Chapter 11

Human Body

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The human body is a set of different structures that are associated and create a network of dependencies between one another. The heart, for example, beats because the brain sends command messages to it. Blood flows because it is pumped by the heart. In other words, the human body is an organism, the term which originates from the Greek *organismós*, which means "together". Therefore, if any organ stops or has its work compromised, the whole body can suffer or become deficient.

11.1 Introduction

The human body is the structure of a human being. It consists of trillions of cells, the fundamental unit of life, which together are responsible for the formation of tissues that protect the organism from the outside world, and several others that are responsible for the formation of internal cavities. Cells group and form organs, which are structured collections of cells with specific functions. The organs are interconnected to each other and are part of specific systems, which maintain the human physical constitution. It also comprises about 60% of water and various elements, and approximately 25 kilograms of a 70-kilogram human are non-human cells or cellular material, one of which is the bones, which are responsible for supporting and protecting the most important internal structures. The combination of all factors allows the organism to guarantee homeostasis, which is the equilibrium state.

In basic anatomy, it is formed by the head, neck, stem (chest and abdomen), arms, hands, legs, and feet [1]. The study of the human body involves anatomy, physiology, and histology in embryology. The body varies anatomically in familiar ways. Physiology studies the systems and organs of the human body and their functions. Many systems and mechanisms interact to maintain homeostasis with safe levels of substances such as sugar and oxygen in the blood [2].

Figure 11.1: Human Body.

The human body is composed of several elements and four of these play fundamental roles, as they are responsible for approximately 95.2% of a human body mass, namely: hydrogen, oxygen, carbon, and nitrogen. The remainder of this mass is formed by various other elements that are found in smaller amounts, such as calcium, phosphor, potassium, sodium, chlorine, magnesium, and sulfur micronutrients (some, according to evidence, are necessary for life) [3, 4, 5, 6, 7, 8, 9].

Not all elements found in small amounts are important for the body [10], being considered simple contaminants that do not have fundamental functions, such as the cesium [11], while others are active toxins depending on the amount, such as mercury [12, 13, 14]. In humans, the arsenic is toxic and its levels in food need to be monitored to reduce or eliminate their digestion [15]. A human body contains at least detectable traces of 60 chemical elements, 25 of which have a positive role in the organism health.

Four elements are responsible for constituting most of the weight of a human, they are carbon, nitrogen, oxygen, and hydrogen. Hydrogen (9.5% of body mass) keeps the structure hydrated, in addition to being present in 90% of the composition of all atoms and it is found in carbohydrates, proteins, starches, and lipids that are necessary to human diet. It is present in adenosine triphosphate (ATP) [16], which is the main energy-transporting molecule [17].

Oxygen (responsible for 65% of body mass) is important for cells as they need oxygen to function, they use the substance mainly for the production of energy from food [18]. It is transported from the lungs to the rest of the organism through the blood, being necessary for metabolism [19], and is responsible for numerous biochemical intracellular reactions [20].

Constituting 18.5% of body mass, carbon is a tetravalent element, meaning it can be related to four other chemical elements [21], so it makes stable bonds with other atoms, which is one of the reasons that make it a fundamental atom. Carbohydrates, fats, and proteins are various examples of molecules composed of the element [22].

Nitrogen, being 3.3% by weight, is some of those responsible for the composition of the amino acids that make up proteins [23]. It is also one of the components of nucleic acids that make up the DNA and RNA [24].

Calcium, phosphorus, and sulfur are the most abundant mineral elements in the body [25]. Calcium is needed to keep bones strong and perform many vital functions, almost all of the substance is stored in bones and teeth, where it supports structure. It is necessary for muscular functions, and it helps blood vessels move blood [26]. Phosphorus, like calcium, supports bone development and plays roles in nucleic acids and cell membranes, helping the body produce energy and ATP, which is related to how the body uses carbohydrates and fats [27, 28]. Sulfur is important for multiple functions, composing and recomposing DNA, and promoting the protection of its microorganisms against damage [29]. In addition, sulfur is responsible for playing important roles in the synthesis of important metabolic intermediates, such as glutathione an essential amino acid found in proteins.

The composition of the human body beyond the atomic level can be seen on a molecular and cellular scale [30]. The molecules are the meeting of two or more atoms [31], such as water (H_2O), glucose ($C_6H_{12}O_6$), and nitrogen (N_2) [32]. Water, one of the critical nutrients whose absence leads to death, makes up between 75% (in infants) and 55% (in the elderly) of a human's body mass [33]. The bonds of molecules form the cells [34], which are the fundamental units and they are what keep the body alive [35]. There are trillions of these living particles that have different structures and functions [36]. Cells group and form tissues that make up structures with specific functions, such as organs [37].

