DOWNLOAD PDF ENDOCRINE GLANDS AND THE SYMPATHETIC SYSTEM

Chapter 1 : Adrenal Medulla- Structure- Function- Pathology

Autonomic Nervous & Endocrine Systems. -stimulated by sympathetic nervous system neurons What is the difference between endocrine and exocrine glands?

There are 2 types of glands. Exocrine glands have ducts or channels which secrete chemicals such as saliva or sweat. Endocrine glands do not have ducts; they secrete hormones directly into the blood stream. Organs of the Endocrine System Hypothalamus The hypothalamus is located in the brain and links the nervous and endocrine systems to each other. It secrets hormones that put the pituitary gland into action. Pineal Gland The pineal gland is a small, pine-cone shaped endocrine gland in the brain. Pituitary gland The pituitary gland, or hypophysis, is an endocrine gland about the size of a pea. It weighs less than an ounce and is one of the most important organs in the body. It is located at the base of the brain and is closely connected to the hypothalamus. The pituitary gland secretes nine hormones that regulate homeostasis by stimulating other endocrine glands to produce and secrete their own hormones. This particular gland has two components: The anterior lobe makes up most of the gland and releases the majority of the hormones. The smaller posterior lobe stores hormones but does not make them. It links the endocrine system with the nervous system by way of the hypothalamus. The hypothalamus controls the production of hormones in both lobes. The pituitary gland produces many important hormones, some of which act on other glands to make them produce hormones. Thyroid The butter-fly shaped thyroid gland is one of the largest endocrine glands. The isthmus bridges the two lobes of the thyroid and is located below the cricoid cartilage. The thyroid gland controls how quickly the body uses energy metabolism , calcium levels in the blood, how the body makes proteins, and how sensitive the body is to other hormones. It produces thyroid hormones, the principal ones being triiodothyronine T3 , thyroxine which can sometimes be called tetraiodothyronine T4 and calcitonin. These hormones regulate the heart rate, the rate of metabolism and affect the growth and rate of function of many other systems in the body. T3 and T4 are made from iodine and tyrosine. Calcitonin slows down the rate at which bone is broken down decreasing the amount of calcium dissolved in the blood. Parathyroid Gland The parathyroid gland controls calcium levels in the blood. The parathyroid is a small of glands around by the thyroid gland. They produce the parathyroid hormone or PTH, which increases the rate at which broke bone is broken down. As a result, more calcium is released into the blood. Parathyroid hormone works in partnership with calcitonin from the thyroid gland. The 2 hormones have the opposite effect. Through negative feedback they keep the calcium level in the blood stable. Hormonal output from the thyroid is regulated by the thyroid-stimulating hormone TSH produced by the anterior pituitary, which itself is regulated by thyrotropin-releasing hormone TRH produced by the hypothalamus. The most common problems of the thyroid gland are overactive thyroid gland, called hyperthyroidism, and an underactive thyroid gland, called hypothyroidism. Thymus The thymus is a specialized organ of the immune system. Adrenal Glands The small, triangular adrenal glands also known as suprarenal glands sit atop the kidneys. Each is divided into two distinct anatomic and functional organs. The adrenal cortex the outer region which secretes corticosteroid hormones that affect metabolism that is how food is stored and used , chemicals in the blood, and characteristics such as body shape and hairiness. They are mainly responsible for releasing hormones in response to stress through the synthesis of corticosteroids such as cortisol and catecholamines such as epinephrine adrenaline and norepinephrine. They also produce androgens. The adrenal glands affect kidney function through the secretion of aldosterone, a hormone that helps regulate the osmolarity of blood plasma. The adrenal glands help us deal with dress and as well as maintain homeostasis. Disorders of the adrenal glands include congenital defects such as adrenal hyperplasia, tumors, autoimmune disorders, infection, and impaired blood supply. Adrenal cortex When looked at under a microscope, the adrenal cortex is made up of 3 distinct zones. The outermost zone secretes the hormone aldosterone, which inhibits the amount of sodium excreted in the urine, maintaining blood pressure and blood volume. The inner and middle zones together secrete hormones hydrocortisone, also called cortisol, corticosterone, as well as small amounts of androgen hormones. The rate of release and amount of secretion is controlled by other hormones made in the hypothalamus and pituitary. Adrenal medulla The adrenal medulla is closely related to nervous tissue and secretes the hormone epinephrine and norepinephrine in response to stimulation by sympathetic nerves. These nerves are most active at times of stress. The release of these hormones increases the heart rate in order to pump more blood to the large skeletal muscles. The airways in the lungs are increased so that more oxygen can be taken in. As more blood is sent to the active organs less blood is sent to the internal organs. Pancreas The pancreas is a gland organ in the digestive system and endocrine system. It is both an endocrine glandâ€”producing several important hormones, including insulin, glucagon, somatostatin, and pancreatic polypeptideâ€”and a digestive organâ€”secreting pancreatic juice containing digestive enzymes that help with the absorption of nutrients and digestion in the small intestine. These enzymes help to break down the carbohydrates, proteins, and fats. Ovaries The ovary is an ovum-producing reproductive organ, often found in pairs in the female reproductive system. Ovaries in women are analogous to testes in malesâ€”they are both gonads and endocrine glands. Our ovaries produce estrogen, progesterone, relaxin and inhibin. Testes The testicle is the male gonad. Like the ovaries in women to which they are homologous, testes are components of both the reproductive system and the endocrine system. The primary functions of the testes are to produce inhibin, sperm spermatogenesis and androgens, primarily testosterone. Hormones Hormones are powerful chemical messengers that our endocrine system uses to control various processes in our body. Hormones can be fat-soluble or water-soluble. Endocrine glands secrete hormones into the blood stream near them; the hormones then travel in our bloodstream until it reaches its destination, called a target cell, in distance parts of the body. This chemical changes inside the target cells and adjusts the rate at which a specific action happens, such as a contraction of the muscle. Hormones can have one target or several targets. Hormones are released when they get feedback from triggers. Some hormones work on specific cells while other hormones work throughout the body. The level of hormones in the body are controlled by feedback. It is important that the amount of hormones in our body is kept at the right level. Although hormones come in contact with many cells in the body, they only react with target cells. A hormone can have more than one target cell, and can have different effects on different targets. Luteininzing Hormone This is a pituitary hormone that helps regulate the function of the reproductive organs. In men it triggers the testes to produce male reproductive hormones. Prolactin This is a pituitary hormone that stimulates the production of milk in the breast. It is one of several hormones that stimulate milk production or lactation. Breast-feeding stimulates the pituitary gland to make more prolactin so that milk is made for as long as the baby breastfeeds. Oxytocin Oxytocin is a pituitary hormone that stimulates muscle contractions in the uterus during childbirth. These contractions cause the release of more oxytocin. This is a positive feedback reaction that makes the cycle continue until the baby is born. Oxytocin also stimulates the breasts to release milk when the baby feeds. Glucagon The hormone glucagon increases the level of sugar in the blood. It plays a vital part in maintaining the correct blood sugar level. It is made by the pancreas, a gland that is part of the endocrine system and the digestive system. The pancreas releases glucagon when the blood sugar level starts to fall. Glucogon makes cells release glucose, and helps convert glycogen, the form of glucose stored in the liver, back to glucose. As a result the blood sugar level rises. Your blood has enough glucose to keep you alive for just 15 min. However, as glucose is used up, more is released to take its place. Reproductive Hormones Reproductive hormones control the reproductive development of boys and girls. The development of primary and secondary characteristics and regulate all reproductive related processes such as sperm and egg production. Primary reproductive characteristics are the development of the major reproductive organs. There are 3 main types of reproductive hormonesâ€”androgens, estrogen, and progesterone. Female Reproductive Hormone Estrogen is the female hormone made mainly in the ovaries. It not only makes the girl reproductive organs develop, and controls her monthly menstrual cycle. Progesterone is the female hormone that prepares the girls uterus for pregnancy every month. Some contraceptive pills have estrogen in them to prevent the ovaries from releasing their egg cells. Male Reproductive Hormone The male reproductive system consists of the penis, scrotum, and the 2 testes. A male reproductive system creates sperm cells that combined with a female egg to create a new human life. The testes and scrotum hang outside the body where it is cooler because it improves sperm production. Sperm cells look like microscopic tadpoles.

