

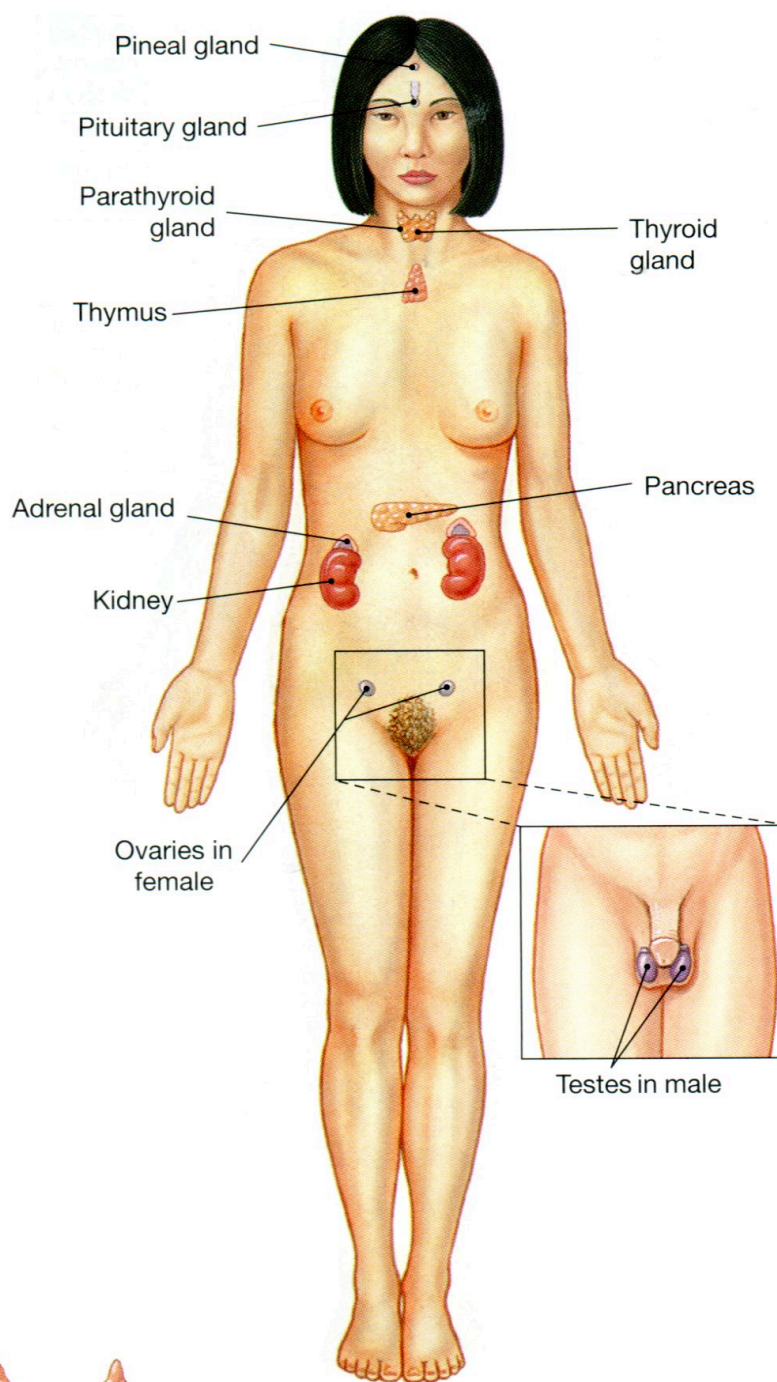
The Endocrine System



ENDOCRINE SYSTEM GLANDS

www.visiblebody.com

COMPILED BY HOWIE BAUM



Organ/Component	Primary Functions
Pineal Gland	May control timing of reproduction and set day-night rhythms
Pituitary Gland	Controls other endocrine glands; regulates growth and fluid balance
Thyroid Gland	Controls tissue metabolic rate; regulates calcium levels
Parathyroid Glands	Regulate calcium levels (with thyroid)
Thymus	Controls maturation of lymphocytes
Adrenal Glands	Adjust water balance, tissue metabolism, cardiovascular and respiratory activity
Kidneys	Control red blood cell production and assist in calcium regulation
Pancreas	Regulates blood glucose levels
Gonads	
Testes	Support male sexual characteristics and reproductive functions (see part k)
Ovaries	Support female sexual characteristics and reproductive functions (see part l)



(e) THE ENDOCRINE SYSTEM

THE ENDOCRINE SYSTEM

Although often overshadowed by the brain and nerves, the Endocrine system is also involved in the information business. Hormones carry essential messages that have far-reaching effects.

They control body processes at every level, from energy uptake of a single cell to the whole body's rate of growth and development.

There are 50 of hormones, which are the body's chemical messengers and they are made by 12 different Endocrine glands.

These glands have no ducts but secrete their hormones directly into the blood, by which means they reach every cell in the body.

Hormones affect certain target tissues or organs and regulate their activities.

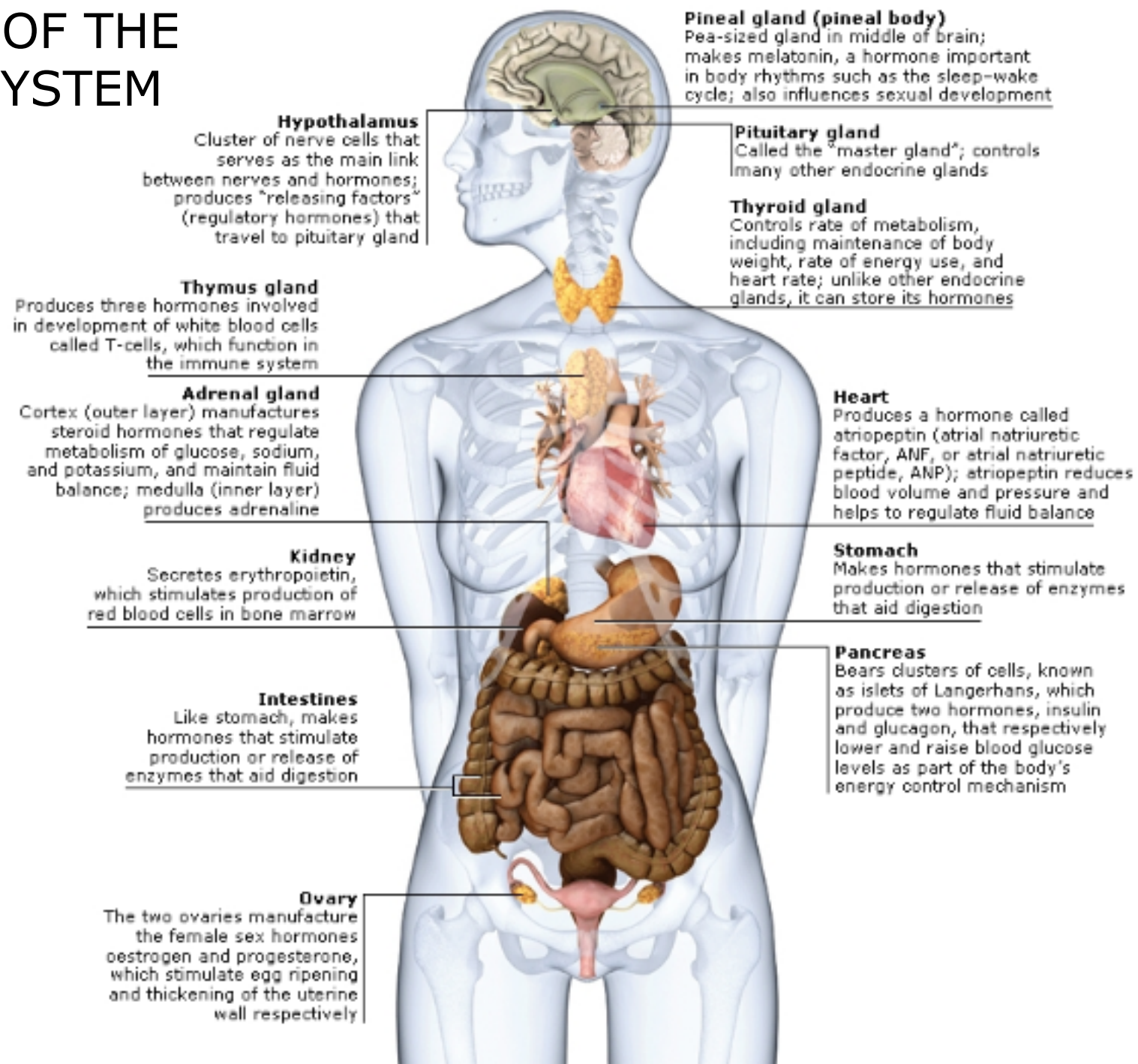
The Endocrine system sends hormones through the Circulatory system to control and coordinate body functions in much the same way as the nervous system uses tiny electrical signals.

