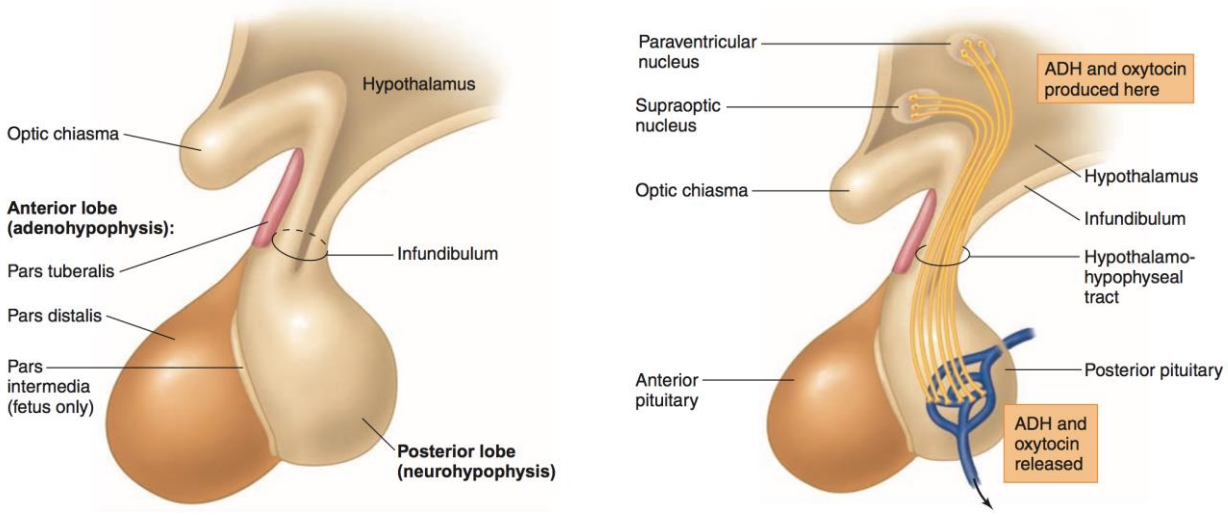
A. Pituitary Gland

The pituitary gland is commonly referred to as the master gland because it regulates the function of other endocrine glands. This notion, despite attractive, is not necessarily true because the hypothalamus controls all actions of the pituitary gland.

The pituitary gland, also called hypophysis is a pea-sized specialized tissue that is located at the base of the brain. This gland is composed of two main parts, namely the anterior pituitary (pars distalis) and the posterior pituitary (pars nervosa or neurohypophysis). These two lobes of the pituitary gland are separated by the pars intermedia. The pituitary gland is connected to the hypothalamus through a stalk-like structure called indundibulum. This portion is partially wrapped with a sheath of tissue called pars tubercles that is connected to the anterior section of the pituitary gland. The partition imparted by the pars intermedia is only evident during embryonic up to the fetal stage of development, and the two lobes seem to combine during adulthood.

The anterior an posterior sections of the pituitary gland secrete different sets of hormones. Prior to introduction of such hormones, it must be recognized that the secretions of the pars distalis are regarded as "trophic" hormones. The word trophic means "feed" as such hormones could lead to hypertrophy (increase in size) of their target organs when released in very high concentrations and atrophy (decrease in size) when secreted in very low concentrations. In order to easily identify such hormones, the suffix -tropin is used in the shorthand names of pituitary hormones which includes the following:

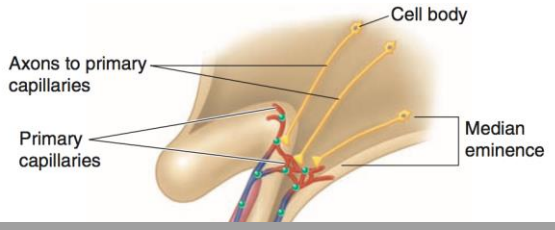
1. **Growth Hormone** *(GH or somatotropin) i* *owth and development as it promotes mobilization of amino acids to* *sed in anabolic processes. Development of muscle, cartilage, and bone* *tion of GH.*
2. **Thyroid-stimulating Hormone** *(TSH or t* *thyroid gland to synthesize and release T3 and T4 which is used by the* *of metabolism.*
3. **Adrenocorticotrophic hormone** *(ACTH* *he adrenal gland to release glucocorticoids such as cortisol. Cortisol is* *d with high levels of stress.*
4. **Follicle-stimulating Hormone** *(FSH or fo* *growth of ovarian follicles and production of spermatocytes in the testi*
5. **Luteinizing Hormone** *(LH or luteotropi* *regarded as gonadrotropic hormones because these are secreted by* *ve organs. In females, LH facilitates ovulation while in males, LH st* *sterone and other male sex hormones from the Leydig cells into the tes*
6. **Prolactin** *(PRL) is a hormone that stim* *lactation in females after parturition. In males, it support the functi* *(FSH and LH), as well as*