11.1.1 Cells

The body contains trillions of cells, the fundamental unit of life [38]. At maturity, there are about 30-37 trillions of these particles in a human [39, 40], an estimate obtained by totaling the number of cells in the human structure. The body also hosts about the same number of non-human microorganisms [41] as well as multicellular organisms that reside in the gastrointestinal tract and on the skin [42]. Cells structure the body, absorb nutrients from foodstuffs and convert these into energy. They also perform specific functions in the body and possess the hereditary material of the body, that is, they can make copies of themselves [43].

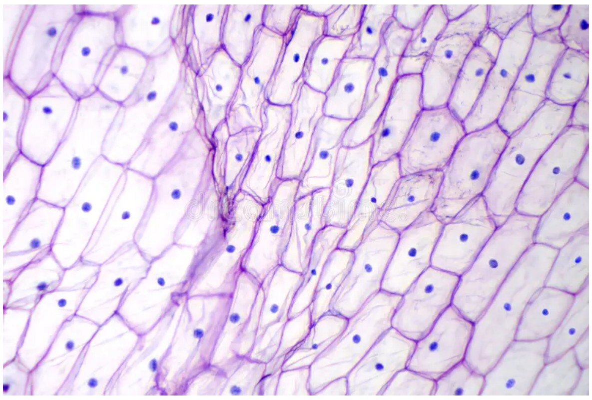

Figure 11.2: Skin section showing a large number of dendritic cells.

Cells have an internal structure with numerous parts, and each one has a distinct function. Some of these parts are called organelles, which are specialized structures that carry out certain functions internally. Human cells have as main parts: the cytoplasm, cytoskeleton, endoplasmic reticulum, Golgi complex, lysosomes and peroxisomes, mitochondria, nucleus, plasma membrane, and ribosomes [43]. The cytoplasm is formed by a gelatinous fluid called cytosol, which fills the interior of the cell and is mainly composed of salts, water, and other organic matter [44]. Its physicochemical properties influence important cellular functions such as protein folding, enzymatic catalysis, intracellular signaling, intracellular transport, and localization of molecules and organelles, as well as the fate of nanoparticles and cell-targeted therapeutic agents [45].

The cytoskeleton is one of the most complex and versatile structures and is involved in processes such as endocytosis, cell division, intracellular transport, motility, force transmission, reaction to external forces, adhesion, preservation, and adaptation of cell shape [46]. Such functions are performed by three categories of cytoskeletal filaments, namely: actin, microtubules, and intermediate filaments. In brain tumors, the cytoskeleton plays an important role in the propagation and migration of tumor cells [47]. The endoplasmic reticulum is a large dynamic structure that performs numerous functions, some of which are: calcium storage, protein synthesis, and lipid metabolism. The Golgi complex organizes molecules processed by the endoplasmic reticulum to the outside of the cell [48].

Lysosomes and peroxisomes are organelles surrounded by a single membrane, within which they have digestive enzymes, and their interior is acidic.They have an important function in metabolism, due to the enzymes that break down fatty acids and amino acids [49]. Mitochondria is a membrane-bound organelle that generates much of the energy to supply the cell's biochemical needs. It stores this energy in adenosine triphosphate [50]. The nucleus is the information center of the microorganism, whose main function is to store the hereditary material (DNA) [51] and manage cell activities [43], which include growth, intermediary metabolism, protein synthesis, and cell division.The plasma membrane is the lining of the cell against the outside, its main function being to regulate the entry and exit of materials[52]. Ribosomes are the structures on which proteins are made [53].

11.1.2 Genome

The cells of the body function because of the DNA. DNA sits inside the nucleus of a cell, parts of the DNA are copied and sent to the cell body via RNA [54]. The RNA is then used to create proteins that form the basis of cells, their activity, and their products. Proteins dictate cellular function and gene expression, a cell can self-regulate by the amount of proteins produced [55]. However, not all cells have DNA; some cells, such as red blood cells mature, lose their core as they mature [56].

11.1.3 Tissues

The human body consists of many categories of tissues, defined as cells that perform a specialized function [57]. The study of tissues is called histology and usually occurs with a microscope. The body consists of four main types of tissues: lining cells (epithelia), connective tissue, nervous tissue, and muscle tissue [58].

Cells found on surfaces exposed to the outside world or gastrointestinal tract (epithelium) or internal cavities (endothelium) come in various shapes and forms, such as single layers, cells with tiny cilia, or cells like columns, for example. Endothelial cells line internal cavities, including blood vessel islands. Lining cells regulate what can and cannot pass through them, protecting internal structures [58].

11.1.4 Bodies

Organs are formed by tissues, that is, collections of structured cells that, even though they are not identical, work with each other [59]. For example, the heart is mainly composed of cardiomyocytes and connective tissue [60]. Organs are considered structures of extreme importance [61], and the human body has five vital organs: brain, heart, lungs, liver, and kidneys, without which the survival of the organism is not possible [62] because, if any of them stop working, death is the consequence when there is no intervention [63].