- ❖ **The Endocrine system and the Nervous system work together to integrate in the brain and complement each other, but they tend to work at different speeds.**
- ❖ **Nerves respond within split-seconds but their action soon fades**
- ❖ **Some hormones have longer lasting effects and act over hours, weeks, and years.**

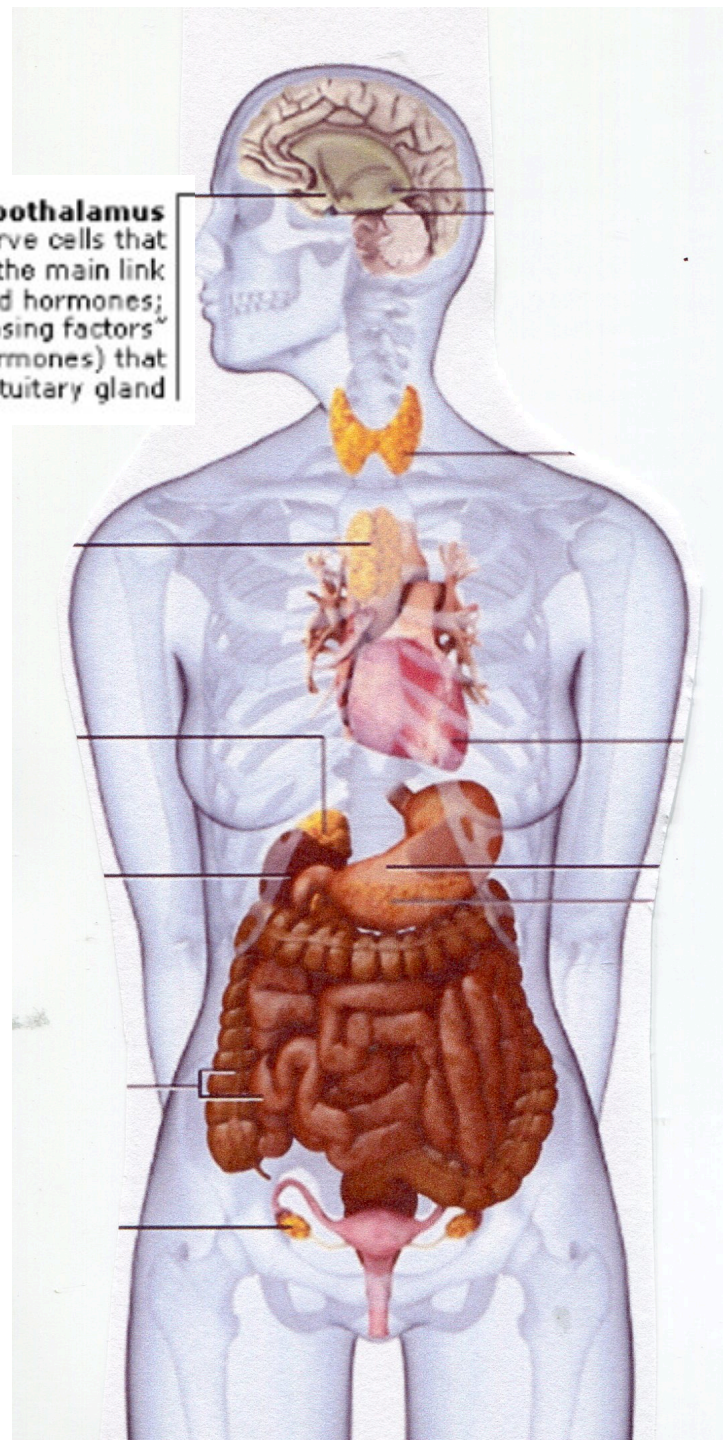
Hormones regulate processes such as:

- ❖ The breakdown of chemical substances in metabolism of what we eat and drink
- ❖ Fluid balance and urine production
- ❖ The body's growth and development
- ❖ Sexual reproduction.

THE 12 PARTS OF THE ENDOCRINE SYSTEM



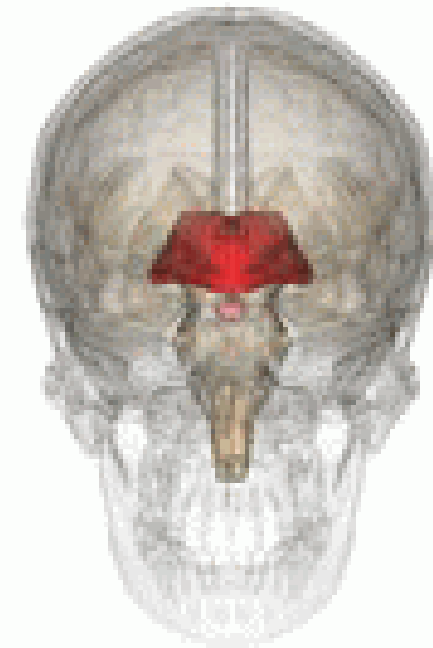
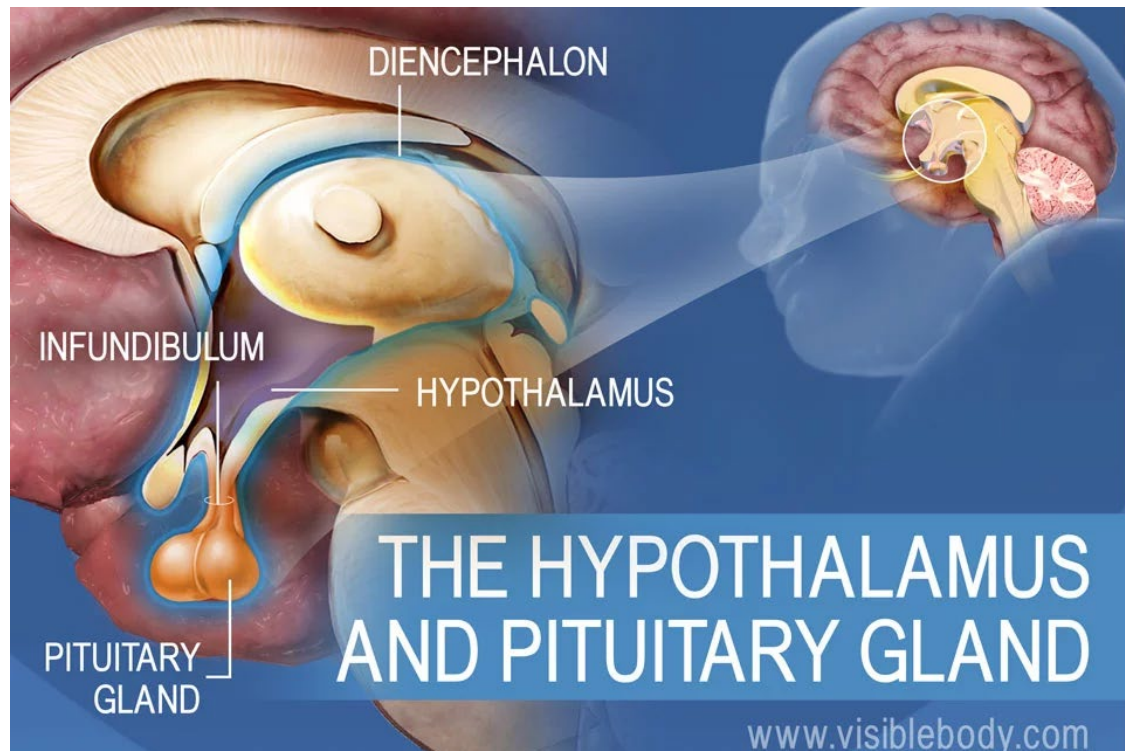
Hypothalamus
Cluster of nerve cells that serves as the main link between nerves and hormones; produces "releasing factors" (regulatory hormones) that travel to pituitary gland



The hypothalamus and the pituitary gland are part of the diencephalon region of the brain.

The hypothalamus connects the nervous system to the endocrine system. It receives and processes signals from other brain regions and pathways and translates them into hormones, the chemical messengers of the endocrine system.

These hormones flow to the pituitary gland, which is connected to the hypothalamus by the **infundibulum**. Some hormones are stored in the pituitary stores for later release; others spur it to secrete its own hormones. The hormones released by the pituitary gland and the hypothalamus control the other endocrine glands and regulate all major internal functions.

