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Opinion

Top Down Algorithm to Analysis Human Body

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Abstract

Human body consist of various functional parts, each part on its term is consisted of some subparts, which are in relation with each other, an illness would begin, if a malfunction occurs between subparts relationships or in their activities. Each subpart is made of smaller parts which are made from cells and molecules which have that parts attribute, and molecules are divided into the smallest object which are called atoms. To analysis the human body in top down manner, the object oriented principle is applied; whole body would be the main system, and different organs are subsystems or sub objects, being able to carry out internal and external activities, and use the output from different organs and input attribute from other organs, so the organs have internal and external relations, these would cause voluntary and involuntary activities of the human body.

Keywords: *Top Down Algorithm; System; Subroutine; Local Variable; Activity*

Introduction

To analysis the body operation system, top down modelling technique is acquired; breaking the body system into smaller sub systems enabling system study, its sub system and their interaction a lot easier and more accurate, and finding problems in sub systems and the whole system.

Scientists in different discipline; biology, chemical engineering, production engineering, and other fields of study, could apply top down modeling technique and its required algorithms, enabling them to analysis system under investigation and its sub systems more easier and effective.

This technique was acquired in computer simulation language Simula, and C++, Python and Java, and also is used in different computer science fields; hardware; hard disc manufacturing principle; disc, sector, files, characters and software; designing a program; program, subprograms, algorithms and statements, in car manufacturing companies different sub sections of cars; engine, gearbox, tiers, and body are manufactured isolated and then assembled, in computer backing storage system, there exists a hierarchal manufacturing procedure; cylinders, discs, tracks, files, fields and characters, and there are other parts which regulate different sections working.

Top down modelling Algorithm

The algorithm could be written in pseudo form, as followed:

System(object$_1$, object$_2$, ……..,object$_n$)

Internal activities;

Relational activities;

Produce results;

End;

Dividing the system to subsystems gives:

Object1:

$Object_1$ ($subobject_{11}$,$subobject_{12}$,……..,$subobject_{1n}$)

Internal activities;

External activities;

Relational activities;

End;

Object 2:

Object2 ($subobject_{21}$,$subobject_{21}$,……..,$subobject_{2n}$)

Internal activities;

External activities;

Relational activities;

End;

Object n:

$Object_n$ ($subobject_{n1}$,$subobject_{n1}$,……..,$subobject_{nn}$)

Internal activities;

External activities;

End;

Using top down modelling to analysis human body system

To analysis the human body system, it could be granulated to following subsystems:

1. Blood-circulation subsystem; hart, blood-vessels.
   Subsystem-hart; arteria, ventricles, valves.
   Subsystem-blood-vessels; arteries, vein, capillary.
2. Digestive- subsystem; mouse, tongue, teeth, Esophagus, stomach, small- intestine, colon, liver, pancreas, gallbladder;
   Subsystem- mouse,
   Subsystem tongue,
   Subsystem teeth,
   Subsystem esophagus,
   Subsystem stomach,
   Subsystem small intestine,
   System colon,
   Subsystem liver,
   Subsystem pancreas,
   Subsystem gallbladder.

3. Endocrine- subsystem; Pituitary-gland, thyroid-gland, Adrenal-glands, Pancreas, Parathyroid-glands, Gonads;
   Subsystem-pituitary-gland,
   Subsystem-thyroid-gland,
   Subsystem-adrenal-glands,
   Subsystem-pancreas,
   Subsystem-parathyroid-glands,
   Subsystem-gonads.
4. Mussels- skeletons- subsystem; bones, Ligaments, tendons, Cartilage, mussels;
   Subsystem-bones- in- body; head, hands, chest, feet, hips;
   Subsystem-ligaments- in- body; head, hands, chest, feet, hips;
   Subsystem-tendons-in-body; head, hands, chest, feet, hips;
   Subsystem-cartilage-in-body; head, hands, chest, feet, hips;
   Subsystem-mussels-in-body; head, hands, chest, feet, hips;
5. Reproduction- subsystem; Gonads, reproductive-organs;
   Subsystem-gonads;
   Subsystem-reproductive-organs.
6. Immune-system (White-blood-cells, Thymus, Lymph-nodes, Lymphatic-channels)
   Subsystem-white-blood-cells,
   Subsystem-thymus,
   Subsystem-lymph-nodes;
   Subsystem-lymphatic-channels;

Other parts of body system could be explained in the same manner.