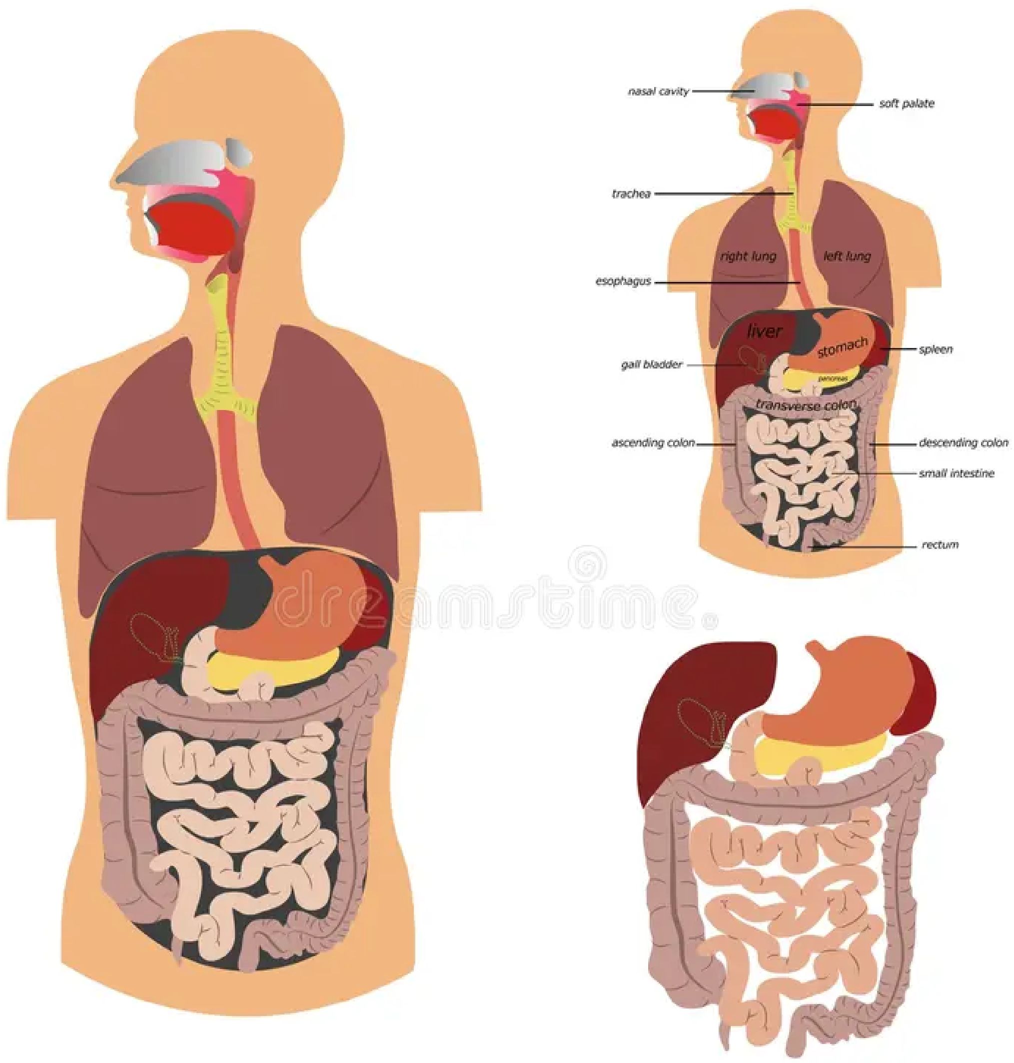

Figure 11.3: Body cavities.

Most of the time the organs are located in internal cavities [61], except the skin, which is considered the largest structure in the body [64], and the cavities are subdivided into dorsal and ventral, within which the internal organs are located. For research purposes and more exact locations, the dorsal and ventral cavities are also subdivided: the dorsal into the cranial cavity (where the brain is located) and the spinal canal (in which passes the spinal cord, which is the extension of the central nervous system); the ventral in the thoracic cavity (locality where the heart and lungs, the thoracic parts of the large vases and other important structures are), and the abdominopelvic, which is divided into the abdominal cavity (where the stomach, liver, gallbladder, spleen, pancreas, small and large intestine, adrenal glands and kidneys are) and pelvic (the region where the reproductive organs are located, as well as the rectum, bladder, and urethra) [65, 66, 67].

The body is made up of multiple organs that are part of systems, which are formed by the assembly of structures that perform specific functions within the body. Each organ has a role within the body [68], (e.g., the heart is part of the circulatory system and its function is to pump the blood [69], while the stomach belongs to the digestive system and its function is to perform the chemical and mechanical digestion of food, so that it transforms the food cake in chyme so that further digestion is continued in the small intestine [70, 71]). Vestigial organs do not have specific and vital functions and are the result of evolutionary adaptations affected by the human being. These structures have already had some main functions before, but with the evolution, their functionalities were modified and they stopped exercising their previous main function. The best example of a vestigial organ is the cecal appendix, which is a small tubular extension of the large intestine, and constitutes a vestige of a redundant organ that in ancestral species had digestive functions, but with the modifications of this structure, its function was modified and, in modernity, it is related to the protection of the population of bacteria that inhabits and interferes with the proper functioning of the digestive system [72, 73, 74] .

