible. The most important starting point for a safe work environment is risk assessment and thus the prevention of dangerous situations. Rules and proper working practices exist to prevent dangerous situations altogether. Therefore, it is important to read and follow the laboratory's operating instructions. Working in a safe work environment is not only more comfortable, but also meaningful. In addition, the results obtained from studies are more reliable when the sample process is always consistent and the correct working methods are followed.

In this guide, we will tell you about the important aspects of laboratory safety so that you know from the beginning how to operate safely in the laboratory and learn how to assess the risks in your work yourself. The guide has been conducted as part of Turku University of Applied Sciences' thesis of Biomedical laboratory Scientists.

Hand Hygiene

The most common route of microbial infection in healthcare facilities is contact through touch. Ensuring good hand hygiene is an important way to prevent microbial infections. Water-soap washing is recommended if there is visible dirt on the hands. Otherwise hand sanitizer is used. Cleaning your hands with an alcohol-based hand sanitizer will cut off infection pathways. If there is dirt on the hands, such as exudates, the disinfectant will not work properly. Hand sanitizer should be applied to the hands generously, approximately 3–5 ml. Make sure that your fingertips, nails and thumbs are also carefully disinfected. Excessive use of hand sanitizer might sometimes make your hands sticky. If so, it is then enough to wash your hands with water alone. The condition of the hands should be taken care of by applying a lotion to them regularly. Microbes tend to stick better to dry skin than to well-moisturized skin. Even small wounds on the hands allow pathogens to enter the body.

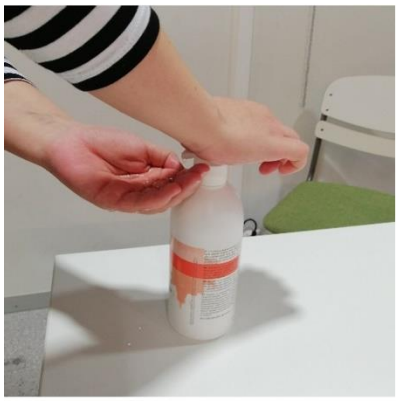
Rings, bracelets and watches collect microbes and thus prevent effective cleaning of the hands. Therefore, the use of these accessories by health care professionals in the workplace is not allowed. The use of nail polish, acrylic nails or gel nails is also not permitted, as microbes accumulate on their surface.

Watch this video instructing on how to wash your hands: Washing your hands with water and soap

Use hand sanitizer to disinfect your hands.

If your hands are visibly dirty, wash them with water and soap.

The time spent on all the steps below should be approximately 20-30 seconds.



1. Take enough hand sanitizer to clean your hands thoroughly.

2. Rub your palms against each other to spread the hand sanitizer.

3. Clean the backs of your hands by rubbing with your fingers overlapping.

4. Rub your palms against eachother with your fingers over-lapping to clean between your fingers.

5. Bend your fingers and rub them simultaneously against the palm of the opposite hand.

6. Clean the thumbs with rotating movements.

7. Rub your fingertips in the palm of the opposite hand to clean them.

Your hands are clean and safe when all the hand sanitizer has dried.

Asepsis in the Laboratory

Asepsis is part of good laboratory practice. Asepsis refers to all measures aimed at maintaining cleanliness and preventing the occurrence of infections. In laboratory work, aseptic procedures avoid contamination of patient samples and instruments with particles that may interfere with or falsify the results obtained. Aseptic measures in the laboratory include regular cleaning and disinfection of surfaces and proper care for hand hygiene. Asepsis creates the basis for laboratory biosafety.

The workwear must be clean and free of visible stains. The workwear protects the employee from possible splashes and dirt. In addition, workwear prevents particles from the worker from contaminating the environment. The materials of the garments greatly affect the particles they release into the environment. Materials should also be able to withstand washing at high temperatures to destroy pathogens. Employees should also take care of their personal hygiene. The use of fragrances should be avoided as they may cause symptoms in people with allergies or hypersensitivity to fragrances. Cleanliness and being odor-free are in everyone's best interest.

Extra supplies that are not needed there are avoided in the laboratory premises. Bags and other personal belongings are left in the lockers or dressing room provided for them. This reduces the additional risk of contamination.