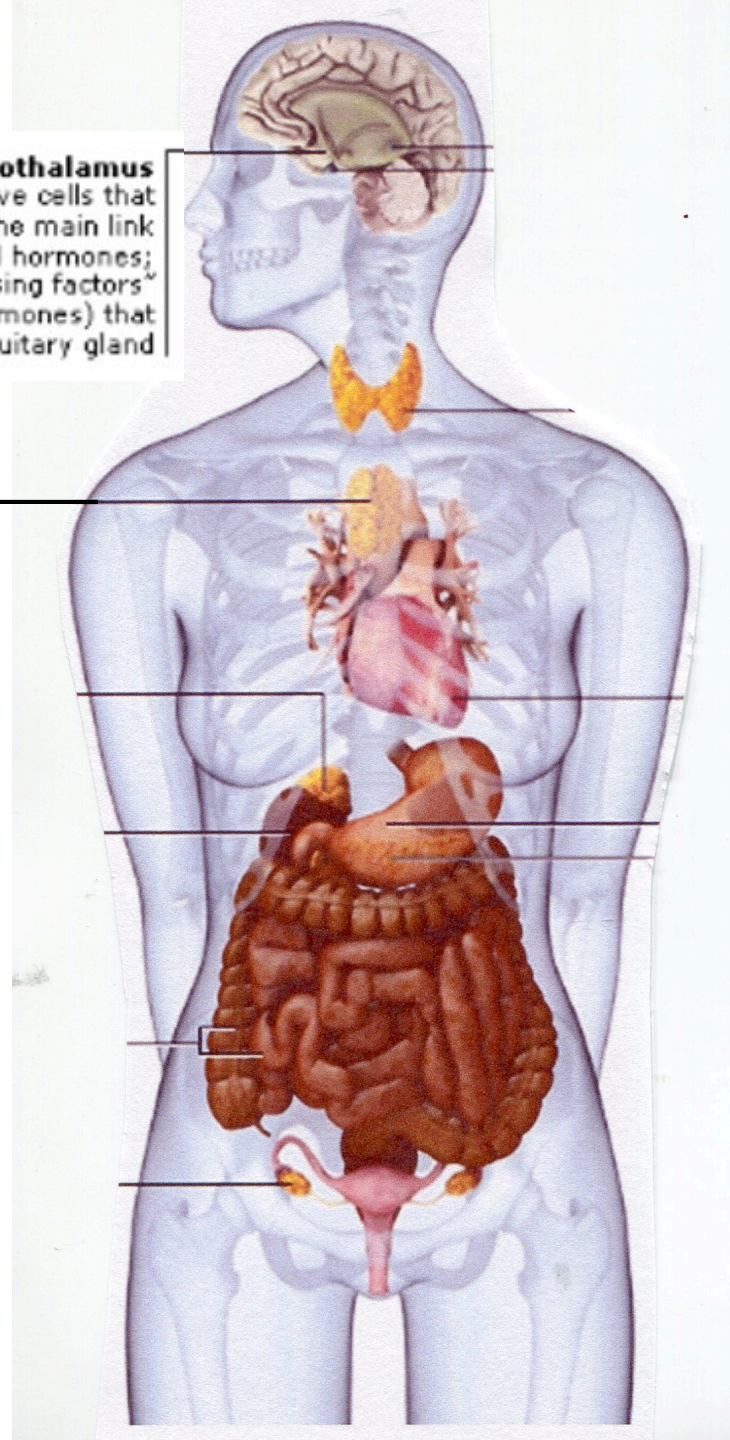


Hypothalamus

Cluster of nerve cells that serves as the main link between nerves and hormones; produces "releasing factors" (regulatory hormones) that travel to pituitary gland

Thymus gland

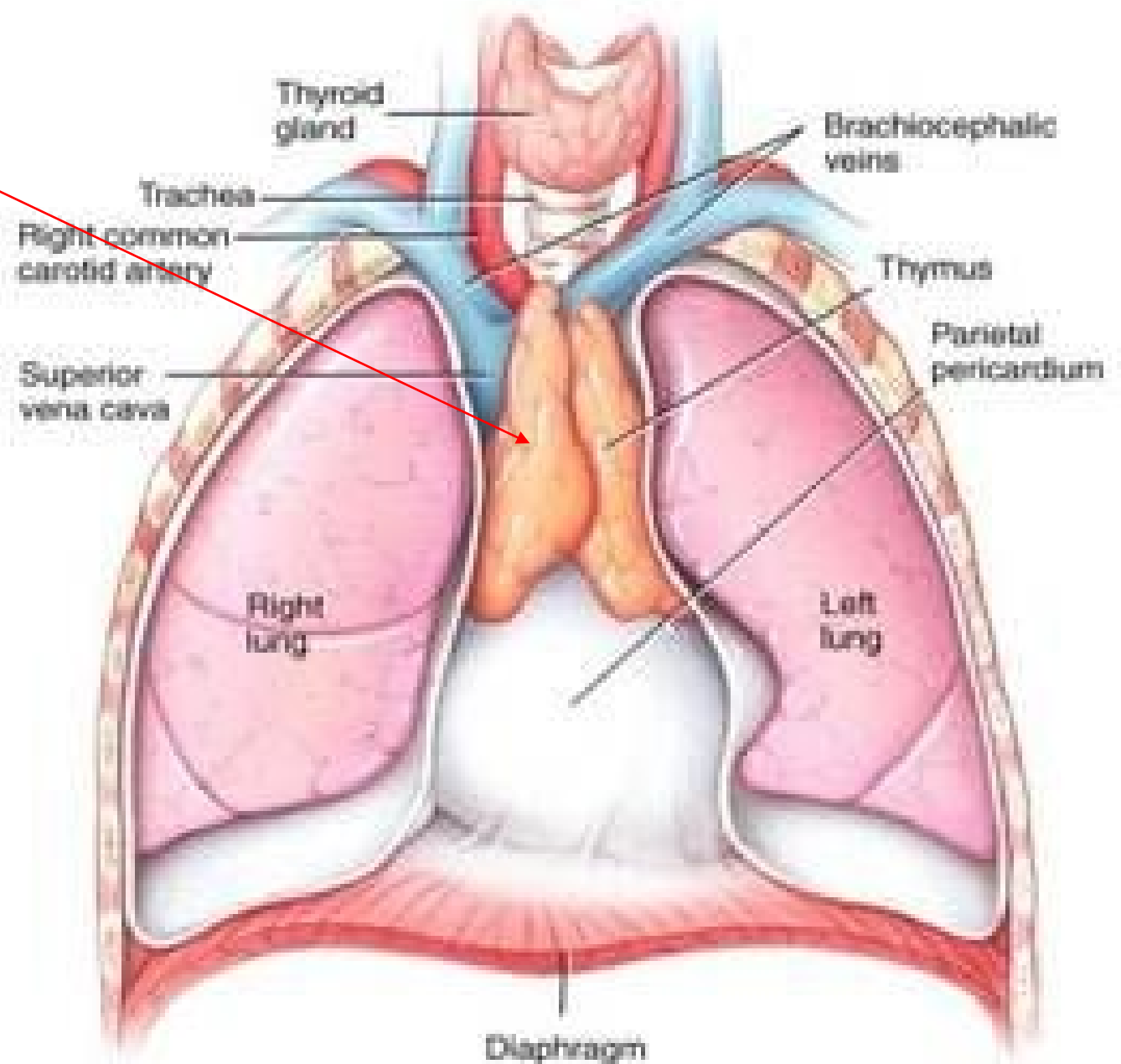
Produces three hormones involved in development of white blood cells called T-cells, which function in the immune system



The thymus gland produces progenitor cells, which mature into T-cells (thymus-derived cells). The body uses T-cells to help destroy infected or cancerous cells.

T-cells created by the thymus also help other organs in the immune system grow properly.

These cells are so vital, they are often donated to those in need. The Thymus gland is the primary donor of cells for the lymphatic system, much as bone marrow is the cell donor for the cardiovascular system.