The word organ comes from the Latin *organum* [75] and from the Greek *organon*, which in literal translation means "instrument" [76], and it was not until the seventeenth century that the term began to be used for anatomical purposes [77]. Approximately four thousand years ago in the region of Mesopotamia and ancient Egypt, the population was already doing investigations to discover better information about the body, and for that, they tried to describe the basics of life, relating erroneous ideas of the function of the liver and other organs (they constantly tried to explain the function of these structures about "soul" of the human being) [78].

11.1.5 Systems

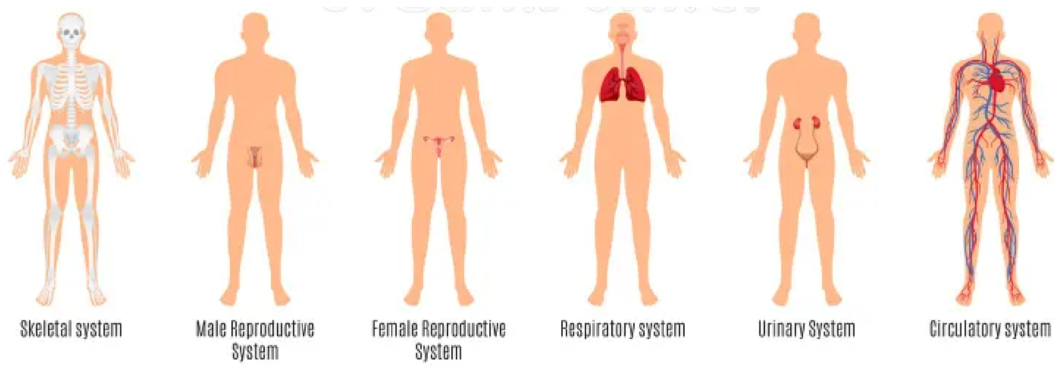

Figure 11.4: Body systems (I).

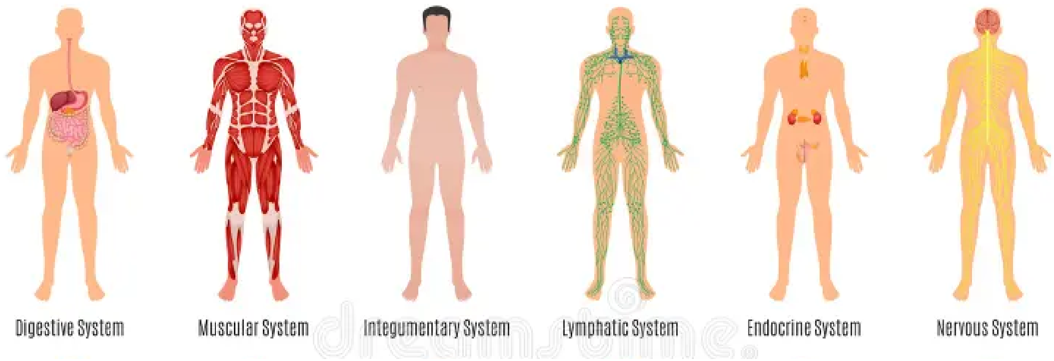

Figure 11.5: Body systems (II).

The body's organs are often associated with systems, which are the assembly of structures that cooperate to carry out complex and considerable functions within the organism. Several systems are necessary for the survival of the species [79], and each one has different functions and, therefore, unique roles to play in physiology [80]. They are: the circulatory (divided into two other systems for research purposes: cardiovascular, responsible for transporting nutrients and oxygen to all cells through the blood and the lymph that collects impurities and conducts the white blood cells and many others, through lymph) [81], digestive (where the transformation of food into nutrients takes place as well as the elimination of what is not necessary through the feces), endocrine (makes the regulation and administration of the functions of the body through glands, which produce and release hormones), immunological(defends the organism from the invasion of pathogens), integument (protects from the outside world, regulates body temperature, and is responsible for sensitivity), locomotoror musculoskeletal (provides structure and locomotion, it is also divided into two other systems which are muscular and skeletal) [82], nervous (body control center, tasked with transmitting signals), breeder (guarantees the descent of the species through gametes, which later fertilization will turn into an embryo in the womb), respiratory (brings oxygen from the air to the body), and urinary (filters the blood and removes toxins and waste, turning it into urine) [83, 84].

Some body organs have multiple functions and are part of more than one system, while others have only one function [84]. For example, the thymus is part of the lymphatic and immune system [85], the ovaries integrate the reproductive and endocrine, the pharynx belongs to the respiratory and digestive [86].

The systems effectively interact with each other, these interactions have basic rules, i.e., latent to the complex hierarchical reorganization in physiological networks with transitions between physiological states. Health and different physiological states arise from network interactions between complex systems of many nonlinear components. Doctors traditionally focus on a single system, for example, cardiologists examine the heart and consider the signs of the ECG; neurologists work with the brain and use signals from MRI and brain waves [87].

