**The Endocrine System**

**-FUNCTION:**

**-THE ENDOCRINE SYSTEM is a major controlling sys. Of the body**

**-it maintains homeostasis by chemicals called (hormones)...And it control prolonged or continuous processes, such as Growth, development, reproduction, metabolism and body defense**

**-endocrine organs are small and widely separated in the body, some are part of mixed glands (both exocrine and endocrine function) example: gonads and pancrease**

**- Others are purely hormone producing ,,(thyroid ,parathyroid, adrenal..)**

**\_THE CHEMISTRY OF HORMONES:**

**-hormones are chemical substances that are secreted by endocrine cells into the extracellular fluids and regulate the metabolic activity of other cells in the body**

**\_HORMONES CLASS. CHEMICALLY IN TO:**

**1) Aminoacid –based molecules (include proteins, peptides and amines)**

**2) Steroids... (Made from cholesterol) ex: sex hormones, hormones of adrenal cortex**

**3) Prostaglandins (local hormones) highly active lipid**

**\_HORMONES ACTION:**

**Hormones affects its target cells or target organs**

**For a target cell to respond to a hormone, specific receptor to which hormone can attach must be present on the cell membrane**

**Only when this binding occur, the hormone influence the working of the cell**

**\_CONTROL OF HORMONE RELEASE:**

**Endocrine organs are activated to release their hormones into the blood by:**

**1) Negative feedback mechanisms**

**2) Hormonal stimuli**

**3) Humoral stimuli**

**4) Neural stimuli**

**\*NEGATIVE FEEDBACK MECHANISM:**

**-Is the chief means of regulating blood levels of nearly all hormones**

**-in such system some internal or external stimulus trigger hormone secretion, then rising hormone level inhibit further hormone release**

**\*HROMONAL STIMULI:**

**-in which endocrine organs are prodded into action by other hormone**

**Ex: hypothalamic hormones\_\_\_\_(stimulate)ant.pituitary (secrete hormone) that stimulate other endocrine hormone**

**\*HUMORAL STIMULI:**

**-changing blood levels of certain ions and nutrients may stimulate hormones to release**

**Ex: drop calcium level \_\_\_(stimulate)\_\_release of parathyroid hormone (PTH) act by several routs to increases CA. level**

**\*NEURAL STIMULI:**

**-in isolated cases , nerve fibers stimulate hormone release**

**Ex: sympathetic nerve system stimulate \_\_adrenal medulla to release epinephrine and norepinephrine during periods of stress**

**\_THE MAJOR ENDOCRINE ORAGANS:**

**GLANDS CLASS...**

**1) ENDOCRINE GLANDS (duct less glands)…**

**They produce hormones released directly into blood or lymph, they are rich in blood supply**

**2) EXOCRINE GLANDS (with duct)…**

**Pour their secretion at body surface or into body cavities by ducts**

**\_The major Endocrine organs of the body include:**

**-pituitary**

**-thyroid**

**-parathyroid**

**-pineal**

**-thymus**

**-Adrenal**

**-pancreases and gonads (mixed exocrine and endocrine)**

**\*HYPOTHALAMUS:**

**-is part of nervous system**

**-it is endocrine organ because it produces several hormones**

**\*Pituitary Gland:**

**It consists of 2 lobes:**

**1) The anterior pit. (Glandular tissue)**

**2) The posterior pit. (Nervous tissue)**

**\_HORMONES of The anterior lobe :**

**- It secret 6 hormones:**

**1) growth hormone**

**2)prolactine hormone**

**3)Thyrotropic hormone(TH)**

**4)Adrenocorticotropic hormone (ACTH)**

**5)Gonadotropic hormones (FSH,LH)**

**-(TH),(ACTH),(FSH),(LH)…called tropic hormones**

**-tropic hormones...Hormones secreted from endocrine glands and affect other endocrine glands**

**- All ant. Pit. Hormones are:**

**1) Proteins (or peptides)**

**2) Act through second messenger system**

**3) Regulated by hormonal stimuli and negative feedback**

**\*GROWTH HORMONE:**

**-it effect the growth of skeletal muscles and long bones of the body**

**-it plays important role in determining final body size**

**-it causes fats to be broken down and used for energy**

**-it maintains blood sugar homeostasis**

**\_HYPOSECRETION of hormone during childhood lead to …DWARFISM**

**\_HYPERSEDRETION of hormone in the childhood lead to...GIGANTISM**

**AND in adults lead to...ACROMEGALY**

**\*PROLACTIN HORMONE:**

**-it’s a protein**

**-it stimulates and maintains milk production by the mother’s breast**

**\*ADRENOCORTICOTROPIC HORMONE (ACTH):**

**-it regulates the activity of adrenal cortex**

**\*THYROID STIMULATING HORMONE (TSH):**

**-Influences the growth and activity of the thyroid gland**

**\*THE GONADOTROPIC HORMONES (FSH) (LH):**

**-regulate the hormonal activity of gonads (ovaries and testes)**

**\_(FSH)FOLLICLE STIMULATING HORMONE:**

* **-in women …it stimulates follicle development in the ovaries when the follicles mature ,they produce estrogen and the eggs become ready for ovulation**
* **-in men… stimulate sperm development by testes**

