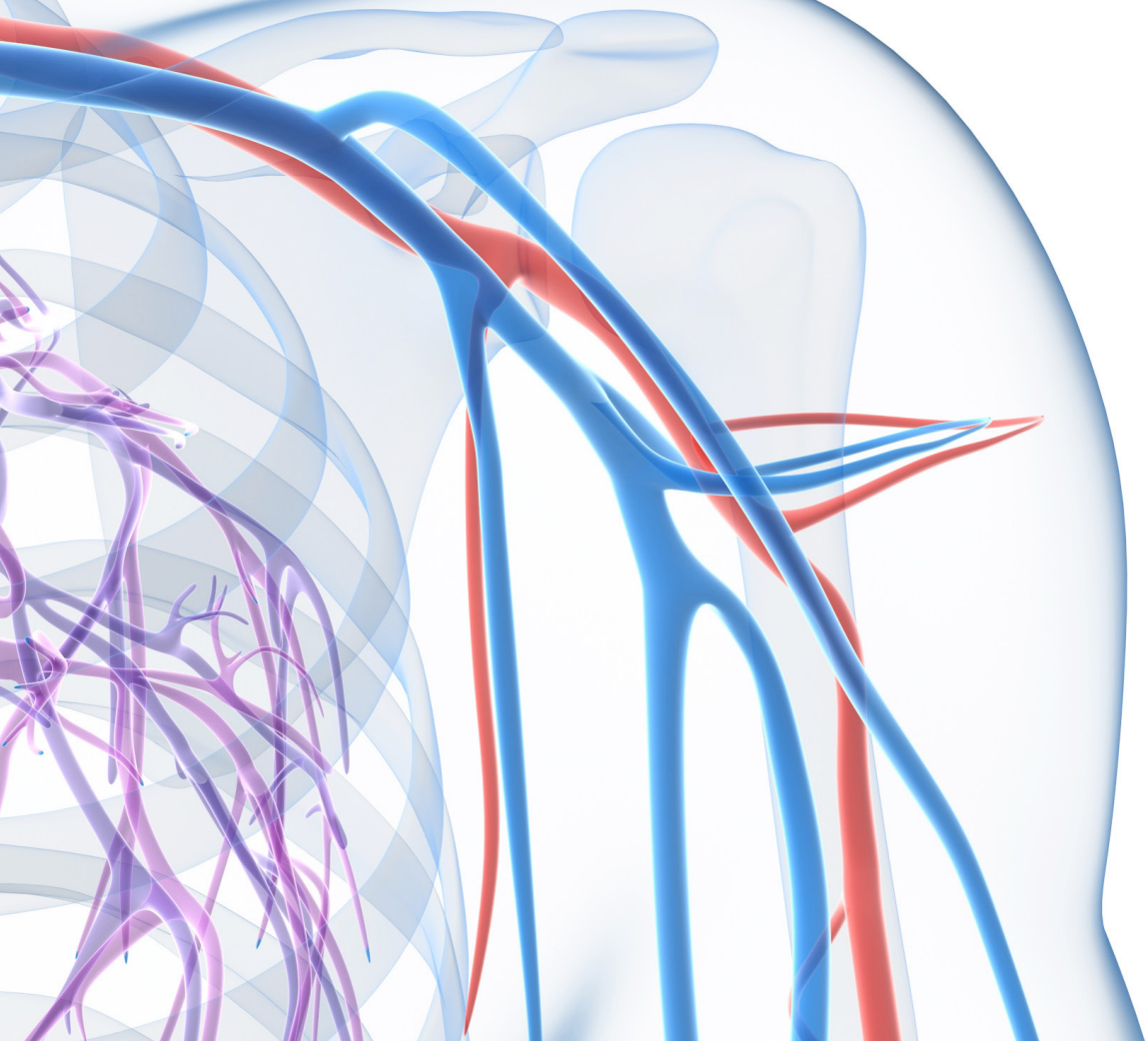
Introduction to Anatomy & Physiology and Pathology

A Course Companion



MedCerts™

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Module 2 Introduction to Anatomy & Physiology and Pathology

2.1 Module Outline

Anatomy & Physiology are the foundation of the Health Sciences. Students not only need to know and understand the structure and function of the whole body, but also have knowledge of its parts down to the cellular level and below. This is fundamental in understanding how disease processes and injuries affect the body. We need this knowledge to further understand how health professionals diagnose and treat diseases and injuries.

- **Module Objectives**
- **Key Vocabulary**
- **Abbreviations, Acronyms, and Symbols**
- **Introduction to Anatomy & Physiology**
  - Principle of Complementarity
  - Standard Anatomical Position
  - Body Planes
  - Directional Terms
  - Regional Terms
- **Introduction to Pathology**
  - Disease
    - Structural Diseases
    - Functional Diseases
    - Causes of Disease
  - Diagnostics
    - Screening
    - Diagnostic Tests and Procedures
  - Treatment
    - Types of Therapy
    - Pharmacology

2.2 Module Objectives

Upon completion of this module, you will be able to:

- Recognize, spell, and build words related to Anatomy & Physiology and Pathology.
- Define Anatomy & Physiology and related subdivisions and describe their importance for the medical field.
- Define Pathology and related subdivisions and describe what pathologists do.
- Define disease and distinguish between symptomatic, asymptomatic, and potential disease.
- Name strategies and procedures to diagnose and treat diseases.
- Demonstrate your understanding of the content of this module by completing the Test Your Knowledge section at the end of the module.