Hypothalamus

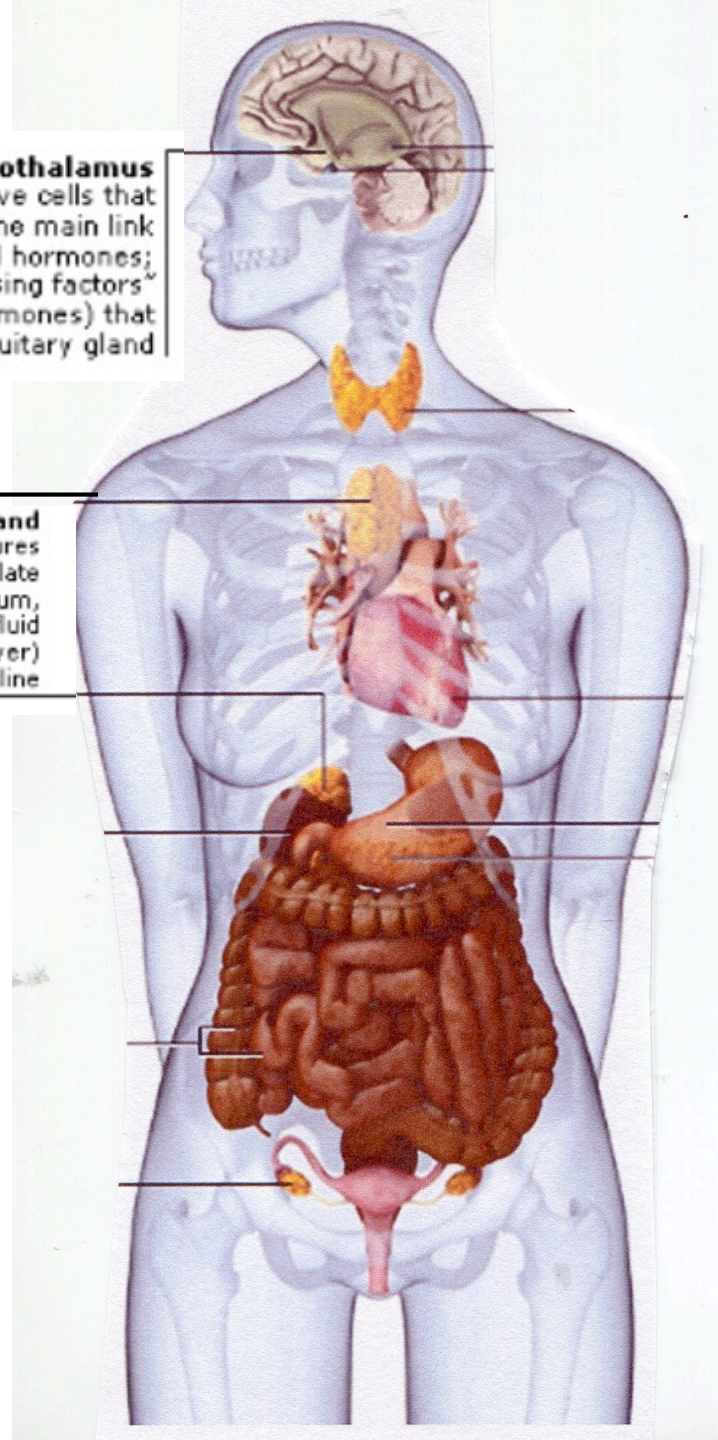
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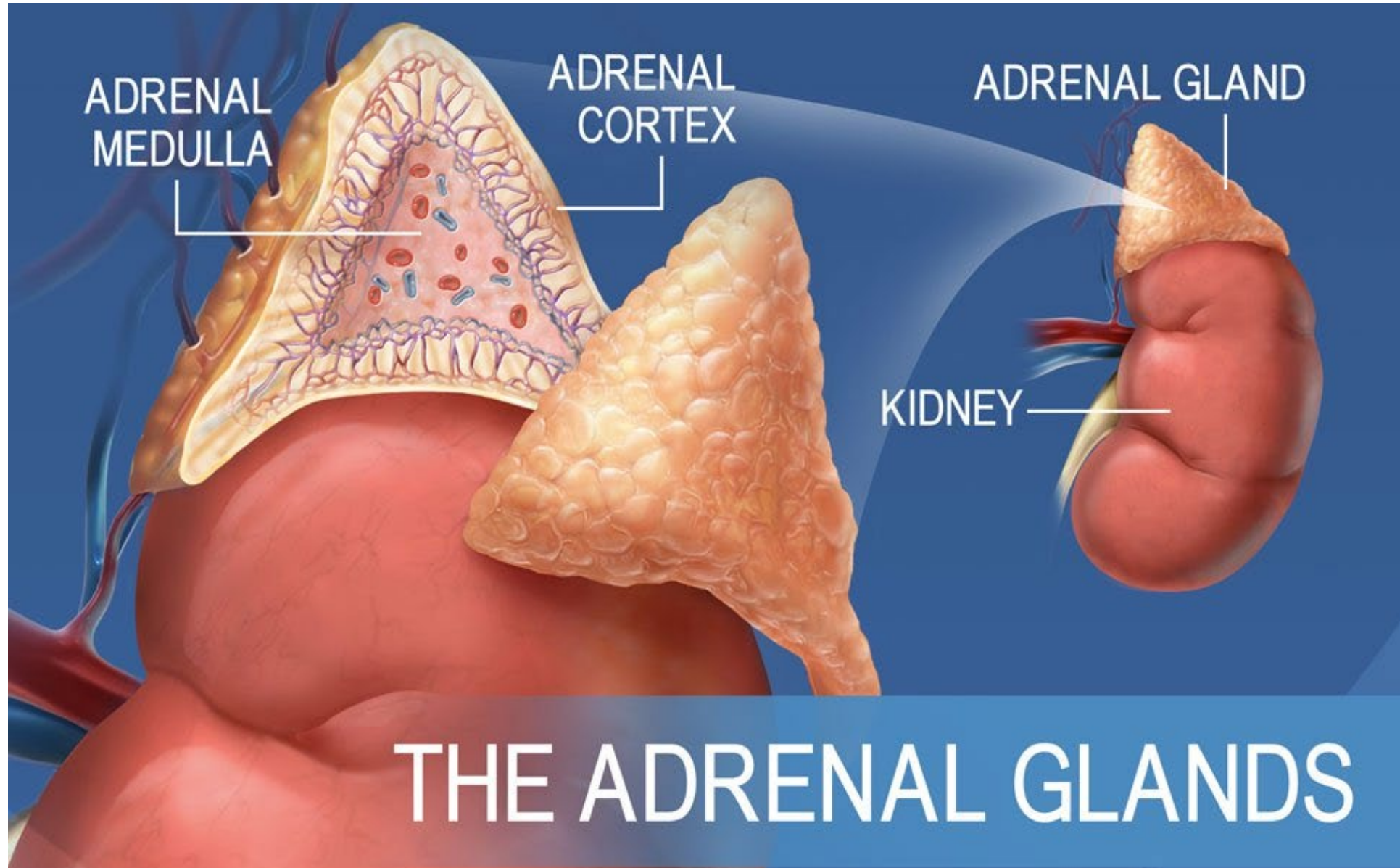
Produces three hormones involved in development of white blood cells called T-cells, which function in the immune system

Adrenal gland

Cortex (outer layer) manufactures steroid hormones that regulate metabolism of glucose, sodium, and potassium, and maintain fluid balance; medulla (inner layer) produces adrenaline



THE ADRENAL GLANDS REGULATE SUBSTANCE LEVELS IN THE BLOOD AND RELEASE "FIGHT-OR-FLIGHT" HORMONES



The adrenal glands are pyramid-shaped organs that sit at the top of each kidney.

Each adrenal gland consists of two structures: an outer adrenal cortex and an inner adrenal medulla.

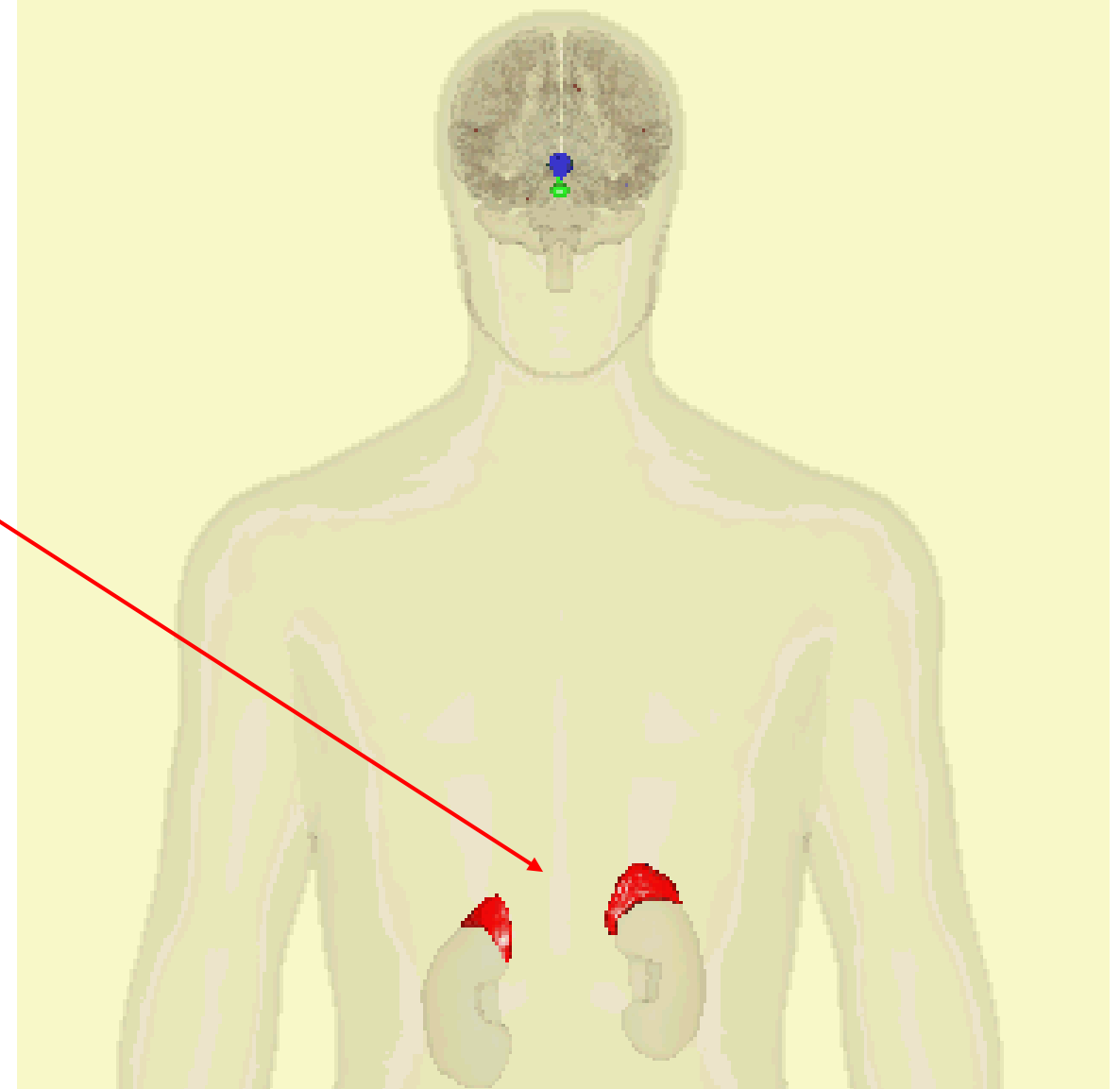
The adrenal cortex is a network of fine connective tissues that makes up most of the gland. It secretes a range of steroid hormones.