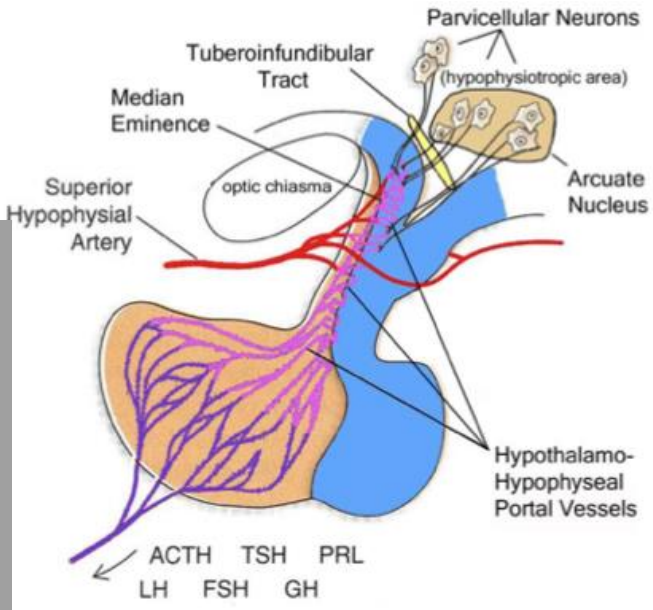


maintain water and electrolyte balance through imposing its effect on the kidneys.

The pars nervosa, on the other hand secretes different types of [redacted] *section of the pituitary is more of a storage site of hormones, rather than being a true* [redacted] *use its secretions come from the paraventricular nucleus and supraoptic nucleus whi* [redacted] *ypothalamic area. The two main hormones of the posterior pituitary include the* **Ar** [redacted] *H) and* **Oxytocin**. *The paraventricular nucleus and supraoptic nucleus of the hypo* [redacted] *lands, and drain their hormones to the pars nervosa through the* **hypothalami-hy** [redacted] *hich is also called the* **arginine vasopressin** *(AVP) that causes the kidneys to reta* [redacted] *sed through the urine. ADH is thus called an anti-diuretic hormone, as diuresis mean* [redacted] *ocin stimulates uterine wall contraction during labor, that is needed for parturition* [redacted] *f mammary gland for lactating reflex. In males, oxytocin levels increase during eja* [redacted] *d importance remains to be explored. The production and secretion of oxytocin* [redacted] *is controlled by the hypothalamus. The suckling of an infant imposes mechanica* [redacted] *y gland of the nursing mother and this stimulus are relayed to the hypothalamus thro* [redacted] *ulses.*

Regulation of the anterior pituitary is performed by the hypo [redacted] *nt mechanism. It must be considered that axons do not reach the area of the ante* [redacted] *e controlled by using molecules secreted by the hypothalamus rather than nerve ir* [redacted] *s controls the anterior pituitary through* **releasing** *and* **inhibiting** *hormones that are* [redacted] *ic neurons, transferred to axon endings at the basal portion of the hypothalamus and* [redacted] *r pituitary through the*