2.3 Key Vocabulary

This section introduces major definitions, combining forms, suffixes, and prefixes related to Anatomy & Physiology and Pathology. For a more complete list, check Commonly Used Adjectives, Prefixes, and Suffixes in the Appendix.

Table 2.1 Overview of Major Definitions and Combining Forms

Term	Definition
Anatomy	The study of the structure of the body and its parts.
Physiology	The study of the function of the whole body or its systems or organs.
Pathology	The study of disease.

Pathophysiology	The study of functional changes associated with disease and injury.
Etiology	The study of the origins and causes of diseases.
Manifestation	Obvious evidence or display of characteristic signs and symptoms of an illness or disorder; specific evidence that a disease is present.
Disease	Harmful structural or functional change to the whole body or part(s) of it.
Syndrome	Set of signs and symptoms occurring together as part of a specific disease.
Diagnosis	The act of identifying a disease or injury.
Symptom	Changes perceived by the patient; for example, pain or diarrhea.
Sign	Changes observed by a person examining a patient; for example, swelling or fever.
Screening	Testing for asymptomatic or potential diseases or injuries.
Pharmacology	The study of sources, properties, and uses of drugs.
Drug	A substance used to diagnose, treat, or prevent disease or injury.

Combining Form(s)	Meaning	Example(s)
alg(o)-, alge-, algesi(o)-, algi(o)-, -algesia, -algia	Pain	*Neuralgia* = pain along a nerve or its innervation area
carcin(o)-	Cancer	*Carcinogen* = cancer causing agent
dys-	Bad, disordered, painful	*Dyspnea* = difficult or labored breathing
ech(o)-	Sound	*Echocardiography* = ultrasound examination of the heart
-ectomy	Surgical removal, excision, cutting out	*Appendectomy* = surgical removal of the appendix
electr(o)-	Electricity	*Electromyography* = recording of the electrical activity of muscles
end(o)-	Inside	*Endogenous* = growing or originating from inside the body
ex(o)-	Outside	*Exogenous* = originating from outside the body
-gram	Picture, recording	*Myogram* = recording of a muscle contraction
-graph	Picture, recording or instrument for recording	*Cardiograph* = instrument for recording heart muscle activity
-graphy	Recording or the process of producing a picture/recording	*Electrocardiography* = recording of the electric activity of heart muscle cells
-iasis	Abnormal condition or disease	*Psoriasis* = abnormal skin condition with thick, silvery scales
-ism	Condition or state of	*Hirsutism* = a condition with excessive hair growth in women
-lithiasis	The presence of stones	*Nephrolithiasis* = the presence kidney stones
-logist, -ologist	A specialist or person who studies a certain subject	*Cardiologist* = specialist for the diagnosis and treatment of heart diseases
-logy, -ology	Study of	*Histology* = the study of tissues
mal-	Bad, poor or evil	*Malabsorption* = deficient absorption (intake) of food in the small intestine
-malacia	Abnormal softening	*Osteomalacia* = softening of bone tissue

Combining Form(s)	Meaning	Example(s)
ne(o)-	New	*Neoplasia* = new, abnormal tissue growth

-necrosis	Tissue death	*Osteonecrosis* = death of bone tissue
nos(o)-	Disease	*Nosology* = systematic classification of diseases
-oma	Tumor, neoplasm	*Melanoma* = black skin cancer
-osis	Disease or abnormal condition	*Hyperostosis* = excessive growth of bone tissue
-ostomy, -stomy	creation of an opening or the opening created	*Colostomy* = creation of an opening in the abdominal wall into colon
-otomy, -tomy	Cutting or a surgical incision	*Colotomy = surgical incision of the colon*
-pathy	Disease, feeling, emotion	*Discopathy* =disease on an intervertebral disc
-plasia	Development, growth, formation	*Hyperplasia* = Enlargement of an organ or tissue
-plasty	Surgical repair	*Rhinoplasty* = plastic surgery on the nose
pur(o)-, py(o)-	Pus	*Purulent* = containing or consisting of pus
pyr(o)-, pyret(o)-	Fever	*Pyretic* = feverish
-rrhagia	Bleeding or abnormal/excessive fluid discharge	*Menorrhagia* = abnormally heavy menstrual bleeding
-rrhea	Flow, discharge	*Diarrhea* = increased frequency of bowel movement with liquid stools
-sclerosis	Abnormal hardening	*Arteriosclerosis* = hardening of the arteries
-scope	Instrument for visual examination	*Ophthalmoscope* = instrument for studying the interior of the eyeball through the pupil
-scopy	Visual examination	*Arthroscopy* = visual examination of a joint with an arthroscope

2.4 Abbreviations, Acronyms, and Symbols

Table 2.2 lists a limited number of abbreviations, acronyms, and symbols. For more see the list of Acronyms, Abbreviations, and Symbols in the Appendix.