Cortisol which manages protein and glucose levels.

Aldosterone which adjusts our levels of water and salt.

Androgens and estrogens are secreted by the adrenal cortex in small amounts by both sexes.

The adrenal medulla (inside the gland) produces epinephrine and nor-epinephrine (NE). These chemicals promote "fight-or-flight," the body's initial response to stress.



The left kidney is located slightly higher than the right kidney due to the larger size of the liver on the right side of the body

SHORT-TERM STRESS

LONG-TERM STRESS

ADRENAL
GLAND

EPINEPHRINE and
NOREPINEPHRINE

Nerve
impulse

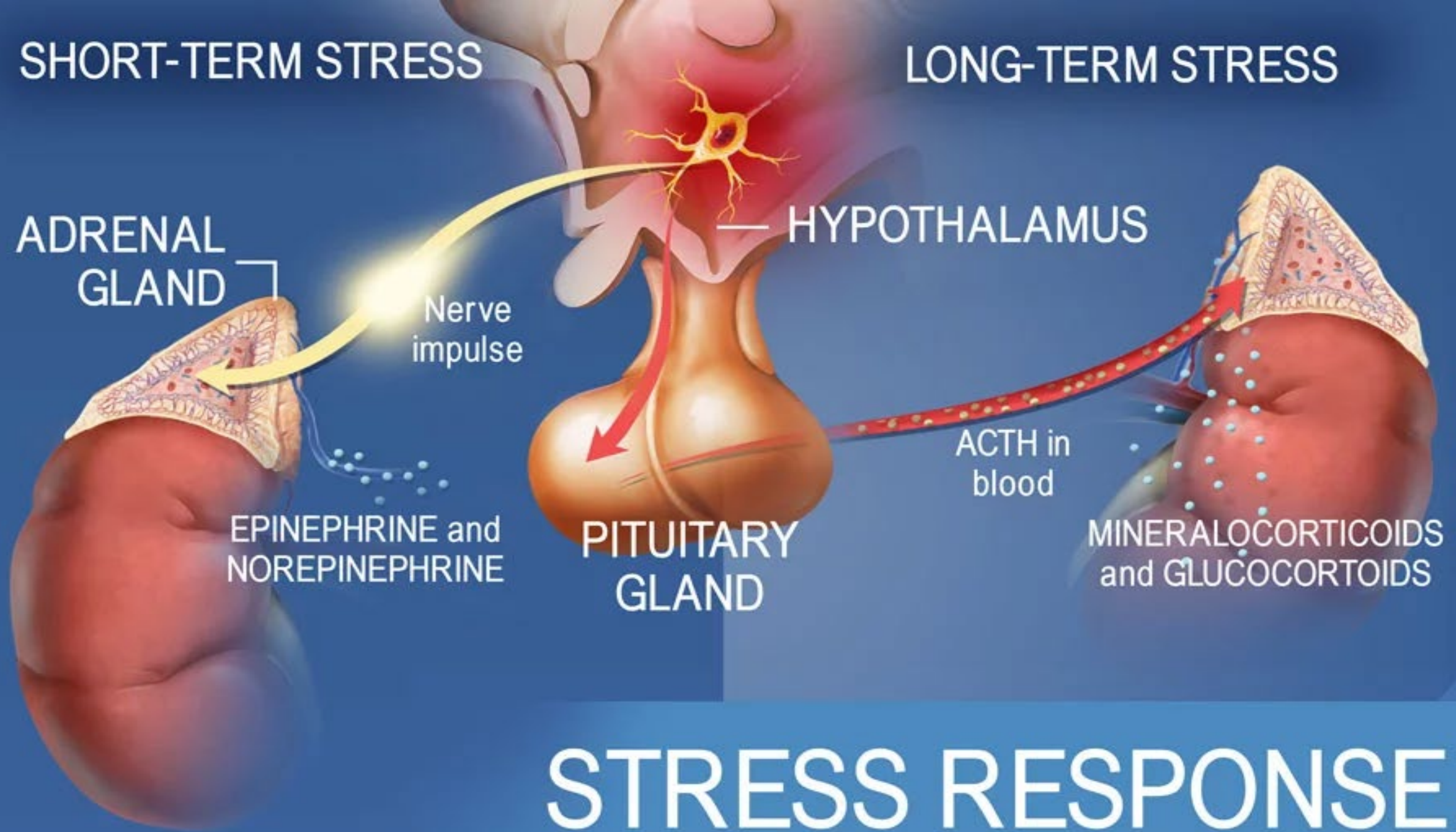
HYPOTHALAMUS

PITUITARY
GLAND

ACTH in
blood

MINERALOCORTICOIDS
and GLUCOCORTICOIDS

STRESS RESPONSE



PARASYMPATHETIC NERVES

"Rest and digest"

Constrict pupils

Stimulate saliva

Slow heartbeat

Constrict airways

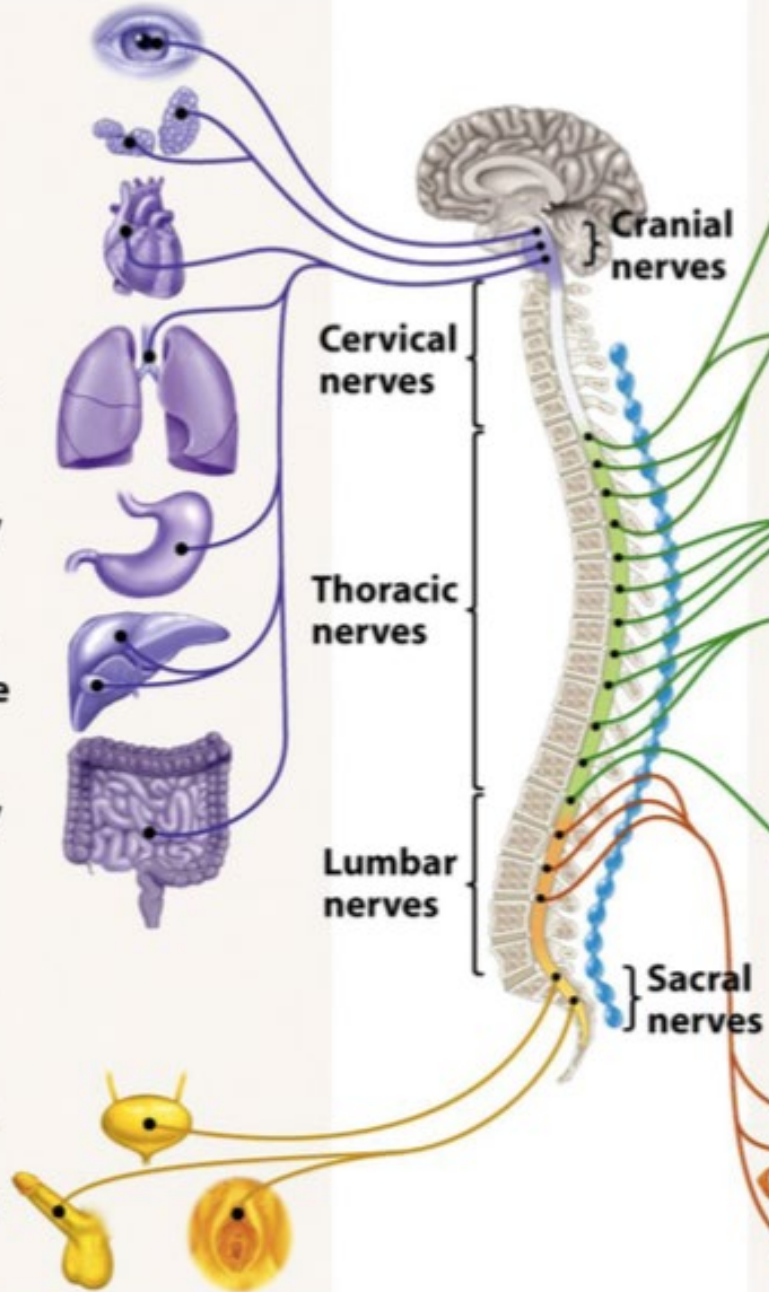
Stimulate activity of stomach

Inhibit release of glucose; stimulate gallbladder

Stimulate activity of intestines

Contract bladder

Promote erection of genitals



SYMPATHETIC NERVES

"Fight or flight"