However, the organism is an integrated network, in which systems formed by various structures make contact continuously through various procedures through various acquired responses and at different time scales to optimize and coordinate their function. These interactions are essential for maintaining health and generating distinct physiological states, such as vigil and sleep, light and deep sleep, conscience, and unconsciousness. Modification or disruption of organ communications can lead to dysfunction of individual systems or the breakdown of the entire organism, for example, fever, hypertension, and multiple organ failure, but despite the importance of cognition of basic physiological functions, there is little about the nature of the dynamic interactions between diverse systems and their collective role as an integrated health network [88].

The word "system" comes from Greek, and originates from *synistanai*, which is the combination of *syn*, which means "gathering or assembly" and *histanai*, in literal translation "to bring to exercise", thus the word *synistanai* portrays "to bring to exercise together ". From this word arose *systema*, meaning the "association of different parts" [89, 90].

11.1.6 Circulatory System

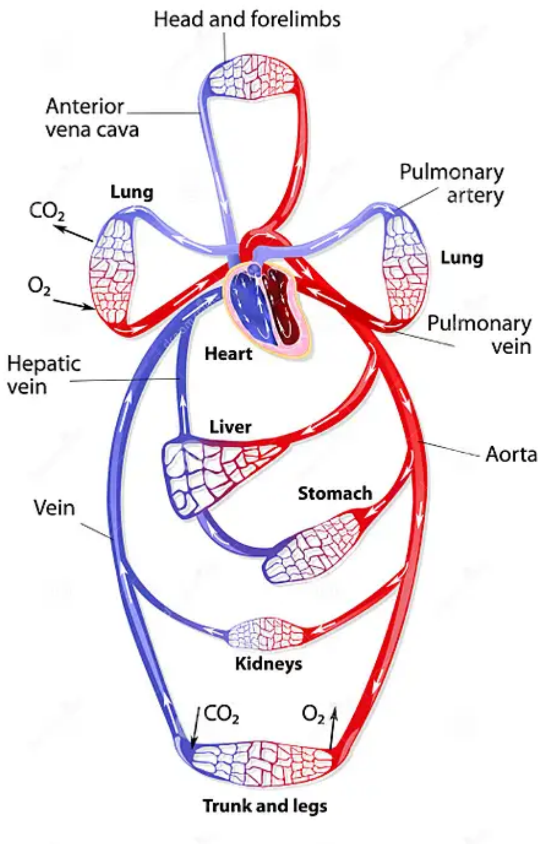

Figure 11.6: Circulatory System.

The circulatory system consists of the heart and blood vessels (arteries, veins, and capillaries). The heart drives blood circulation, which serves as a "transport system" to transfer oxygen, nutrients, waste products, immune cells, and signaling molecules (i.e., hormones) from one part of the body to another. The pathways of blood circulation within the human body can be divided into two circuits: the pulmonary circuit, which pumps blood into the lungs to take in oxygen and leave carbon dioxide, and the systemic circuit, which carries blood from the heart to the rest of the body [91, 92, 93].

11.1.7 Digestive System

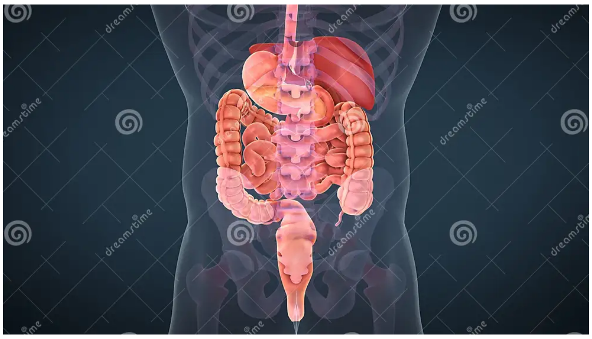

Figure 11.7: Digestive System.

The digestive system consists of the mouth, including the language and the teeth, the esophagus, the stomach, gastrointestinal tract (intestines and rectum), as well as the liver, pancreas, gallbladder, and salivary glands. It converts food into small, nutritious, non-toxic molecules for distribution and absorption throughout the body. These molecules take the form of proteins, which are broken into amino acids, fats, vitamins, and minerals (the latter of which are primarily ionic rather than molecular). After being swallowed, food moves through the gastrointestinal tract through the peristalsis: the systematic expansion and contraction of muscles to push food from one area to another [94].

Digestion begins in the mouth, which chews food into smaller pieces for easier digestion. It is then swallowed and passes through the esophagus into the stomach. In the stomach, food is mixed with gastric acids to allow the extraction of nutrients. What remains is called chyme; it then moves to the small intestine, which absorbs nutrients and water from the chyme. What is left goes to the large intestine, where it is dried to form feces; these are then stored in the rectum until they are expelled through the anus [95].