Chapter 2 : Full text of "Endocrine glands and the sympathetic system"

The pituitary is often referred to as the "master gland" because its messenger hormones control all the other glands in the endocrine system, although it mostly carries out instructions from the hypothalamus.

All the authors equally contributed to this work. Published by Baishideng Publishing Group Inc. This article has been cited by other articles in PMC. Abstract The function of the heart is to contract and pump oxygenated blood to the body and deoxygenated blood to the lungs. Heartbeats originate from the rhythmic pacing discharge from the sinoatrial SA node within the heart itself. In the absence of extrinsic neural or hormonal influences, the SA node pacing rate would be about beats per minute. Here we review how the cardiovascular system is controlled and influenced by not only a unique intrinsic system, but is also heavily influenced by the autonomic nervous system as well as the endocrine system. The function of the heart is to contract and pump oxygenated blood to the body and deoxygenated blood to the lungs. The heart serves as the pump that moves blood through blood vessels thereby providing the needed oxygen and nutrients to the body. The heart consists of four chambers: The right atrium receives oxygen-poor blood from the systemic veins; this blood then moves across the tricuspid valve to the right ventricle. From the right ventricle the de-oxygenated blood is pumped pass semilunar valves out through the pulmonary arteries to the lungs. In the lungs, the blood becomes oxygenated and returns to the left atrium via the pulmonary veins. This oxygen-rich blood next moves across the mitral valve to the left ventricle and is pumped out across semilunar valves to the systemic arteries and to body tissues. Autorhythmic cardiac cells initiate and distribute impulses action potentials throughout the heart. The intrinsic conduction system coordinates heart electrical activity. This electrical activity in the heart corresponds to electrocardiogram ECG wave tracings. On a normal ECG recording, the P wave reflects atrial depolarization followed by atrial contraction. The QRS wave reflects ventricular depolarization followed by ventricular contraction and the T wave reflects ventricular repolarization and ventricular relaxation. In the intrinsic conduction system, heartbeats originate from the rhythmic pacing discharge from the sinoatrial node SA node within the heart itself. The SA node, located in the right atrium, is a part of the intrinsic conduction or nervous system found in the heart. This conduction system in order of rate of depolarization starts with the SA node or pacemaker and results in atrial depolarization and atrial contraction, the internodal pathway, the AV node where the impulse is delayed , AV bundle, the left and right branches of the bundle of His and lastly the Purkinje fibers, both of which result in ventricular depolarization and contraction. All of the components of the intrinsic conduction system contain autorhythmic cells that spontaneously depolarize. In the absence of extrinsic neural or hormonal influences, the SA node pacing rate would be about beats per minute bpm. Specifically the ANS can regulate heart rate, blood pressure, rate of respiration, body temperature, sweating, gastrointestinal motility and secretion, as well as other visceral activities that maintain homeostasis[1 - 4]. The ANS functions continuously without conscious effort. The ANS, however, is controlled by centers located in the spinal cord, brain stem, and hypothalamus. The ANS has two interacting systems: The sympathetic system prepares the body for energy expenditure, emergency or stressful situations, i. Conversely, the parasympathetic system is most active under restful conditions. The parasympathetic counteracts the sympathetic system after a stressful event and restores the body to a restful state. The sympathetic nervous system releases norepinephrine NE while the parasympathetic nervous system releases acetylcholine ACh. Sympathetic stimulation increases heart rate and myocardial contractility. During exercise, emotional excitement, or under various pathological conditions e. The stimulation of the sympathetic nervous system causes pupil dilatation, bronchiole dilatation, blood vessel constriction, sweat secretion, inhibits peristalsis, increases renin secretion by the kidneys, as well as can induce reproductive organ contraction and secretion. In contrast, parasympathetic stimulation decreases heart rate and constricts the pupils. It also increases secretion of the eye glands, increases peristalsis, increases secretion of salivary and pancreatic glands, and constricts bronchioles. Most organs receive innervations from both systems, which usually exert opposing actions. However, this is not always the case. Some systems do not have a response to parasympathetic stimulation. For example, most blood vessels lack parasympathetic innervations and their diameter is regulated by sympathetic nervous system input, so that they have a constant state of sympathetic tone. It is a decrease in sympathetic stimulation or tone that allows vasodilatation. During rest, sleep, or emotional tranquility, the parasympathetic nervous system predominates and controls the heart rate at a resting rate of bpm. At any given time, the effect of the ANS on the heart is the net balance between the opposing actions of the sympathetic and parasympathetic systems.