Table 2.2 Abbreviations, Acronyms, and Symbols

A	anterior
Abd, Abdo	abdomen
anat	anatomy
BP	blood pressure
bpm	beats per minute
CA, ca	cancer
CBC	complete blood count
CC	chief complaint
CD	communicable disease
CT	computed tomography
CVA	cerebrovascular accident (stroke)
cyt	1. cytology 2. cytoplasm
D	dorsal
DX	diagnosis

ECG, EKG	electrocardiogram
EEG	electroencephalogram
epidem	epidemic
FHx	family history
GERD	gastroesophageal reflux disease
GI	gastrointestinal
GU	genitourinary
GYN	gynecology
H&P	history and physical
HPI	history of present illness
Hx	history
MAR	medication administration record
MRI	Magnetic resonance imaging
P	1. physiology 2. posterior
PE	physical exam
PFSH	personal, family, social history
PMH	past medical history
ROS	review of systems
Rx	prescription
Tx	treatment
U/A	urinalysis
U/S	ultrasound
V, vent, ventr	ventral
WBC	white blood count

2.5 Introduction to Anatomy & Physiology

Anatomy is the study of the structure of the body or its parts. The term derives from *ana-* (apart) and *–tomy* (cutting), which reflects how early anatomists studied the body: they cut dead bodies into pieces and then named and described those pieces. In the early days anatomy was restricted to the study of structures that could be seen with the unaided eye (**gross** or **macroscopic anatomy**). Once the microscope was invented at the end of the 16th century, scientists were also able to study smaller structures, and **microscopic anatomy** was born.

There are many **subdivisions of anatomy**. The most important for our purpose are:

- **Surface anatomy** studies the surface of the body as well as structures that are visible underneath the surface, such as the kneecaps.
- **Systemic anatomy** subdivides the body into systems, such as the cardiovascular system (**cardiovascular anatomy**).
- **Regional anatomy** describes the different structures in a certain region, such as the shoulder or hip.
- **Developmental anatomy** looks at how our body evolved and developed over time or during our time from conception to birth (**embryology**).
- **Cytology** is the study of cells; **histology** is the study of tissues (see **Module 3 Cells – The Foundation of Life**).

The principal tool for the study of anatomy is mastery of anatomical terminology. Anatomy is a purely descriptive science and without knowledge and understanding of its language, students will struggle to succeed.

Physiology is the study of the function of the whole body or its systems and organs on many levels. Physiology explains the what, where, when, why, and how of things happening in our body. Anatomy describes the structure of the kidney; physiology teaches us how the kidney produces urine and that this process depends on our actual physical needs.

The term physiology is derived from *physi(o)-* (nature, physical) and *–ology* (science or study of). It is subdivided into the physiology of organs (for example **renal physiology**) and systems (for example **cardiovascular physiology**). **Essential**

tools for the study of physiology are an ability to focus on different levels (from systemic to cellular and molecular) and knowledge of basic principles of biology, physics, and chemistry.

2.5.1 Principle of Complementarity

The Principle of Complementarity states that a) anatomy and physiology are inseparable, b) structure reflects function, and c) what a structure can do depends on its specific form.

For example, if the structure (anatomy) of a bone is changed by a fracture, then the function of the bone (physiology) is also changed – the patient may not be able to walk because the shinbone is broken. Bones are made of an exceptionally strong tissue (anatomy), because they must withstand powerful mechanical forces (physiology). The shoulder joint has a greater range of motion (physiology) than the elbow joint because of its different structure (anatomy).

2.5.2 Standard Anatomical Position

The standard anatomical position describes the body in a standing upright position with the hands turned out so that the palms are facing forward. Anatomists and clinicians use this standard position to describe the location of organs or body parts to each other (see **Directional Terms** below).

2.5.3 Body Planes

Body planes are flat surfaces along which the body or a structure is cut for anatomical or pathological study. Any diagonal cut, regardless of the plane it lies in, produces an **oblique section**.

Table 2.3 Body Planes

Body Plane	Description
Coronal or **frontal**	Divides the body into anterior and posterior portions.
Transverse or **horizontal**	Divides the body into superior (upper) and inferior (lower) portions
Sagittal	Divides the body into left and right portions.
Midsagittal	Divides the body into *equal* left and right halves.
Parasagittal	Divides the body into *unequal* left and right halves.

Figure 2.1 Standard anatomical position (left) and body planes (right)