Results and Discussions

Using this algorithm each object or entity could be defined, its activities could be monitored using different random input, and its interaction with other objects tested and manipulated, helping physicians to find new ways of curing illnesses.

Appendix

System-body (subsystem-Nerves-system, subsystem-mussels-skeletons, Subsystem-blood-circulations, Subsystem- Digestive, Subsystem-body-covering, Subsystem-Urinary-tract, Subsystem- reproduction, Subsystem-Immune-system, Subsystem-Endocrine-system)

Subsystem-Nerves-system (subsystem-Brain, subsystem-spinal-cord)
Subsystem-Brain (feeling, memory, process-feeling, interconnection-of-systems);
Subsystem-spinal-cord (movement-of-systems);
End;

Subsystem- mussels- skeletons (bones, Ligaments, tendons, Cartilage, mussels)
Subsystem-bones- in- body (head, hands, chest, feet, hips);
Subsystem-ligaments- in- body (head, hands, chest, feet, hips);
Subsystem-tendons-in-body (head, hands, chest, feet, hips);
Subsystem-cartilage-in-body (head, hands, chest, feet, hips);
Subsystem-mussels-in-body (head, hands, chest, feet, hips);
End;

Subsystem-body-covering (skin, nails, hairs, fat-glands, sweat-glands)

Subsystem-skin (The human skin is the outer covering of the body. In humans, it is the largest organ of the integumentary system. The skin has up to seven layers of ectodermal tissue and guards the underlying muscles, bones, ligaments and internal organs [1]. Human skin is similar to most of the other mammals skin, and human skin is very similar to pig skin. Though nearly all human skin is covered with hair follicles, it can appear hairless. There are two general types of skin, hairy and glabrous skin (hairless);

Subsystem-nail (A nail is a horn-like envelope covering the tips of the fingers and toes in most primates and a few other mammals. Nails are similar to claws in other animals. Fingernails and toenails are made of a tough protective protein called alpha-keratin. This protein is also found in the hooves and horns of different animals;

Subsystem-hairs);

Subsystem-fat-glands (Sebaceous glands are microscopic exocrine glands in the skin that secrete an oily or waxy matter, called sebum, to lubricate and waterproof the skin and hair of mammals. In humans, they occur in the greatest number on the face and scalp, but also on all parts of the skin except the palms of the hands and soles of the feet. The type of secretion of the sebaceous glands is referred to as holocrine. In the eyelids, meibomian glands, also called tarsal glands, are a type of sebaceous gland that secrete a special type of sebum into tears. Fordyce spots are ectopic (misplaced) sebaceous glands found usually on the lips, gums and inner cheeks, and genitals. Areolar glands surround the female nipples);

Subsystem-sweat-glands (Sweat glands, also known as sudoriferous or sudoriparous glands, from, are small tubular structures of the skin that produce sweat. Sweat glands are a type of exocrine gland, which are glands that produce and secrete substances onto an epithelial surface by way of a duct. There are two main types of sweat glands that differ in their structure, function, secretory product, mechanism of excretion, anatomic distribution, and distribution across species, Eccrine gland; sometimes called merocrine glands) are the major sweat glands of the human body, found in virtually all skin, with the highest density in palms and soles, then on the head, but much less on the trunk and the extremities. In lower mammals, they are relatively sparse, being found mainly on hairless areas such as foot pads. They reach their peak of development in humans, where they may number 200 - 400/cm^2 of skin surface]. They produce a clear, odorless substance, sweat, consisting primarily of water);

End;

Subsystem-blood-circulations (hart, blood vessels)

Subsystem-hart (arteria, ventricles, valves);

Subsystem-blood-vessels (Arteries, Vein, Capillary)

End;

Subsystem- Digestive (mouse, tongue, teeth, Esophagus, stomach, Small-intestine, colon, liver, pancreas, Gallbladder)