Chapter 3 : Endocrine System Development - Embryology

*Endocrine glands and the sympathetic system [Pierre Lereboullet, Daniel Roe Ayres, H Carrion] on calendrierdelascience.com *FREE* shipping on qualifying offers. This is a reproduction of a book published before*

Pituitary gland The pituitary gland hangs from the base of the brain by a stalk and is enclosed by bone. It consists of a hormone-producing glandular portion anterior pituitary and a neural portion posterior pituitary , which is an extension of the hypothalamus. The hypothalamus regulates the hormonal output of the anterior pituitary and creates two hormones that it exports to the posterior pituitary for storage and later release. Four of the six anterior pituitary hormones are tropic hormones that regulate the function of other endocrine organs. Most anterior pituitary hormones exhibit a diurnal rhythm of release, which is subject to modification by stimuli influencing the hypothalamus. Somatotropic hormone or Growth hormone GH is an anabolic hormone that stimulates growth of all body tissues but especially skeletal muscle and bone. It may act directly, or indirectly via insulin-like growth factors IGFs. GH mobilizes fats, stimulates protein synthesis, and inhibits glucose uptake and metabolism. Hypersecretion causes gigantism in children and acromegaly in adults; hyposecretion in children causes pituitary dwarfism. Thyroid-stimulating hormone TSH promotes normal development and activity of the thyroid gland. Thyrotropin-releasing hormone TRH stimulates its release; negative feedback of thyroid hormone inhibits it. Adrenocorticotropic hormone ACTH stimulates the adrenal cortex to release corticosteroids. The gonadotropins â€” follicle-stimulating hormone FSH and luteinizing hormone LH regulate the functions of the gonads in both sexes. FSH stimulates sex cell production; LH stimulates gonadal hormone production. Gonadotropin levels rise in response to gonadotropin-releasing hormone GnRH. Negative feedback of gonadal hormones inhibits gonadotropin release. Prolactin PRL promotes milk production in human females. The neurohypophysis stores and releases two hypothalamic hormones: Oxytocin stimulates powerful uterine contractions, which trigger labor and delivery of an infant, and milk ejection in nursing women. Its release is mediated reflexively by the hypothalamus and represents a positive feedback mechanism. Antidiuretic hormone ADH stimulates the kidney tubules to reabsorb and conserve water, resulting in small volumes of highly concentrated urine and decreased plasma osmolarity. ADH is released in response to high solute concentrations in the blood and inhibited by low solute concentrations in the blood. Hyposecretion results in diabetes insipidus. Thyroid The thyroid gland is located at the front of the neck, in front of the thyroid cartilage , and is shaped like a butterfly, with two wings connected by a central isthmus. Thyroid tissue consists of follicles with stored protein called colloid, containing thyroglobulin , a precursor to other thyroid hormones, which are manufactured within the colloid. The thyroid hormones increase the rate of cellular metabolism , and include thyroxine T4 and triiodothyronine T3. Secretion is stimulated by the hormone TSH, secreted by the anterior pituitary. When thyroid levels are high, there is negative feedback that decreases the amount of TSH secreted. Most T4 is converted to T3 a more active form in the target tissues. Calcitonin , produced by the parafollicular cells of the thyroid gland in response to rising blood calcium levels, depresses blood calcium levels by inhibiting bone matrix resorption and enhancing calcium deposit in bone. Parathyroid gland The parathyroid glands, of which there are , are found on the back of the thyroid glands, and secrete parathyroid hormone PTH , [1] which causes an increase in blood calcium levels by targeting bone, the intestine, and the kidneys. PTH is the antagonist of calcitonin. PTH release is triggered by falling blood calcium levels and is inhibited by rising blood calcium levels. Adrenal gland The adrenal glands are located above the kidneys in humans and in front of the kidneys in other animals. The adrenal glands produce a variety of hormones including adrenaline and the steroids aldosterone and cortisol. It stimulates the heart and its conducting tissues and metabolic processes. Pancreas The pancreas, located in the abdomen, below and behind the stomach, is both an exocrine and an endocrine gland. The alpha and beta cells are the endocrine cells in the pancreatic islets that release insulin and glucagon and smaller amounts of other hormones into the blood. Insulin and glucagon influence blood sugar levels. Glucagon is released when blood glucose level is low, and stimulates the liver to release glucose into the blood. Insulin increases the rate of glucose uptake and metabolism by most body cells. Gonad The ovaries of the female, located in the pelvic cavity, release two main hormones. Secretion of estrogens by the ovarian follicles begins at puberty under the influence of FSH. Estrogens stimulate maturation of the female reproductive system and development of the secondary sexual characteristics. Progesterone is released in response to high blood levels of LH. It works with estrogens in establishing the menstrual cycle. The testes of the male begin to produce testosterone at puberty in response to LH. Testosterone promotes maturation of the male reproductive organs, development of secondary sex characteristics, and production of sperm by the testes. Pineal gland The pineal gland is located in the diencephalon of the brain. It primarily releases melatonin , which influences daily rhythms and may have an antigonadotropic effect in humans.

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The endocrine system is also essential to communication. This system utilizes glands located throughout the body, which secrete hormones that regulate a variety of things such as metabolism, digestion, blood pressure and growth.