11.1.8 Endocrine System

The endocrine system consists of the main endocrine glands: hypophysis, thyroid, adrenals, pancreas, parathyroids, and gonads, but almost all organs and tissues also produce specific endocrine hormones. Endocrine hormones serve as signals from one body system to another regarding a huge variety of conditions, resulting in a variety of changes in function [96].

11.1.9 Immune System

The immune system consists of white cells of the blood, the thymus, lymph nodes, and the lymphatic channels, which are also part of the lymphatic system. The immune system provides a mechanism for the body to distinguish its cells and tissues from foreign cells and

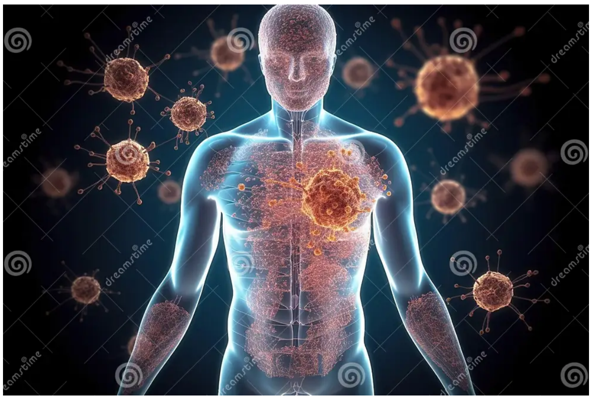

Figure 11.8: Immune system.

substances and to neutralize or destroy the latter using specialized proteins such as antibodies, cytokines, and isotype receptors, among many others [97].

11.1.10 Integumentary System

The integumentary system consists of the covering of the body (the skin), including hair and nails, as well as other functionally important structures such as the sweat glands and the sebaceous glands. The skin provides containment, structure, and protection for other organs and serves as an important sensory interface with the external world [98, 99].

11.1.11 Lymphatic system

The lymphatic system extracts, transports, and metabolizes lymph, the fluid found between cells. The lymphatic system is similar to the circulatory system in terms of its structure and most basic function, i.e., the transport of body fluid.

11.1.12 Locomotor System

The locomotor system consists of the human skeleton (which includes bones, ligaments, tendons, and cartilage) and muscles. It gives basic structure to the body and the ability to move. In addition to their structural role, the larger bones of the body contain the bone marrow, the site of production of blood cells. In addition, all bones are major storage sites for calcium and phosphate. This system can be divided into the muscular and the skeletal systems [100].

11.1.13 Nervous System

The nervous system consists of neurons and glial cells of the body, which together form the nerves, ganglia, and a gray matter which, in turn, forms the brain and related structures. The brain is the organ of thought, emotion, memory, and sensory processing; it serves many aspects of communication and controls various systems and functions. The senses consist of

Figure 11.9: Locomotor system.

Figure 11.10: Nervous system.

vision, hearing, palate, smell, and tact. Eyes, ears, tongue, nose, and skin gather information about the body's environment [101].

From a structural perspective, the nervous system is normally subdivided into two parts: the central nervous system (CNS), composed of the brain and spinal cord, and the peripheral nervous system (PNS), made up of the nerves and ganglia outside the brain and spinal cord [102]. The CNS is primarily responsible for organizing movement, processing sensory information, thinking, memory, cognition, and other similar functions [103]. It is still a matter of debate whether the CNS directly gives rise to consciousness. The peripheral nervous system (PNS) is primarily responsible for gathering information with sensory neurons and directing body movements with motor neurons [102].

From a functional perspective, the nervous system is again divided into two parts: the somatic nervous system (SNS) and the autonomic nervous system (ANS). The SNS is involved in voluntary functions such as speech and sensory processes. The ANS is involved in involuntary processes such as digestion and the regulation of blood pressure [104].

The nervous system is subject to many different diseases. In epilepsy, abnormal electrical activity in the brain can cause seizures. In multiple sclerosis, the immune system attacks the nerve linings, impairing the nerves' ability to transmit signals. Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is a motor neuron disease that gradually reduces the patient's movements. There are also many other diseases of the nervous system [102].

11.1.14 Reproductive System

The reproductive system consists of gonads and internal and external sexual organs. The reproductive system produces different gametes for each gender, a mechanism for their combination. In women's organisms, there is a nurturing environment for the first nine months of a baby development [105].

11.1.15 Respiratory System

The respiratory system consists of the nose, nasopharynx, trachea, and lungs. It brings oxygen from the air and excretes carbon dioxide and water back into the air. First, the air is drawn through the trachea into the lungs by the diaphragm pushing down, which creates a vacuum. The air is briefly stored inside small bags known as alveoli, before being expelled from the lungs when the diaphragm contracts again. Each alveolus is surrounded by capillaries that carry oxygenated blood, which absorbs oxygen from the air into the bloodstream [106, 107].