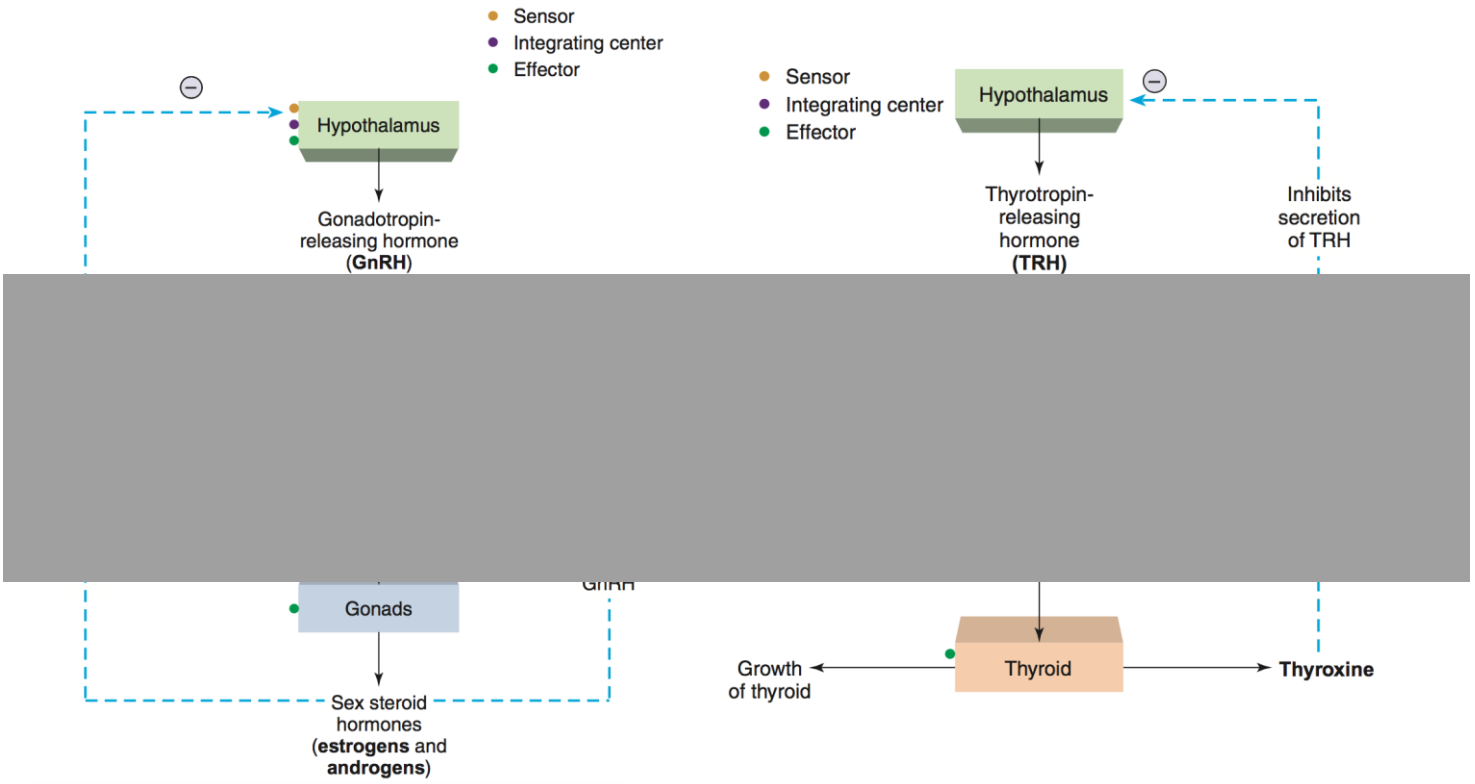




[redacted] *e blood that contain the inhibiting and releasing factors* [redacted] *tem and is called the* **hypothalamo-hypophyseal portal**

ones include the Corticotropin-releasing hormone, Growth hormone-sing hormone to stimulate release of FSH and LH, Thyrotropin-releasing e and somatostatin otherwise called the Growth hormone-inhibiting

The processes of the anterior pituitary is also controlled by feedback control. This means that activity of both hypothalamus and pituitary glands are regulated by the target glands that they control. Then, this clarifies the point that neither the hypothalamus not the pituitary is the master gland. Negative feedback inhibition affects the secretion of ACTH, TSH, FSH and LH through the hypothalamus-pituitary-gonad axis as shown in Future



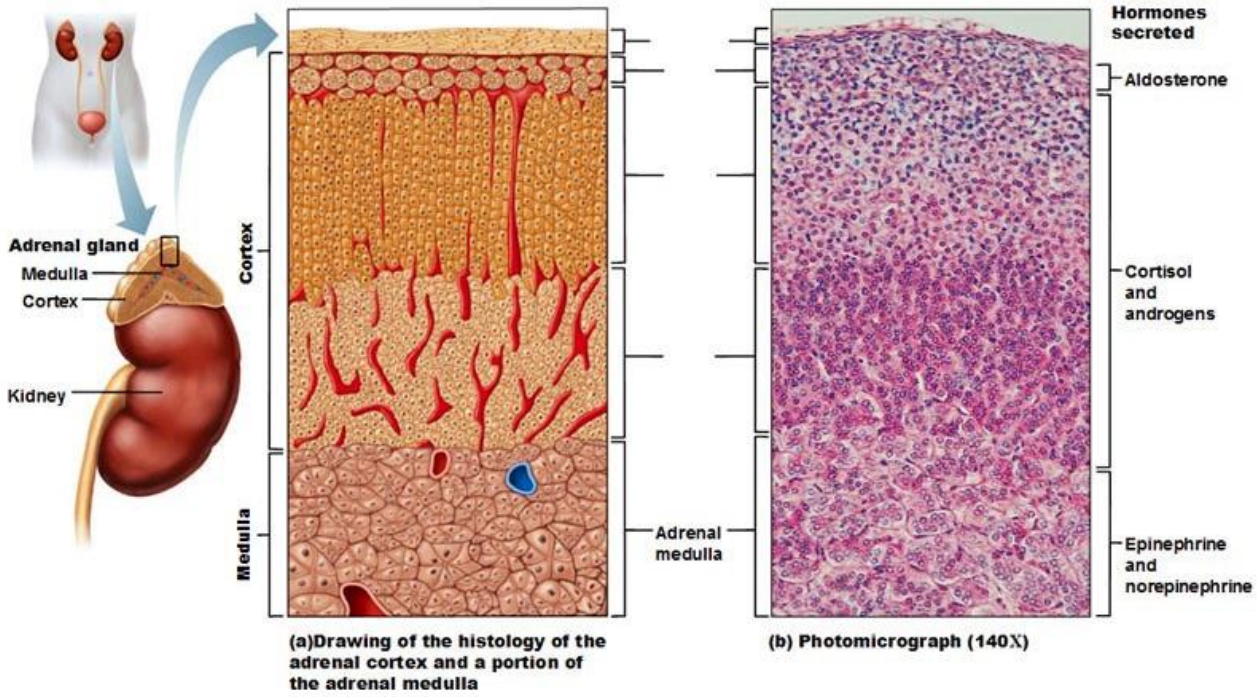
X.