Anatomy of the Pancreas Gross Anatomy The pancreas is a narrow, 6-inch long gland that lies posterior and inferior to the stomach on the left side of the abdominal cavity. The pancreas extends laterally and superiorly across the abdomen from the curve of the duodenum to the spleen. The head of the pancreas, which connects to the duodenum, is the widest and most medial region of the organ. Extending laterally toward the left, the pancreas narrows slightly to form the body of the pancreas. The tail of the pancreas extends from the body as a narrow, tapered region on the left side of the abdominal cavity near the spleen. Glandular tissue that makes up the pancreas gives it a loose, lumpy structure. The glandular tissue surrounds many small ducts that drain into the central pancreatic duct. The pancreatic duct carries the digestive enzymes produced by endocrine cells to the duodenum. Microscopic Anatomy The pancreas is classified as a heterocrine gland because it contains both endocrine and exocrine glandular tissue. The exocrine tissue is arranged into many small masses known as acini. Acini are small raspberry-like clusters of exocrine cells that surround tiny ducts. The exocrine cells in the acini produce digestive enzymes that are secreted from the cells and enter the ducts. The ducts of many acini connect to form larger and larger ducts until the products of many acini run into the large pancreatic duct. The endocrine portion of the pancreas is made of small bundles of cells called islets of Langerhans. Many capillaries run through each islet to carry hormones to the rest of the body. There are 2 main types of endocrine cells that make up the islets: Alpha cells produce the hormone glucagon, which raises blood glucose levels. Beta cells produce the hormone insulin, which lowers blood glucose levels. Physiology of the Pancreas Digestion The exocrine portion of the pancreas plays a major role in the digestion of food. The stomach slowly releases partially digested food into the duodenum as a thick, acidic liquid called chyme. The acini of the pancreas secrete pancreatic juice to complete the digestion of chyme in the duodenum. Pancreatic juice is a mixture of water, salts, bicarbonate, and many different digestive enzymes. The bicarbonate ions present in pancreatic juice neutralize the acid in chyme to protect the intestinal wall and to create the proper environment for the functioning of pancreatic enzymes. The pancreatic enzymes each specialize in digesting specific compounds found in chyme. Pancreatic amylase breaks large polysaccharides like starches and glycogen into smaller sugars such as maltose, maltotriose, and glucose. Maltase secreted by the small intestine then breaks maltose into the monosaccharide glucose, which the intestines can directly absorb. Trypsin, chymotrypsin, and carboxypeptidase are protein-digesting enzymes that break proteins down into their amino acid subunits. These amino acids can then be absorbed by the intestines. Pancreatic lipase is a lipid-digesting enzyme that breaks large triglyceride molecules into fatty acids and monoglycerides. Bile released by the gallbladder emulsifies fats to increase the surface area of triglycerides that pancreatic lipase can react with. The fatty acids and monoglycerides produced by pancreatic lipase can be absorbed by the intestines. Ribonuclease and deoxyribonuclease are nucleases, or enzymes that digest nucleic acids. Ribonuclease breaks down molecules of RNA into the sugar ribose and the nitrogenous bases adenine, cytosine, guanine and uracil. Deoxyribonuclease digests DNA molecules into the sugar deoxyribose and the nitrogenous bases adenine, cytosine, guanine, and thymine. Blood Glucose Homeostasis The endocrine portion of the pancreas controls the homeostasis of glucose in the bloodstream. Blood glucose levels must be maintained within certain limits so that there is a constant supply of glucose to feed the cells of the body but not so much that glucose can damage the kidneys and other organs. The pancreas produces 2 antagonistic hormones to control blood sugar: The alpha cells of the pancreas produce glucagon. Glucagon raises blood glucose levels by stimulating the liver to metabolize glycogen into glucose molecules and to release glucose into the blood. Glucagon also stimulates adipose tissue to metabolize triglycerides into glucose and to release glucose into the blood. Insulin is produced by the beta cells of the pancreas. This hormone lowers blood glucose levels after a meal by stimulating the absorption of glucose by liver , muscle, and adipose tissues. Insulin triggers the formation of glycogen in the muscles and liver and triglycerides in adipose to store the absorbed glucose. Regulation of Pancreatic Function The pancreas is controlled by both the autonomic nervous system ANS and the endocrine system. The ANS has 2 divisions: Nerves of the sympathetic division become active during stressful situations, emergencies, and exercise. Sympathetic neurons stimulate the alpha cells of the pancreas to release the hormone glucagon into the bloodstream. Glucagon stimulates the liver to begin the breakdown of the energy storage molecule glycogen into smaller glucose molecules. Glucose is then released into the bloodstream for the organs, especially the heart and skeletal muscles , to use as energy. The sympathetic nerves also inhibit the function of beta cells and acini to reduce or prevent the secretion of insulin and pancreatic juice. The inhibition of these functions provides more energy for other parts of the body that are active in dealing with the stressful situation. Nerves of the parasympathetic division of the ANS become active during restful times and during the digestion of a meal. Parasympathetic nerves stimulate the release of insulin and pancreatic juice by the pancreas. The endocrine system uses 2 hormones to regulate the digestive function of the pancreas: Cells in the lining of the duodenum produce secretin in response to acidic chyme emerging from the stomach. Secretin stimulates the pancreas to produce and secrete pancreatic juice containing a high concentration of bicarbonate ions. Bicarbonate reacts with and neutralizes hydrochloric acid present in chyme to return the chyme to a neutral pH of around 7. CCK is a hormone produced by cells in the lining of the duodenum in response to the presence of proteins and fats in chyme. CCK travels through the bloodstream and binds to receptor cells in the acini of the pancreas. CCK stimulates these cells to produce and secrete pancreatic juice that has a high concentration of digestive enzymes. The high levels of enzymes in pancreatic juice help to digest large protein and lipid molecules that are more difficult to break down. Pancreatic Health Problems If the ducts leading from the pancreas are blocked in some way â€" such as when a gallstone blocks the ampulla of Vater - pancreatic fluids can build up in the pancreas and may then become activated so that they digest the pancreas itself. This condition is known as acute pancreatitis. If the onset is gradual and longer-term, we call it chronic pancreatitis. Pancreatic cancer has one of the direst prognoses of any of the types of cancer, in part because it tends to be very metastatic it spreads rapidly and because it is often undiagnosed at an early stage. Pancreatic surgery can be quite problematic for several reasons: Tumors are often advanced by the time they are detected. Due to the complexities, candidates for surgery are often strongly advised to seek their treatment in a facility that conducts a higher volume of such procedures. Hereditary hemochromatosis and diabetes mellitus involve the pancreas as well. You can test for your inherited genetic risk of hemochromatosis using modern DNA health testing.

Chapter 5 : Human Physiology/The endocrine system - Wikibooks, open books for an open world

Excerpt from Endocrine Glands and the Sympathetic System In a series of investigations, between and he admitted that the secretory cell attracts, creates, elab orates in itself secretions which it pours out, either on the outside on the mucous membranes or directly into the blood stream.