Dilate pupils

Inhibit salivation

Increase heartbeat

Relax airways

Inhibit activity of stomach

Stimulate release of glucose; inhibit gallbladder

Inhibit activity of intestines

Secrete epinephrine and norepinephrine

Relax bladder

Promote ejaculation and vaginal contraction



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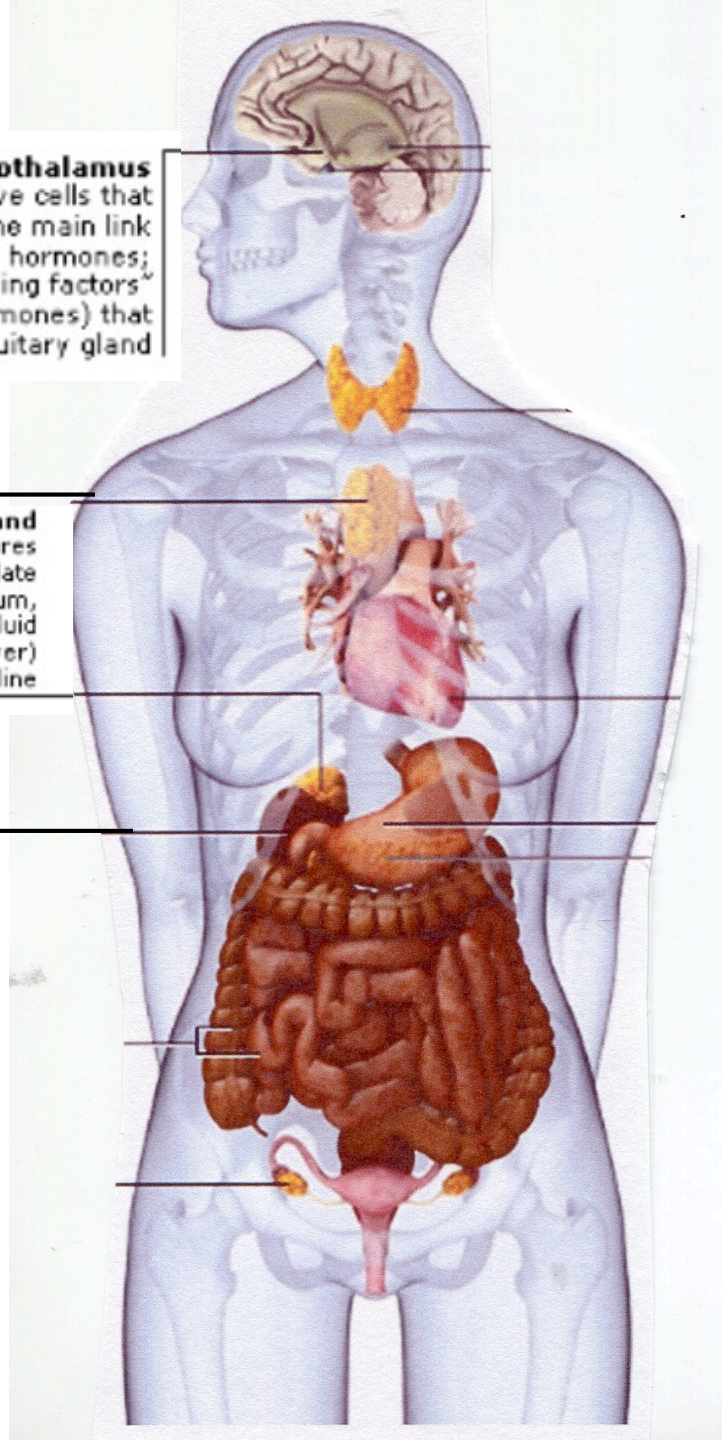
Produces three hormones involved in development of white blood cells called T-cells, which function in the immune system

Adrenal gland

Cortex (outer layer) manufactures steroid hormones that regulate metabolism of glucose, sodium, and potassium, and maintain fluid balance; medulla (inner layer) produces adrenaline

Kidney

Secretes erythropoietin, which stimulates production of red blood cells in bone marrow



2 HORMONES MADE BY THE KIDNEYS

The kidneys make two main hormones, vitamin D and erythropoietin.

Vitamin D is essential for a number of different functions in the body.

Most of the vitamin D that is in the blood is inactive and it is modified by the kidney and other tissues to activate it.

Active vitamin D stimulates the uptake of calcium from food, is important for the maintenance of healthy bones and also helps to regulate the response of the immune system to infection.

Erythropoietin is produced when oxygen levels in the blood are low.

It acts in bone marrow to stimulate the production of mature red blood cells and to maintain healthy oxygen levels in our tissues.

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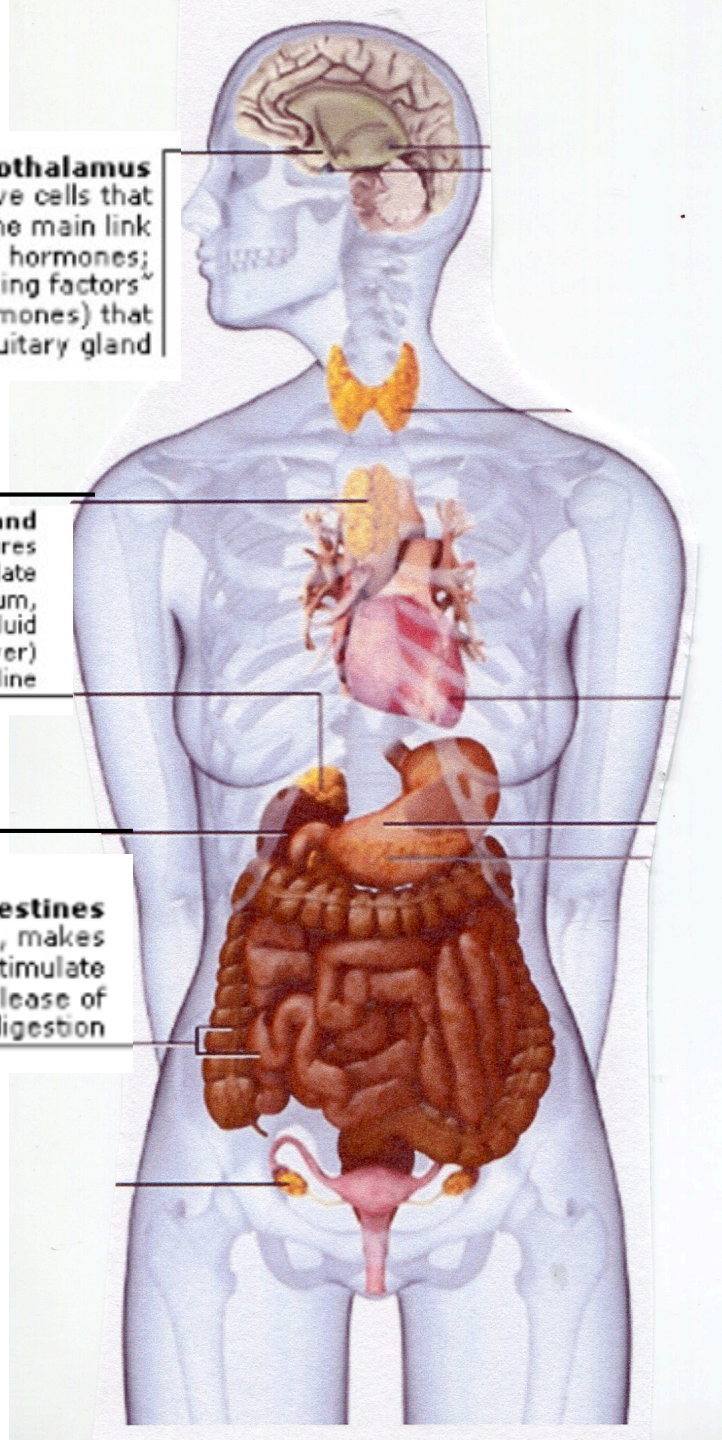
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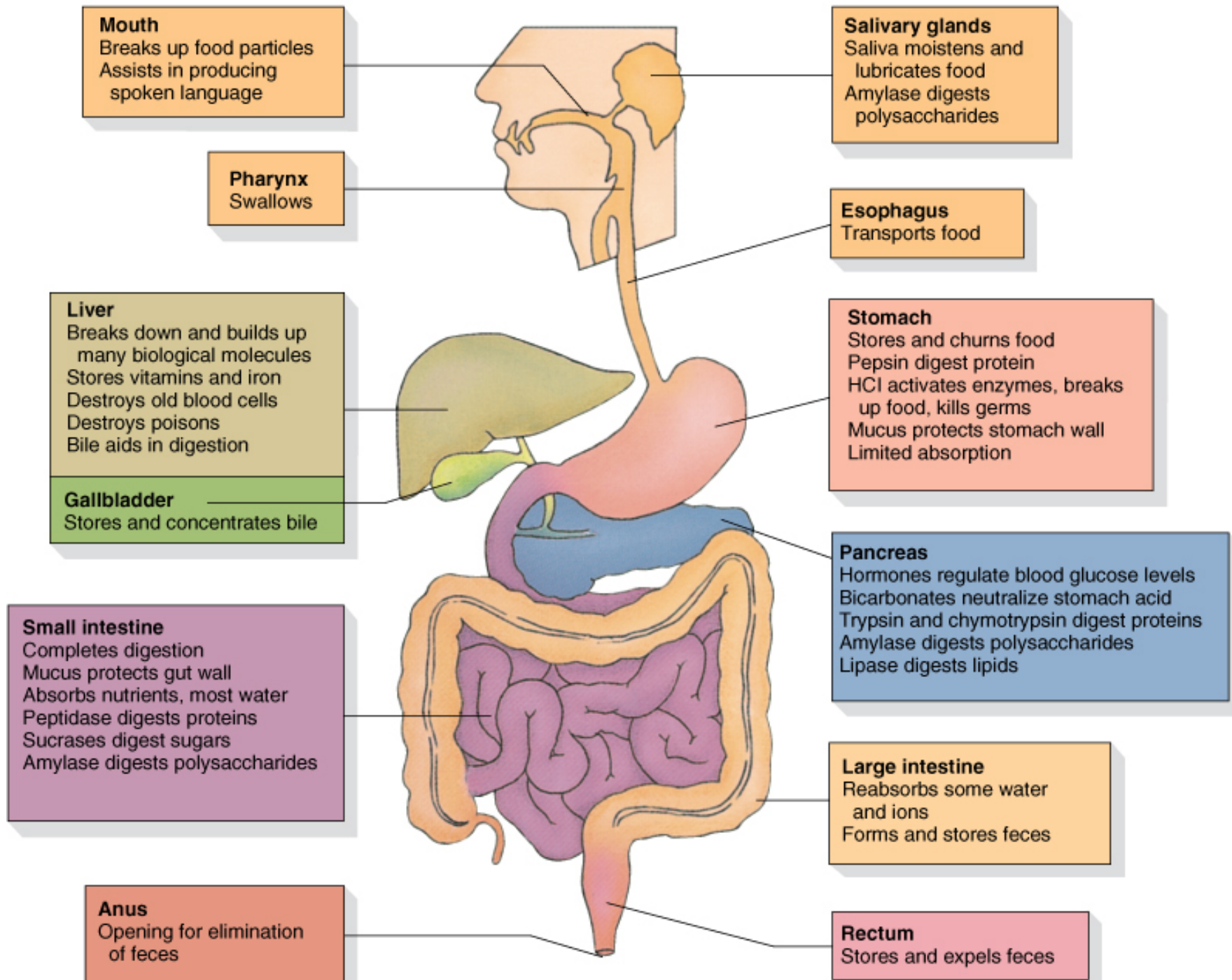
Kidney