Subsystem-mouse (In human anatomy, the mouth is the first portion of the alimentary canal that receives food and produces saliva [1]. The oral mucosa is the mucous membrane epithelium lining the inside of the mouth. In addition to its primary role as the beginning of the digestive system, in humans the mouth also plays a significant role in communication. While primary aspects of the voice are produced in the throat, the tongue, lips, and jaw are also needed to produce the range of sounds included in human language. The mouth consists of two regions, the vestibule and the oral cavity proper. The mouth, normally moist, is lined with a mucous membrane, and contains the teeth. The lips mark the transition from mucous membrane to skin, which covers most of the body);

Subsystem-tongue (The tongue is a muscular organ in the mouth of most vertebrates that manipulates food for mastication, and is used in the act of swallowing. It is of importance in the digestive system and is the primary organ of taste in the gustatory system. The tongue's

upper surface (dorsum) is covered by taste buds housed in numerous lingual papillae. It is sensitive and kept moist by saliva, and is richly supplied with nerves and blood vessels. The tongue also serves as a natural means of cleaning the teeth [2]. A major function of the tongue is the enabling of speech in humans and vocalization in other animals. The human tongue is divided into two parts, an oral part at the front and a pharyngeal part at the back. The left and right sides are also separated along most of its length by a vertical section of fibrous tissue (the lingual septum) that results in a groove, the median sulcus on the tongue's surface. There are two groups of muscles of the tongue. The four intrinsic muscles alter the shape of the tongue and are not attached to bone. The four paired extrinsic muscles change the position of the tongue and are anchored to bone);

Subsystem-teeth (The human teeth function to mechanically break down items of food by cutting and crushing them in preparation for swallowing and digesting. Humans have four types of teeth: incisors, canines, premolars, and molars, each with a specific function. The incisors cut the food, the canines tear the food and the molars and premolars crush the food. The roots of teeth are embedded in the maxilla (upper jaw) or the mandible (lower jaw) and are covered by gums. Teeth are made of multiple tissues of varying density and hardness);

Subsystem-esophagus (The esophagus (American English) or esophagus (British English, commonly known as the food pipe or gullet (gut), is an organ in vertebrates through which food passes, aided by peristaltic contractions, from the pharynx to the stomach. The esophagus is a fibromuscular tube, about 25 centimeters long in adults, which travels behind the trachea and heart, passes through the diaphragm and empties into the uppermost region of the stomach. During swallowing, the epiglottis tilts backwards to prevent food from going down the larynx and lungs. The wall of the esophagus from the lumen outwards consists of mucosa, submucosa (connective tissue), layers of muscle fibers between layers of fibrous tissue, and an outer layer of connective tissue. The mucosa is a stratified squamous epithelium of around three layers of squamous cells, which contrasts to the single layer of columnar cells of the stomach. The transition between these two types of epithelium is visible as a zig-zag line. Most of the muscle is smooth muscle although striated muscle predominates in its upper third. It has two muscular rings or sphincters in its wall, one at the top and one at the bottom. The lower sphincter helps to prevent reflux of acidic stomach content. The esophagus has a rich blood supply and venous drainage. Its smooth muscle is innervated by involuntary nerves (sympathetic nerves via the sympathetic trunk and parasympathetic nerves via the vagus nerve) and in addition voluntary nerves (lower motor neurons) which are carried in the vagus nerve to innervate its striated muscle);

Subsystem-stomach (The stomach is a muscular, hollow organ in the gastrointestinal tract of humans and many other animals, including several invertebrates. The stomach has a dilated structure and functions as a vital digestive organ. In the digestive system the stomach is involved in the second phase of digestion, following mastication (chewing). In humans and many other animals, the stomach is located between the oesophagus and the small intestine. It secretes digestive enzymes and gastric acid to aid in food digestion. The pyloric sphincter controls the passage of partially digested food (chyme) from the stomach into the duodenum where peristalsis takes over to move this through the rest of the intestines);