Adrenal Glands[edit] The fetal adrenal cortex can be identified within four weeks of gestation. The gonadal ridge produces the steroidogenic cells for both the gonads and the adrenal cortex. Cells that will become adrenal tissue move retroperitoneally to the upper portion of the mesonephros. At seven weeks of gestation, the adrenal cells are joined by sympathetic cells that originate from the neural crest to form the adrenal medulla. At the end of the eighth week, the adrenal glands have been encapsulated and have formed a distinct organ above the developing kidneys. At 25 weeks, the adult adrenal cortex zone develops and is responsible for the primary synthesis of steroids during the early postnatal weeks. One part is from the thickening of the pharyngeal floor, which serves as the precursor of the thyroxine T4 producing follicular cells. The other part is from the caudal extensions of the fourth pharyngobranchial pouches which results in the parafollicular calcitonin-secreting cells. Around the 24th day of gestation, the foramen cecum, a thin, flask-like diverticulum of the median anlage develops. At approximately 24 to 32 days of gestation the median anlage develops into a bilobed structure. By 50 days of gestation, the medial and lateral anlage have fused together. At 20 weeks, the fetus is able to implement feedback mechanisms for the production of thyroid hormones. During fetal development, T4 is the major thyroid hormone being produced while triiodothyronine T3 and its inactive derivative, reverse T3, are not detected until the third trimester. Once the fetus reaches four weeks of gestation, the parathyroid glands begins to develop. The third and fourth pouch are responsible for developing into the inferior and superior parathyroid glands, respectively. The fourth pharyngeal pouch later encounters the developing thyroid gland and migrates to the upper poles of the thyroid lobes. At 14 weeks of gestation, the parathyroid glands begin to enlarge from 0. Studies in mice have shown that interfering with the HOX15 gene can cause parathyroid gland aplasia , which suggests the gene plays an important role in the development of the parathyroid gland. These mutations also lead to varying degrees of hypopituitarism. Five weeks later, the pancreatic alpha and beta cells have begun to emerge. Reaching eight to ten weeks into development, the pancreas starts producing insulin , glucagon , somatostatin , and pancreatic polypeptide. The alpha cells reach their peak in the middle stage of gestation. From the middle stage until term, the beta cells continue to increase in number until they reach an approximate 1: The insulin concentration within the fetal pancreas is 3. At 31 weeks of development, the islets of Langerhans have differentiated. While the fetal pancreas has functional beta cells by 14 to 24 weeks of gestation, the amount of insulin that is released into the bloodstream is relatively low. In a study of pregnant women carrying fetuses in the mid-gestation and near term stages of development, the fetuses did not have an increase in plasma insulin levels in response to injections of high levels of glucose. Just like insulin, fetal glucagon plasma levels do not change in response to an infusion of glucose. This is thought to be a result of the relatively stable levels of fetal serum glucose concentrations achieved via maternal transfer of glucose through the placenta. On the other hand, the stable fetal serum glucose levels could be attributed to the absence of pancreatic signaling initiated by incretins during feeding. Fetal insulin is responsible for increasing glucose uptake and lipogenesis during the stages leading up to birth. Fetal cells contain a higher amount of insulin receptors in comparison to adults cells and fetal insulin receptors are not downregulated in cases of hyperinsulinemia. Poorly managed maternal diabetes mellitus is linked to fetal macrosomia , increased risk of miscarriage, and defects in fetal development. Maternal hyperglycemia is also linked to increased insulin levels and beta cell hyperplasia in the post-term infant. Development of the gonads The reproductive system begins development at four to five weeks of gestation with germ cell migration. The bipotential gonad results from the collection of the medioventral region of the urogenital ridge. At the five-week point, the developing gonads break away from the adrenal primordium. Gonadal differentiation begins 42 days following conception. Male Gonadal Development[edit] For males, the testes form at six fetal weeks and the sertoli cells begin developing by the eight week of gestation. SRY , the sex-determining locus, serves to differentiate the Sertoli cells. At 10 weeks of gestation, the Leydig cells begin to produce androgen hormones. The androgen hormone dihydrotestosterone is responsible for the development of the male external genitalia. During the transabdominal stage 8 to 15 weeks of gestation , the gubernacular ligament contracts and begins to thicken. The craniosuspensory ligament begins to break down. During the transinguinal phase 25 to 35 weeks of gestation , the testicles descend into the scrotum. This stage is regulated by androgens, the genitofemoral nerve, and calcitonin gene-related peptide. During the second and third trimester, testicular development concludes with the diminution of the fetal Leydig cells and the lengthening and coiling of the seminiferous cords. The absence of testosterone results in the diminution of the Wolffian structures. The urogenital sinus develops into the urethra and lower region of the vagina, the genital tubercle develops into the clitoris, the urogenital folds develop into the labia minora, and the urogenital swellings develop into the labia majora. At 20 weeks of gestation, the theca cell precursors are present and oogonia mitosis is occurring. At 25 weeks of gestation, the ovary is morphologically defined and folliculogenesis can begin. During the first 12 weeks of gestation, the anterior pituitary undergoes cellular differentiation. At 20 weeks of gestation, the hypophyseal portal system has developed. The posterior pituitary lobe is formed from the diverticulum. Portions of the pituitary tissue may remain in the nasopharyngeal midline. In rare cases this results in functioning ectopic hormone-secreting tumors in the nasopharynx. Other essential proteins necessary for pituitary cell proliferation are Fibroblast growth factor 8 FGF8 , [30] Wnt4, [31] and Wnt5. These factors are essential for coordinating early patterns of cell proliferation. By seven weeks of gestation, the anterior pituitary is capable of secreting ACTH. Within eight weeks of gestation, somatotroph cells begin to develop with cytoplasmic expression of human growth hormone. Once a fetus reaches 12 weeks of development, the thyrotrophs begin expression of Beta subunits for TSH, while gonadotrophs being to express beta-subunits for LH and FSH.

Chapter 6 : An Overview of the Hypothalamus - The Endocrine Systemâ€™s Link to the Nervous System

The adrenal glands have a multi-functional role in the endocrine system. The two very different parts of these glands, the medulla and cortex, regulate and maintain many of your internal processesâ€”from metabolism to the fight-or-flight response.