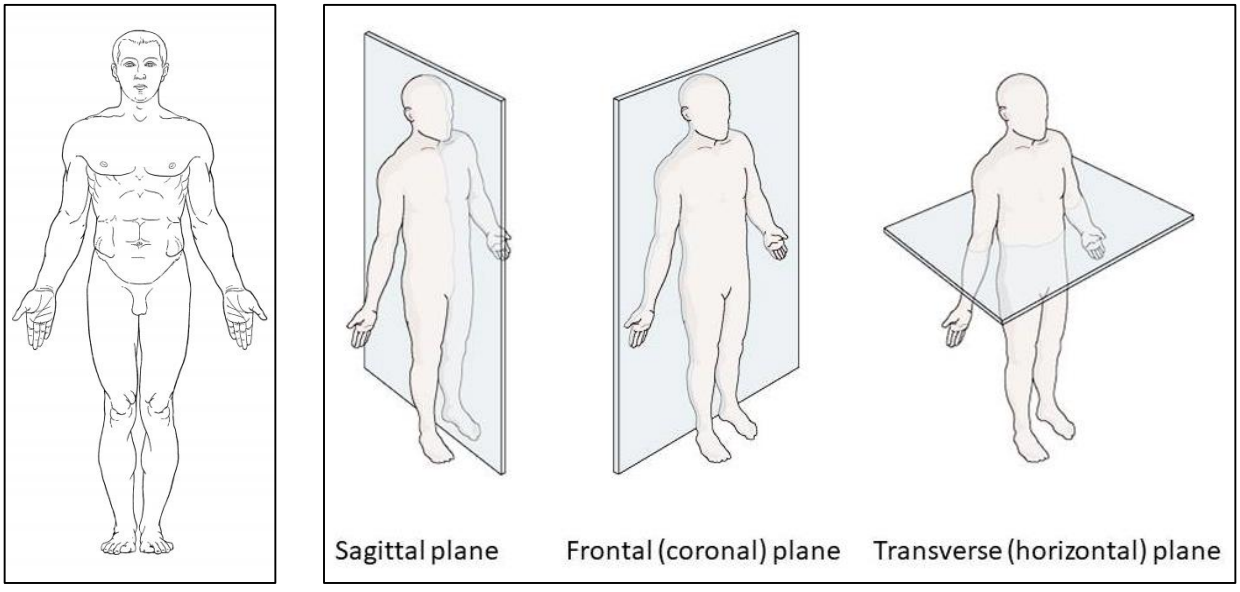
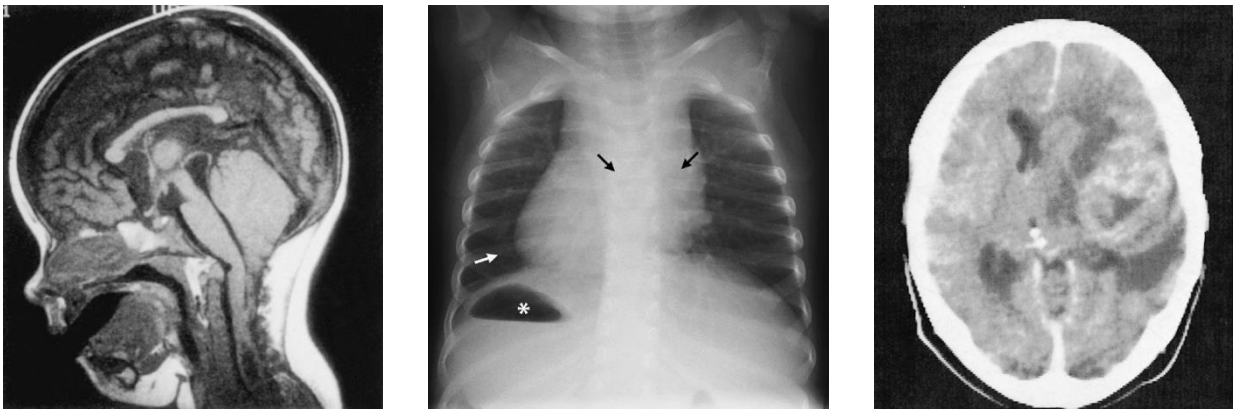


Figure 2.2 Sagittal plane (MRI, head), frontal plane (X-ray, chest), and transverse plane (CT, brain)



2.5.4 Directional Terms

Directional terms describe the location of a structure in relation to other structures or locations. To remove uncertainty, directional terms are always based on the standard anatomical position. For example, the bladder is located lower than the kidney in a standing person, which is why we say "the bladder is inferior to the kidney." However, in a patient lying flat on his/her back the kidneys are closer to the ground than the bladder. If we didn't use the standard anatomical position we would have to say that the "kidneys are inferior to the bladder." Using this system helps healthcare workers to communicate properly.

Table 2.3 gives examples of directional terms. For more terms see list of Commonly Used Adjectives, Prefixes, and Suffixes in the Appendix.

Table 2.3 Examples of Directional Terms

Directional Term	Definition
anterior	Closer to the front of the body
cranial	Toward the head
contralateral	On opposite sides of the body
deep	Farther away from the surface of the body
distal	Farther away from the body's core
dorsal	Toward the back of the body
inferior	Below, lower
ipsilateral	On the same side of the body
lateral	Away from the midline of the body
medial	Toward the midline of the body
posterior	Closer to the back of the body
proximal	Nearer/closer to the body's core
superficial	Close(r) to the surface
superior	Above, higher
ventral	Toward or at to the front of the body

2.5.5 Regional Terms

Regional terms designate specific areas, i.e., they are adjectives relating to a defined structure(s) or area(s). Please note that some terms, such as "cranial" or "dorsal", can be used as either regional or directional terms.

Table 2.4 gives examples of regional terms. For more terms see list of Commonly Used Adjectives, Prefixes, and Suffixes in the Appendix.