This axis works when hypothalamus secretes Gonadotropin-releasing hormone to si gland to produce FSH and LH. These two hormones further stimulate the gonads to s as estrogen, progesterone and testosterone. The concentration of these hormones mu their physiologic effects on the secondary sex characteristics of both males and concentration of sex hormones are in the bloodstream, these molecules inhibit the h more Gonadotropin-releasing hormone, as well as the anterior pituitary in releasin

feedback inhibition has also been observed when the levels of T4 and T3 in the bloo concentrations. Numerous brain areas have the capacity to control the hypothalamus, activity of other glands in the body. The epithelial tissues of the olfactory system are lin as well as the amygdala which is the central site for the feeling of fear. This establis sense of smell and the functions of the reproductive organs. Stress could also affect well as the notion of "day and night" or circadian rhythms. The rate of growth of gro by current state of the individual such as excitement, trauma, starvation, hypoglycaem

B. Adrenal Glands

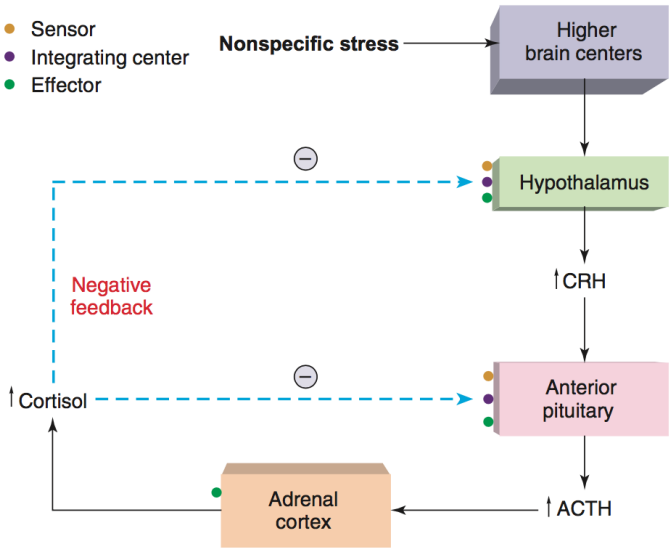
The adrenal glands are situated at the top of both kidneys and are responsible for se hormones that are required during fight-or-flight situations and the mineralocorticoids regulate mineral and energy balance within the body, respectively. Each adrenal glan parts namely the adrenal cortex and the adrenal medulla. The adrenal cortex is consists namely zona glomerulosa, zona fasciculata and zona reticularis. The zona glomerulo reticularis are responsible for secretion one of the most potent mineralocorticoid c regulates the electrolyte balance, blood pressure and blood volume. Aldosterone cau sodium ions and water, while excreting potassium ions through the urine. The glucoc produced in the zona fasciculata which stimulates gluconeogenesis and raise blood g during stressful conditions. Glucocorticoids also promote degradation of lipids in th



results to an increase in the concentration of free fatty acids in the blood.

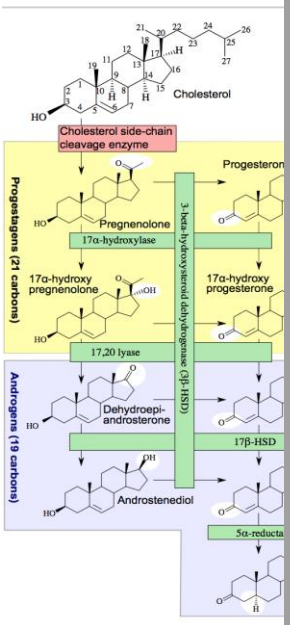
http://antranik.org/the-endocrine-system/

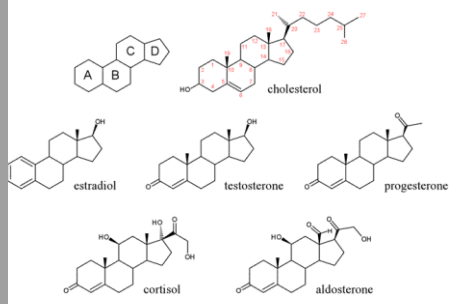
The adrenal medulla secretes epinephrine, also called adrenaline and norepinephrine, which are both catecholamine hormones. It can be recalled in that catecholamines are derivatives of the amino acid tyrosine. When a stressful condition is encountered, the hypothalamus is triggered to release Corticotropin-releasing hormones that stimulates the anterior pituitary to produce ACTH that signals cortisol release by the adrenal cortex. These hormones then turns on sympathetic mode of the nervous system to make an individual become alert and ready to face the potentially-stressful situation. A high concentration of cortisol in the blood also inhibits the hypothalamus and the anterior pituitary through negative feedback inhibition.