Subsystem-small-intestine (The small intestine or small bowel is the part of the gastrointestinal tract between the stomach and the large intestine, and is where most of the end absorption of food takes place. The small intestine has three distinct regions - the duodenum, jejunum, and ileum. The duodenum is the shortest part of the small intestine and is where preparation for absorption begins. It also receives bile and pancreatic juice through the pancreatic duct, controlled by the Glisson's sphincter. The primary function of the small intestine is the absorption of nutrients and minerals from food, using small finger-like protrusions called villi);

Subsystem-colon (The large intestine, also known as the large bowel or colon, is the last part of the gastrointestinal tract and of the digestive system in vertebrates. Water is absorbed here and the remaining waste material is stored as feces before being removed by defecation. Most sources define the large intestine as the combination of the cecum, colon, rectum, and anal canal [2,3]. Some other sources exclude the anal canal. In humans, the large intestine begins in the right iliac region of the pelvis, just at or below the waist, where it is joined to the end of the small intestine at the cecum, via the ileocecal valve. It then continues as the colon ascending the abdomen,

across the width of the abdominal cavity as the transverse colon, and then descending to the rectum and its endpoint at the anal canal. Overall, in humans, the large intestine is about 1.5 meters (long, which is about one-fifth of the whole length of the gastrointestinal tract);

Subsystem-liver (The liver, an organ only found in vertebrates, detoxifies various metabolites, synthesizes proteins, and produces biochemical necessary for digestion. In humans, it is located in the right upper quadrant of the abdomen, below the diaphragm. Its other roles in metabolism include the regulation of glycogen storage, decomposition of red blood cells and the production of hormones. The liver is an accessory digestive gland that produces bile, an alkaline compound which helps the breakdown of fat. Bile aids in digestion via the emulsification of lipids. The gallbladder, a small pouch that sits just under the liver, stores bile produced by the liver. The liver's highly specialized tissue consisting of mostly hepatocytes regulates a wide variety of high-volume biochemical reactions, including the synthesis and breakdown of small and complex molecules, many of which are necessary for normal vital functions. Estimates regarding the organ's total number of functions vary, but textbooks generally cite it being around 500);

Subsystem-pancreas (The pancreas is a glandular organ in the digestive system and endocrine system of vertebrates. In humans, it is located in the abdominal cavity behind the stomach. It is an endocrine gland producing several important hormones, including insulin, glucagon, somatostatin, and pancreatic polypeptide, all of which circulate in the blood [2]. The pancreas is also a digestive organ, secreting pancreatic juice containing bicarbonate to neutralize acidity of chyme moving in from the stomach, as well as digestive enzymes that assist digestion and absorption of nutrients in the small intestine. These enzymes help to further break down the carbohydrates, proteins, and lipids in the chyme. The pancreas is known as a mixed gland);

Subsystem-gallbladder (In vertebrates, the gallbladder is a small hollow organ where bile is stored and concentrated before it is released into the small intestine. In humans, the pear-shaped gallbladder lies beneath the liver, although the structure and position of the gallbladder can vary significantly among animal species. It receives and stores bile, produced by the liver, via the common hepatic duct, and releases it via the common bile duct into the duodenum, where the bile helps in the digestion of fats);

End;

Subsystem-Urinary-tract (kidneys, Ureters, Bladder, Urethral-tubes);

Subsystem-kidney (The kidneys are two bean-shaped organs present in left and right sides of the body in vertebrates. They are located at the back of the abdominal cavity. In adults they are about 11 centimeters (4.3 in) in length. They receive blood from the paired renal arteries; blood exits into the paired renal veins. Each kidney is attached to a ureter, a tube that carries excreted urine to the bladder. The nephron is the structural and functional unit of the kidney. Each adult kidney contains around one million nephrons. The nephron utilizes four processes to alter the blood plasma which flows to it: filtration, reabsorption, secretion, and excretion. the kidney participates in the control of the volume of various body fluid compartments, fluid osmolality, acid-base balance, various electrolyte concentrations, and removal of toxins. Filtration occurs in the glomerulus: one-fifth of the blood volume that enters the kidneys is filtered. Examples of substances reabsorbed are solute-free water, sodium, bicarbonate, glucose, and amino acids. Examples of substances secreted are hydrogen, ammonium, potassium and uric acid. The kidneys also carry out functions independent of the nephron. For example, they convert a precursor of vitamin D to its active form, calcitriol; and synthesize the hormones erythropoietin and renin);