Table 2.4 Examples of Regional Terms

Regional Term	Definition
abdominal	Relating to the abdomen

brachial	Relating to the arm
cardiovascular	Relating to the heart and circulation or blood vessels
cervical	Relating to a neck or cervix
cranial	Relating to the skull (cranium)
dorsal	Relating to the back (dorsum)
femoral	Relating to the femur
humeral	Relating to the upper arm or humerus
lumbar	Relating to the loins
malleolar	Relating to ankle/malleolus or ankle region
nasal	Relating to the nose
pelvic	Relating to the pelvis
radial	Relating to the radius
spinal	Relating to the spine or the spinal cord
tracheobronchial	Relating to the trachea and the bronchi
vertebral	Relating to a vertebra

2.6 Introduction to Pathology

The word pathology has two meanings. Its basic meaning is study of disease (*path(o)-* disease; *-ology* study or science of), but the term is also applied to the field of medicine that focuses on the diagnosis of diseases. Pathology includes the study of structural and functional changes associated with or leading to disease and their clinical manifestations. **Etiology** (*eti(o)-* cause; *-ology* study or science of) is the study of the origins and causes of diseases. **Pathophysiology** (*path(o)-* disease; *physi(o)-* nature, physical; *-ology* study or science of) is the study of functional changes associated with disease and injury.

Pathologists can be subdivided into:

- **Experimental pathologists**, who focus on research and conduct experiments.
- **Anatomical pathologists**, who perform autopsies and examine tissues removed during procedures (**surgical pathology**) and cell preparations (**cytopathology**).
- **Clinical pathologists**, who usually practice laboratory medicine and analyze blood, urine, feces, spinal fluid, saliva, sweat and other specimens removed from patients.
- **Academic pathologists**, who engage in all three areas and in the teaching of pathology for students in the health professions.

2.6.1 Disease

Disease can be defined as **a harmful structural or functional change** that is not caused by a physical injury. It can affect part (**localized disease**) or all of the body (**generalized disease**) and occur suddenly (**acute disease**) or take a prolonged course (**chronic disease**). **Symptoms** are changes perceived by the patient; they are subjective and sometimes cannot be verified by the observer, such as pain. **Signs** are physical changes recorded during an examination of a patient, such as swelling or wheezing. Both signs and symptoms may be unspecific and may not be an indication of a pathologic process. For example, redness of the skin can be a sign of an allergic reaction; yet, it can also be caused by excitement. However, if the signs and symptoms are characteristic for a specific disease, we consider them **manifestations** of the disease.

A **syndrome** is a set of signs and symptoms occurring together as part of a specific disease. Sometimes the terms “disease,” “illness,” and “syndrome” are used as synonyms.

Because injuries can cause many of the same signs and symptoms of diseases and require similar treatment, we will include injuries in our discussion of structural diseases as well as of causes, diagnosis, and therapy of structural diseases.

Even more useful from a clinical point is the following classification of diseases:

- **Symptomatic diseases** are usually diagnosed when the patient seeks out a health professional because of perceived symptoms or not feeling well, maybe feeling unusually tired or unable to sleep.
- **Asymptomatic diseases**, such as high blood pressure, may be diseases that usually aren’t accompanied by physical signs and symptoms, or diseases that develop visible/perceivable signs late in the disease progress.

- **Potential diseases** can develop due to a genetic disposition or due to a buildup of risk factors. **Preventive medicine** is the discipline trying to find ways to stop people from developing potential diseases. Vaccinations, for example, against measles, mumps, and rubella (MMR), or teeth brushing and cleaning are preventive strategies.

2.6.1.1 Structural Diseases

As the name already implies, **structural** or **organic diseases** are defined by structural changes to organs or tissues, which are called **lesions**. These lesions may be visible (e.g., decubitus ulcer) or invisible to the unaided eye. If the damage leads to tissue death, it is called **necrosis**.

There are three major categories of structural diseases:

1. **Genetic and developmental diseases**, such as congenital heart defects. Some genetic disorders may not be apparent at birth, but develop later in life (e.g., symptoms of Huntington's disease usually start between 30 and 50 years of age).
2. **Hyperplasia and neoplasms** are both caused by an abnormal growth of tissues. Neoplasms are divided into benign and malignant neoplasms, which are usually called **cancers** (see also **Module 3 Cells – The Foundation of Life**).
3. **Injuries and inflammatory diseases** are caused by external (physical and chemical agents, microbes) and internal factors (lack of oxygen and nutrient supply). Inflammation is a uniform response of the body that attempts to contain and localize damage and to start the healing/repair process (see also **Module 12 Blood & Immune System**). But, it can also cause signs and symptoms of disease (for example, swelling and pain), damage organs, and lead to death.

2.6.1.2 Functional Diseases

In contrast to structural diseases, functional diseases have no apparent lesions, although lesions may develop later on and the disease then becomes a structural disease. For example, a migraine is considered a functional disease; however, if the cause turns out to be a brain tumor it is a structural disease.

Many diseases of the internal organs and systems are functional diseases, such as diabetes mellitus type I and II and high blood pressure (hypertension). However, these diseases often develop structural lesions over time. For example a diabetic foot indicates that a classification of diseases from simply a functional and structural disease standpoint may be too simplistic.

2.6.1.3 Causes of Disease

Disease causing agents that act from the outside are called exogenous (*exo-* outside, out of; *-genous* producing). Microbial agents that can cause disease, such as bacteria and viruses, are called **pathogens** (*path(o)-* disease; *-gen* producing, forming). Direct physical injury is called **trauma**. It can, for example, be caused by force, heat, cold, electricity, chemicals, pressure, and radiation.

