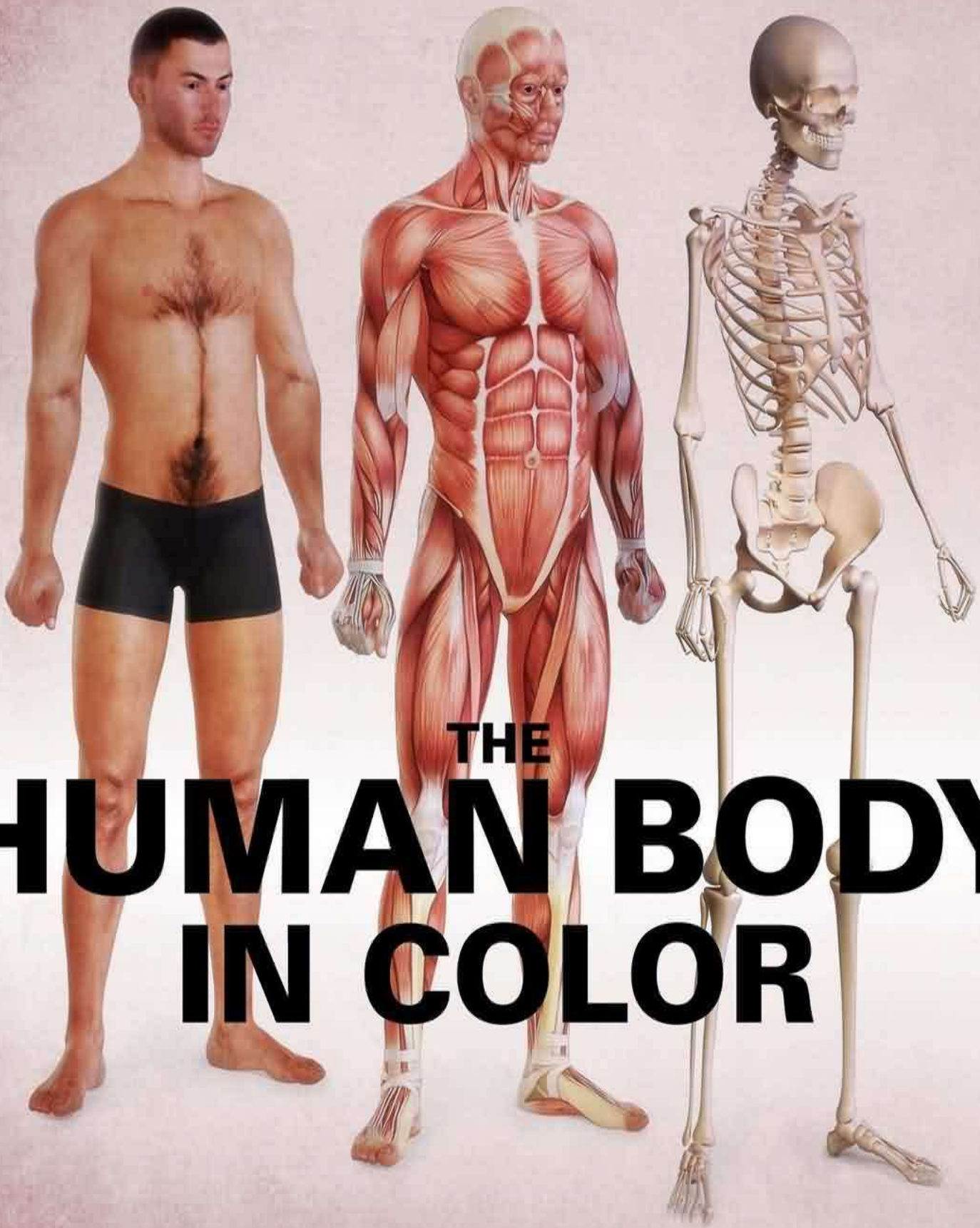
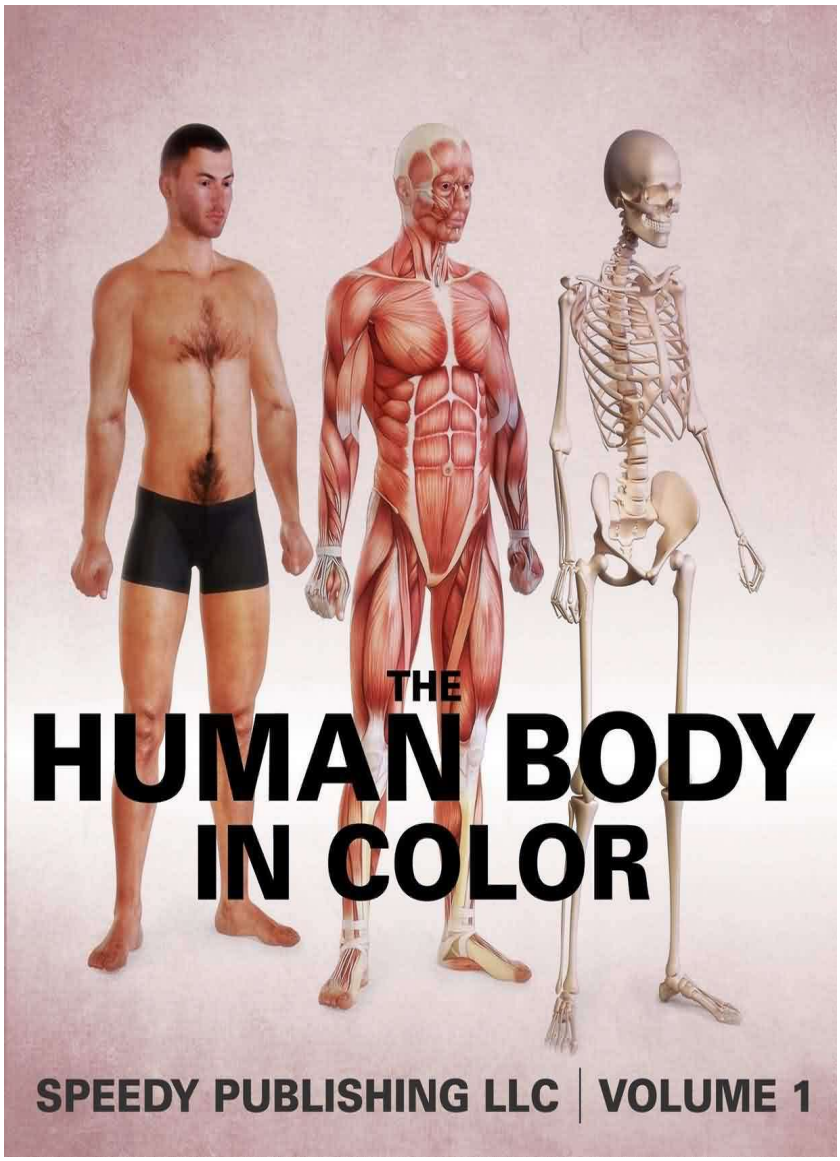


THE HUMAN BODY IN COLOR

SPEEDY PUBLISHING LLC | VOLUME 1

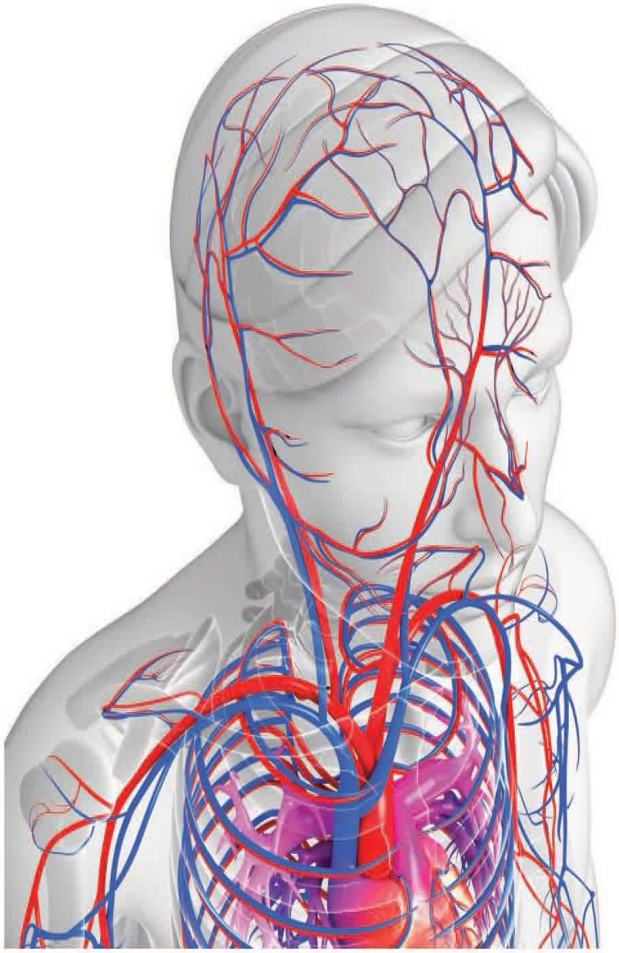

THE
HUMAN BODY
IN COLOR
SPEEDY PUBLISHING LLC | VOLUME 1

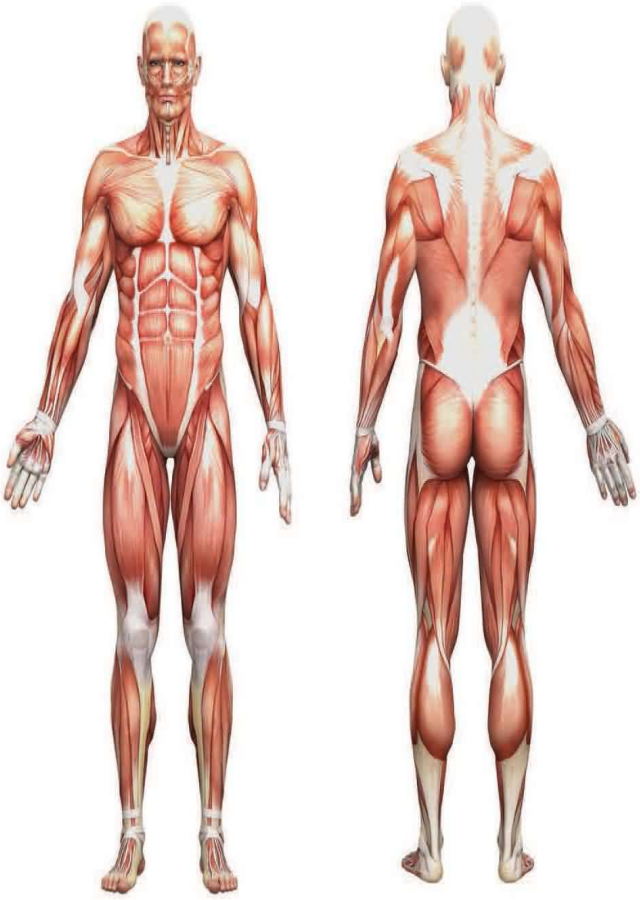
The Human Body In Color Volume 1

Speedy Publishing LLC
40 E. Main St. #1156
Newark, DE 19711

www.speedypublishing.com

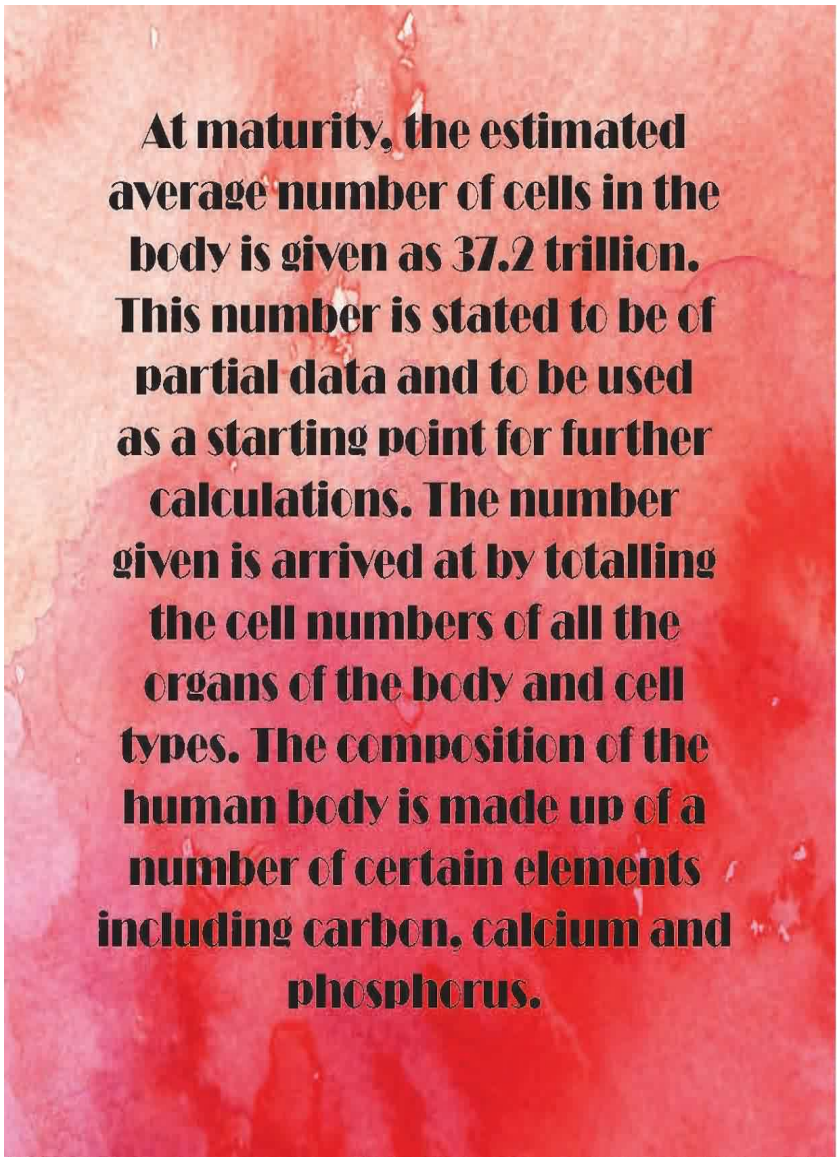
9781635013870
First Printed November 26, 2014