Secretes erythropoietin, which stimulates production of red blood cells in bone marrow

Intestines

Like stomach, makes hormones that stimulate production or release of enzymes that aid digestion







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Ovary

The two ovaries manufacture the female sex hormones oestrogen and progesterone, which stimulate egg ripening and thickening of the uterine wall respectively

SEX GLANDS AND HORMONES

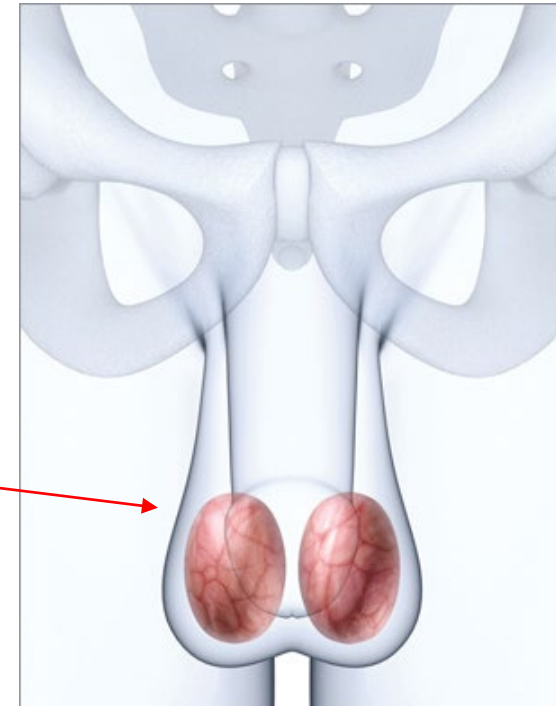
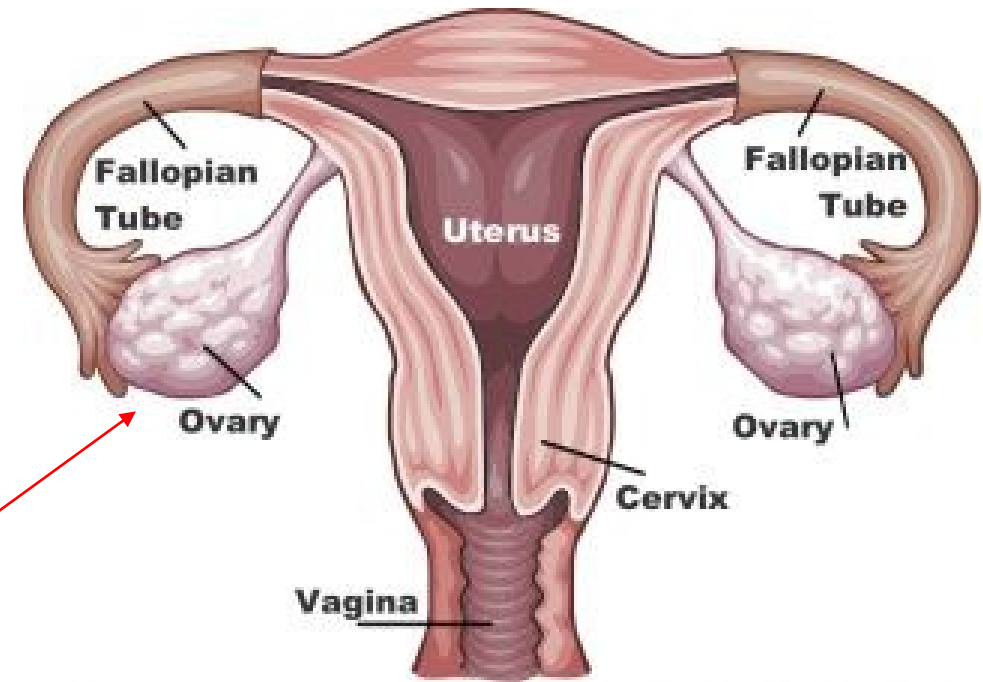
The main sex glands are the ovaries in females and testes in males.

The sex hormones they produce stimulate the production of eggs and sperm respectively and influence the early development of the embryo into a boy or girl.

After birth, the circulating levels remain low until puberty.

Then, in males, the testes increase their output of androgens (male sex hormones), such as testosterone.

In females, the ovaries produce more oestrogens and progesterone.



Pineal gland (pineal body)

Pea-sized gland in middle of brain; makes melatonin, a hormone important in body rhythms such as the sleep-wake cycle; also influences sexual development