Table 2.5 Exogenous Causes of Disease

Physical causes	Force, heat, cold, electricity, pressure, radiation
Chemical causes	Chemicals (acids, bases), poison, drug reactions
Microbiologic causes (pathogens)	Bacteria, fungi, viruses, parasites (protozoa, worms)

Endogenous (*endo-* inside; *-genous* producing) **causes** can arise from within the body (e.g., genetic disorders) or as a reaction to outside factors (e.g., arteriosclerosis due to being overweight and physically inactive). Just like we saw in the discussion of structural vs. functional diseases, dividing the causes of disease into exogenous and endogenous is often too simplistic, but works on a basic level.

Table 2.6 Endogenous Causes of Disease

Vascular causes	Obstruction, bleeding, altered blood flow
Metabolic causes	Deficiency or abnormal metabolism of carbohydrates, lipids, proteins, minerals, vitamins, water
Immunologic causes	Acquired and congenital immune deficiency, allergy, autoimmune diseases

2.7 Diagnostics

Although a small number of diseases are diagnosed incidentally, the vast majority of diagnoses are made based on a structured workup that may take anywhere from a few minutes to several weeks. Injuries are usually easier to diagnose than internal diseases, but there are always exceptions to the rule. For example, a patient may not remember a fall if he/she was intoxicated at the time of the accident and there are no visible signs of an injury. But, the patient can still suffer from a ruptured spleen or a pierced lung.

In symptomatic diseases taking the **history** of the patient from either the patient or family/friends should always be the first step. A thorough **physical examination** may confirm some of the symptoms described and reveal further manifestations of the disease process. It is also important to rule out some potential diagnoses. Depending on the situation, these two steps may already be sufficient to diagnose the underlying cause and decide on a course of action. However, most of the time history and physical examination will have to be supplemented by diagnostic tests, such as bloodwork or x-rays.

2.7.1 Screening

The purpose of screening for asymptomatic and potential diseases is a) to identify people at risks for certain diseases (for example, pre-diabetic conditions), b) to catch diseases early to improve the chance of healing (for example, Pap smear for cervical cancer), and c) to diagnose asymptomatic diseases so they can be treated early to delay progression and associated damage (for example, high blood pressure).

Table 2.7 Examples of Screening Tests and Procedures

Test or Procedure	For Detection/Diagnosis of
A1C	Long-term control of diabetes treatment
Blood pressure control	High blood pressure
Chest X-rays	Lung cancer
Colonoscopy	Cancer of the colon and/or rectum
Complete blood count	Anemia, leukemia
Fecal occult blood test	Cancer of the colon and/or rectum
Mammography	Breast cancer
Oral glucose tolerance test	Diabetes
Pap smear	Cervical cancer
PSA test	Prostate cancer
Serum lipids (esp. cholesterol)	Hypercholesterolemia
Tuberculin skin test	Tuberculosis
Urinalysis	Bladder or kidney disease

2.7.2 Diagnostic Tests and Procedures

Most health professionals use the term **test** for analyses of specimens, such as blood or tissue sample. **Procedures** usually involve manipulation of the patient beyond a physical examination and may be performed to obtain samples for tests. Performing a gastroscopy and taking biopsies of suspected areas for closer examination by a pathologist would be an example of a **clinical procedure**. As mentioned above, **clinical pathology** or **laboratory medicine** analyzes blood, urine, feces, spinal fluid, saliva, sweat and other specimens removed from patients. Traditional subspecialties are clinical chemistry, hematology, microbiology, immunopathology, cytology and blood bank (transfusion medicine). Newer subspecialties, such as cytogenetics, molecular diagnostics, and proteomics, have not only increased the range of diagnostic tests available, but, also enabled health professionals to better classify the disease of individual patients and design a specific treatment plant (see targeted therapy below).

Originally **radiologic procedures** used high-energy radiation called x-rays to look into and through the body in search of changes and abnormality. Over time, the field of **imaging techniques** expanded and now includes **x-rays**, **computed tomography** (CT), **magnetic resonance imaging** (MRI), **ultrasound**, **positron emission tomography** (PET), and other applications based on **nuclear medicine** (for example, the use of radioactive iodine for thyroid diagnosis).

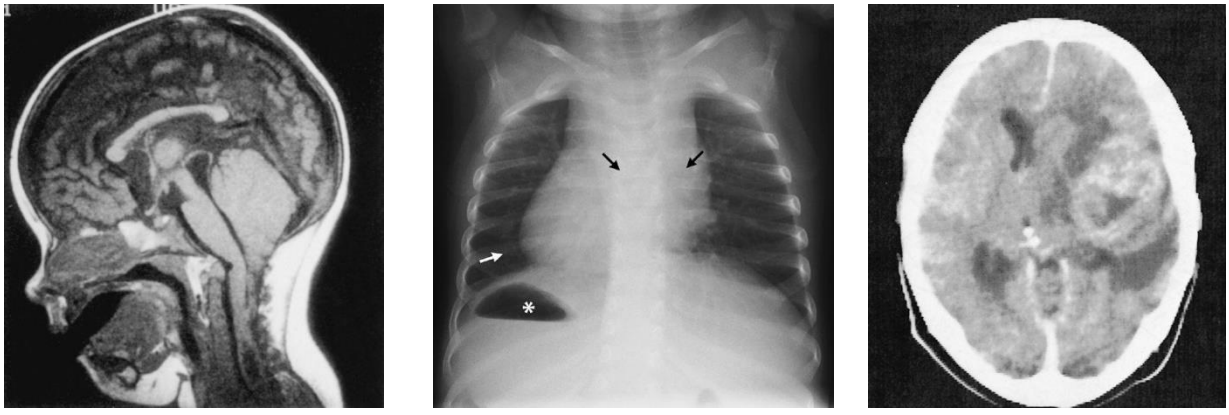
Some of these procedures, especially those that do not involve exposure to radiation, are also used to study the function of healthy tissues and organs. These imaging procedures help anatomists and physiologists, as well as clinicians, to better

understand how our body works, which changes of normal functions should be considered pathological and need treatment, and which ones can be left alone for the time being. Thanks to these new techniques we now know much more about the function of the brain, for example, than we could have ever learned from the study of tissues from dead bodies or samples taken during surgical procedures.