The adrenal cortex also produces sex hormo sor. Different enzymes are used to process cholesterol and convert it to variou l. This suggests that estrogen and progesterone are not exclusively produced is only synthesized by males. The

concentration, rather than [redacted] mones determine the secondary sex eristics that will emerge in an ual.

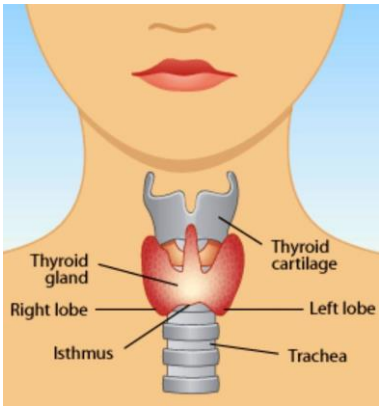


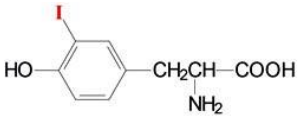


edia.org/wikipedia/commons/1/13/Steroidogenesis.svg
entist.wordpress.com/2013/10/27/macronutrients-101-cholesterol/

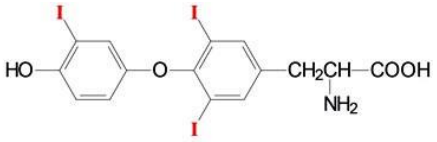
C. Thyroid Gland

The thyroid gland is the largest among all endocrine glands, and is located just below the larynx an dis composed of two separate lobes. The two lobes are positioned on both sides of the trachea and are connected through the

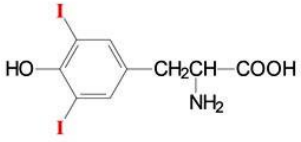




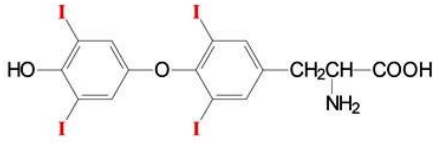
3-monoiodotyrosine (MIT)



3,5,3′-triiodothyronine (T_3)



3,5-diiodotyrosine (DIT)



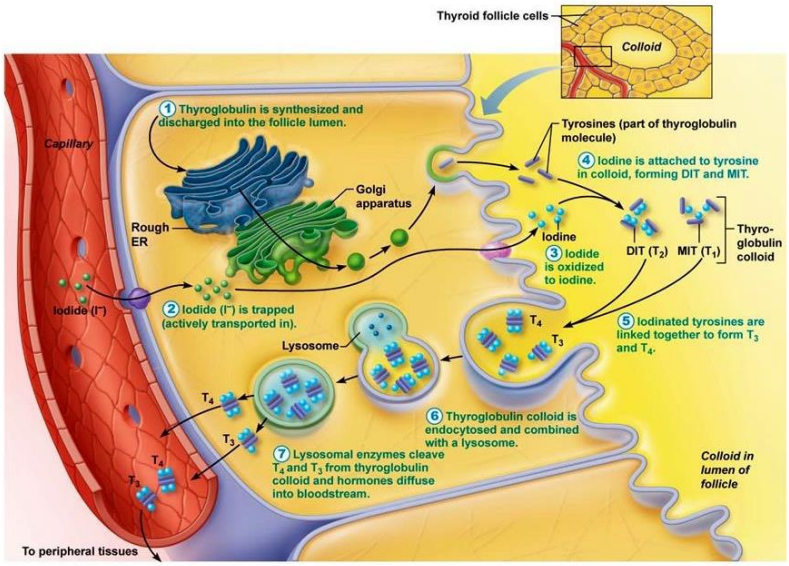
3,5,3′,5′-tetraiodothyronine (thyroxine: T_4)

isthmus. It contains thyroid follicles which are sites of the biosynthesis of Thyroxine (T3 and T4).

https://www.maryvancenc.com/hypothyroidism/
https://themedicalbiochemistrypage.org/images/thyroid-hormones.jpg
http://slideplayer.com/slide/10661844/36/images/12/2.7+Describe+the+synthesis+of+thyroid+hormones+and+its+regulation.jpg

Thyroxine synthesis is initiated through entry and accumulation of exogenous iodine from the diet into the colloidal part of the follicular cells. Iodine is oxidized to form iodine ions, and are incorporated into tyrosine residues of the peptide called thyroglobulin. When one or two iodine atoms are incorporated into the thyroglobulin structure, it is called monoiodotyrosine (MIT) or diiodotyrosine (DIT), respectively. Regrouping

of the such iodinated tyrosine residues occur to form either T3 (MIT + DIT) or T4 (DIT + DIT). The synthesized T3 and T4 are then released from the thyroglobulin structure and are secreted into the bloodstream. T3 and T4 are important in regulating the metabolic rate of the body, in which hyperthyroidism results to unusual fast