The autonomic nervous system mediates actions that occur without voluntary control such as heart rate or blood pressure. It consists of both the sympathetic and parasympathetic nervous systems, and they often act in a complementary manner. The functions of the SNS are varied, and can depend on whether it is activated in a localized manner or across the body. The SNS can maintain homeostasis through actions like sweating to dissipate heat, or by altering cardiac output based on position and activity level. Specifically, when the entire SNS is activated, there is a cascade of reactions from all the organ systems of the body, which prepare the individual to deal with an emergency. This includes an increase in heart rate, bronchial dilation, increase in cardiac output, and dilation of pupils, all of which are directed towards heightened awareness and preparation to combat danger. Blood circulation is preferentially targeted towards skeletal muscle, with a reduction in blood flow towards non-essential organs. Therefore, there is vasoconstriction in the gastrointestinal tract and skin, and compensatory piloerection to allow the body to remain warm. While it could be a short-lived physical danger that you have to either fight or escape from, the SNS could also be activated in response to long-term psychological or emotional stress. The SNS consists of two sets of neurons â€” those that have their cell bodies within the spinal cord, and those whose soma resides in ganglia outside the central nervous system. The first set, called presynaptic neurons, has its cell bodies within the thoracic and lumbar sections of the spinal cord, and release a neurotransmitter called acetylcholine at synapses within ganglia. Sympathetic Innervation Acetylcholine is taken up by receptors on postsynaptic neurons. The activation of postsynaptic neurons leads to the transmission of an electrochemical impulse along the length of their axons, till there is a release of noradrenalin at the synapses with peripheral tissues. Among the many targets for presynaptic neurons, is the adrenal medulla. Prolonged systemic activation of the SNS leads to the release of adrenaline and noradrenaline from the adrenal medulla. Functions of the Sympathetic Nervous System While the SNS is commonly referenced with respect to its whole-body response, it has a number of roles to maintain homeostasis. It regulates body temperature, both by mobilizing fat reserves to enhance heat production and by changing blood flow to the skin. The SNS can also stimulate sweat glands to cool the body down. It can initiate a long-term response to prolonged cold periods by controlling some cells of adipose tissues and stimulating the release of fatty acids from them. At the same time, heat is lost from peripheral extremities through sweat, even when the body is at rest. Additionally, the sympathetic nervous system regulates minute changes to the cardiovascular system. When there is a change in posture, from sitting to standing, for example, cardiac output needs to change to accommodate this alteration. In people suffering from disorders of the SNS, one of the first signs of an ailment is postural dizziness. Similarly, during intense exercise, the body needs to focus on delivering nutrients and oxygen to skeletal muscle and quickly removing the metabolic waste generated in the tissue. This is also mediated by the sympathetic nervous system. It can even modulate circadian rhythms and there is usually a surge of SNS activity during the transition from sleep towards awakening. When the body faces a perceived threat, the entire SNS comes into play. Skeletal muscles contract, and begin to convert glycogen into glucose. There is an increase in heart rate as well as heart output, and bronchial tubes dilate to facilitate better gas exchange. Pupils dilate to enhance visual input, even in low light. All these changes are geared towards intense physical activity. At the same time, salivary and gastric secretions decrease, peristaltic movement reduces, gastric and intestinal sphincters are constricted. Urinary output also declines, as the body increases its need for water. SNS activity also controls blood loss through vasoconstriction. Upon extended SNS activation, a number of negative side effects appear, such as poor appetite and digestion, difficulty in urinating, low sexual desire, permanently elevated blood pressure and heightened cardiac stress. Among the key endocrine targets for the SNS is the adrenal medulla, which is stimulated to secrete epinephrine and norepinephrine, to enhance the effect of the neuronal activity of the SNS. In fact, presynaptic neurons directly synapse with cells in the adrenal gland, making it functionally similar to postsynaptic neurons of the SNS. In extreme conditions like blocks in the coronary artery leading to heart failure, the sympathetic nervous system can have a counterproductive effect, increasing the force of cardiac muscle contraction, and mediating higher blood pressure through vasoconstriction in peripheral blood vessels. In each of these actions, the parasympathetic nervous system can act as an antagonist, and help the body recover after the threat has disappeared. Comparatively, the SNS has shorter axons than the parasympathetic nervous system and also acts more quickly. Examples of the Sympathetic Nervous System Response The classic case of SNS response is a physical danger, especially with a potential predator, and the preparation of the body for either fight-or-flight. The overall system is designed to enhance voluntary muscle activity while shutting down all non-essential functions. Arterioles and veins in most vascular beds constrict, reducing blood flow to the skin and digestive organs. Sphincters in the digestive organs also constrict, to control the flow of food from one organ to the next. However, coronary blood vessels, pulmonary circulation and parts of the respiratory tree respond with dilation, to enhance cardiac output. The heart beats with greater contractile force and at a higher frequency as well. Vasoconstriction in many parts of the body also increases blood pressure. For instance, when faced with a charging elephant or bull, the body quickly primes itself to run quickly, and for a prolonged period. All the changes to the cardiovascular system are designed to sustain this mode of survival, to focus energy on physical safety. Interestingly, though, the body responds in a similar fashion even when the threat is merely being observed rather than experienced. For instance, when a violent movie scene is being watched, or the highpoint in a thriller novel is being read, the pupils of the eye dilate, the heart pounds, and there is piloerection. Hormones and Receptors There are three major molecules that are secreted within the sympathetic nervous system â€” acetylcholine, epinephrine, and norepinephrine. Acetylcholine plays a major role in synaptic transmission of electrochemical signals from the presynaptic neurons. Norepinephrine is more abundant as a neurotransmitter released by postsynaptic neurons, and binds to specific receptors within effector cells. Examples of effector cells include those that line glands, cells of cardiac or skeletal muscle, etc. The responses that the SNS can mediate are derived from the different types of receptors for these molecules in various cells. Related Biology Terms Ganglion â€” In neurobiology, refers to a cluster of neural cell bodies consisting of soma and dendrites. Different cells within ganglia are linked to each other through synapses, different ganglia interact to form a plexus. Piloerection â€” Involuntary bristling of hair on the body, usually in response to cold, or fear. Plexus â€” Branching network of interconnecting nerves or ganglia, that can innervate a relatively large area within the body. Soma â€” Bulbous cell body of a neuron, containing the nucleus. Which of these statements about the sympathetic nervous system is true? Is a part of the central and autonomic nervous systems B. Presynaptic neurons secrete acetylcholine as a neurotransmitter C. The adrenal cortex releases epinephrine D. All of the above Answer to Question 1 B is correct. The sympathetic nervous system is part of the autonomic nervous system, which is often considered as part of the peripheral nervous system. Even though cell bodies of presynaptic neurons emanate from the spinal cord, they are not technically considered a part of the central nervous system. Presynaptic neurons predominantly secrete acetylcholine at the synaptic clefts within ganglia. Epinephrine or adrenaline is produced by the adrenal gland. However, it is the medulla and not the cortex that secretes this hormone. Why would prolonged activation of the SNS be harmful?

Chapter 7 : Endocrine gland - Wikipedia

Major endocrine glands (names, locations, products) Hypothalamus: Releasing hormones for the pituitary, ADH and oxytocin. Releasing hormones/factors stimulates pituitary to release its hormone.