Table 2.8 Examples of Imaging Procedures

Test or Procedure	For Detection/Diagnosis of
Barium enema	Tumors, ulcers, or diverticula of the intestines
Chest X-rays	Lung cancer, acute and chronic inflammations, pneumothorax (air in the thorax cavity)
Computed tomography (CT)	Tumors, infarcts, blood clots, fractures, wear-and-tear of joints, acute inflammation (abscess)
Intravenous urogram	Obstruction of the urinary tract, impaired kidney function
Magnetic resonance imaging (MRI)	Tumors, infarcts, blood clots, fractures, abscesses, disk prolapse
Myelogram	Narrowing or obstruction of the space surrounding the spinal cord
Nuclear isotope scan	Tumors, altered tissue uptake of defined substances
Ultrasound	Gallstones, cysts, joint development in infants, impaired blood flow in arteries
Upper gastrointestinal series	Ulcers or tumors of the esophagus, stomach, and upper small intestine
X-rays	Damage or changes to tissues that contain minerals (bones, teeth), abnormal air accumulation

Figure 2.3 Head/brain MRI(left), chest x-ray (center), and brain CT (right)



Endoscopies involve the use of flexible or rigid tubes with a light source and an optic (**fiber-optic scopes**) that are inserted into a body cavity that is open to the outside through a preexisting passageway (for example, through the anus into the rectum and colon), or into a closed cavity, such as a joint cavity, after surgical incision. Most scopes are equipped with biopsy forceps to take a tissue sample. Doctors can also use such instruments to remove or repair structures, such as the gallbladder or the menisci of the knee joint.

In order to obtain images or video from areas too remote for endoscopy (for example, the lower parts of the small intestine), patients may be asked to swallow a tiny camera that takes picture or videos while it passes through in its way to the anus. The pictures/videos may be downloaded after recovery of the camera and be transmitted to a recording device in real time.

Table 2.9 Examples of Procedures Involving Fiber-optic Scopes

Test or Procedure	Structures Inspected
Arthroscopy	Joints
Bronchoscopy	Throat, larynx (voice box), trachea (windpipe), and lower airways
Colonoscopy	Colon and distal ileum (small intestine)
Cystoscopy	Bladder

Test or Procedure	Structures Inspected
Gastroscopy	Stomach
Laparoscopy	Organs inside the abdominopelvic cavity, such as ovaries, uterus, small and large intestine
Proctoscopy	Rectum and anal canal
Upper gastrointestinal endoscopy	Esophagus, stomach, and first part of duodenum

2.8 Treatment

The terms **treatment** and **therapy** are usually used interchangeably, although therapy refers more to the overall medical and nursing care given to a patient, whereas treatment refers to a specific physical or mental illness or injury. The goal of a therapy depends on many factors, such as the disease (acute vs. chronic disorder), the patient (young, healthy patient vs. older patient with other diseases), the overall situation (hospital care vs. roadside care after an accident), or socioeconomic factors (insured vs. uninsured patients).

Most of the time, patients expect or hope for a **curative therapy** that will cure the root cause of the disorder and lead to complete recovery without lasting effects. However, most of the time, complete cure is only possible for acute disease or injuries. Chronic or incurable disorders may force doctors to settle for stopping the disease from progressing any further (**abortive therapy**) or to increase the patient's comfort without treating or changing the underlying condition (**supportive therapy**).

Most treatments are still decided based on clinical, educated experience (**empiric therapy**), as with antibiotic therapy for a urinary tract infection, for example. However, empiric therapy has its limitations and short comings, and **evidence-based medicine**, which uses guidelines based on a thorough review of scientific literature, has become more common.

2.8.1 Types of Therapy

Preventive treatment strives to prevent illnesses from developing in the first place. Strategies include health education and vaccinations, as well as laws against driving under influence or the requirement to wear a seat belt. Preventive treatment also uses screening tests (see above) to diagnose asymptomatic or potential diseases.

For symptomatic diseases, different types of therapy can be distinguished by the level of care, the line of therapy, the intent of the therapy, the use of instruments or other devices (surgical vs. nonsurgical), and the use of drugs (pharmaceutical treatment), etc. Table 2.10 lists examples for different types of therapy.