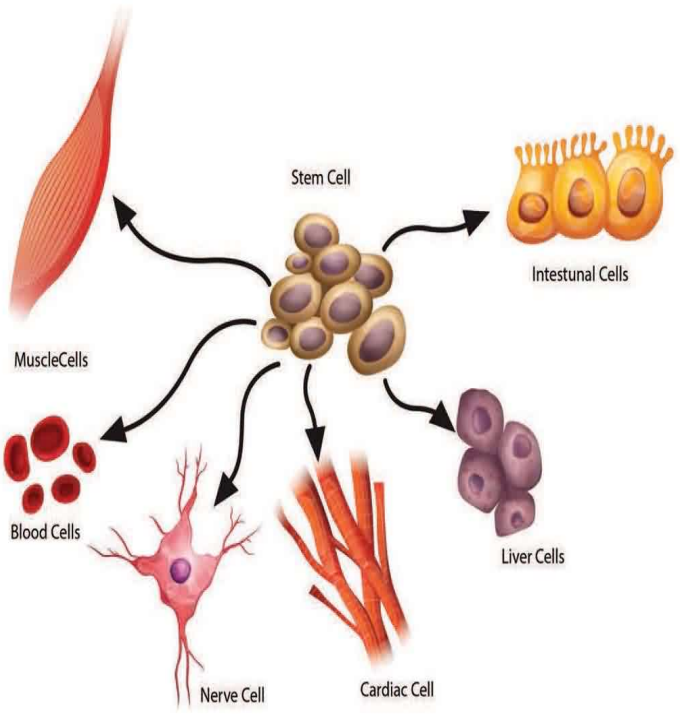


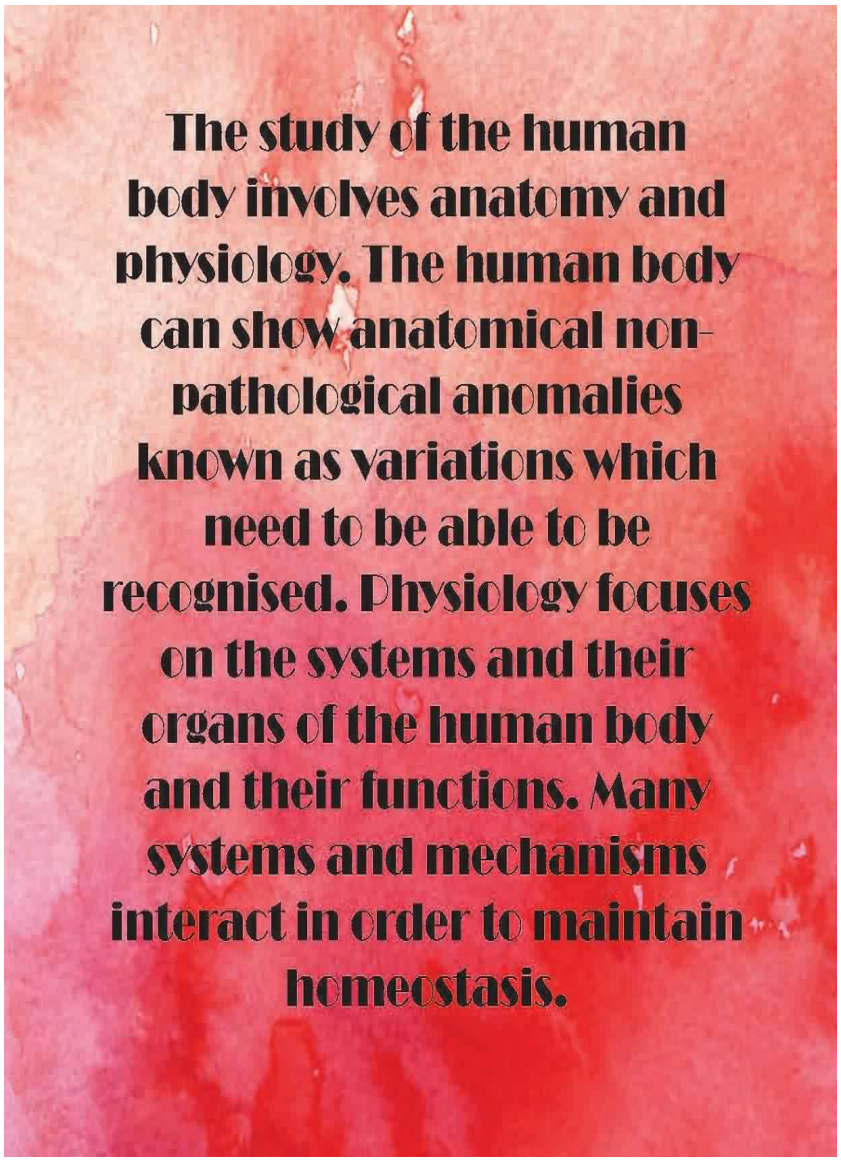


Human body

The human body is the entire structure of a human being and comprises a head, neck, trunk (which includes the thorax and abdomen), arms and hands, legs and feet. Every part of the body is composed of various types of cell.

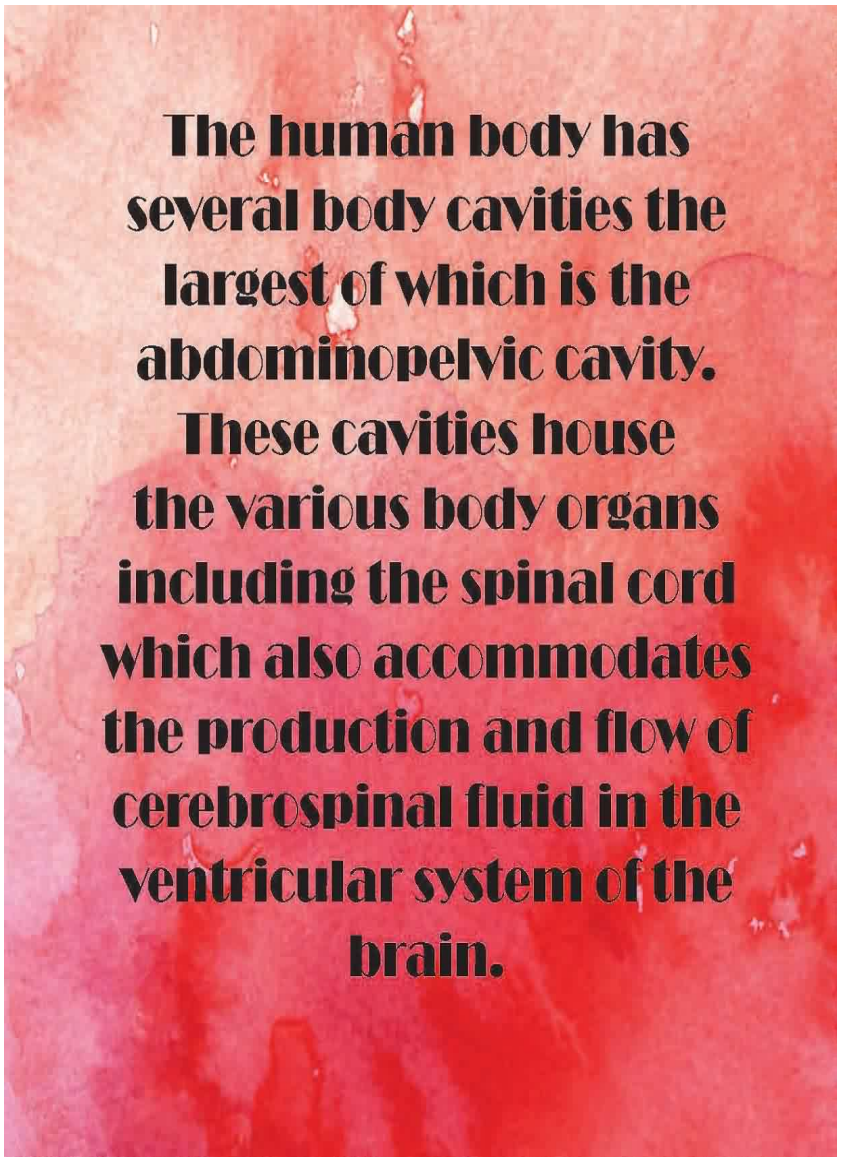

At maturity, the estimated average number of cells in the body is given as 37.2 trillion. This number is stated to be of partial data and to be used as a starting point for further calculations. The number given is arrived at by totalling the cell numbers of all the organs of the body and cell types. The composition of the human body is made up of a number of certain elements including carbon, calcium and phosphorus.


Stem Cell
Intestunal Cells
MuscleCells
Blood Cells
Liver Cells
Nerve Cell
Cardiac Cell

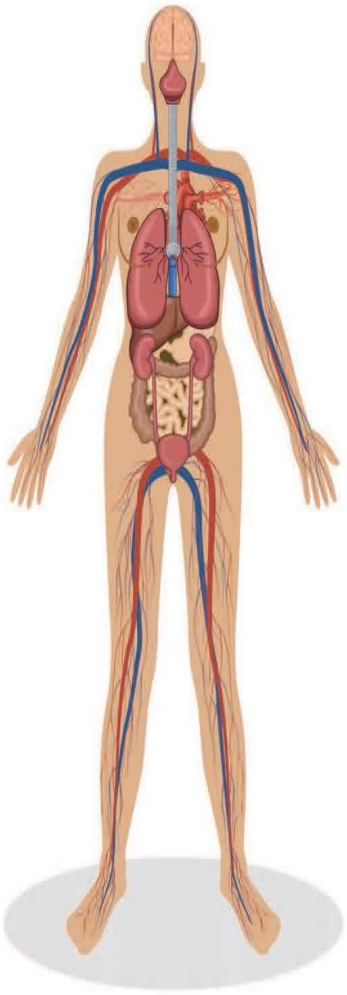

The study of the human body involves anatomy and physiology. The human body can show anatomical non-pathological anomalies known as variations which need to be able to be recognised. Physiology focuses on the systems and their organs of the human body and their functions. Many systems and mechanisms interact in order to maintain homeostasis.

Body Structure

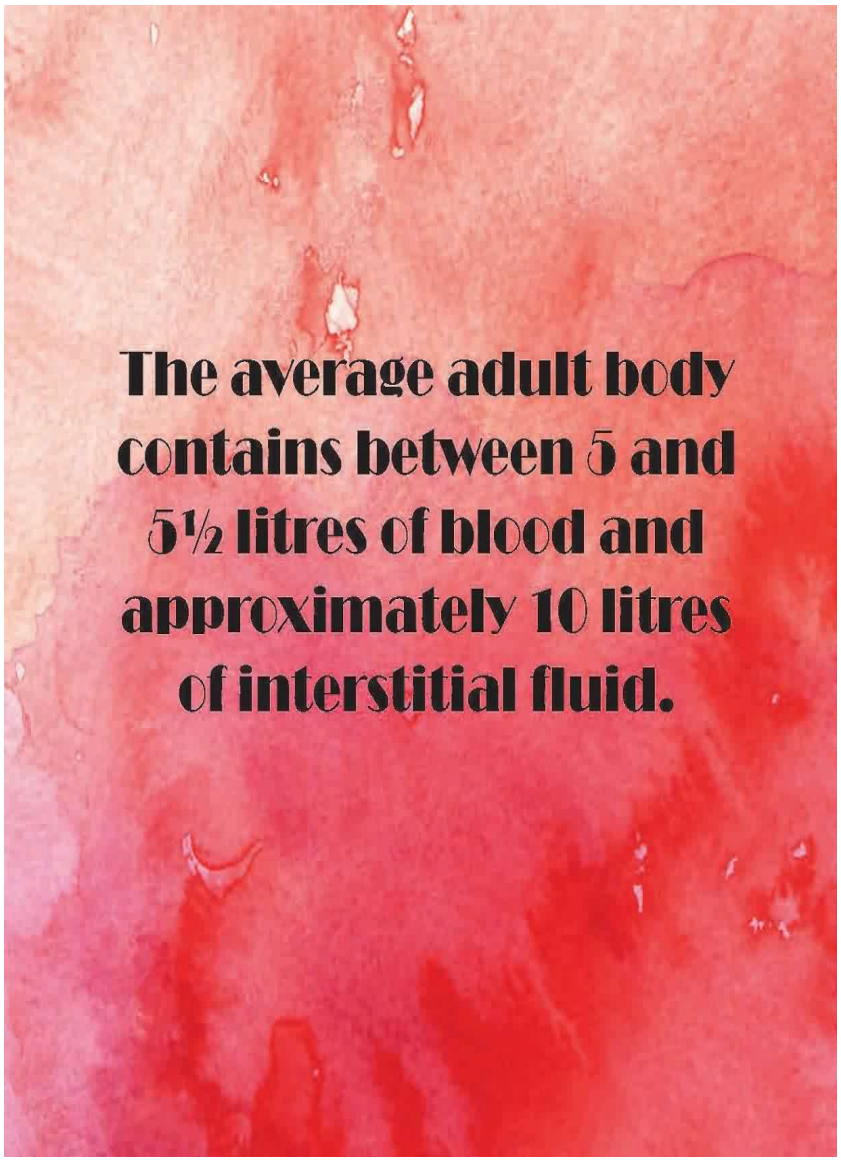
Skeletal structure frames the overall shape of the body and does not alter much over a lifetime. General body shape (and female body shape) is influenced by the distribution of muscle and fat tissue and is also affected by various hormones. The average height of an adult male human (in developed countries) is about 1.7–1.8 m (5'7" to 5'11") and the adult female is about 1.6–1.7 m (5'2" to 5'7") .[3] Height is largely determined by genes and diet. Body type and composition are influenced by factors such as genetics, diet, and exercise.