Instrument Technicians

The instruments used to ensure the quality of the laboratory must be clean and reliable. Alongside biomedical laboratory scientists, this is handled by instrument technicians, who are on their part responsible for ensuring the availability of clean and reliable equipment in the laboratory. Instrument technicians clean, disinfect, pack, and sterilize laboratory equipment. The maintenance of laboratory centrifuges and analyzers is also sometimes done by instrument technicians.

Laboratory personnel should rinse the equipment they used thoroughly with water or place them in a soaking solution before it is handled by instrument technicians. Dirty equipment has its own containers where the instrument technician staff can find them. It is also the responsibility of laboratory personnel to dispose of disposable equipment in the appropriate garbage can, so that the instrument technicians can focus on handling the reusable equipment.

Ergonomics

Ergonomics refer to the adaptation of tools, furniture and working methods to the characteristics and abilities of the employee. In a clinical laboratory, it is important to take care of ergonomic factors, as the work done by hand puts strain on the upper body. Functional workspaces promote occupational safety and well-being at work. This chapter introduces some practical tips for common laboratory workstations and tasks.

Working in a Laminar Flow Cabinet

Infectious samples should be handled in a laminar flow cabinet, as the air flow in the cabinet is filtered through HEPA filters. The air flow prevents infections and fumes affecting the worker. When working in a laminar flow cabinet, hands of the worker are inside the cabinet and the face is protected by a protective glass screen from possible splashes and inhalation of hazardous substances or pathogens.

Most laminar flow cabinets or biosafety cabinets have the following features to improve the ergonomics:

- The protective glass screen of the cabinet is slanted and non-reflective.
- The height of the cabinet can be adjusted so that work can be done both standing and sitting.
- There is good lighting inside the cabinet.
- The surfaces of the cabinet are easy to clean.
- The cabinet is quiet.
- The legroom of the cabinet is open.
- There is enough table space around the cabinet to store supplies.

Working on a Microscope

Since the school has a lot of working on the microscope, it is important to find the right working position to prevent aches and health issues. Microscopy requires precision, so a good posture will also help you to focus on the work itself. It is important that the workstation table, chair and the eyepieces of the microscope are adjustable. Adjustable table allows the microscope to be used while standing as well.

In a good working posture:

- the neck and back are in a straight position.
- the shoulders are relaxed and the upper arms are close to the body.
- the forearms are supported on the table.
- the wrists are straight.
- the soles of the feet are flat on the ground.

Pipetting

Pipetting is one of the most common tasks in laboratories. While pipetting, the hand movement is repetitive, which is why special attention should be paid to ergonomics in work. According to research, excessive pipetting has been linked to hand and shoulder problems. Pipetting robots are utilized in the pipetting of large batches, which reduces the repetitive mechanical movement of workers. There are many electronic pipettes in use today that have less hand strain than mechanical pipettes.

Supporting the elbow on the worktop makes pipetting less tiring. Holding the hand in the air strains the muscles of the shoulder area. The waste container for pipette tips should be as close as possible on the desk so that you do not have to make any twisting motion or raise your hand to drop the tip. The pipettes are stored upright in a pipette rack where they are easy to pick up and put back down.

Chemical Safety

Clinical laboratories handle chemicals that can be dangerous as well as acutely toxic. Hazardous chemicals refer to chemicals that are flammable, explosive and hazardous to health and the environment. The basis of chemical safety is to know the chemicals handled and to know their properties and safe uses. When handling chemicals, it is important to follow certain rules. Cleanliness of the laboratory and equipment as well as appropriate protective equipment reduce potential risks and hazards.

Handling the Chemicals

Chemicals should always be handled in a biosafety cabinet and with clean equipment. The skin does not block chemicals from entering the body, so it is important to protect yourself from dangerous chemicals with appropriate gloves. Avoid contact with chemicals with bare hands. Do not taste chemicals or smell gases. Chemicals must not be measured or mixed near the face, and it must be ensured that there is a biosafety cabinet screen between the container and the face. Chemical containers are always kept and transported with the lid closed. Large storage bottles are not transported in the laboratory. The required amount should be poured into a beaker or other similar chemical container.