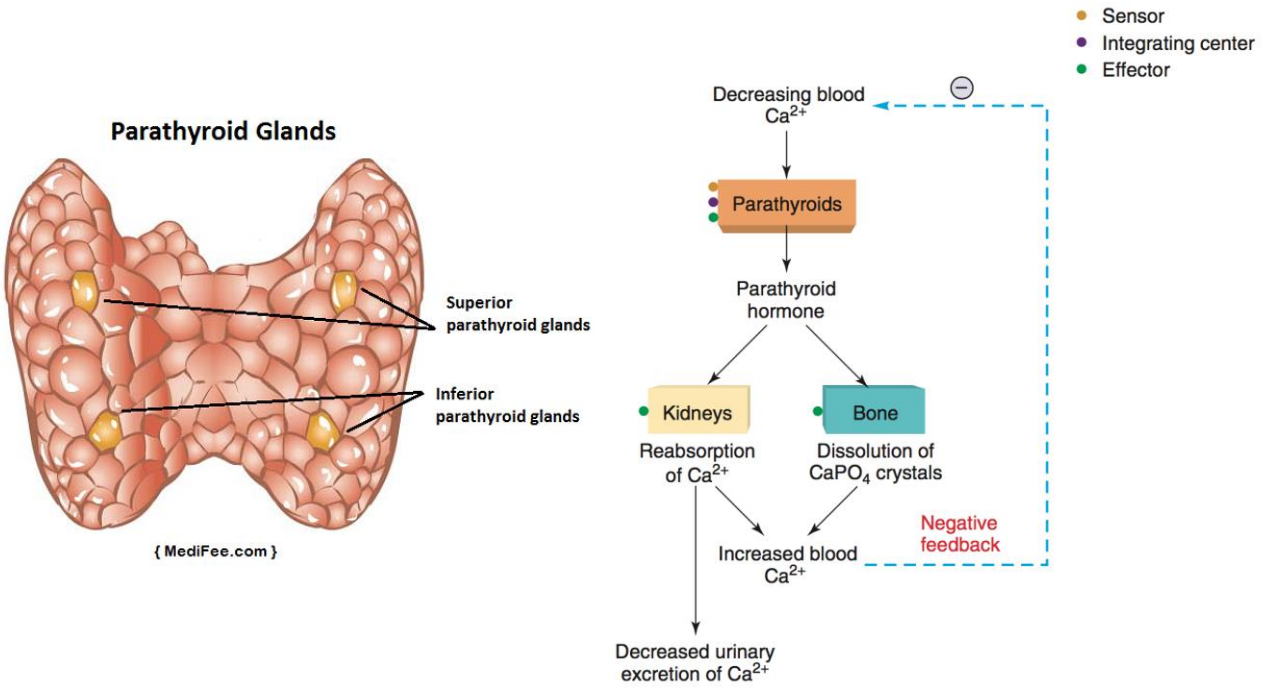


metabolic rate, while the reverse effect is observed in hypothyroidism.

D. Parathyroid Glands

The four parathyroid glands are superficially located at the posterior surfaces of the lateral lobes of the thyroid gland. These glands secrete parathyroid hormone (PTH) that control the calcium levels of the body. When parathyroid gland is secreted, calcium levels in the blood is increased either through bone desorption, retention of calcium ions in the kidneys or increased intake of dietary calcium through the intestines. Like the other glands which were previously discussed, the release of PTH is mediated by the action of the hypothalamus. A decline

in calcium level in the blood signals the parathyroids to secrete PTH, while high concentration of calcium in the



blood imparts a negative feedback to the parathyroid glands.

https://www.medifee.com/blog/parathyroid-glands-four-pillars-of-your-bone-health/