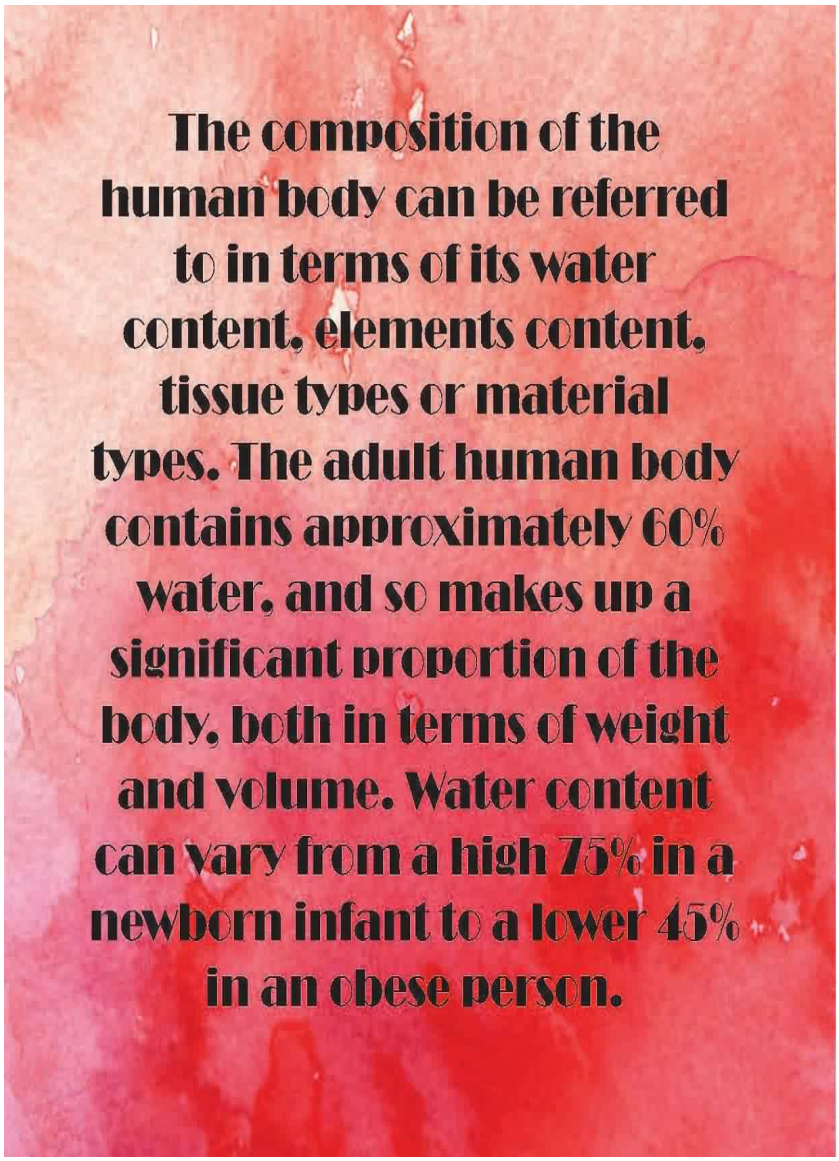

The human body has
several body cavities the
largest of which is the
abdominopelvic cavity.
These cavities house
the various body organs
including the spinal cord
which also accommodates
the production and flow of
cerebrospinal fluid in the
ventricular system of the
brain.

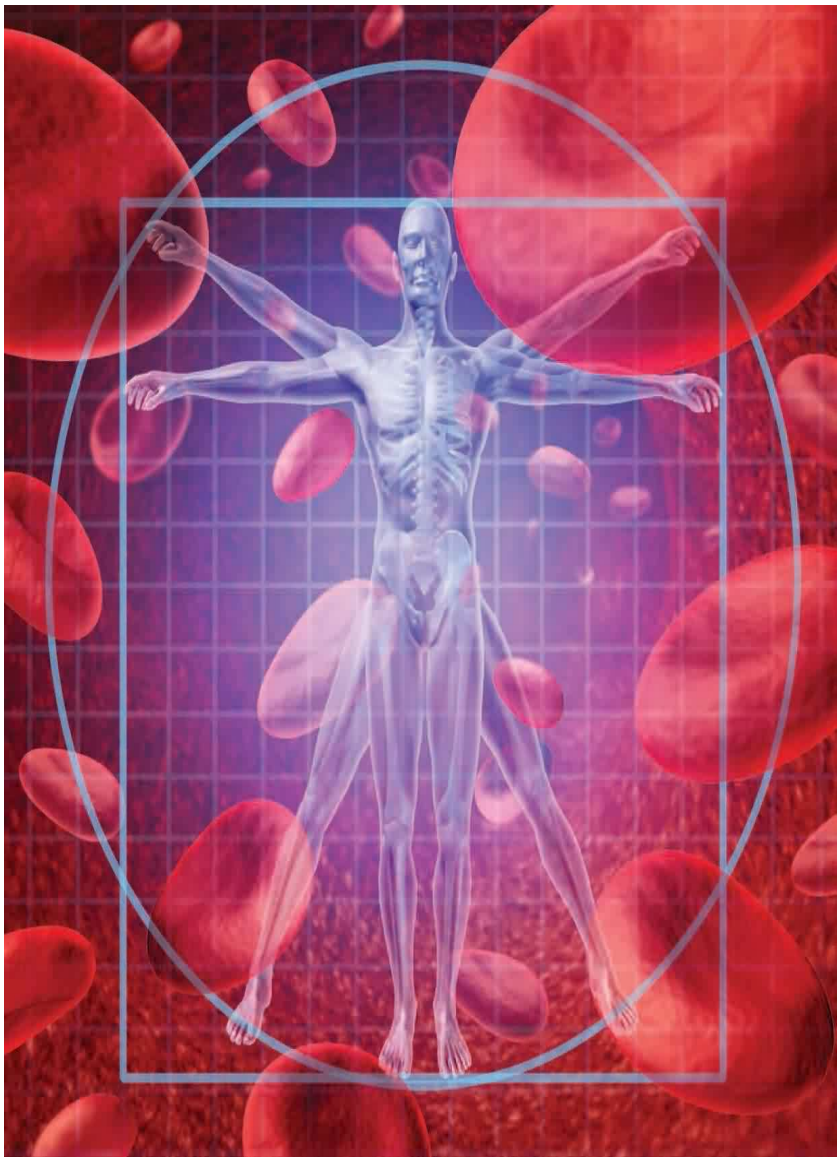
Many other smaller cavities exist throughout the body called sinuses, which have varied functions. Sinuses in general usage refers to the paranasal sinuses which are involved in the condition sinusitis. The paranasal sinuses are four pairs of vital air-cavities in the cranial bones. These air-filled spaces are paired between the eyes, above the eyes, deeper behind the eyes and around the nasal cavity.

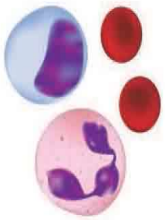


Composition of the Human Body

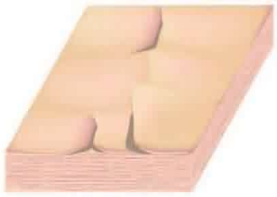

The average adult body contains between 5 and 5½ litres of blood and approximately 10 litres of interstitial fluid.


The composition of the human body can be referred to in terms of its water content, elements content, tissue types or material types. The adult human body contains approximately 60% water, and so makes up a significant proportion of the body, both in terms of weight and volume. Water content can vary from a high 75% in a newborn infant to a lower 45% in an obese person.