Subsystem-ureters (In human anatomy, the ureters are tubes made of smooth muscle fibers that propel urine from the kidneys to the urinary bladder. In the adult, the ureters are usually 25 - 30 cm (10 - 12 in) long and around 3 - 4 mm (0.12 - 0.16 in) in diameter. Histologically, the ureter is lined by the urothelium, a type of transitional epithelium, and has an additional smooth muscle layer in the more distal one-third to assist with peristalsis);

Subsystem-bladder (The urinary bladder is a hollow muscular organ in humans and some other animals that collects and stores urine from the kidneys before disposal by urination. In the human the bladder is a hollow muscular, and distensible (or elastic) organ, that sits

on the pelvic floor. Urine enters the bladder via the ureters and exits via the urethra. The typical human bladder will hold between 300 and 500 mL (10.14 and 16.91 fl oz) before the urge to empty occurs, but can hold considerably more);

Subsystem-urethral-tubes (In anatomy, the urethra is a tube that connects the urinary bladder to the urinary meatus for the removal of urine from the body. In males, the urethra travels through the penis and also carries semen [1]. In human females (and in other primates), the urethra connects to the urinary meatus above the vagina, whereas in non-primates, the female's urethra empties into the urogenital sinus. Females use their urethra only for urinating, but males use their urethra for both urination and ejaculation. The external urethral sphincter is a striated muscle that allows voluntary control over urination. Only in the male is there an additional internal urethral sphincter muscle);

End;

Subsystem- reproduction (Gonads, reproductive-organs)

Subsystem-gonads(A gonad or sex gland or reproductive gland [1] is a mixed gland that produces the gametes (sex cells) and sex hormones of an organism. In the female of the species the reproductive cells are the egg cells, and in the male the reproductive cells are the sperm [2]. The male gonad, the testicle, produces sperm in the form of spermatozoa. The female gonad, the ovary, produces egg cells. Both of these gametes, are haploid germ cells);

Subsystem-reproductive-organs (The reproductive system or genital system is a system of sex organs within an organism which work together for the purpose of sexual reproduction. Many non-living substances such as fluids, hormones, and pheromones are also important accessories to the reproductive system. Unlike most organ systems, the sexes of differentiated species often have significant differences. These differences allow for a combination of genetic material between two individuals, which allows for the possibility of greater genetic fitness of the offspring);

End;

Subsystem-Immune-system (White-blood-cells, Thymus, Lymph-nodes, Lymphatic-channels)

Subsystem-white-blood-cells (White blood cells (WBCs), also called leukocytes or leucocytes, are the cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders. All white blood cells are produced and derived from multipotent cells in the bone marrow known as hematopoietic stem cells. Leukocytes are found throughout the body, including the blood and lymphatic system. All white blood cells have nuclei, which distinguishes them from the other blood cells, the anucleated red blood cells(RBCs) and platelets. Types of white blood cells can be classified in standard ways. Two pairs of broadest categories classify them either by structure (granulocytes or agranulocytes) or by cell division lineage (myeloid cells or lymphoid cells). These roadest categories can be further divided into the five main types: neutrophils, eosinophils(acidophilus), basophils, lymphocytes and monocytes. These types are distinguished by their physical and functional characteristics. Monocytes and neutrophils are phagocytic. Further subtypes can be classified; for example, among lymphocytes, there are B cells, T cells, and NK cells. The number of leukocytes in the blood is often an indicator of disease, and thus the WBC count is an important subset of the complete blood count. The normal white cell count is usually between 4×10^9/L and 1.1×10^{10}/L. In the US, this is usually expressed as 4,000 to 11,000 white blood cells per microliter of blood [3]. They make up approximately 1% of the total blood volume in a healthy adult, making them substantially less numerous than the RBCs at 40% to 45%. However, this 1% of the blood makes a large difference to health, because immunity depends on it. An increase in the number of leukocytes over the upper limits is called leukocytosis. It is normal when it is part of healthy immune responses, which happen frequently. It is occasionally abnormal, when it is neoplastic or autoimmune in origin. A decrease below the lower limit is called leukopenia. This indicates a weakened immune system);