For the respiratory system to function properly, there must be as few impediments to the movement of air within the lungs as possible. Inflammation of the lungs and excess mucus are common sources of breathing difficulties. At asthma, the respiratory system is persistently inflamed, causing wheezing and/or shortness of breath. A pneumonia occurs by infection of the alveoli and can be caused by tuberculosis. The emphysema is usually the result of smoking and is caused by damage to the connections between the alveoli [108].

Figure 11.11: Respiratory System.

11.1.16 Urinary System

The urinary system consists of the kidneys, ureters, bladder, and the urethra. It removes toxic materials from the blood to produce urine, which carries a variety of waste molecules and excess ions, and water out of the body [109].

11.2 Anatomy

Human anatomy is the study of the shape and form of the human body. The human body has four limbs (two arms and two legs), a head, and a neck that connect to the body torso. The body's shape is determined by a strong skeleton made of bone and cartilage, surrounded by fat, muscles, connective tissue, organs, and other structures. A spinal column is the back of the skeleton that surrounds the spinal cord, which is a collection of nerve fibers that connect the brain to the rest of the body. Nerves connect the spinal cord and brain to the rest of the body. All major bones, muscles, and nerves in the body are named, except anatomical variations such as sesamoid bones and accessory muscles [110].

Blood vessels carry blood throughout the body, which moves because of heartbeats. Venules and veins collect low-oxygen blood from body tissues. These group into progressively larger veins until they reach the two largest veins in the body, the superior and inferior vena cava, which drain blood to the right side of the heart. From here, blood is pumped to the lungs, where it receives oxygen, and is drained back to the left side of the heart, where it is pumped to the largest artery of the body, the aorta, and then arteries and arterioles progressively smaller until reaching the tissues. Here, blood passes from small arteries to capillaries, then to small veins and the process starts again. Blood carries oxygen, waste products, and hormones from one place to another in the body. Blood is filtered in the kidneys and liver [110].

The body consists of several body cavities, separate areas that house different organ systems. The brain and central nervous system reside in an area protected from the rest of the body by the blood-brain barrier. The lungs are in the pleural cavity. The intestines, liver,

Figure 11.12: Human anatomy.

and spleen are in the abdominal cavity [110].

Height, Weight, shape, and other body proportions vary individually and with age and sex. Body shape is influenced by the distribution of muscles and adipose tissue [110].

11.3 Physiology

Human physiology is the study of how the human body works. This includes the mechanical, physical, bioelectrical, and biochemical functions of humans in good health, from the organs to the cells that compose them. The human body consists of many interacting organ systems. They interact to keep homeostasis, keeping the body in a stable state with safe levels of substances like sugar and oxygen in the blood [111].

Each system contributes to homeostasis, of itself, of other systems, and of the whole body. Some combined systems are jointly named, e.g., the nervous system and the endocrine system work together like the neuroendocrine system. The nervous system receives information from the body and transmits it to the brain through nerve impulses and neurotransmitters. At the same time, the endocrine system releases hormones, which help regulate blood pressure and volume. Together, these systems regulate the body's internal environment, maintaining the blood flow, posture, energy supply, temperature, and acid balance (pH) [111].

11.4 Development

The development of the human body is the process of growing to maturity. The process starts with fertilization, where the ovum released from the ovary of a woman is penetrated by sperm. The fertilised ovum then lodges in the uterus, where the embryo and subsequently the fetus develop until birth. Growth and development occur after birth and include physical and psychological development, influenced by genetic, hormonal, environmental, and other factors. Development and growth continue throughout life, from infancy, adolescence, and adulthood to old age, and are referred to as the aging process [112].

11.5 Society and Culture

11.5.1 Professional Study

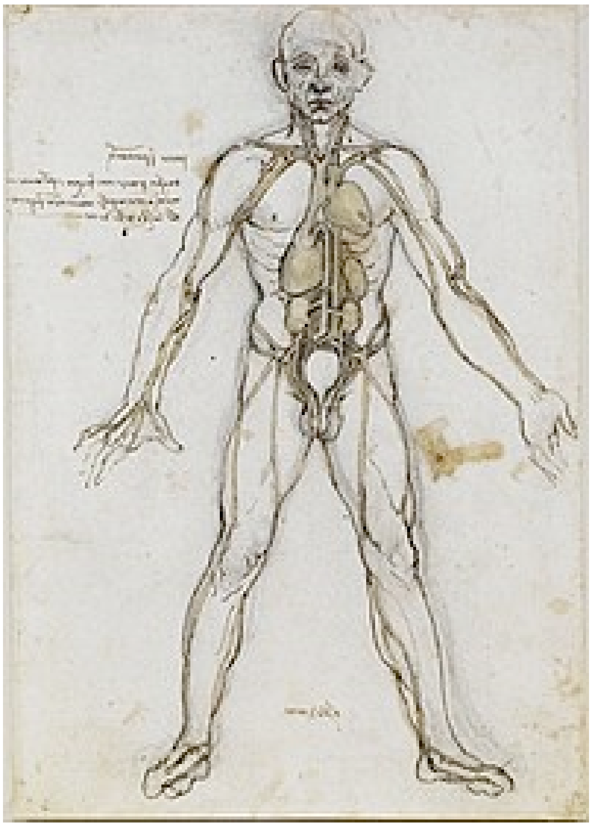

Figure 11.13: Anatomical study of Leonardo da Vinci.