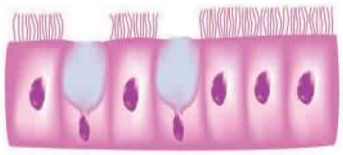


Blood cells



Surface skin cells

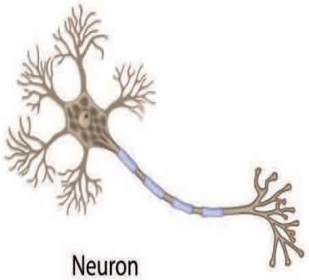
Bone cell



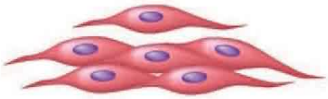
Columnar epithelial and Goblet cells

Cardiac muscle cell

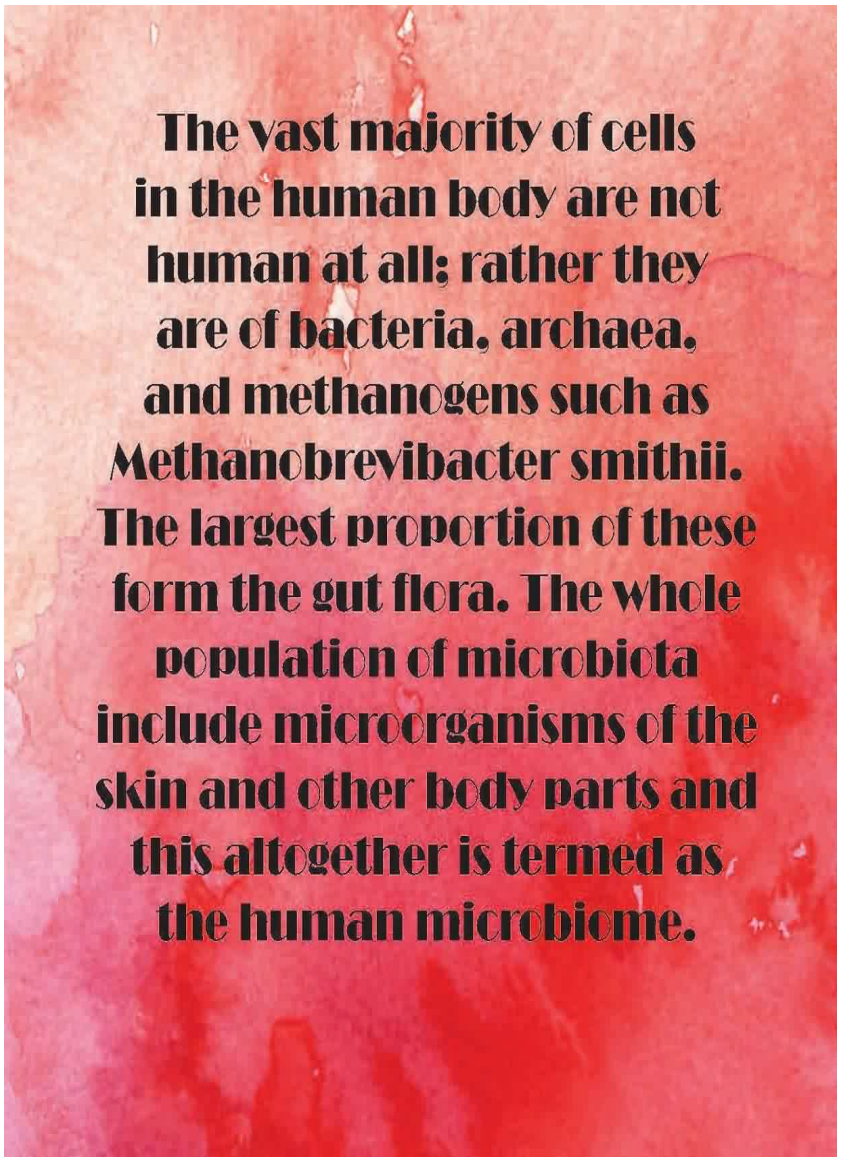
Skeletal muscle cells

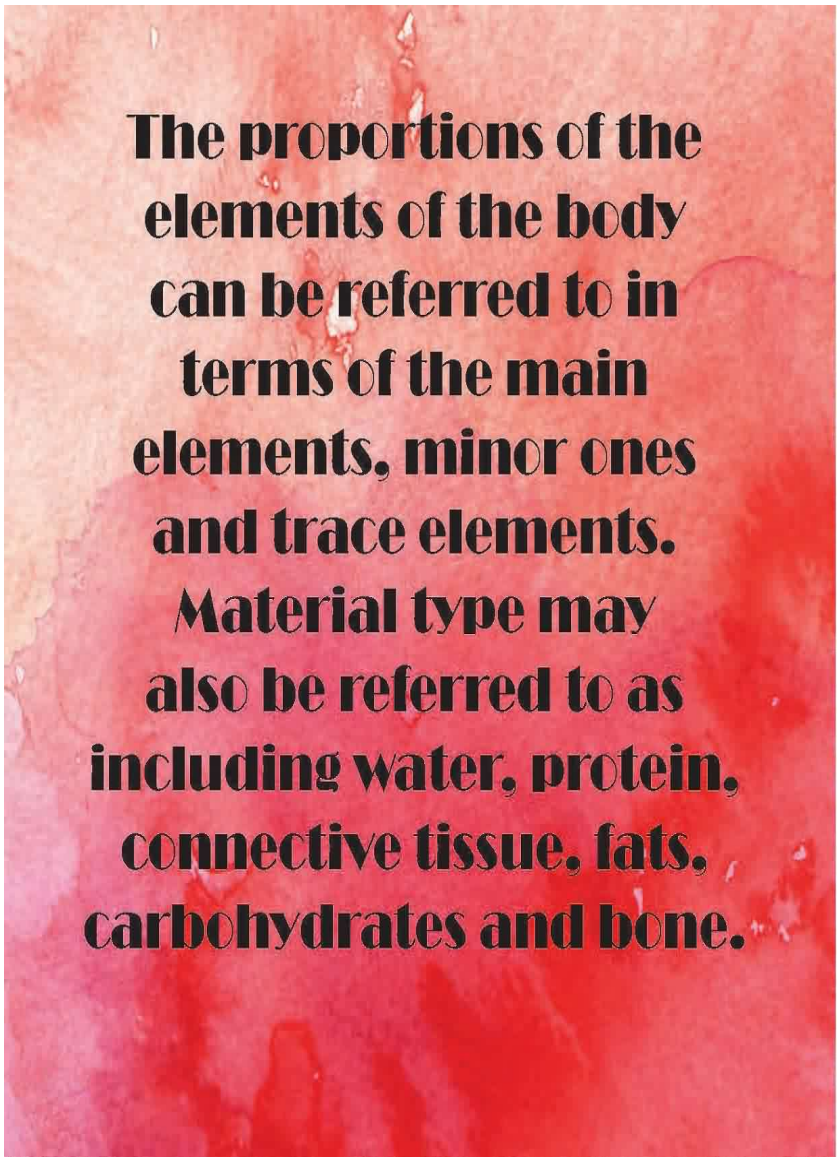


Neuron



Smooth muscle cells

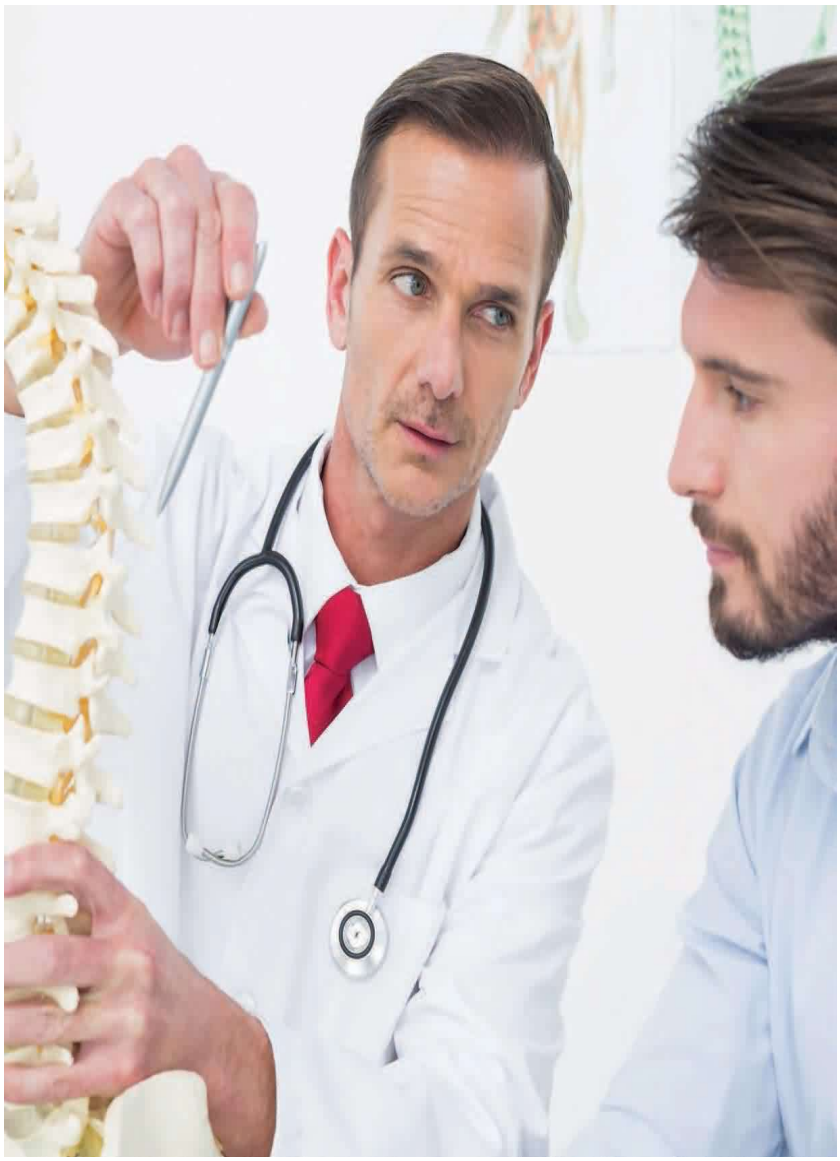

The vast majority of cells
in the human body are not
human at all; rather they
are of bacteria, archaea,
and methanogens such as
Methanobrevibacter smithii.
The largest proportion of these
form the gut flora. The whole
population of microbiota
include microorganisms of the
skin and other body parts and
this altogether is termed as
the human microbiome.


The proportions of the elements of the body can be referred to in terms of the main elements, minor ones and trace elements. Material type may also be referred to as including water, protein, connective tissue, fats, carbohydrates and bone.

Human Anatomy & Physiology

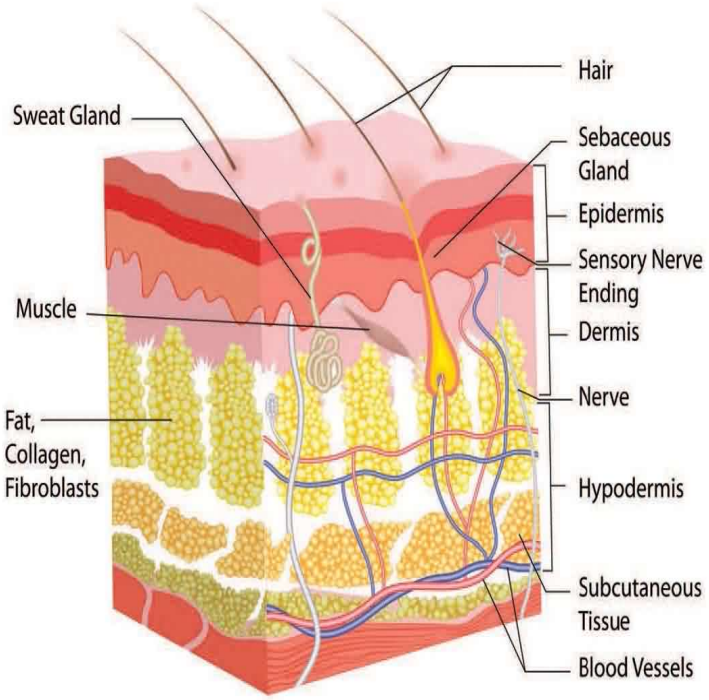
Human anatomy is primarily the scientific study of the morphology of the human body. Anatomy is subdivided into gross anatomy and microscopic anatomy (histology). Gross anatomy (also called topographical anatomy, regional anatomy, or anthropotomy) is the study of anatomical structures that can be seen by the naked eye. Microscopic anatomy involves the use of microscopes to study minute anatomical structures, and is the field of histology which studies the organization of tissues at all levels, from cell biology (previously called cytology), to organs.

Human physiology is the science of the mechanical, physical, bioelectrical, and biochemical functions of humans in good health, their organs, and the cells of which they are composed. Physiology focuses principally at the level of organs and systems. Most aspects of human physiology are closely homologous to corresponding aspects of animal physiology, and animal experimentation has provided much of the foundation of physiological knowledge. Anatomy and physiology are closely related fields of study: anatomy, the study of form, and physiology, the study of function, are intrinsically related and are studied in tandem as part of a medical curriculum.

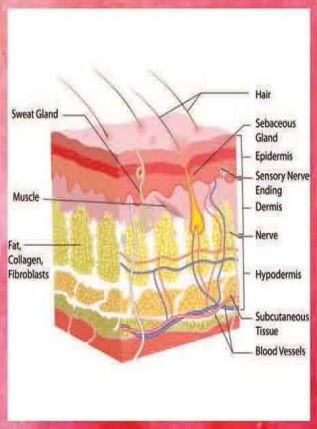


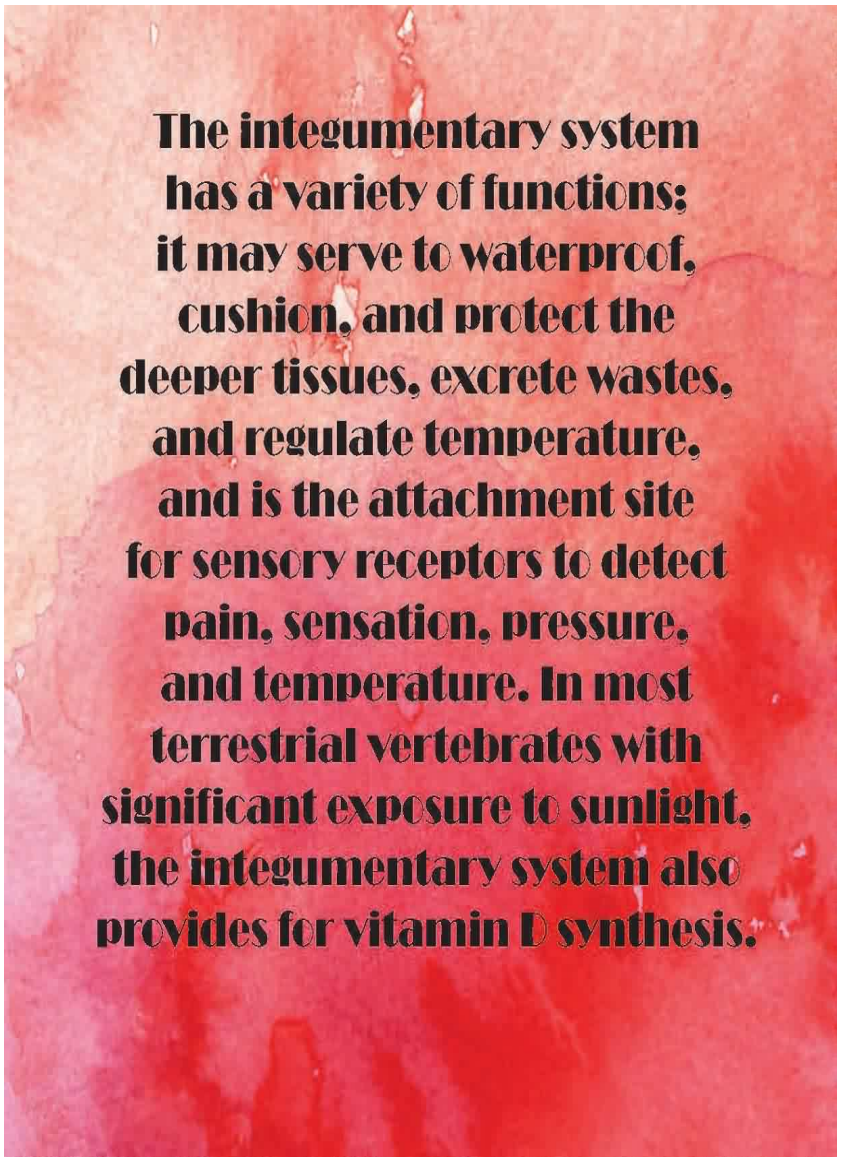
The Major Systems of the Human Body

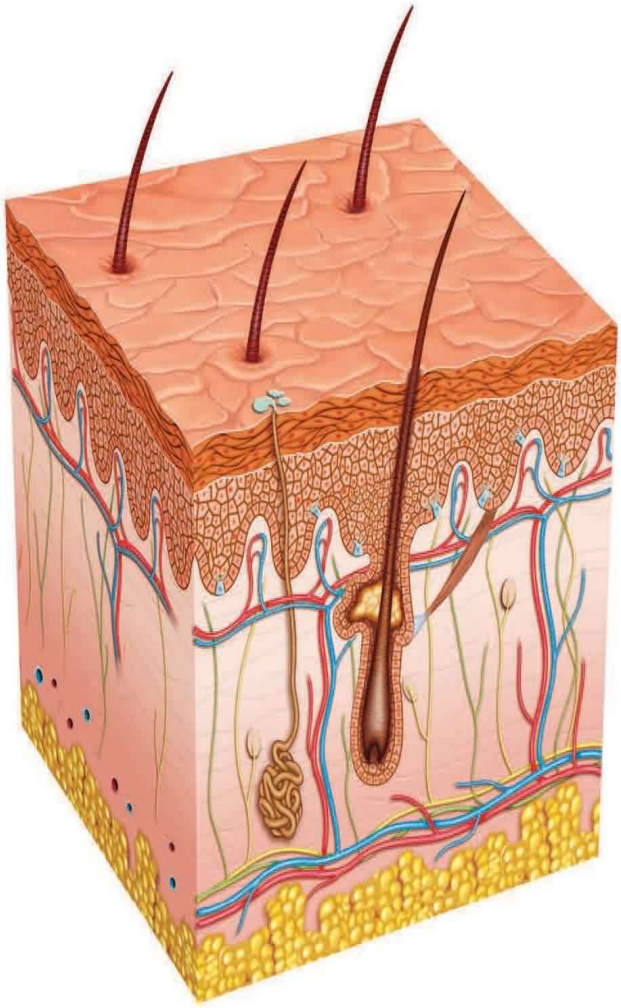
The Integumentary System


Hair
Sweat Gland
Sebaceous Gland
Epidermis
Sensory Nerve Ending
Muscle
Dermis
Nerve
Fat, Collagen, Fibroblasts
Hypodermis
Subcutaneous Tissue
Blood Vessels

The integumentary system is the organ system that protects the body from various kinds of damage, such as loss of water or abrasion from outside. The system comprises the skin and its appendages (including hair, scales, feathers, hooves, and nails).




The integumentary system
has a variety of functions;
it may serve to waterproof,
cushion, and protect the
deeper tissues, excrete wastes,
and regulate temperature,
and is the attachment site
for sensory receptors to detect
pain, sensation, pressure,
and temperature. In most
terrestrial vertebrates with
significant exposure to sunlight,
the integumentary system also
provides for vitamin D synthesis.



Structure

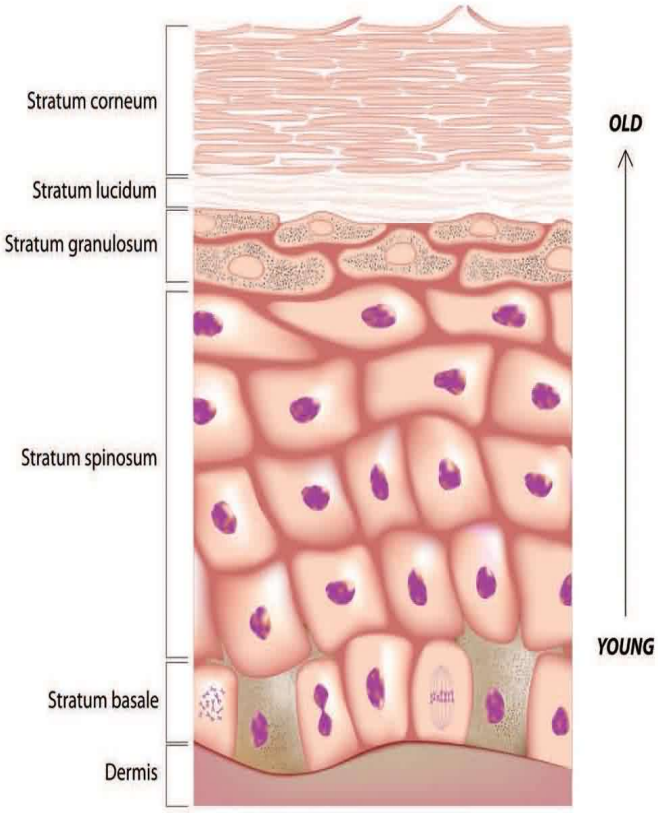
The skin is the largest organ in the body. In humans, it accounts for about 12 to 15 percent of total body weight and covers 1.5-2m2 of surface area. It distinguishes, separates, and protects the organism from its surroundings. Small-bodied invertebrates of aquatic or continually moist habitats respire using the outer layer (integument). This gas exchange system, where gases simply diffuse into and out of the interstitial fluid, is called integumentary exchange.