Subsystem-thymus (The thymus is a specialized primary lymphoid organ of the immune system. Within the thymus, T cells mature. T cells are critical to the adaptive immune system, where the body adapts specifically to foreign invaders. The thymus is composed of two identical lobes and is located anatomically in the anterior superior mediastinum, in front of the heart and behind the sternum. Histologically, each lobe of the thymus can be divided into a central medulla and a peripheral cortex which is surrounded by an outer capsule. The cortex and medulla play different roles in the development of T cells. Cells in the thymus can be divided into thymic stromal cells and cells of hematopoietic origin (derived from bone marrow resident hematopoietic stem cells). Developing T cells are referred to as thymocytes and are of hematopoietic origin. Stromal cells include epithelial cells of the thymic cortex and medulla, and dendritic cells. The thymus provides an inductive environment for development of T cells from hematopoietic progenitor cells. In addition, thymic stromal cells allow for the selection of a functional and self-tolerant T cell repertoire. Therefore, one of the most important roles of the thymus is the induction of central tolerance. The thymus is largest and most active during the neonatal and pre-adolescent periods. By the early teens, the thymus begins to atrophy and thymic stroma is mostly replaced by adipose (fat) tissue. Nevertheless, residual T lymphopoiesis continues throughout adult life); Subsystem-lymph-nodes (A lymph node or lymph gland is an ovoid or kidney-shaped organ of the lymphatic system, and of the adaptive immune system, that is widely present throughout the body. They are linked by the lymphatic vessels as a part of the circulatory system. Lymph nodes are major sites of B and T lymphocytes, and other white blood cells. Lymph nodes are important for the proper functioning of the immune system, acting as filters for foreign particles and cancer cells. Lymph nodes do not have a detoxification function, which is primarily dealt with by the liver and kidneys. In the lymphatic system the lymph node is a secondary lymphoid organ. A lymph node is enclosed in a fibrous capsule and is made up of an outer cortex and an inner medulla. Lymph nodes also have clinical significance. They become inflamed or enlarged in various diseases which may range from trivial throat infections, to life-threatening cancers. The condition of the lymph nodes is very important in cancer staging, which decides the treatment to be used, and determines the prognosis. When swollen, inflamed or enlarged, lymph nodes can be hard, firm or tender);

Subsystem-lymphatic-channels (The lymphatic vessels (or lymph vessels or lymphatics) are thin-walled vessels structured like blood vessels, that carry lymph. As part of the lymphatic system, lymph vessels are complementary to the cardiovascular system. Lymph vessels are lined by endothelial cells, and have a thin layer of smooth muscle, and adventitia that bind the lymph vessels to the surrounding tissue. Lymph vessels are devoted to the propulsion of the lymph from the lymph capillaries, which are mainly concerned with absorption of interstitial fluid from the tissues. Lymph capillaries are slightly larger than their counterpart capillaries of the vascular system. Lymph vessels that carry lymph to a lymph node are called afferent lymph vessels, and those that carry it from a lymph node are called efferent lymph vessels, from where the lymph may travel to another lymph node, may be returned to a vein, or may travel to a larger lymph duct. Lymph ducts drain the lymph into one of the subclavian veins and thus return it to general circulation. Generally, lymph flows away from the tissues to lymph nodes and eventually to either the right lymphatic duct or the largest lymph vessel in the body, the thoracic duct. These vessels drain into the right and left subclavian veins respectively);

End;

Subsystem-Endocrine-system (Pituitary-gland, thyroid-gland, Adrenal-glands, Pancreas, Parathyroid-glands, Gonads);

Subsystem-pituitary-gland (Pituitary gland: The main endocrine gland. It is a small structure in the head. It is called the master gland because it produces hormones that control other glands and many body functions including growth. The pituitary consists of the anterior and posterior pituitary. The anterior pituitary is the front portion of the pituitary. Hormones secreted by its influence growth, sexual development, skin pigmentation, thyroid function, and adrenocortical function. These influences are exerted through the effects of pituitary hormones on other endocrine glands except for growth hormone which acts directly on cells. The effects of under function of the anterior pituitary include growth retardation (dwarfism) in childhood and a decrease in all other endocrine gland functions normally under the control of the anterior pituitary (except the parathyroid glands). The results of over function of the anterior pituitary include overgrowth (gigantism) in children and a condition called acromegaly in adults. The posterior pituitary is the back portion of the pituitary.