**\_(LH) LUTEIIZING HORMONES :**

**-it triggers ovulation of an egg from ovary and causes the ruptured follicle to produce progesterone and some estrogen**

**- In men … it stimulate testestrone production by the interstitial cells of the testes**

**-HYPOSECRETION OF (LH) AND (FSH) lead to sterility**

**\_HORMONES of the posterior pituitary:**

**-post. Pit. Not endocrine gland (it not makes hormones)**

**- It acts as a storage area for hormones made by hypothalamic neurons**

**1) OXYTCIN:**

**-it released only during childbirth and in nursing women**

**-it stimulus powerful contractions of uterine muscles during labor, during sexual relations and during breast feeding**

**-it also causes milk ejection in nursing women**

**-both natural and synthetic oxytcic drugs are used to induce labor or to hasten labor**

**-oxytocics are used to stop postpartum bleeding and to stimulate the milk ejection reflex**

**2) ANTIDIURETIC HORMONE (ADH):**

**-antidiuretic is a chemical that inhibits or prevents urine production**

**-(ADH) causes the kidney to reabsorb more water from the forming urine , as a result urine volume decrease and blood volume increase**

**-(ADH) also increase blood pressure by causing constriction of the arterioles ,for this reason ,it is sometimes called vasopressin**

**-hyposecretion of (ADH) lead to diabetes insipidus(excessive urine output)**

**\_THYROID GLAND……**

**-the thyroid gland is located in the anterior throat**

**-it consists of 2 lobes, joined by isthmus**

**-it makes 2 hormones:**

**1) Thyroid hormone (T4<thyroxine>, T3)**

**2) Calcitonin**

**\_THYROID HORMONE (T3&T4)**

**-the body major metabolic hormone , is iodine –containing hormone**

**\*THYROXINE (T4) & TRRI-IODOTHYRONINE (T3) is releases from thyroid follicles**

**-the thyroid hormone controls the rate at which glucose is burned or oxidized and converted to body heat and chemical energy**

**-the thyroid hormone is also important for normal tissue growth and development, especially in the reproductive and nervous system**

**\*LACK OF IODINE…leads to goiter (enlarged of thyroid gland)**

**\*HYPOSECRETION OF THYROXINE**

**- In childhood… lea d to cretinism (dwarfism)**

**-in adults…lead to myxedema (poor muscle tone, low body temperature, obesity, dry skin)**

**\*HYPERTHYROIDISM….(result from tumor of thyroid gland)**

**Lead to;**

**-Graves disease >>increase basal metabolic rate, intolerance to heat**

**-enlarge and protrude eye (exophthalmos)**

**\_CALCITONIN….**

**-it is released by parafolliculer cells**

**-it decreases blood calcium level, by deposit calcium in bone**

**-it acts antagonistically to parathyroid hormone**

**-it released directly to blood in respance to increasing levels of blood calcium**

**\_PARATHYROID GLANDS……**

**-they are 4 glands found on the posterior surface of thyroid gland**

**-they secrete parathyroid hormone (PTH) or parathormone**

**Which regulate calcium ion homeostasis of blood.**

**-when blood calcium level drop, the parathyroids release (PTH),**

**Which stimulate oesteoclasts (bone destruction cell) to breakdown bone matrix and release calcium into blood .**

**-increase (PTH)….hypercalcemic**

**-increase calcitonin…hypocalcemic**

**- (PTH) also stimulates the kidneys and intestine to absorb more calcium from urinary filtrate and food**

**-HYPOSECRETION of (PHT) lead to uncontrollable spasms of muscle (tetany), which may be fetal**

**-sever HYPERPARATHYRODISM causes massive bone destruction, the bone become very fragile and spontaneous fratures occur**

**\_ADRENAL GLANDS…..**

**-they cover the top of the kidneys**

**-it is structurally and functionally 2 endocrine organs in one**

**-it consists of: 1) glandular part (cortex)**

**2) Neural tissue (medulle)**

**-HORMONES OF THE ADRENAL CORTEX:**

**-the adrenal cortex produce 3 major group of steroid hormones which called ( CORTICOSTEROIDS) which are ;**

**-mineralocorticoids**

**-glucocorticoids**

**-sex hormones**

**\*MINERALOCORTICOIDS……**

**-mainly aldosterone, are produced by outer layer of adrenal cortex**

**-they are important in regulating the mineral (or salt) content of blood especially concentration of sodium and potassium ion**

**-they act on kidney tubules that reabsorb the mineral or allow them to be flushed out of the body in urine**

**-the mineralocorticoids help regulate both water and electrolyte balance in body fluid**

**-the release of aldosterone is stimulated by humoral factors and by (ACTH)**

**-RENIN…..produced by kidney when blood pressure drops angiotinsinogen the (RENIN)\_\_angiotesin 1\_\_angiotesin 2\_\_stimulate release \_\_aldosterone \_\_reabsorb NA and water increase blood pressure**