The human skin (integument) is composed of a minimum of three major layers of tissue: the epidermis; dermis; and hypodermis. The epidermis forms the outermost layer, providing the initial barrier to the external environment. Beneath this, the dermis comprises two sections, the papillary and reticular layers, and contains connective tissues, vessels, glands, follicles, hair roots, sensory nerve endings, and muscular tissue. The deepest layer is the hypodermis, which is primarily made up of adipose tissue. Substantial collagen bundles anchor the dermis to the hypodermis in a way that permits most areas of the skin to move freely over the deeper tissue layers.

Epidermis

This is the top layer of skin made up of epithelial cells. It does not contain blood vessels. Its main function is protection, absorption of nutrients, and homeostasis. In structure, it consists of a keratinized stratified squamous epithelium comprising four types of cells: keratinocytes, melanocytes, Merkel cells, and Langerhans' cells. The major cell of the epidermis is the keratinocyte, which produces keratin.

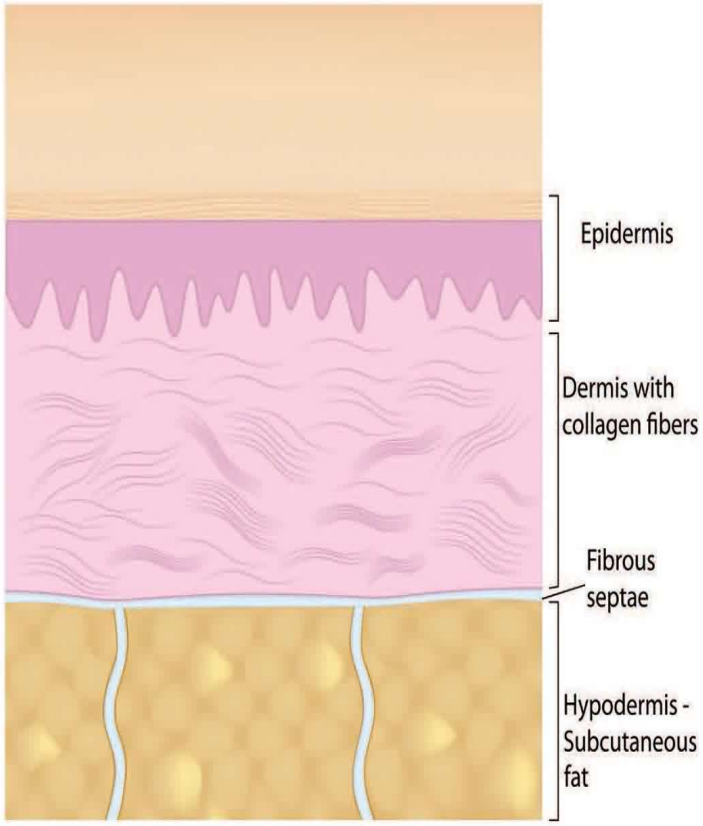
Structure of the Epidermis



Dermis

The dermis is the middle layer of skin, composed of dense irregular connective tissue and areolar connective tissue such as collagen with elastin arranged in a diffusely bundled and woven pattern. The dermis has two layers. One is the papillary layer which is the superficial layer and consists of the areolar connective tissue. The other is the reticular layer which is the deep layer of the dermis and consists of the dense irregular connective tissue.

Normal Skin

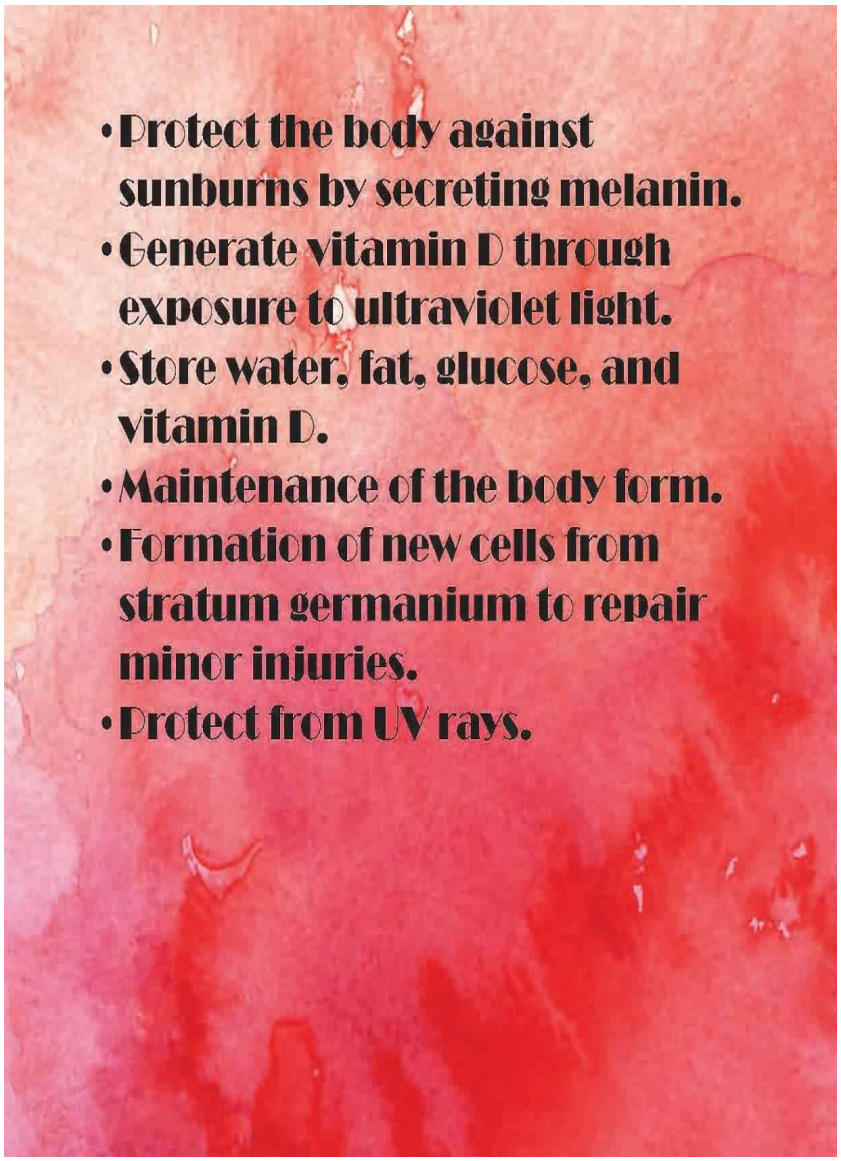

Epidermis
Dermis with collagen fibers
Fibrous septae
Hypodermis - Subcutaneous fat

Hypodermis

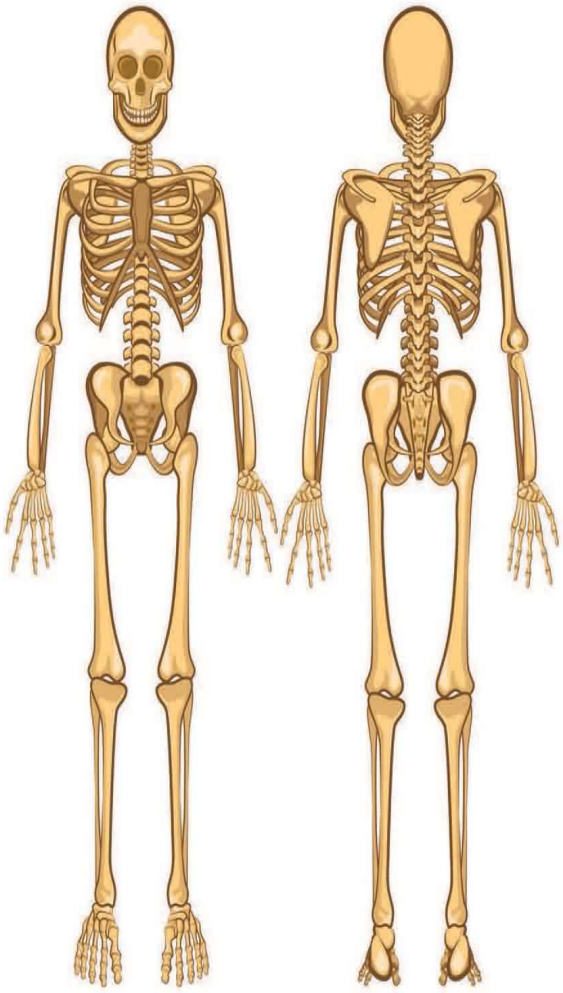
The hypodermis is the innermost and thickest layer of the skin. It invaginates into the dermis and is attached to the latter, immediately above it, by collagen and elastin fibres. It is essentially composed of a type of cell specialised in accumulating and storing fats, known as adipocytes. These cells are grouped together in lobules separated by connective tissue .

Functions of the Integumentary System

- Protect the body's internal living tissues and organs.
- Protect against invasion by infectious organisms.
- Protect the body from dehydration.
- Protect the body against abrupt changes in temperature, maintain homeostasis.
- Help excrete waste materials through perspiration.
- Act as a receptor for touch, pressure, pain, heat, and cold (see Somatosensory system).


• Protect the body against sunburns by secreting melanin.
• Generate vitamin D through exposure to ultraviolet light.
• Store water, fat, glucose, and vitamin D.
• Maintenance of the body form.
• Formation of new cells from stratum germanium to repair minor injuries.
• Protect from UV rays.

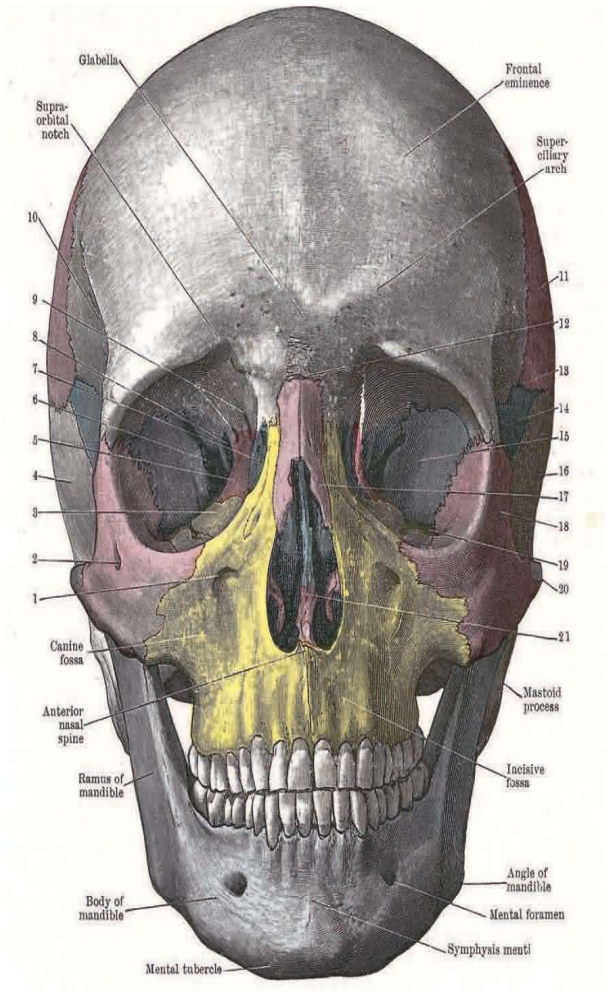
Skeletal System



Human Skeleton

The human skeleton is the internal framework of the body. It is composed of 270 bones at birth – this total decreases to 206 bones by adulthood after some bones have fused together. The bone mass in the skeleton reaches maximum density around age 30. The human skeleton can be divided into the axial skeleton and the appendicular skeleton. The axial skeleton is formed by the vertebral column, the rib cage and the skull. The appendicular skeleton, which is attached to the axial skeleton, is formed by the pectoral girdle, the pelvic girdle and the bones of the upper and lower limbs.

The human skeleton serves six major functions; support, movement, protection, production of blood cells, storage of ions and endocrine regulation. The human skeleton is not as sexually dimorphic as that of many other primate species, but subtle differences between sexes in the morphology of the skull, dentition, long bones, and pelves exist. In general, female skeletal elements tend to be smaller and less robust than corresponding male elements within a given population. The human female pelvis is also different from that of males in order to facilitate child birth.


Glabella
Frontal eminence
Supra-orbital notch
Super-cillary arch
10
11
9
12
8
13
7
14
6
15
5
16
4
17
3
18
2
19
1
20
21
Canine fossa
Mastoid process
Anterior nasal spine
Incisive fossa
Ramus of mandible
Angle of mandible
Body of mandible
Mental foramen
Symphysis menti
Mental tubercle

Divisions

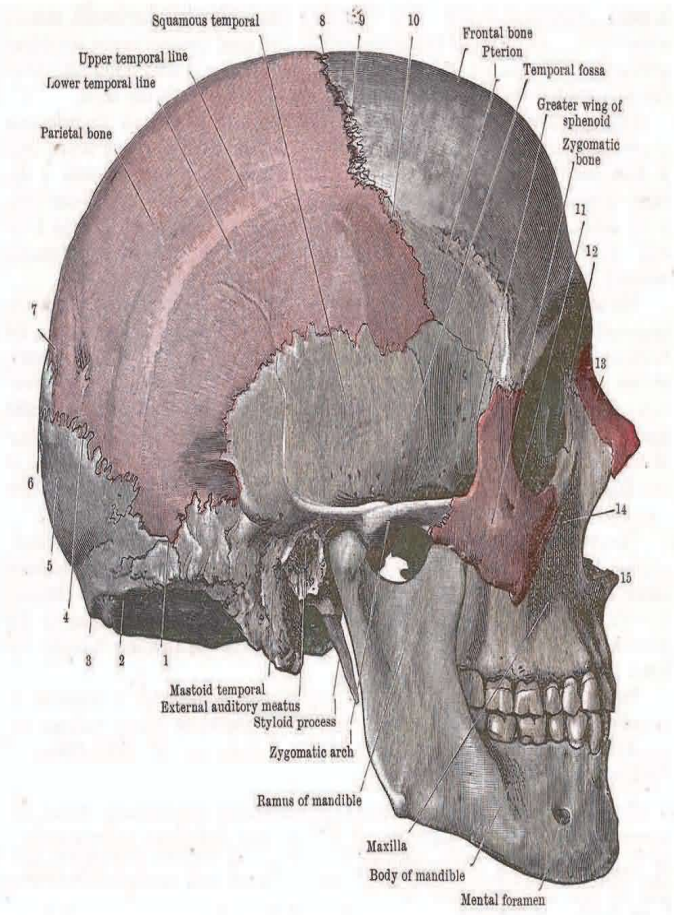
Axial Skeleton

The axial skeleton (80 bones) is formed by the vertebral column (32–34 bones; the number of the vertebrae differs from human to human as the lower 2 parts, sacral and coccygeal bone may vary in length), the rib cage (12 pairs of ribs and the sternum), and the skull (22 bones and 7 associated bones).