E. The Pancreas

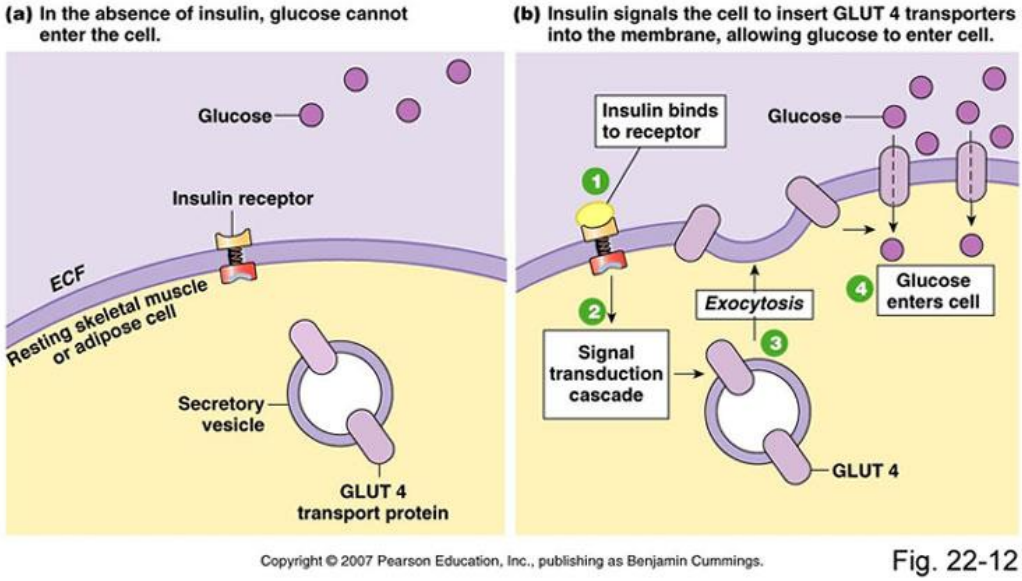
In the pancreas reside the Islets of Langerhans which is consists of alpha, beta and gamma cells. Insulin is secreted by the beta cells, while glucagon is produced by the alpha cells. It must be noted that aside from being endocrine gland, the pancreas is also an exocrine gland. This is due to the presence of the pancreatic duct where pancreatic juice is released to the duodenum. As previously described, insulin is a protein which interacts with tyrosine kinase. Activation of the insulin receptor triggers gene expression that lead to production and translocation of glucose transporters [redacted] ose transporters facilitate uptake of glucose molecules that will be used in [redacted] in the cell. Not al organs in the body are equally responsive to the effects [redacted] permeable to glucose even without insulin. This ensures that neural functi[redacted] of insulin secretion by the pancreas. As the brain is highly dependent on [redacted] blood glucose concentration is kept

within 20 to 50 mg/dL to prevent hyp *ainting, seizures and eventually,*

coma.

https://en.wikipedia.org/wiki/Pancreas#/media/File:Blau
https://www.wonderwhizkids.com/images/content/biolo */Pancreas.html*

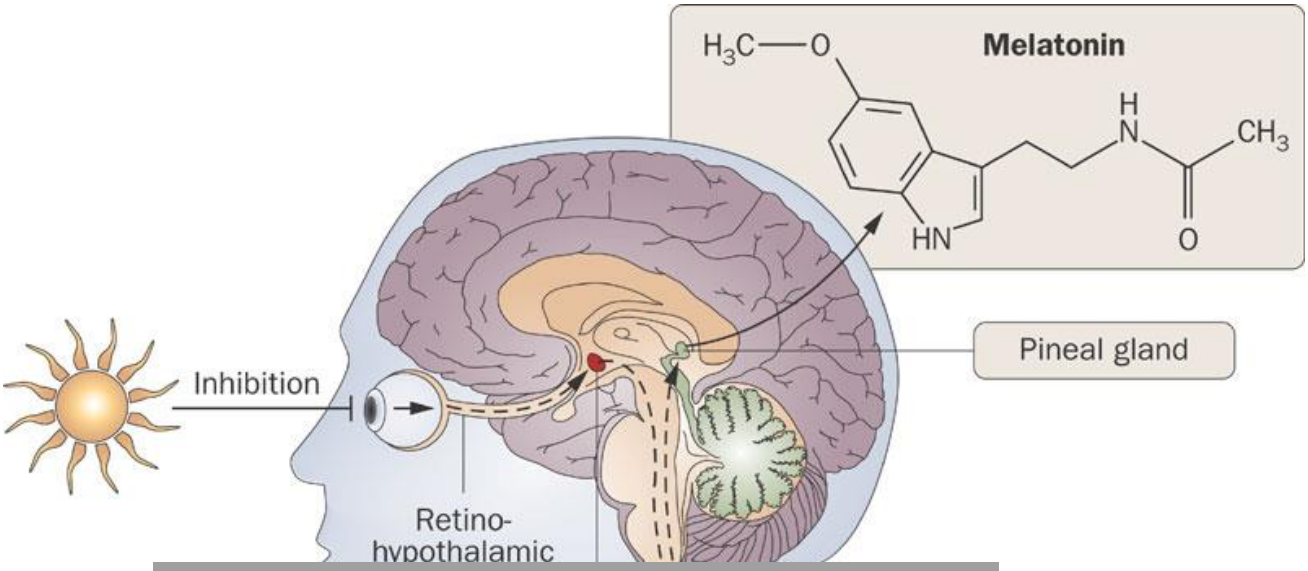
Glucagon elicits an antagonistic function to insulin, as it signals breakdown of glucose and lipid reserves of the body. In times of fasting or starvation, the level of glucagon in the blood is increased to facilitate breakdown of



fatty acids to generate ketone bodies that will help the body sustain its function despite depleted glucose levels.

https://fanaticcook.com/2014/06/05/mechanism-by-which-dietary-fat-can-raise-blood-glucose-and-insulin/

