

Introduction to Medical Laboratory Technology

Technology (Greek: *techné* means ‘art, skill, cunning of hands’) is the **collection of techniques, skills, methods and processes used in the production of goods or services**, or in the accomplishment of objectives, such as **scientific investigations**. Technology can be the knowledge of techniques, processes, etc. or it can be embedded in machines, computers, devices and factories, which can be operated by individuals without detailed knowledge of the working of such things.

LABORATORY

A **laboratory (lab)** may be referred to a **facility that provides controlled conditions in which scientific or technological researches, experiments and measurements are performed**. It may be a **building, part of a building or other place equipped with scientific equipment for doing scientific tests and/or teaching science, or some area where chemicals or medicines may be produced**.

Laboratories used for scientific research may have many forms due to the differing requirements of specialists, in various fields of science. Whatever the type of the laboratory may be, it is a challenging working environment with the aim of protecting people, assets and the environment, from explosives, and avoiding cross-contamination.

A laboratory should:

- be subjected to strict regulatory requirements;
- ensure data storage without gaps or losses.

MEDICAL LABORATORY

A medical laboratory, also referred to as a **clinical laboratory**, is a laboratory **where tests are done on clinical specimen, in order to get information about the health of a patient**, as pertaining to:

- Diagnosis,
- Confirmation of clinical interpretation,

- Monitoring any therapy,
- Establish prognosis,
- Treatment, and
- Screening of the disease.

CLINICAL LABORATORIES SET UP IN A HEALTH INSTITUTION

Types of clinical laboratories in a health institution vary from one place to another. Most commonly included are:

1. Clinical Chemistry Lab

Clinical chemistry (clinical biochemistry lab), also referred as chemical pathology laboratory, **usually receives blood, serum or plasma, and chemically analyzes** it or other body fluids for a variety of substances, such as sugar, lipids, enzymes or hormones, etc.

It may also include **urine analysis** for the measurement of urinary constituents; analysis of body fluids, like ascitic fluid, pleural fluid or CSF for various biochemical components; analysis of calculi from various tissues for their biochemical composition; and blood gas analysis.

Various sections under clinical chemistry include **analysis of blood or its components, enzymology, toxicology, endocrinology**, etc.

2. Clinical Microbiology Lab

Clinical microbiology laboratory receives any clinical specimen, including **swab, feces, urine, blood, sputum, cerebrospinal fluid, synovial fluid or infected tissue**.

- The work mainly concerned with **culture** is to look for **suspected pathogens**.
- To determine whether the pathogen is sensitive or resistant to a suggested medicine, **sensitivity testing**



is carried out. Thereafter, results are reported with the identified organism(s) and the type of drug(s) that should be prescribed for the patient.

- Routine immunological tests like ELISA for HIV, HBV, HCV, etc.

Clinical microbiology has different units including **bacteriology, virology, parasitology, immunology, mycology**, etc.

3. Pathology Lab

Pathology mainly includes **histopathology, cytology, hematology** and **serology**.

- a. **Histopathology processes biopsies** (solid tissues removed from the body) for evaluation at the microscopic level.
- b. In **cytopathology**, **smears of cells** from all over the body, such as cervix, are examined for the evidence of inflammation, cancer or any other condition.
- c. **Hematology** works with whole blood, to do full **blood counts** and blood films as well as many other specialized immunohematological tests. It also includes **coagulation studies**, such as clotting time and the study of coagulation factors.
- d. **Serology** includes the concept of antigen–antibody interaction as a diagnostic tool. It is also used for compatibility of the transplanted organ.

4. Blood Bank

- This section **determines blood groups** and performs **compatibility testing** on blood donors and recipients.
- Prepares **blood components**, derivatives and products for transfusion.
- Determines patient's blood type and **Rh status**.

MEDICAL LABORATORY TECHNOLOGY

Medical laboratory technology, also called **clinical laboratory science**, is an **allied health profession**, which is concerned with the **diagnosis, treatment and prevention of diseases** through the **use of clinical laboratory tests**. The tests help the physicians to detect, diagnose and treat a disease.

MEDICAL LABORATORY TECHNOLOGIST

Medical laboratory technologist (also referred to as **medical laboratory scientist, clinical laboratory scientist** or **clinical laboratory technologist**) is a healthcare professional, who performs various laboratory tests, by analysing body fluids and tissues,

blood typing, microorganism screening, chemical analysis, cell counts of human body, etc. Thus, they play an important role in collecting the samples, and testing, reporting, quality control and documentation of the various laboratory investigations.

They may work in any area of the medical laboratory, e.g. blood bank, clinical chemistry (chemical analysis of body fluids), hematology, immunology (study of immune system), microbiology (study of bacteria and other disease organisms), etc. They may also work in the areas of cytotechnology (study of human tissue), phlebotomy (collection of blood sample), urine analysis, coagulation studies, parasitology or serology.