The upright posture of humans is maintained by the axial skeleton, which transmits the weight from the head, the trunk, and the upper extremities down to the lower extremities at the hip joints. The bones of the spine are supported by many ligaments. The erectors spinae muscles are also supporting and are useful for balance. A human is able to survive with just the axial portion of their skeleton.

Appendicular Skeleton

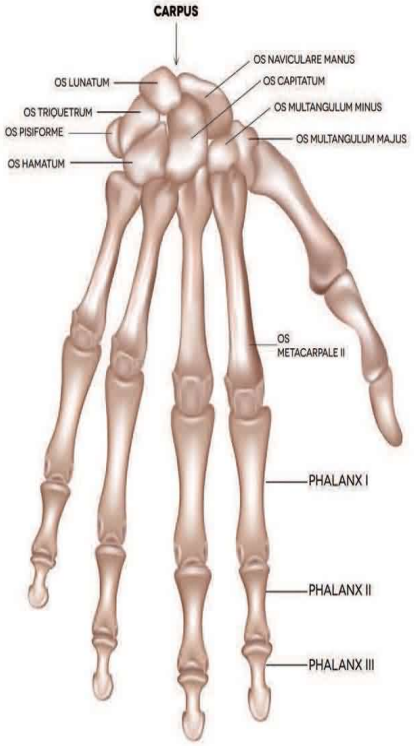
The appendicular skeleton (126 bones) is formed by the pectoral girdles, the upper limbs, the pelvic girdle or pelvis, and the lower limbs. Their functions are to make locomotion possible and to protect the major organs of digestion, excretion and reproduction.


Squamous temporal
8
9
10
Frontal bone
Pterion
Temporal fossa
Greater wing of sphenoid
Zygomatic bone
Upper temporal line
Lower temporal line
Parietal bone
11
12
7
13
6
14
5
15
4
3
2
1
Mastoid temporal
External auditory meatus
Styloid process
Zygomatic arch
Ramus of mandible
Maxilla
Body of mandible
Mental foramen

Functions

BONES OF THE RIGHT HAND

(OSSA MANUS)



FROM THE DORSAL SURFACE

Support

The skeleton provides the framework which supports the body and maintains its shape. The pelvis, associated ligaments and muscles provide a floor for the pelvic structures. Without the rib cages, costal cartilages, and intercostal muscles, the lungs would collapse.

Blood cell production

The skeleton is the site of haematopoiesis, the development of blood cells that takes place in the bone marrow. In children, haematopoiesis occurs primarily in the marrow of the long bones such as the femur and tibia. In adults, it occurs mainly in the pelvis, cranium, vertebrae, and sternum.

Movement

The joints between bones allow movement, some allowing a wider range of movement than others, e.g. the ball and socket joint allows a greater range of movement than the pivot joint at the neck. Movement is powered by skeletal muscles, which are attached to the skeleton at various sites on bones. Muscles, bones, and joints provide the principal mechanics for movement, all coordinated by the nervous system.

Endocrine regulation

Bone cells release a hormone called osteocalcin, which contributes to the regulation of blood sugar (glucose) and fat deposition. Osteocalcin increases both the insulin secretion and sensitivity, in addition to boosting the number of insulin-producing cells and reducing stores of fat.

Protection

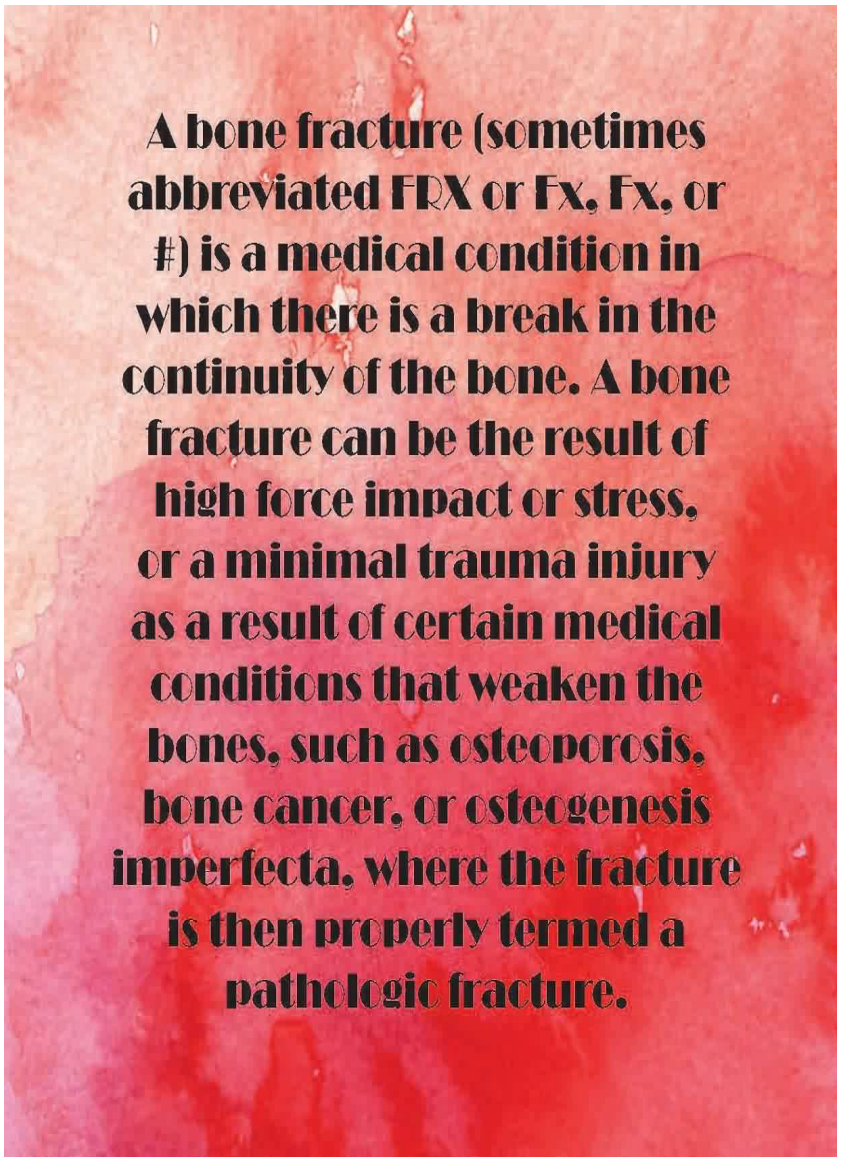
The skeleton helps protect our many vital internal organs from being damaged.

- The skull protects the brain, the eyes, and the middle and inner ears.
- The vertebrae protect the spinal cord.
- The rib cage, spine, and sternum protect the lungs, heart and major blood vessels.
- The clavicle and scapula protect the shoulder.
- The ilium and spine protect the digestive and urogenital systems and the hip.
- The patella and the ulna protect the knee and the elbow respectively.
- The carpals and tarsals protect the wrist and ankle respectively.

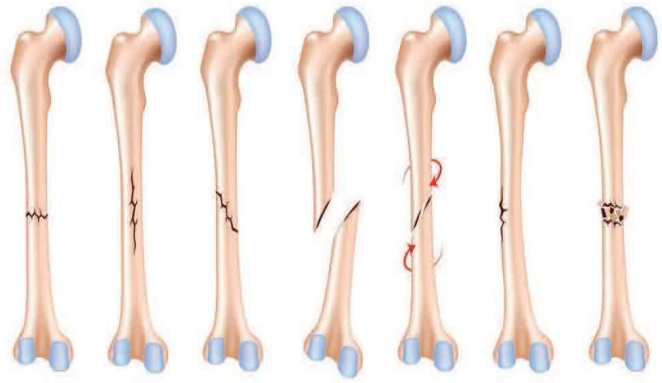
Storage

The bone matrix can store calcium and is involved in calcium metabolism, and bone marrow can store iron in ferritin and is involved in iron metabolism. However, bones are not entirely made of calcium, but a mixture of chondroitin sulfate and hydroxyapatite, the latter making up 70% of a bone. Hydroxyapatite is in turn composed of 39.8% of calcium, 41.4% of oxygen, 18.5% of phosphorus, and 0.2% of hydrogen by mass. Chondroitin sulfate is a sugar made up primarily of oxygen and carbon.

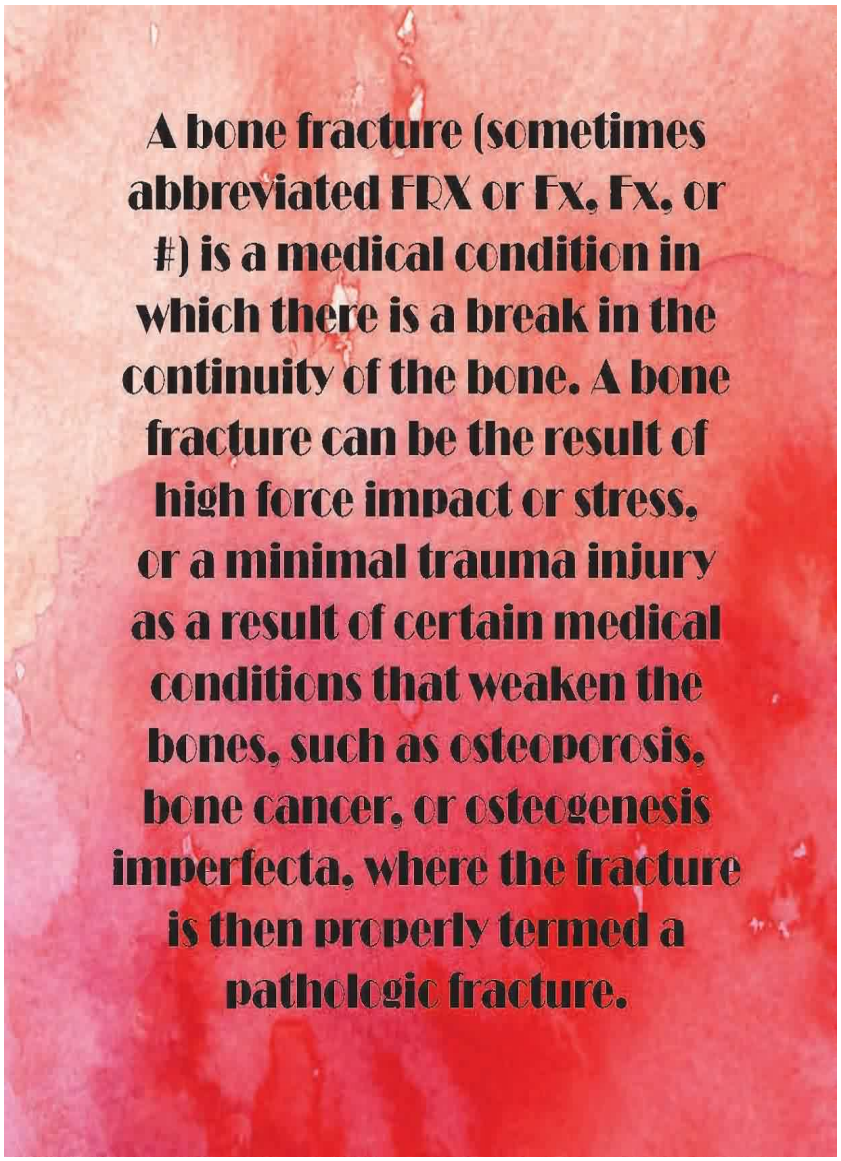
Bone Fracture


A bone fracture (sometimes abbreviated FRX or Fx, Fx, or #) is a medical condition in which there is a break in the continuity of the bone. A bone fracture can be the result of high force impact or stress, or a minimal trauma injury as a result of certain medical conditions that weaken the bones, such as osteoporosis, bone cancer, or osteogenesis imperfecta, where the fracture is then properly termed a pathologic fracture.

Types of Bone Fractures



Transverse | Linear | Oblique, nondisplaced | Oblique, displaced | Spiral | Greenstick | Comminuted

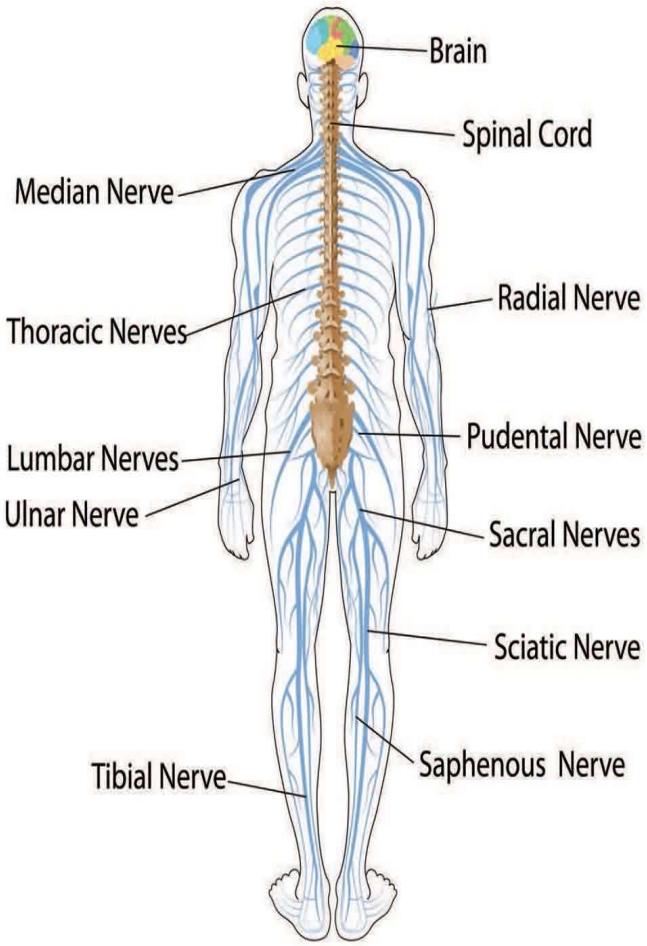

A bone fracture (sometimes abbreviated FRX or Fx, Fx, or #) is a medical condition in which there is a break in the continuity of the bone. A bone fracture can be the result of high force impact or stress, or a minimal trauma injury as a result of certain medical conditions that weaken the bones, such as osteoporosis, bone cancer, or osteogenesis imperfecta, where the fracture is then properly termed a pathologic fracture.