Health professionals learn about the human body through illustrations, models, and demonstrations. Furthermore, students from medicine gain practical experience, for example, in the dissection of dead bodies. Human anatomy, physiology, and biochemistry are basic medical sciences, usually taught to medical students in their first year of medical school [113].

11.5.2 Representation

Figure 11.14: The born of Venus per Sandro Botticelli (1485).

Anatomy has served the visual arts since the times of ancient Greece when the sculptor Polykletus of 5th century BC wrote his canon on the ideal proportions of the body. During the Italian Renaissance, artists such as Piero della Francesca (c. 1415–1492) onwards, including Leonardo da Vinci (1452–1519) and his collaborator Luca Pacioli (c. 1447–1517), learned and wrote about the rules of the art, including the visual perspective and the proportions of the human body [114].

11.5.3 Philosophy

The body has always been an object of curiosity because it is a mysterious mechanism. This fact led each area of human knowledge to present possible definitions for the body as its object of study [115].

Plato defined man as composed of body and soul. Plato's philosophical theory is fundamentally based on the split between two worlds: the intelligible of the soul and the sensible of the body. The Platonic thinking is essential for understanding an entire philosophical lineage that values the intelligible world to the detriment of the sensible. The soul holds wisdom and the body is the prison where the soul is dominated by it, when it is incapable of regulating the desires and tendencies of the sensible world [115].

Foucault conceived the body as the place of all interdictions. All social rules tend to build a body through the aspect of multiple determinations. For Lacan, the body is the mirror of the mind and says a lot about ourselves. For Nietzsche, there is only the body that we are, and this is more surprising than the olden soul [115].

For Michel de Certeau, the body is found as the place of crystallization of all interdictions and also the place of all freedoms. Georges Bataille defined the body as a base, submissive, servile thing like a stone or a piece of wood [115].

For Rene Descartes, whose philosophy originated the system of Cartesianism, the body as an organism is a machine, in contrast to the mind, and this separation is known as mind-body dualism. Baruch Espinoza also shared the definition of body and mind but considered them in their monism as continuations of the same substance [116].

For Gilles Deleuze, a body can be controllable, since logical meanings can be attributed to it. stated this philosophy that we are "desiring machines". In his theory, when talking about bodies-language he said that the body "is the language because it can hide the word and cover it up". The description of the body is psychomotor, not psychic, it is a union between psychism and motricity [116].

Merleau-Ponty mentioned that the body is a mirror of another body. About the metamorphosis of the body, Paul Valery proposed the problem of three bodies: the body itself; the reflex body, point narcissus, inflection that relates to the surroundings, the seen, what you see; and the body that is precisely the unfathomable spaces, both by sight and by touch, function, physiology and functioning, the microscopic universe, liquids, liquefaction [116].

11.5.4 Phenomenology

From the 1970s, body art began to include the body as a subject of the spectacle and for art in itself. With the technological impulse, from the 1990s, there was a greater self-appropriation by the artist of his body and the body of others as subject and object of the aesthetic experience. Every day television is stamping "vignettes" and soap opera openings with digital effects inside our homes, showing bodily performances: the simulacrum of the body [116].

11.5.5 History of Anatomy

In Ancient Greece, the Corpus Hippocraticum described the anatomy of the skeleton and muscles.The 2nd Century Physician Claude Galen compiled classical knowledge of anatomy into a text that was used during the Middle Ages. Anatomy advanced further with the invention of the microscope and the study of the cellular structure of tissues and organs. Modern anatomy uses techniques such as MRI, computed tomography, fluoroscopy, and ultrasound to study the body in unprecedented detail [117].

11.5.6 History of Physiology

The study of human physiology began with Hippocrates in Ancient Greece, around 420 BC, and with Aristotle (384-322 BC), who applied critical thinking and an emphasis on the relationship between structure and function. Galen (126–199) was the first to use experiments to probe body functions. The term physiology was introduced by the French physician Jean Fernel (1497–1558). In the XVII century, William Harvey (1578-1657) described the circulatory system, pioneering the combination of close observation with careful experiments.In the XIX century, physiological knowledge began to accumulate at a rapid pace with the cell theory of Matthias Schleiden and Theodor Schwannin in 1838, which determined that organisms are made of cells. Claude Bernard (1813–1878) created the concept of milieu interior (internal environment), which Walter Canon (1871–1945) later said was regulated to a steady state of homeostasis. In the twentieth century, the physiologists Knut Schmidt-Nielsen and George Bartholomew extended their studies to comparative physiology and ecophysiolog. More recently, evolutionary physiology became a distinct subdiscipline [118].

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