Role of Medical Laboratory Technologist

As we know, this is the era of evidence-based medicine (EBM), nearly 60 to 70% of all decisions regarding patient's diagnosis and treatment, and hospital admission and discharge, are based on laboratory test results, thus, medical laboratory technologists play an important role in finding out the cause of the disease, by providing the physician with the required laboratory test results and help the patient to get well soon.

Role of a medical laboratory technologist includes:

1. **Setting up of laboratory equipment:** Usually, their day begins with the setting up of and adjusting the laboratory equipment, including its cleaning, maintenance, sterilization, etc.
2. **Collection of patient's sample:** Throughout the day, their task includes sample collection, and receiving the blood, tissue, urine and other body fluid samples from patients, for which they should ensure proper collection methods and maintain a proper record of collection.
3. **Preparation of the sample:** They are required to handle the specimen carefully and to prepare the sample for all types of tests, and examine them for various chemical constituents (analytes), cells or bacteria. They may also be required **to prepare tissues for microscopic examination** by the pathologist.
4. **Analysis:** They are required to analyze blood sample accurately, for its chemical constituents, perform blood counts and cross match blood samples for transfusion. For the purpose, they should work with appropriate safety precautions. Urgent samples, referred to as STAT, should be given preference.
5. **Reporting of the test results:** It is necessary to keep all reports ready in time, keeping in mind the turnaround time (TAT) of the laboratory.



6. **Quality control:** They are also required to perform equipment validation and calibration, and follow quality control procedures, which help to control different types of errors, viz. preanalytical, analytical and postanalytical errors, in the clinical laboratory.
7. **Supplies:** They are also supposed to keep the reagent bottles, pipettes and other laboratory requirements at the appropriate place after use.
8. **Standardization: Standardize and modify procedures** to ensure accuracy of the test.
9. **Research: Help scientists in research.**

Ethics

Medical laboratory technologists perform various laboratory tests that are crucial for accurate diagnosis and treatment. Thus, maintaining a strong work ethics is necessary to assure the patient and the treating physician that the test results are accurate and reliable. Thus, a medical laboratory technologist should be:

1. **Respectful:** Medical laboratory technologist should value and protect welfare and dignity of all the individuals. They should be respectful, accessible and cooperative with the patients, colleagues and other healthcare professionals, to provide effective patient care.
2. **Maintain patient's dignity:** They must respect dignity and independence of the patient, at all times. Race, religion, occupation, gender and lifestyle must never, negatively, impact professional conduct.
3. **Patient's privacy:** Another important aspect of the ethical behavior is protecting patient's privacy. Since they have access to the sensitive information, they must preserve patient's confidentiality, which otherwise could potentially damage the patient's personal and professional life.
4. **Maintain state-of-the-art skill:** Since technology continuously creates new laboratory testing protocols and equipments, the technologist must accept the fact that lifelong learning is concomitant for pursuing the profession.
5. **Recognise competence of others:** They must recognise competence of others and seek their assistance, as and when required. They should also collaborate with other health professionals in the care of the patient, and functioning and improvement of health services.
6. **Share knowledge:** They must share their knowledge with the colleagues, students and other healthcare providers.

7. **Follow safety procedures:** They should promote a culture of safety. They must compliance with current regulations for protection of patients, colleagues, healthcare providers, society, environment and themselves with the intention of minimizing the risk.

Responsibilities

1. Every medical laboratory technologist must maintain **high moral and professional standard** of behavior. Truth must always be told, because a wrong result may lead to patient's death. The laboratory worker **should not offer personal excuses** for shortcomings in the performance of duty. An error should promptly be reported to the superior without fear, so that it can be corrected timely.
2. It is also necessary to **keep all the reports ready in time**, particularly, the urgent ones.
3. In the course of laboratory testing, laboratory technologist gains information about patient and the illness. They must keep this information **strictly confidential**. Only the physician, who requested the examination, should receive the **patient's report**.
4. The laboratory technologist should **look after all the equipment** carefully and use correct amount of the reagent or the sample, needed for each test.
5. It is necessary to keep the kits, reagent bottles, glassware and other **laboratory requirements at the appropriate place**, after use.
6. At the end of the day, they must keep the laboratory and all equipment, in preparation for the next day.
7. They must perform equipment's **validation and calibration**, maintain **quality control**, STAT or run-by-run assessment, statistical control of the observed data and record normal operations.
8. Some **samples may need to be stored** under controlled conditions for future use, accordingly, these samples should be stored with caution.
9. While working with infectious patients and samples, or hazardous chemicals, **safety precautions** must be taken, to avoid infection or injury.
10. The workplace must be clean, sanitized and well lit.
11. They must wear protective clothing, including lab coats, masks, goggles and gloves, particularly, when handling infected specimen.
12. When working in shifts, they must be ready for call in case of emergency.



Important Questions

1. Discuss role of a medical laboratory technologist.
2. Write notes on:
 - i. Medical laboratory technologist
 - ii. Responsibilities of a medical laboratory technologist