**-heart release atrial natriureticpeptide (ANP), prevent aldosterone release, which reduce blood volume and blood pressure**

**\*THE GLUCOCORTICOIDS:**

**- produced by middle layer, they include cortisone and cortisal**

**-glucocorticoids promote normal cell metabolism and help the body to restst long-term stressors, by increasing blood glucose level**

**-glucocorticoids also depressing the inflammatory response, by decreasing edema and reduce pain by inhibiting pain causing molecules**

**Called prostaglendins , so they used as drugs to suppress inflammation**

**-glucocorticoids are released from the adrenal cortex in response to rising blood level of (ACTH)**

**\*SEX HORMONES…..**

**-are produced by inner most layer of cortex**

**-adrenal cortex produce both male and female sex hormones**

**-the sex hormones are mainly androgens and some estrogens**

**-HYPOSECRETION of adrenal cortex hormones leads to Addison’s disease**

**-HYPERSECRETION :**

**-OUTER LAYER LEAD TO HYPERALDOSTERONISM (excessive water and sodium are retired, leading to increase blood pressure )**

**-MIDDLE LAYER \_\_Cushing’s syndrome**

**-INNER LAYER \_\_ Musuliniztion**

**\_HORMONES OF ADRENAL MEDULLA……**

**-when adrenal medulla is stimulate by sympathetic nerve system its cells release 2 similar hormones ,epinephrine (adrenaline) and norepinephrine (noradrenaline) , these hormones are called catecholamines , which increase heart rate ,blood pressure and blood glucose level**

**Catecholamines enhance and prolong the effect of the (fight or flight)**

**(Sympathetic nerve system) response to short term stress**

**HYPERSECRETION leads to symptoms of excessive sympathetic nerve system activity**

**\_PANCREATIC ISLETS,,,,,,,**

**-pencrease is a mixed gland consists of :**

**1) Exocrine part (enzyme)**

**2) Endocrine part (islet of langerham’s)**

**-pancreatic islts cells produce 2 hormones which are insulin and glucagon and small amounts of other hormones**

**-INSULIN: is release when blood levels of glucose are high, it increases the rate of glucose uptake and metabolism by body cells**

**- Insulin secreted from beta cells and its effect hypoglycemic**

**-HYPOSECRETION OF INSULIN: result in diabetes mellitus which severly disturbs body metabolism, signs as polyuria , polydipsia ,polyphagia**

**-GLUCAGON: release when blood levels of glucose are low, stimulates the liver to release glucose to blood, thus increasing blood glucose levels**

**\_PINEAL GLAND ……**

**-it is a small gland that hangs from the roof of the third ventricles of the brain**

**-it secrete melatonin hormone**

**-the level of melatonin rise and fall during the course of the day and night (increase level at night and lowest level at day-night)**

**-melatonin is believed to be a (sleep trigger)**

**-in some animals, regulate mating behavior and rhythms**

**\_THMUS…..**

**-it is located in the upper thorax, posterior to sternum**

**-it is large in infants and children and it decrease in size in adult**

**-it produce thymosin hormone, which is normal for development of T-lymphocyte and immune response**

**\_GONADS…..**

**-the femal and male gonads are mixed glands**

**-EXOCRINE (produce sex cells)**

**-ENDOCRINE (produce sex hormones)**

**\*Hormones of the Ovaries:**

**- Ovaries produce 2 groups of steroid hormones (estrogen, progestron)**

**1)ESTROGEN : it is released from ovaries at puberty under the influence of FSH**

**-it is responsible for growth and maturation of reproductive organ and appearance of secondary sex characters**

**-it act with progestron , to promote breast development and cyclic changes in the uterine lining (the menstrual cycle )**

**2) PROGESTRON: it is released from ovaries in response to high level of LH, it quiets the muscles of the uterus, to prevent abortion**

**\*Hormones of the testes:**

**- They are mixed glands**

**-EXOCRINE: produce sperms**

**-ENDOCRINE: produce male hormones (androgens) testestrone , is the most important one**

**-at puberty, testestron promotes growth and maturation of reproductive organs and also causes secondary sex characters**

**- In adult, testestron is necessary for continuous production of sperms**

**-hyposecretion lead to sterility**

**\_PLACENTA…..**

**-the placenta is temporary organ formed in the uterus of pregnant women**

**-during early pregnancy, produce human chorionic gonadotropin (HCG)**

**-IN 3RD month produce estrogen and progesterone, to maintain the lining of uterus (thus the pregnancy)**

**-it produce human placental lactogen (HPL) ,,which work with estrogen and progestron in preparing the breast for lactation**

**-it produce relaxin hormone, causes the mother’s pelvic ligament and pubic symphysis to relax and eases birth passage**