Table 2.10 Examples for Types of Therapy

Therapy	Description
Abortive therapy	Therapy intended to stop the further progress of a disease.
Ambulatory care	Provides care on an outpatient basis. The term comes from the fact that patients are typically able to walk in on their own (are ambulatory).
Chemotherapy	Treatment of cancer using drugs that are destructive to malignant cells and tissues.
Combination therapy also called **polytherapy**	Use of multiple therapies or drugs at the same time, for example, combination chemotherapy.
Curative therapy	Therapy intended to cure the root cause of a disease.
Elective surgery	Surgery to correct a non-life-threatening condition.
Emergency care	Handles medical emergencies and is a point of first contact for less serious illnesses or injuries.
Exploratory surgery	Surgery to aid in or confirming a diagnosis.
First-line therapy, also called **induction therapy**, **primary therapy**, **front-line therapy**	The first therapy that will be tried based on experience (**empiric therapy**) or guideline (**evidence-based medicine**).
Intensive or **critical care**	Treats extremely ill (for example, heart attack) or injured patients (for example, burn injuries).

Therapy	Description
Pharmacotherapy	Treatment by means of drugs, such as antibiotics, pain killers, or anti-inflammatory drugs.
Plastic surgery	Surgery to reconstruct or repair parts after injury. Often used to refer to **cosmetic** or **aesthetic surgery** that aims to increase or restore the appearance of a body part.
Primary care	General care that includes referred providers from different medical fields.
Secondary care	Care provided by medical specialists and other health professionals who generally do not have first contact with patients.
Second-line therapy	Therapy used if first-line therapy fails or produces side effect.
Supportive therapy	Treatment that does not treat or improve the underlying condition, but is designed to increase the patient's comfort. May be used in benign situations, such as the common cold or viral diarrhea, but also in patients with incurable diseases, such as cancer (**palliative care**).
Surgery	Treatment that involves cutting of a patient's tissues or closing of an injured tissue/organ.
Tertiary care	Specialized care, usually provided to hospitalized patients.

2.8.2 Pharmacology

Pharmacology is the science of the nature, uses, effects, and modes of action of **drugs** (substances used to diagnose, treat, or prevent disease or injury). Drugs may be available over the counter (OTC) or by prescription only. **OTC drugs** may be sold in pharmacies, in convenient stores, and online. **Prescription drugs** may only be legally dispensed by a **pharmacist**.

Drugs can have four different names:

1. **Generic name**: The general name assigned to a drug (for example acetaminophen).
2. **Trade name**: The pharmaceutical company's name for the drug is copyrighted and used exclusively by that company (for example Tylenol©).
3. **Chemical name**: The exact molecular formula of a drug (for example N-acetyl-para-aminophenol).
4. **Official name**: The name of the drug as it appears in the official reference is generally the same as the generic name (for example acetaminophen).

There are different ways to administer drugs. Which method of administration is chosen for a specific drug and patient, may depend on the physical properties of the drug (water-soluble substances will not be absorbed through the skin) or the clinical situation. An unconscious patient, for example, is unable to swallow but may receive drugs via intravenous injection.

Table 2.11 Methods of Drug Administration

Method	Description
Buccal administration	The medication is applied to the cheek (buccal) area of the mouth.
Oral administration	The medication is taken by mouth.
Sublingual administration	Placement of medications under the tongue.
Inhalation	Breathing in of vapors, steam, or gases through mouth or nose.
Rectal administration	Insertion of the medication as liquid (enema) or suppository into the rectum.
Topical application	Liquid, cream, or ointment is applied onto the area of skin or mucous membrane to be treated.
Transdermal administration	The medication is part of a patch that is applied onto unbroken skin.
Parenteral administration	Any administration that does not involve the digestive tract.
Subcutaneous injection (SC)	Injection into the fat layer just below the skin.
Intradermal injection	Injection into the middle layer of the skin
Intramuscular injection (IM)	Injection into muscle tissue.
Intravenous injection (IV)	Injection directly into a vein.

Drugs can be classified by their therapeutic use into groups of drugs with similar actions. Table 2.12 lists some of the major classes of drugs.

Table 2.12 Major Classes of Drugs

Drug class	Action
Analgesics	Lessen pain
Anesthetics	Cause lack of feeling or awareness; produce the sensation of numbness
Antacids	Neutralize gastric acid or decrease gastric acid release
Antiarrhythmics	Prevent cardiac irregularities
Antibiotics	Destroy or inhibit bacterial growth
Anticoagulants	Prevent the formation of blood clots; decrease the formation of existing clots
Anticonvulsants	Reduce the number and severity of seizures in patients with epilepsy
Antidepressants	Elevate mood
Antidiabetics	Oral medications to control sugar levels in patients with type II, non-insulin-dependent diabetes
Antiemetics	Control nausea, vomiting, and motion sickness
Antihistamines	Relieve symptoms of allergies like sneezing, itchy and watery eyes, and a runny nose; can also relieve itchiness caused by insect bites and stings
Anti-inflammatories	Reduce inflammation
Antipyretics	Reduce fever
Antiseptics	Used for surgical scrubs and applied to the skin as bacteriostatic skin cleansers
Antitussives	Relieve or prevent cough
Contraceptives	Used to prevent pregnancy
Decongestants	Decrease nasal congestion
Diuretics	Increase urination
Expectorants	Increase secretions and help to expel sputum
Laxatives	Promote evacuation of the intestine
Muscle relaxants	Short-term treatment of muscle pain, spasm, and impaired mobility
Platelet inhibitors	Decrease blood platelet clumping and blood clot formation
Vasoconstrictors	Constrict blood vessels to increase blood pressure
Vasodilators	Dilate coronary arteries immediately or for long-term management