Introduction:

Clinical laboratory :

A **medical laboratory** or **clinical laboratory** is a laboratory where tests are usually done on clinical specimens in order to obtain information about the health of a patient as pertaining to the diagnosis, treatment, and prevention of disease.

TYPES OF CLINICAL LABORATORIES

Clinical laboratories can be placed into two groups: hospital laboratories and nonhospital laboratories. Although most people think of hospitals when they think of clinical laboratories, laboratories can also be in clinics, group practices, physician offices, nursing homes, veterinary offices, government agencies, industry settings, and military installations. Some clinical laboratories, such as regional reference laboratories, are independent from medical facilities that provide direct patient care.

1-Hospital Laboratories

Clinical laboratories are found in private hospitals, university teaching hospitals, and government-operated institutions such as military hospitals and veterans' hospitals. The clinical laboratory is one of many hospital departments. The level of services available from a hospital laboratory is usually determined by the size of the hospital. A laboratory in a small hospital (fewer than 100 beds) performs primarily routine test procedures; complicated or infrequently requested tests are sent to reference laboratories.

2-Nonhospital Clinical Laboratories

Nonhospital clinical laboratories can be publicly (government) or privately operated. They provide a variety of services and employment for many skilled workers. It found in types as following :

-Physician Office Laboratories

Physician office laboratories (POLs) are laboratories in a physician's office or physicians' group practice. The increased availability of rapid-test kits and small, easy-to-operate analyzers has broadened the scope of testing in the POL. Several laboratory tests, such as hemoglobin, hematocrit, urine reagent strip, urine pregnancy test, blood glucose, and occult blood, are classified as **waived tests** and can be performed in the POL by multiskilled personnel such as medical assistants. waived tests are simple laboratory tests and procedures that "have an insignificant risk of an erroneous result." The **Food and Drug Administration (FDA)** determines which tests meet the criteria of being simple and with low risk for error. The FDA currently lists over 100 analytes for which waived tests are available.

-Reference Laboratories

Reference laboratories are usually privately owned, regional laboratories that do high-volume testing and offer a wide variety of tests. Large hospitals use reference laboratories primarily to perform complex or infrequently ordered tests. Small hospitals or physicians' offices use their services for a wide range of tests. Reference laboratories provide courier service to transport specimens from the collection site to the testing laboratory.

Departments of the Clinical Laboratory

The number of departments in clinical laboratories varies. Clinical chemistry, hematology, microbiology, blood bank, and support services (phlebotomy and specimen processing) usually operate as departments or sections, each with its own department head or general supervisor. The subdivisions within each department differ from one laboratory to another. Large laboratories often have separate departments for urinalysis, coagulation, immunology, and parasitology.

Hematology

Most **hematology** tests involve studying the cellular components of blood. Hematology procedures can be qualitative or quantitative. The *quantitative* procedures include counts of the various blood components, such as the number of leukocytes (white blood cells), erythrocytes (red blood cells), or platelets; hemoglobin and hematocrit tests are commonly performed and can aid indiagnosis of anemia. These tests can be performed manually but are usually performed on a cell counter or hematology analyzer. Many analyzers are capable of performing several hematological procedures simultaneously. In *qualitative* procedures, blood components are observed for qualities such as cell size, shape, and maturity. Using a microscope, a laboratory worker can view a blood smear to determine the types of leukocytes present; estimate the size, shape, and hemoglobin content of erythrocytes; or estimate the number of platelets. Cell abnormalities, including immature leukocytes or erythrocytes, are noted during microscopic examination of the blood smear. In large laboratories, complicated tests such as special stains to classify leukemic cells might be performed in a hematology section called *special hematology*. Some tests in special hematology are performed manually.

Clinical Chemistry

In the **clinical chemistry** department, test procedures can be performed on plasma, serum, urine, and other body fluids such as spinal fluid and joint fluid. **Serum** is the liquid part of blood remaining after a clot has formed. Serum is obtained by collecting blood without anticoagulant, allowing it to clot, and centrifuging it to separate blood cells from the serum. Many chemistry analyzers can perform assays using plasma; this eliminates the time delay required for blood to clot if serum is used. Clinical chemistry is the largest department in most laboratories. Procedures performed in the clinical chemistry department include blood glucose, cholesterol, assays of heart and liver enzymes, and electrolytes (chloride, bicarbonate, potassium, and sodium). Common

subdepartments in clinical chemistry are *special chemistry* and *toxicology*. Procedures such as electrophoresis and measurement of hormone levels are performed in special chemistry. In toxicology, blood or urine can be analyzed to determine the drug involved in an overdose or blood levels of prescribed drugs. The types of chemistry analyzers have increased rapidly in the last several years (see Lessons 6-3 and 6-4). Many of these analyzers provide a wide range of test procedures yet are relatively simple to operate. Thus, it is possible for even the smallest laboratory to perform some routine chemistry tests.

Immunology

Immunology can be a separate department or, in small laboratories, a part of another department such as blood bank or microbiology. In the past, this department was called **serology** because serum was the specimen most often used in the tests. In the immunology department, many tests are based on antigen-antibody methods. Among tests performed in this section are those for pregnancy, arthritis, and autoimmune diseases. Tests for infectious mononucleosis, HIV infection, influenza, hepatitis, sexually transmitted diseases, and other infectious diseases are also performed using immunological methods.

Blood Bank/Transfusion Services

The **blood bank** department is also called **immunohematology** or transfusion services. Procedures performed in this department are critical to patient well-being. If a transfusion is required, the patient's ABO group and Rh type are determined by blood bank technologists. Before blood is transfused, stored components of donor blood are tested for compatibility with patient blood. The blood bank department might also have the capability to collect special blood donations or process donated blood into specialized components. The blood bank is the only area of the clinical laboratory for which there are no waived tests.

Microbiology

The **microbiology** department is responsible for culturing and identifying microorganisms.

-Bacteriology. Bacteriology procedures make up the majority of the work in microbiology. Bacteria can be isolated from specimens such as sputum, wounds, blood, urine, or other body fluids by inoculating the specimen to culture media. Organisms that grow in the culture are identified, and susceptibility tests are performed to determine the most effective antibiotic treatment. This is done by exposing the bacterial culture to different antibiotics and observing their effect on the organism's growth. Automated systems that can detect growth of an organism, identify an organism, and determine its antibiotic susceptibility are widely used in bacteriology.

-Virology and Mycology.

Procedures involving **virology**, the study of viruses, and **mycology**, the study of fungi, are usually performed in the microbiology department. Often specimens for virology and mycology are sent to a **reference laboratory** for culture and identification. Because cultures of pathogenic fungi as well as mycobacteria must be handled with special care, specimens suspected of containing these organisms are usually inoculated to media and then sent to a reference laboratory for identification.

-Parasitology. In parasitology, usually a part of the microbiology department, patient specimens are examined for parasites. Fecal samples are examined microscopically for evidence of intestinal parasites such as intestinal ameba, tapeworms, or hookworms. Immunological tests are performed to detect parasite antigens in fecal samples. Tests for blood parasites, such as the malarial parasite, are usually performed in the hematology department..

Histopathology

processes solid tissue removed from the body (biopsies) for evaluation at the microscopic level.

Cytopathology

examines smears of cells from all over the body (such as from the cervix) for evidence of inflammation, cancer, and other conditions.

Electron microscopy

prepares specimens and takes micrographs of very fine details by means of TEM and SEM.

Cytogenetics

involves using blood and other cells to get a karyotype. This can be helpful in prenatal diagnosis (e.g. Down's syndrome) as well as in cancer (some cancers have abnormal chromosomes).