Some fracture types are:

- Greenstick fracture: an incomplete fracture in which the bone is bent. This type occurs most often in children.
- Transverse fracture: a fracture at a right angle to the bone's axis.
- Oblique fracture: a fracture in which the break has a curved or sloped pattern.
- Comminuted fracture: a fracture in which the bone fragments into several pieces.

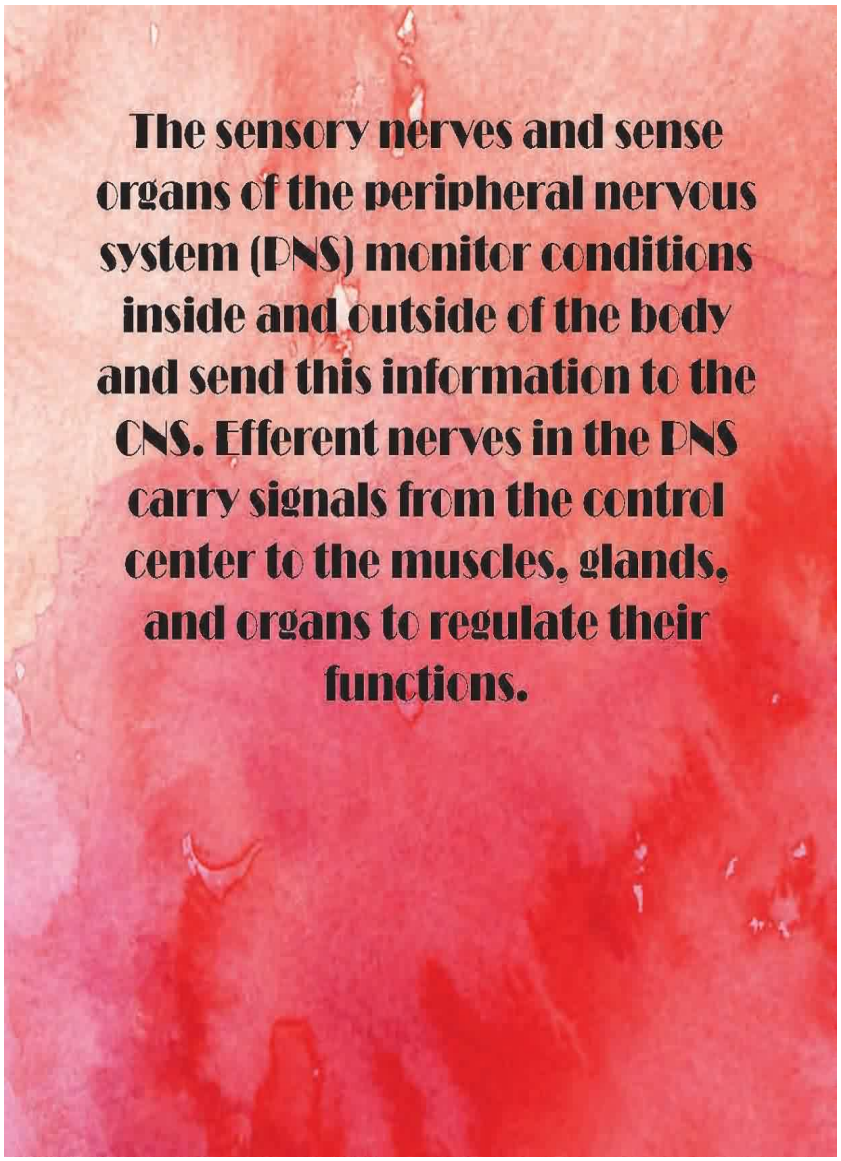
- An impacted fracture is one whose ends are driven into each other. This is commonly seen in arm fractures in children and is sometimes known as a buckle fracture. Other types of fracture are pathologic fracture, caused by a disease that weakens the bones, and stress fracture, a hairline crack.
- Other types of fracture are pathologic fracture, caused by a disease that weakens the bones, and stress fracture.

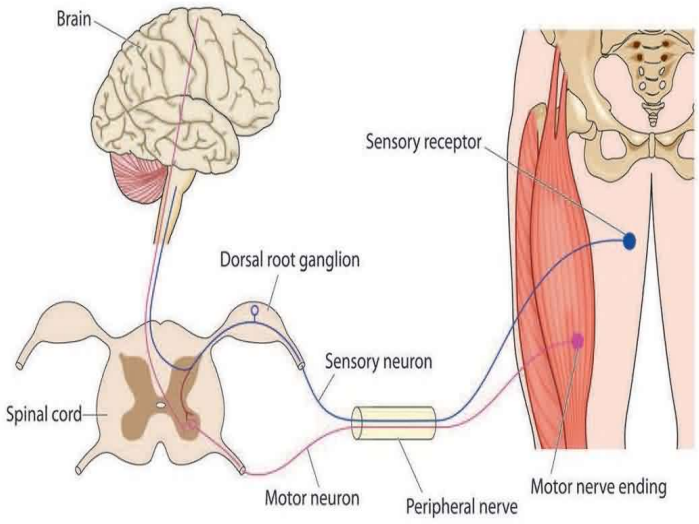
Nervous System


Brain
Spinal Cord
Median Nerve
Radial Nerve
Thoracic Nerves
Pudental Nerve
Lumbar Nerves
Ulnar Nerve
Sacral Nerves
Sciatic Nerve
Saphenous Nerve
Tibial Nerve

Definition

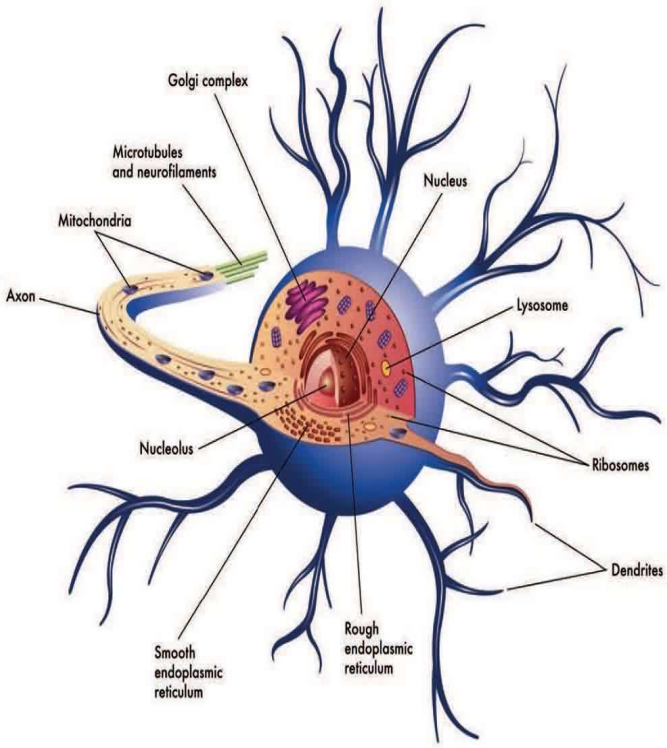
The nervous system consists of the brain, spinal cord, sensory organs, and all of the nerves that connect these organs with the rest of the body. Together, these organs are responsible for the control of the body and communication among its parts. The brain and spinal cord form the control center known as the central nervous system (CNS), where information is evaluated and decisions made.


The sensory nerves and sense organs of the peripheral nervous system (PNS) monitor conditions inside and outside of the body and send this information to the CNS. Efferent nerves in the PNS carry signals from the control center to the muscles, glands, and organs to regulate their functions.


Brain
Sensory receptor
Dorsal root ganglion
Sensory neuron
Spinal cord
Motor neuron
Peripheral nerve
Motor nerve ending

Nervous Tissue

- Neurons. Neurons, also known as nerve cells, communicate within the body by transmitting electrochemical signals. Neurons look quite different from other cells in the body due to the many long cellular processes that extend from their central cell body. The cell body is the roughly round part of a neuron that contains the nucleus, mitochondria, and most of the cellular organelles. Small tree-like structures called dendrites extend from the cell body to pick up stimuli from the environment, other neurons, or sensory receptor cells. Long transmitting processes called axons extend from the cell body to send signals onward to other neurons or effector cells in the body.


Golgi complex
Microtubules
and neurofilaments
Mitochondria
Axon
Nucleus
Lysosome
Nucleolus
Ribosomes
Dendrites
Smooth
endoplasmic
reticulum
Rough
endoplasmic
reticulum

There are 3 basic classes of neurons: afferent neurons, efferent neurons, and interneurons.

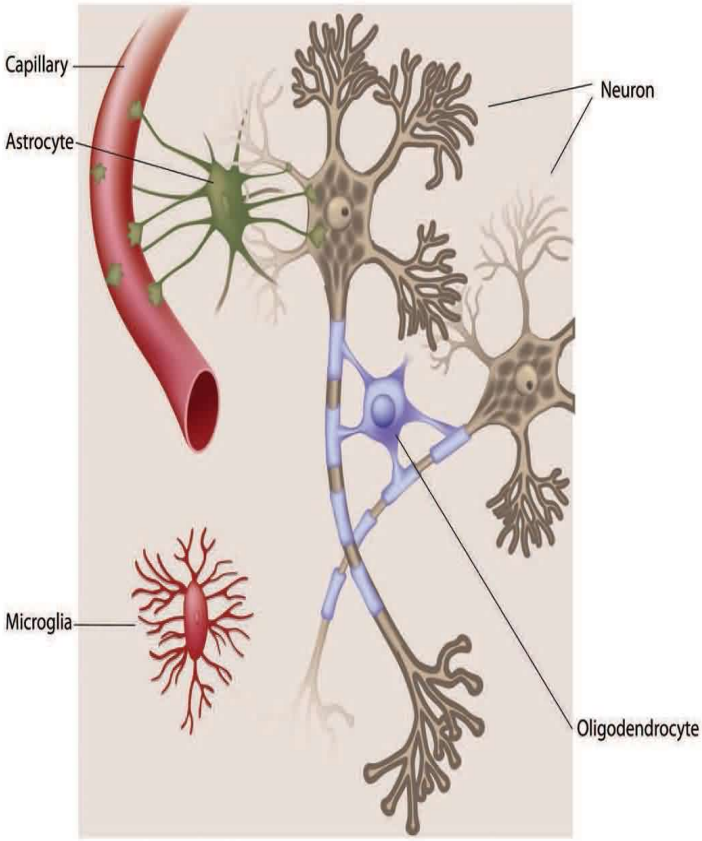
- Afferent neurons. Also known as sensory neurons, afferent neurons transmit sensory signals to the central nervous system from receptors in the body.

- Efferent neurons. Also known as motor neurons, efferent neurons transmit signals from the central nervous system to effectors in the body such as muscles and glands.

- Interneurons. Interneurons form complex networks within the central nervous system to integrate the information received from afferent neurons and to direct the function of the body through efferent neurons.

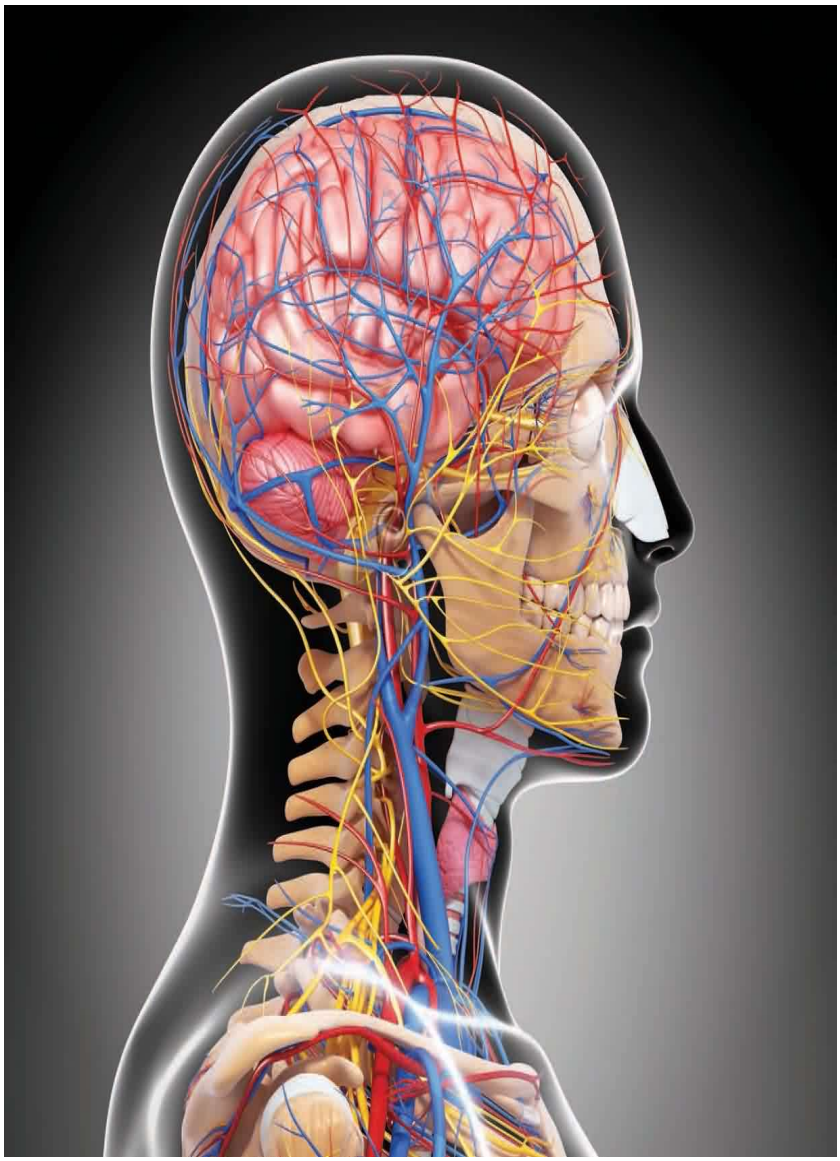
- Neuroglia. Neuroglia, also known as glial cells, act as the "helper" cells of the nervous system. Each neuron in the body is surrounded by anywhere from 6 to 60 neuroglia that protect, feed, and insulate the neuron. Because neurons are extremely specialized cells that are essential to body function and almost never reproduce, neuroglia are vital to maintaining a functional nervous system.