The control of release of hormones from the pituitary is via negative feedback from the target gland. For example homeostasis of thyroid hormones is achieved by the following mechanism; TRH from the hypothalamus stimulates the release of TSH from the anterior pituitary. The TSH, in turn, stimulates the release of thyroid hormones form the thyroid gland. The heart, gastrointestinal tract, the placenta, the kidneys and the skin, whose major function is not the secretion of hormones, also contain some specialized cells that produce hormones. In addition, all cells, except red blood cells secrete a class of hormones called eicosanoids. These hormones are paracrines, or local hormones, that primarily affect neighboring cells. Two groups of eicosanoids, the prostaglandins PGs and the leukotrienes LTs , have a wide range of varying effects that depend upon the nature of the target cell. Eicosanoid activity, for example, may impact blood pressure, blood clotting, immune and inflammatory responses, reproductive processes, and the contraction of smooth muscles. Antagonistic Hormones[edit] Maintaining homeostasis often requires conditions to be limited to a narrow range. When conditions exceed the upper limit of homeostasis, specific action, usually the production of a hormone is triggered. When conditions return to normal, hormone production is discontinued. If conditions exceed the lower limits of homeostasis, a different action, usually the production of a second hormone is triggered. Hormones that act to return body conditions to within acceptable limits from opposite extremes are called antagonistic hormones. The two glands that are the most responsible for homeostasis is the thyroid and the parathyroid. The regulation of blood glucose concentration through negative feedback illustrates how the endocrine system maintains homeostasis by the action of antagonistic hormones. Bundles of cells in the pancreas called the islets of Langerhans contain two kinds of cells, alpha cells and beta cells. These cells control blood glucose concentration by producing the antagonistic hormones insulin and glucagon. Beta cells secrete insulin. When the concentration of blood glucose raises such in after eating, beta cells secret insulin into the blood. Insulin stimulates the liver and most other body cells to absorb glucose. Liver and muscle cells convert glucose to glycogen, for short term storage, and adipose cells convert glucose to fat. In response, glucose concentration decreases in the blood, and insulin secretion discontinues through negative feedback from declining levels of glucose. Alpha cells secrete glucagon. When the concentration of blood glucose drops such as during exercise, alpha cells secrete glucagon into the blood. Glucagon stimulates the liver to release glucose. The glucose in the liver originates from the breakdown of glycogen. Glucagon also stimulates the production of ketone bodies from amino acids and fatty acids. Ketone bodies are an alternative energy source to glucose for some tissues. When blood glucose levels return to normal, glucagon secretion discontinues through negative feedback. Calcitonin CT produces the opposite effect by inhibiting the breakdown of bone matrix and decreasing the release of calcium in the blood. Thyroid gland[edit] The Thyroid gland is one of the largest endocrine glands in the body. It is positioned on the neck just below the Larynx and has two lobes with one on either side of the trachea. It is involved in the production of the hormones T3 triiodothyronine and T4 thyroxine. The thyroid also produces and releases the hormone calcitonin thyrocalcitonin which contributes to the regulation of blood calcium levels. Thyrocalcitonin or calcitonin decreases the concentration of calcium in the blood. Most of the calcium removed from the blood is stored in the bones. The thyroid hormone consists of two components, thyroxine and iodine. This hormone increases the metabolism of most body cells. A deficiency of iodine in the diet leads to the enlargement of the thyroid gland, known as a simple goiter. Hypothyroidism during early development leads to cretinism. In adults, it produces myxedema, characterized by obesity and lethargy. Hyperthyroidism leads to a condition known as exophthalmic goiter, characterized by weight loss as well as hyperactive and irritable behavior. The thyroid gland is a two-lobed gland that manifests a remarkably powerful active transport mechanism for up-taking iodide ions from the blood. As blood flows through the gland, iodide is converted to an active form of iodine. This iodine combines with an amino acid called tyrosine. Two molecules of iodinated tyrosine then combine to form thryroxine. Following its formation, the thyroxine becomes bound to a polysaccharide-protein material called thyroglobulin. The normal thyroid gland may store several weeks supply of thyroxine in this bound form. An enzymatic splitting of the thyroxine from the thyroglobulin occurs when a specific hormone is released into the blood. This hormone, produced by the pituitary gland, is known as thyroid-stimulating hormone TSH. TSH stimulates certain major rate-limiting steps in thyroxine secretion, and thereby alters its rate of release. A variety of bodily defects, either dietary, hereditary, or disease induced, may decrease the amount of thyroxine released into the blood. The most popular of these defects is one that results from dietary iodine deficiency. The thyroid gland enlarges, in the continued presence of TSH from the pituitary, to form a goiter. This is a futile attempt to synthesize thyroid hormones, for iodine levels that are too low. Normally, thyroid hormones act via a negative feedback loop on the pituitary to decrease stimulation of the thyroid. In goiter, the feedback loop cannot be in operation - hence continual stimulation of the thyroid and the inevitable protuberance on the neck. Formerly, the principal source of iodine came from seafood. As a result, goiter was prevalent amongst inland areas far removed from the sea. Today, the incidence of goiter has been drastically reduced by adding iodine to table salt. Thyroxine serves to stimulate oxidative metabolism in cells; it increases the oxygen consumption and heat production of most body tissues, a notable exception being the brain. Thyroxine is also necessary for normal growth. The most likely explanation being that thyroxine promotes the effects of growth hormone on protein synthesis. The absence of thyroxine significantly reduces the ability of growth hormone to stimulate amino acid uptake and RNA synthesis. Thyroxine also plays a crucial role in the closely related area of organ development, particularly that of the central nervous system. If there is an insufficient amount of thyroxine, a condition referred to as hypothyroidism results. Symptoms of hypothyroidism stem from the fact that there is a reduction in the rate of oxidative energy-releasing reactions within the body cells. Usually the patient shows puffy skin, sluggishness, and lowered vitality. Other symptoms of hypothyroidism include weight gain, decreased libido, inability to tolerate cold, muscle pain and spasm, and brittle nails. Hypothyroidism in children, a condition known as cretinism, can result in mental retardation, dwarfism, and permanent sexual immaturity. Sometimes the thyroid gland produces too much thyroxine, a condition known as hyperthyroidism. This condition produces symptoms such as an abnormally high body temperature, profuse sweating, high blood pressure, loss of weight, irritability, insomnia and muscular pain and weakness. It also causes the characteristic symptom of the eyeballs protruding from the skull called exopthalmia. This is surprising because it is not a symptom usually related to a fast metabolism. Hyperthyroidism has been treated by partial removal or by partial radiation destruction of the gland. More recently, several drugs that inhibit thyroid activity have been discovered, and their use is replacing the former surgical procedures. T3 and T4 Function within the body[edit] File: PNG Iodine and T4 stimulate the spectacular apoptosis programmed cell death of the cells of the larval gills, tail and fins Transforming the aquatic, vegetarian tadpole into the terrestrial, carnivorous frog with better neurological, visuospatial, olfactory and cognitive abilities for hunting. Contrary to amphibian metamorphosis, thyroidectomy and hypothyroidism in mammals may be considered a sort of phylogenetic and metabolic regression to a former stage of reptilian life. Indeed, many disorders that seem to afflict hypothyroid humans have reptilian-like features, such as dry, hairless, scaly, cold skin and a general slowdown of metabolism, digestion, heart rate and nervous reflexes, with lethargic cerebration, hyperuricemia and hypothermia Venturi, They stimulate all cells within the body to work at a better metabolic rate. Their release will be increased under certain situations such as cold temperatures when a higher metabolism is needed to generate heat. When children are born with thyroid hormone deficiency they have problems with physical growth and developmental problems. Brain development can also be severely impaired The significance of iodine[edit] Thyroid hormone cannot be produced without an abundant source of iodine. When the thyroid is low on iodine the body will try harder to produce T3 and T4 which will often result in a swelling of the thyroid gland, resulting in a goiter. Extrathyroidal iodine[edit] Sequence of iodide human scintiscans after an intravenous injection, from left after 30 minutes, 20 hours, and 48 hours. A high and rapid concentration of radio-iodide is evident in the periencephalic and cerebrospinal fluid left , salivary glands, oral mucosa and the stomach. Highest iodide-concentration by the mammary gland is evident only in pregnancy and lactation. High excretion of radio-iodide is observed in the urine. In the cells of these tissues iodide enters directly by sodium-iodide symporter NIS. Its role in mammary tissue is related to fetal and neonatal development, but its role in the other tissues is unknown. It has been shown to act as an antioxidant in these tissues. These higher recommended daily allowance levels of iodine seem necessary for optimal function of a number of body systems, including lactating breast, gastric mucosa, salivary glands, oral mucosa, thymus, epidermis, choroid plexus, etc. It is an additional hormone produced by the thyroid, and contributes to the regulation of blood calcium levels. Thyroid cells produce calcitonin in response to high calcium levels in the blood. This hormone will stimulate movement of calcium into the bone structure. It can also be used therapeutically for the treatment of hypercalcemia or osteoporosis. Without this hormone calcium will stay within the blood instead of moving into bones to keep them strong and growing. Its importance in humans has not been as well established as its importance in other animals.