F. Pineal Gland



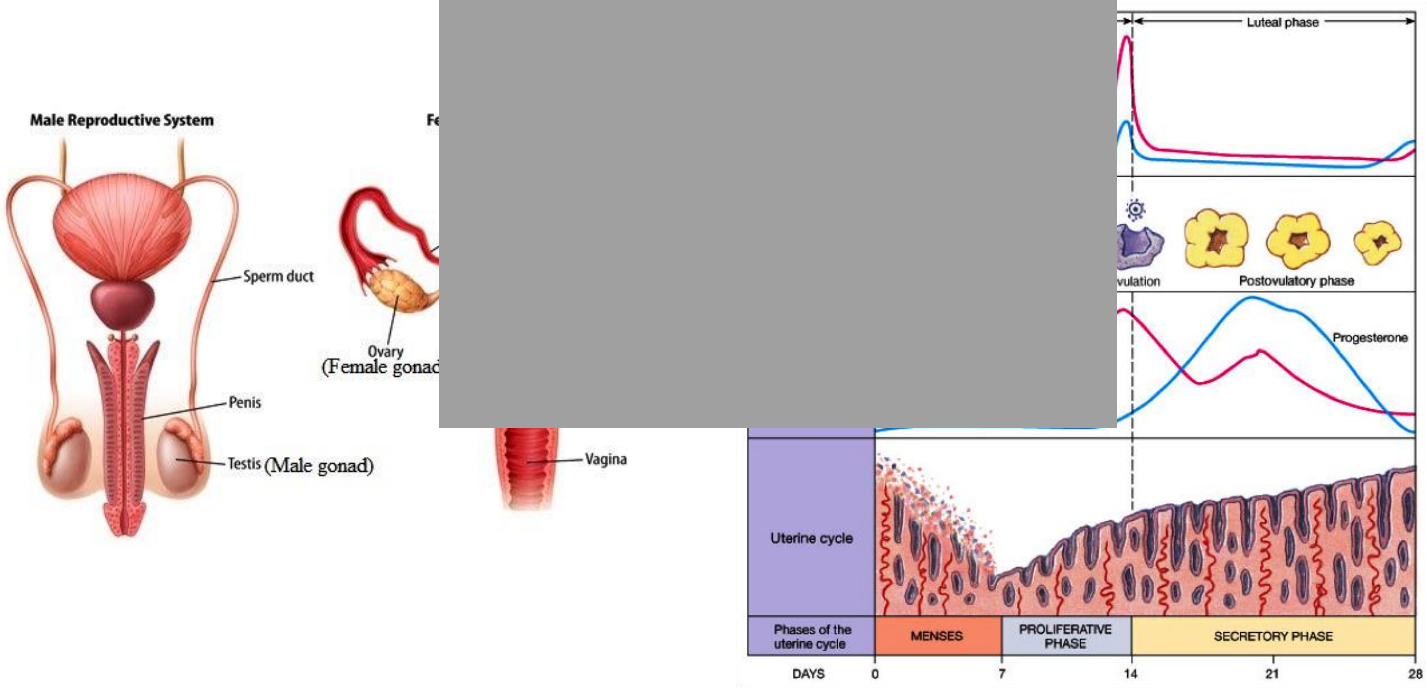
https://www.researc *239810*

The pineal g *lon. In children, the pineal gland weigh* *th and nine millimeters in terms of wi* *s. It is regulated by the suprachiasm* *nance of processes of the body that cy* *he SCN with concomitant release of melatonin peaks during the night and is depressed during daytime. Thus the neural pathways and processes in the retina signals the activity of SCN and melatonin production.*

It has been shown that the activity of the pineal gland in hamster which were exposed to more than 13 hours of darkness has been activated, whereas lesser exposure period of exposure failed to activate the pineal gland. Gonadotrophin secretion declines in response to melatonin release, and this is beneficial for animals which experience longer periods of inactivity during winter. This somehow explains why springtime is a breeding season for most animals, as longer days result to lower pineal gland activation and unregulated function of the gonads.

G. Gonads

The testes and ovaries, collectively referred as the gonads secrete sex hormones called androgens, estrogens and progesterone. The testes contains two compartment called seminiferous tubules that generates the sperm cells and the Leydig cells, where the main male hormone, testosterone is synthesised. Testosterone is important for development of secondary male characteristics and development of the penis and scrotum, as well as accessory sex organs. The ovaries on the other hand, produce estradiol-17B. In further detail, the ovary contains egg cells (ovum), granulosa cells that secrete estrogen and ovarian follicles produce estradiol-17B during the first half of the menstru[redacted]l cycle and facilitate ovulation. The biological activity[redacted]otent estriol that is produced by the placenta. When f[redacted]en is called estrone, and is secreted by the fat cells. T[redacted]during the different



stages of the menstrual cycle is shown in Fig X.

https://static1.squarespace.com/static/56a3fd72d8af10f9cc8115e7/t/56be1c934c2f85900ce1b49f/1455299737780/

Estrogens can cause development of the stroll tissue of the breast and fat deposition in the breast. Despite the importance of estrogen, the action of progesterone and prolactin are important for further development and function of these structures. A decreased level of estrogen during old age has been linked to osteoporosis because

formation of the bones by osteoblasts declines, diminished bone matrix and decreased rate of deposition of calcium and phosphates in bones. Estrogen is also important in growth of rain in pubic regions and development of softer and smoother skin.