Storing the Chemicals

Chemicals are stored in their original containers. Chemical packaging should always include the necessary warnings and instructions for use. Labels that are unclear (e.g., ripped or gotten wet) should be replaced by new labels containing the necessary information.

Chemicals used in the laboratory can react strongly with each other. Incompatible chemicals are kept separate so that they cannot cause environmental problems or health damage in hazardous situations.

Chemicals to be kept separate:

- Flammable liquids and gases
- Other combustible chemicals and materials
- Acutely toxic chemicals
- Oxidizing agents

Chemicals can cause serious damage to health. They break down slowly in the body and the environment. Exposure to dangerous chemicals can occur through the skin, mouth or respiratory tract. Exposure to hazardous chemicals can cause cancer, damage to the genome and affect reproduction. Long-term exposure causes greater harm than short-term exposure.

The interaction of chemicals can lead to a greater hazard and a stronger impact than a single chemical would cause.

How chemicals are stored at Turku UAS. Notice the appropriate warning labels and how the cabinet can be locked. The temperatures of the refrigerators are monitored to make sure that the chemicals are stored to their standards.

In Case of Emergency

Due to the risk of splashing toxic or corrosive chemicals, the laboratory premises have a bag or box containing various safety equipment and first aid supplies. All safety devices have a plate that describes the operation of the device.

In case of chemical coming in contact with the eyes, rinse immediately with plenty of water from the emergency shower or an eyewash bottle. The harmful substance is rinsed out with a large amount of liquid. With an eyewash bottle the rinsing duration is about 90 seconds.

The first aid kit contains the supplies needed to treat burns. The burn should be cooled under running cold water. The burn is protected for a couple of days with a bandage. The bandage should not get wet.

An emergency shower has been installed in the laboratory premises to quickly extinguish hair or clothing caught on fire. The shower should also be used when a corrosive, irritating or toxic substance splashes on the skin.

Warning labels on chemical containers contain safety and hazard statements. The label describes the hazardous properties of the chemical and the measures to be taken to prevent potential exposures.

You can always learn from dangerous situations and near misses! Think about what can be done differently to avoid similar situations from happening again.

Warning Labels

The hazardous chemical is identified by warning labels on the packaging. The table below lists the most common warning signs, the hazards they indicate, and the precautions to be taken.

Warning labels		The hazard	Precautions
	Health hazard	Irritation to the eyes and the skin. Could cause allergic reactions. Irritation to the respiratory tract. Immediate toxicity. Drowsiness and dizziness	Use protective gloves and eyewear. Avoid inhaling the substance.
	Corrosive	Causes damage to tissue and surfaces. Severe damage to the eyes.	Use protective gloves and eyewear. Avoid inhaling the substance.
	Flammable	Liquids or other substances and their fumes and gases that could catch fire and burn intensely.	Protect from heat, open fire and sparks. Never smoke near these substances. Use protective gloves and eyewear if there's a risk of splashes.
	Hazardous to the environment	Toxic or dangerous to the environment.	Never dispose in the drain. Avoid releasing substance into the environment.

	Serious health hazard	Causes severe health issues (cancer, damage to the genome, fertility issues or fetal damage). Allergic reactions.	Use protective gloves and eyewear. Avoid inhaling the substance.
	Oxidizing	Causes or promotes the ignition of other materials.	Store separately from flammable substances. Protect from heat, open fire and sparks. Never smoke near these substances. Use protective gloves and eyewear. Avoid inhaling the substance.
	Acute toxicity	Toxic or deadly if ingested, inhaled or in contact with the skin.	Use the appropriate protective wear: Protective eyewear, gloves and a respirator mask.
	Gas under pressure	Gases that are stored in a high pressure container.	Protect from direct sunlight and heat.
	Explosive	Object or chemical could potentially explode.	Use protective eyewear. Protect from heat, open fire and sparks. Never smoke near these substances.

Waste Management

In addition to general waste the Laboratory generates waste that is harmful and hazardous to health. Due to the risks, the handling, sorting and transporting of the waste should be managed safely. The waste can be sorted according to its place of origin, properties, harmfulness or handling possibilities.

Waste management means the collection, recovery, transport and treatment of waste. Waste management should not cause harm to health at any point of the process.