It secretes the hormone oxytocin which increases uterine contractions and antidiuretic hormone (ADH) which increases reabsorption of water by the tubules of the kidney. Underproduction of ADH results in a disorder called diabetes insipidus characterized by inability to concentrate the urine and, consequently, excess urination leading potentially to dehydration. The urine is "insipid" (overly dilute);

Subsystem-thyroid-gland (The thyroid is a butterfly-shaped gland that sits low on the front of the neck. Your thyroid lies below your Adam's apple, along the front of the windpipe. The thyroid has two side lobes, connected by a bridge (isthmus) in the middle. When the thyroid is its normal size, you can't feel it. Brownish-red in color, the thyroid is rich with blood vessels. Nerves important for voice quality also pass through the thyroid. The thyroid secretes several hormones, collectively called thyroid hormones. The main hormone is thyroxine, also called T4. Thyroid hormones act throughout the body, influencing metabolism, growth and development, and body temperature. During infancy and childhood, adequate thyroid hormone is crucial for brain development);

Subsystem-adrenal-glands (The adrenal gland has several metabolic roles in the human body. Our two adrenal glands can be found lying on top of each of our kidneys. Together, they release the hormones that help us metabolize, undergo sexual maturation as we grow, as well as respond to stress. The latter may be known to us as the primal "fight or flight" response. It is the knee-jerk reaction we get upon seeing a life-endangering stimulus. Cortisol is the key to coordinating the processes that allow us to fight or run from this perceived danger. There is an obvious evolutionary value in being able to do this. Anything that shortens the time in which we can engage our muscles and run will likely increase our chance of survival. But even more low key scenarios trigger the release of cortisol. A feeling we may be familiar with is the intense focus we feel when studying for an exam the night before we have it. Cortisol is largely responsible for this newfound focus. In spite of all of the negative connotations associated with stress, in normal amounts the stress hormones allow us to focus better to perform the tasks at hand);

Subsystem-pancreas (The pancreas has an endocrine function because it releases juices directly into the load stream, and it has an exocrine function because it releases juices into ducts. Enzymes, or digestive juices, are secreted by the pancreas into the small intestine. There, it continues breaking down food that has left the stomach. The pancreas also produces the hormone insulin and secretes it into the bloodstream, where it regulates the body's glucose or sugar level. Problems with insulin control can lead to diabetes,

Other possible health problems include pancreatitis and pancreatic cancer);

Subsystem-gonads (A gonad is a specialized organ which contains germ cells. Germ cells are responsible for producing the haploid cells required for sexual reproduction. Typically in sexually reproducing animals, each organism has a set number of chromosomes. Each chromosome has two parts, one from the mother and one from the father. Every cell in an organism contains all the chromosomes, with both parts);

Subsystem-parathyroid-glands (The parathyroid glands are four tiny glands, located in the neck, that control the body's calcium levels. Each gland is about the size of a grain of rice (weighs approximately 30 milligrams and is 3 - 4 millimeters in diameter). The parathyroid produce a hormone called parathyroid hormone (PTH). PTH raises the blood calcium level by: breaking down the bone (where most of the body's calcium is stored) and causing calcium release, increasing the body's ability to absorb calcium from food, increasing the kidney's ability to hold on to calcium that would otherwise be lost in the urine. Normal parathyroid glands work like the thermostat in your home to keep blood calcium levels in a very tightly controlled range. When the blood calcium level is too low, PTH is released to bring the calcium level back up to normal. When the calcium level is normal or gets a little too high, normal parathyroid will stop releasing PTH. Proper calcium balance is crucial to the normal functioning of the heart, nervous system, kidneys, and bones).

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