Cells of the Central Nervous System



Brain

The brain, a soft, wrinkled organ that weighs about 3 pounds, is located inside the cranial cavity, where the bones of the skull surround and protect it. The approximately 100 billion neurons of the brain form the main control center of the body. The brain and spinal cord together form the central nervous system (CNS), where information is processed and responses originate. The brain, the seat of higher mental functions such as consciousness, memory, planning, and voluntary actions, also controls lower body functions such as the maintenance of respiration, heart rate, blood pressure, and digestion.

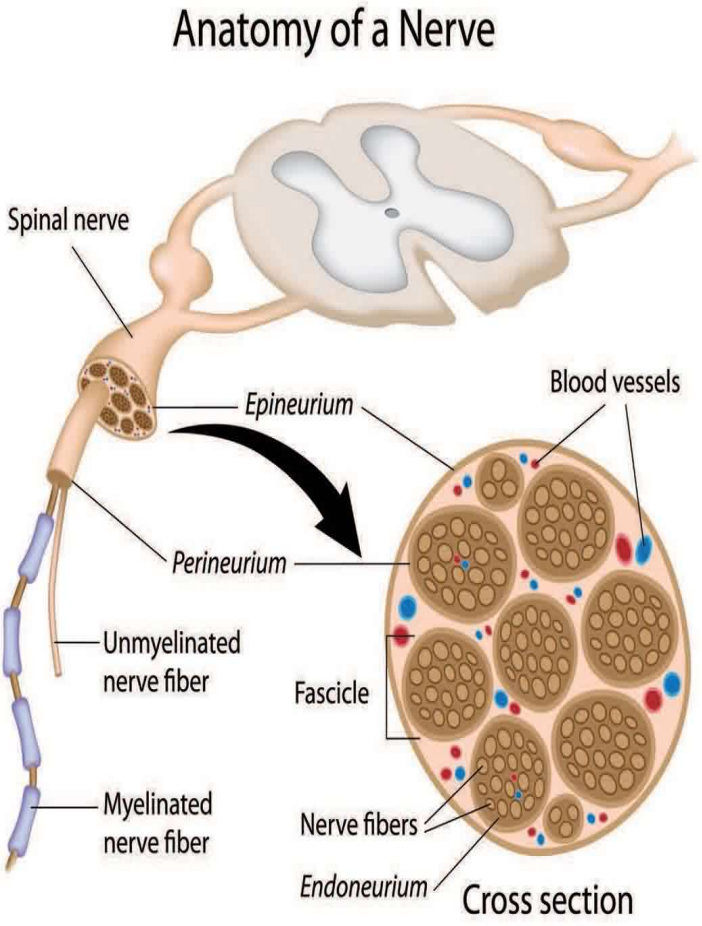


Spinal Cord

The spinal cord is a long, thin mass of bundled neurons that carries information through the vertebral cavity of the spine beginning at the medulla oblongata of the brain on its superior end and continuing inferiorly to the lumbar region of the spine. In the lumbar region, the spinal cord separates into a bundle of individual nerves called the cauda equina (due to its resemblance to a horse's tail) that continues inferiorly to the sacrum and coccyx. The white matter of the spinal cord functions as the main conduit of nerve signals to the body from the brain. The grey matter of the spinal cord integrates reflexes to stimuli.

Nerves

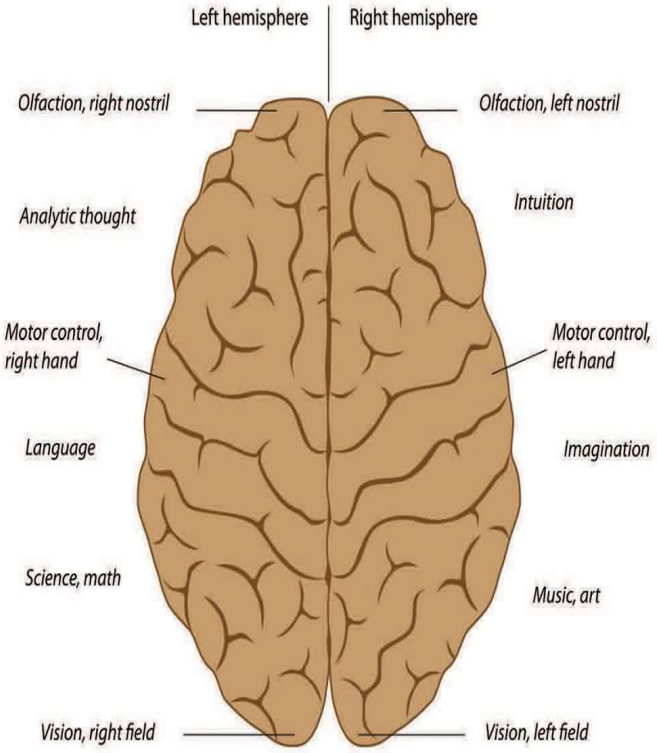
Nerves are bundles of axons in the peripheral nervous system (PNS) that act as information highways to carry signals between the brain and spinal cord and the rest of the body. Each axon is wrapped in a connective tissue sheath called the endoneurium. Individual axons of the nerve are bundled into groups of axons called fascicles, wrapped in a sheath of connective tissue called the perineurium. Finally, many fascicles are wrapped together in another layer of connective tissue called the epineurium to form a whole nerve. The wrapping of nerves with connective tissue helps to protect the axons and to increase the speed of their communication within the body.


Anatomy of a Nerve
Spinal nerve
Epineurium
Blood vessels
Perineurium
Unmyelinated
nerve fiber
Fascicle
Myelinated
nerve fiber
Nerve fibers
Endoneurium
Cross section

Sense Organs

All of the bodies' many sense organs are components of the nervous system. What are known as the special senses—vision, taste, smell, hearing, and balance—are all detected by specialized organs such as the eyes, taste buds, and olfactory epithelium. Sensory receptors for the general senses like touch, temperature, and pain are found throughout most of the body. All of the sensory receptors of the body are connected to afferent neurons that carry their sensory information to the CNS to be processed and integrated.

Lateralization of Brain Functions



Cerebrospinal Fluid

The space surrounding the organs of the CNS is filled with a clear fluid known as cerebrospinal fluid (CSF). CSF is formed from blood plasma by special structures called choroid plexuses. The choroid plexuses contain many capillaries lined with epithelial tissue that filters blood plasma and allows the filtered fluid to enter the space around the brain.

Cerebrospinal fluid provides several vital functions to the central nervous system:

- CSF absorbs shocks between the brain and skull and between the spinal cord and vertebrae. This shock absorption protects the CNS from blows or sudden changes in velocity, such as during a car accident.
- The brain and spinal cord float within the CSF, reducing their apparent weight through buoyancy. The brain is a very large but soft organ that requires a high volume of blood to function effectively. The reduced weight in cerebrospinal fluid allows the blood vessels of the brain to remain open and helps protect the nervous tissue from becoming crushed under its own weight.
- CSF helps to maintain chemical homeostasis within the central nervous system. It contains ions, nutrients, oxygen, and albumins that support the chemical and osmotic balance of nervous tissue. CSF also removes waste products that form as byproducts of cellular metabolism within nervous tissue.

Meninges

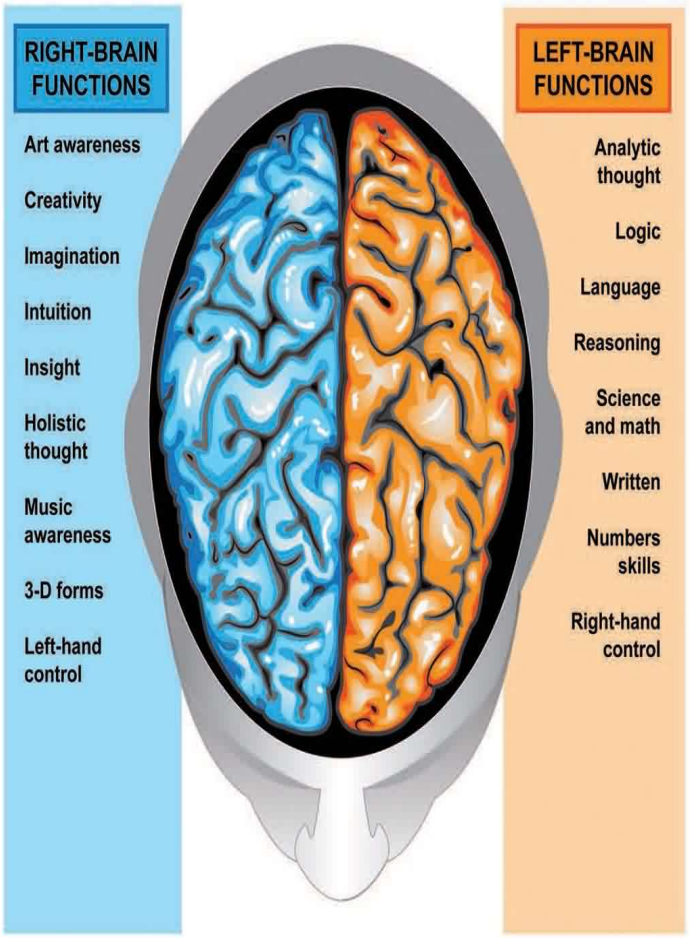
The meninges are the protective coverings of the central nervous system (CNS). They consist of three layers: the dura mater, arachnoid mater, and pia mater.

- Dura mater. The dura mater, which means "tough mother," is the thickest, toughest, and most superficial layer of meninges. Made of dense irregular connective tissue, it contains many tough collagen fibers and blood vessels. Dura mater protects the CNS from external damage, contains the cerebrospinal fluid that surrounds the CNS, and provides blood to the nervous tissue of the CNS.

- **Arachnoid mater.** The arachnoid mater, which means "spider-like mother," is much thinner and more delicate than the dura mater. It lines the inside of the dura mater and contains many thin fibers that connect it to the underlying pia mater. These fibers cross a fluid-filled space called the subarachnoid space between the arachnoid mater and the pia mater.

- **Pia mater.** The pia mater, which means "tender mother," is a thin and delicate layer of tissue that rests on the outside of the brain and spinal cord. Containing many blood vessels that feed the nervous tissue of the CNS, the pia mater penetrates into the valleys of the sulci and fissures of the brain as it covers the entire surface of the CNS.

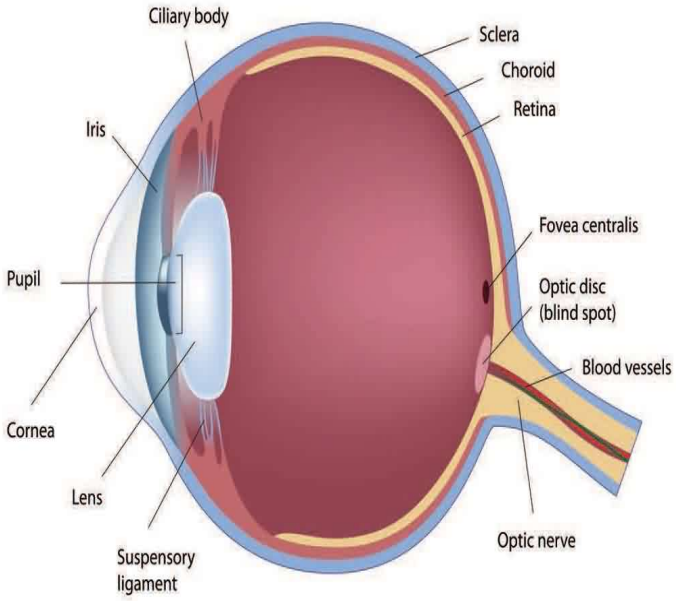
Functions of the Nervous System


RIGHT-BRAIN FUNCTIONS
Art awareness
Creativity
Imagination
Intuition
Insight
Holistic thought
Music awareness
3-D forms
Left-hand control
LEFT-BRAIN FUNCTIONS
Analytic thought
Logic
Language
Reasoning
Science and math
Written
Numbers skills
Right-hand control

Sensory

The sensory function of the nervous system involves collecting information from sensory receptors that monitor the body's internal and external conditions. These signals are then passed on to the central nervous system (CNS) for further processing by afferent neurons (and nerves).

Human Eye Anatomy



Sensory

The sensory function of the nervous system involves collecting information from sensory receptors that monitor the body's internal and external conditions. These signals are then passed on to the central nervous system (CNS) for further processing by afferent neurons (and nerves).

Sensory

The sensory function of the nervous system involves collecting information from sensory receptors that monitor the body's internal and external conditions. These signals are then passed on to the central nervous system (CNS) for further processing by afferent neurons (and nerves).

Functions of the Cranial Nerves

Each of the 12 cranial nerves has a specific function within the nervous system.

- The olfactory nerve (I) carries scent information to the brain from the olfactory epithelium in the roof of the nasal cavity.
- The optic nerve (II) carries visual information from the eyes to the brain.
- Oculomotor, trochlear, and abducens nerves (III, IV, and VI) all work together to allow the brain to control the movement and focus of the eyes. The trigeminal nerve (V) carries sensations from the face and innervates the muscles of mastication.
- The facial nerve (VII) innervates the muscles of the face to make facial expressions and carries taste information from the anterior 2/3 of the tongue.

- The vestibulocochlear nerve (VIII) conducts auditory and balance information from the ears to the brain.
- The glossopharyngeal nerve (IX) carries taste information from the posterior 1/3 of the tongue and assists in swallowing.
- The vagus nerve (X), sometimes called the wandering nerve due to the fact that it innervates many different areas, "wanders" through the head, neck, and torso. It carries information about the condition of the vital organs to the brain, delivers motor signals to control speech and delivers parasympathetic signals to many organs.
- The accessory nerve (XI) controls the movements of the shoulders and neck.
- The hypoglossal nerve (XII) moves the tongue for speech and swallowing.

The Cranial Nerves