Chapter 8 : Development of the endocrine system - Wikipedia

The pancreas is a glandular organ in the upper abdomen, but really it serves as two glands in one: a digestive exocrine gland and a hormone-producing endocrine gland. Functioning as an exocrine gland, the pancreas excretes enzymes to break down the proteins, lipids, carbohydrates, and nucleic acids in food.

The hypothalamus is the link between the endocrine and nervous systems. The hypothalamus produces releasing and inhibiting hormones, which stop and start the production of other hormones throughout the body. The hypothalamus plays a significant role in the endocrine system. Heart rate and blood pressure Body temperature Fluid and electrolyte balance, including thirst Appetite and body weight Glandular secretions of the stomach and intestines Production of substances that influence the pituitary gland to release hormones Sleep cycles The hypothalamus is involved in many functions of the autonomic nervous system, as it receives information from nearly all parts of the nervous system. As such, it is considered the link between the nervous system and the endocrine system. You can learn more by reading a SpineUniverse article about the nervous system. Anatomy of the Hypothalamus The hypothalamus is located below the thalamus a part of the brain that relays sensory information and above the pituitary gland and brain stem. It is about the size of an almond. Hormones of the Hypothalamus The hypothalamus is highly involved in pituitary gland function. When it receives a signal from the nervous system, the hypothalamus secretes substances known as neurohormones that start and stop the secretion of pituitary hormones. Primary hormones secreted by the hypothalamus include: This hormone increases water absorption into the blood by the kidneys. CRH sends a message to the anterior pituitary gland to stimulate the adrenal glands to release corticosteroids, which help regulate metabolism and immune response. GnRH stimulates the anterior pituitary to release follicle stimulating hormone FSH and luteinizing hormone LH , which work together to ensure normal functioning of the ovaries and testes. In children, GH is essential to maintaining a healthy body composition. In adults, it aids healthy bone and muscle mass and affects fat distribution. Oxytocin is involved in a variety of processes, such as orgasm, the ability to trust, body temperature, sleep cycles, and the release of breast milk. PRH prompts the anterior pituitary to stimulate breast milk production through the production of prolactin. Conversely, PIH inhibits prolactin, and thereby, milk production. Thyrotropin releasing hormone TRH: TRH triggers the release of thyroid stimulating hormone TSH , which stimulates release of thyroid hormones, which regulate metabolism, energy, and growth and development. Hypothalamic Disease A disease or disorder of the hypothalamus is known as a hypothalamic disease. A physical injury to the head that impacts the hypothalamus is one of the most common causes of hypothalamic disease. Hypothalamic diseases can include appetite and sleep disorders, but because the hypothalamus affects so many different parts of the endocrine system , it can be hard to pinpoint whether the root cause of the disorder is actually related to another gland. These are known as hypothalamic-pituitary disorders. However, there are hormone tests that help shed light on which part of the body is the root cause. The hypothalamus is arguably the most essential of the endocrine system. By alerting the pituitary gland to release certain hormones to the rest of the endocrine system, the hypothalamus ensures that the internal processes of your body are balanced and working as they should.

DOWNLOAD PDF ENDOCRINE GLANDS AND THE SYMPATHETIC SYSTEM

Chapter 9 : An Overview of the Adrenal Glands - Beyond Fight or Flight

The endocrine system is made of 9 major glands located throughout our body. Together, these glands make dozens of chemical messengers called hormones and release them directly into the blood stream that surrounds the glands.

ORDER NOW adrenal cortex The adrenal cortex produces steroid hormones which regulate carbohydrate and fat metabolism and mineralocorticoid hormones which regulate salt and water balance in the body adrenal gland Either of two small endocrine glands, one located above each kidney. The outer portion, or cortex, secretes steroid hormones corticosteroids. The inner portion, or medulla, secretes epinephrine and norepinephrine adrenal medulla is part of the adrenal gland. It is located at the center of the gland, being surrounded by the adrenal cortex. There are two kinds: They have various metabolic functions and some are used to treat inflammation. One of the glucocorticoids, it is also made synthetically for use as an anti-inflammatory and anti-allergy agent. The major glands of the endocrine system include the pineal gland, pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland, hypothalamus and adrenal glands epinephrine another term for adrenaline. Such hormones are also produced artificially for use in oral contraceptives or to treat menopausal and menstrual disorders. The lack of insulin causes a form of diabetes. It is also used as a drug to raise blood pressure. Embedded in the pancreas are the islets of Langerhans, which secrete into the blood the hormones insulin and glucagon pancreatic islets The pancreas contains clusters of cells that produce hormones. These clusters are known as islets. There are several different types of cells in an islet. For example, alpha cells make the hormone glucagon, which raises the glucose a type of sugar level in the blood. Humans usually have four parathyroid glands, variably located on the back of the thyroid gland, although considerable variation exists. A pea-sized body attached to the base of the brain, the pituitary is important in controlling growth and development and the functioning of the other endocrine glands. They include many hormones, alkaloids, and vitamins. A cell selectively affected by a particular agent, such as a virus, drug, or hormone. They are derived from a polypeptide called prothymosin-alpha PTMA or alpha thymosin. The human thymus becomes much smaller at the approach of puberty.