Special waste generated in the laboratory include accidental waste, ethical waste, infectious waste, and harmful and hazardous waste. In addition, confidential waste is generated in the clinical laboratory.

Sharp Waste

Sharp waste is a typical laboratory waste. Sharp waste is classified as sharp or edged waste that can cause cuts or punctures. The waste is collected in a yellow plastic box or a bottle that can't be punctured, i.e. a sharp waste container. The container is sealed so that it can't be easily or accidentally opened after it is filled up to the maximum capacity line. Sharp waste is buried in the waste treatment area.

Sharp or potentially sharp waste generated in the laboratory:

- Needles
- Lancets
- Pipette tips
- Urine chemical screening test strips
- Capillary samples and test tubes

Ethical Waste

Ethical waste, or biological waste, is tissue waste that is then classified into identifiable and non-identifiable biological waste. Identifiable biological waste is clearly identifiable body parts and organs. Non-identifiable waste includes wet fabrics rich in biological material or blood tubes, organ parts and tissues that don't have any information connected to them.

Ethical waste is packed in a sealed waste bag that does not leak and can withstand transportation. Unidentifiable biological waste such as blood tubes or blood-contaminated supplies is collected in a separate container.

Waste containers for biological waste. Container is labelled for blood sample tubes.

Infectious Waste

Infectious waste is waste that is hazardous to an individual or society. Infectious waste can cause diseases to humans or other organisms.

Treatment of a patient suffering from an infectious disease could create infectious waste. Illnesses classified as infectious diseases are for example plague, anthrax, smallpox and hemorrhagic fevers (Ebolavirus, Lass fever, Marburg disease).

Hazardous Waste

Hazardous waste is waste that due to its chemical properties, can cause harm to health or the environment.

- Hazardous waste must not be discharged into drains, evaporated into the air or sorted into mixed waste.
- Where possible, waste should be stored in the original container.
- The waste should be tightly packed. It needs to be ensured that the caps of the containers are closed.
- Containers should be marked as hazardous waste and the necessary warning labels are intact.

Hazardous waste generated in the laboratories include chemicals, staining solutions and reagents. The generation of chemical waste cannot be avoided, but the amount can be minimized by using only the necessary amounts of chemicals or safer optional chemicals. Incompatible chemicals must not be mixed.

Do not discharge clogging substances, concentrated acids and bases or flammable waste into drains. Diluted acid and base solutions, ethanol-containing washing solutions and saline solutions can be drained. However, solutions that are drained should always be rinsed with plenty of water.

Chemical waste should be disposed in original containers or similar packaging. The waste container should clearly state that it is a container containing waste and the type or quality of the waste. The container needs to have the necessary warning labels showing the hazards of the waste.

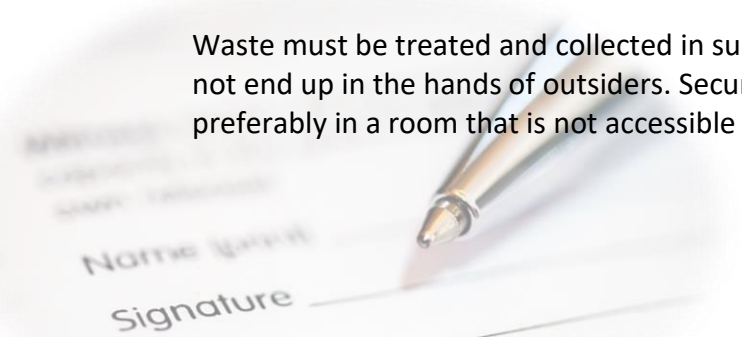
Separately collected chemicals:

- Flammable and combustible substances
- Flammable and oxidizing substances
- Corrosive substances

Confidential Waste

Confidential waste is sensitive material that must be disposed of properly. The waste can be papers, sample ID stickers, patient identification wristbands, or any other material that contains personal information such as names, social security numbers or addresses. Sample codes are also security waste, as they can be used to connect a sample to a patient even if they don't contain the direct patient information.

Waste must be treated and collected in such a way that the information contained in it does not end up in the hands of outsiders. Security waste is stored in a locked container and preferably in a room that is not accessible to outsiders.



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