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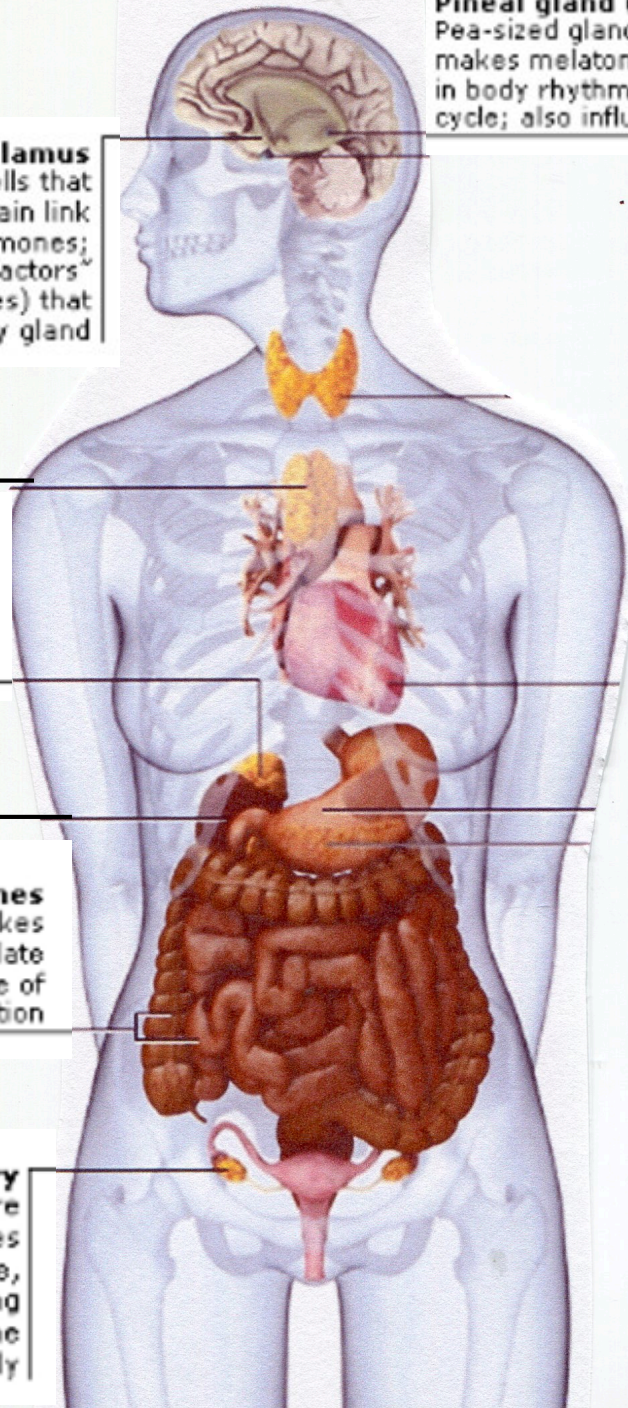
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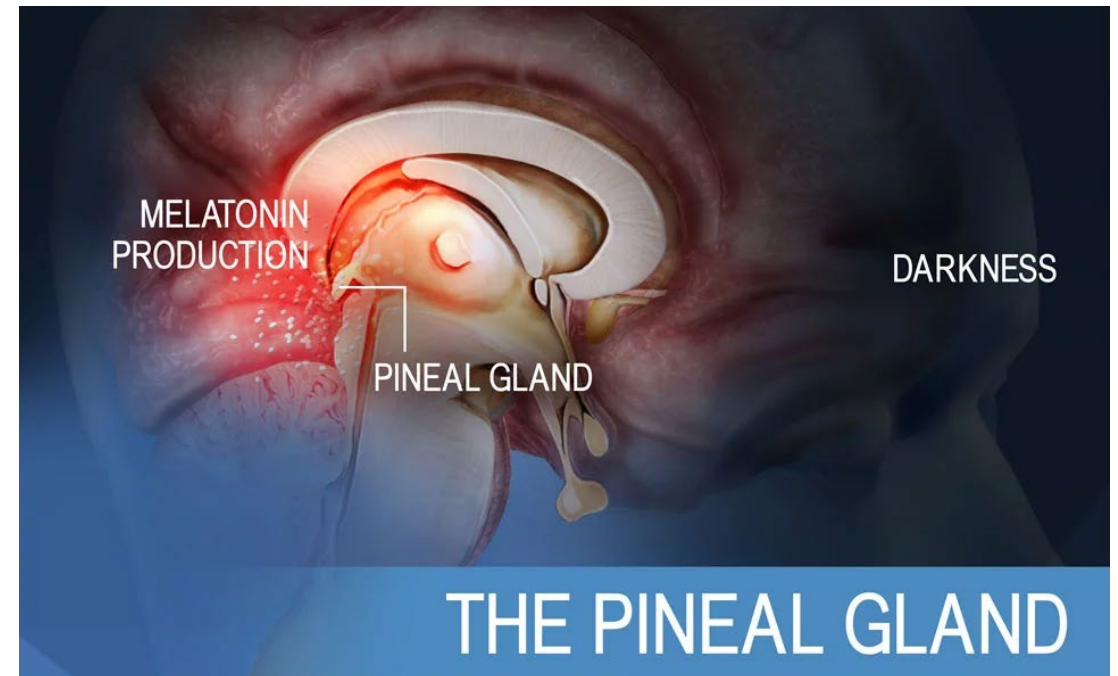
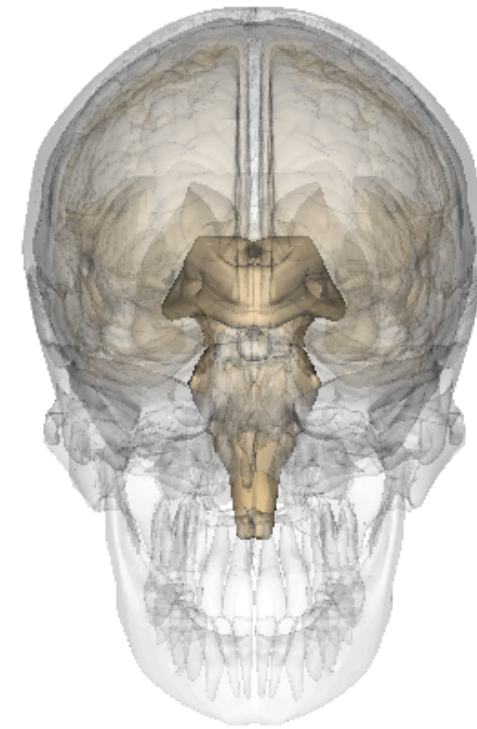
THE PINEAL GLAND

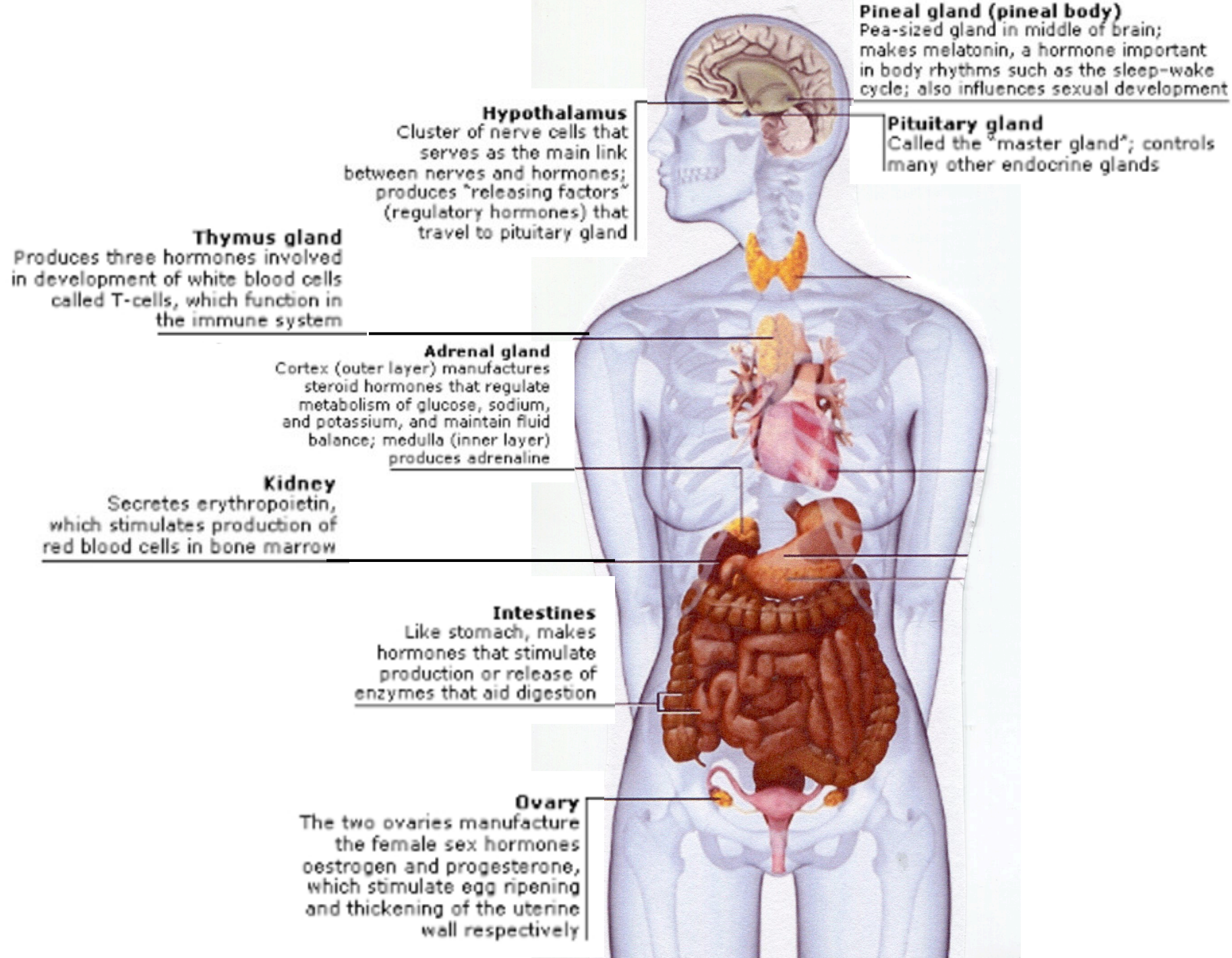
The pineal gland is small and pine cone-shaped, (which is how it got its name) located at the back of the diencephalon region in the brain.

At night, in the absence of light, the pineal gland secretes the hormone melatonin.

Melatonin regulates the body's sleep patterns in both circadian (daily) and seasonal patterns.

In the morning, when light hits the eye, photo receptors in the retina send signals to the pineal gland, which then decreases melatonin production and we wake up.





MASTER GLAND

The pituitary is the most influential gland in the endocrine system.

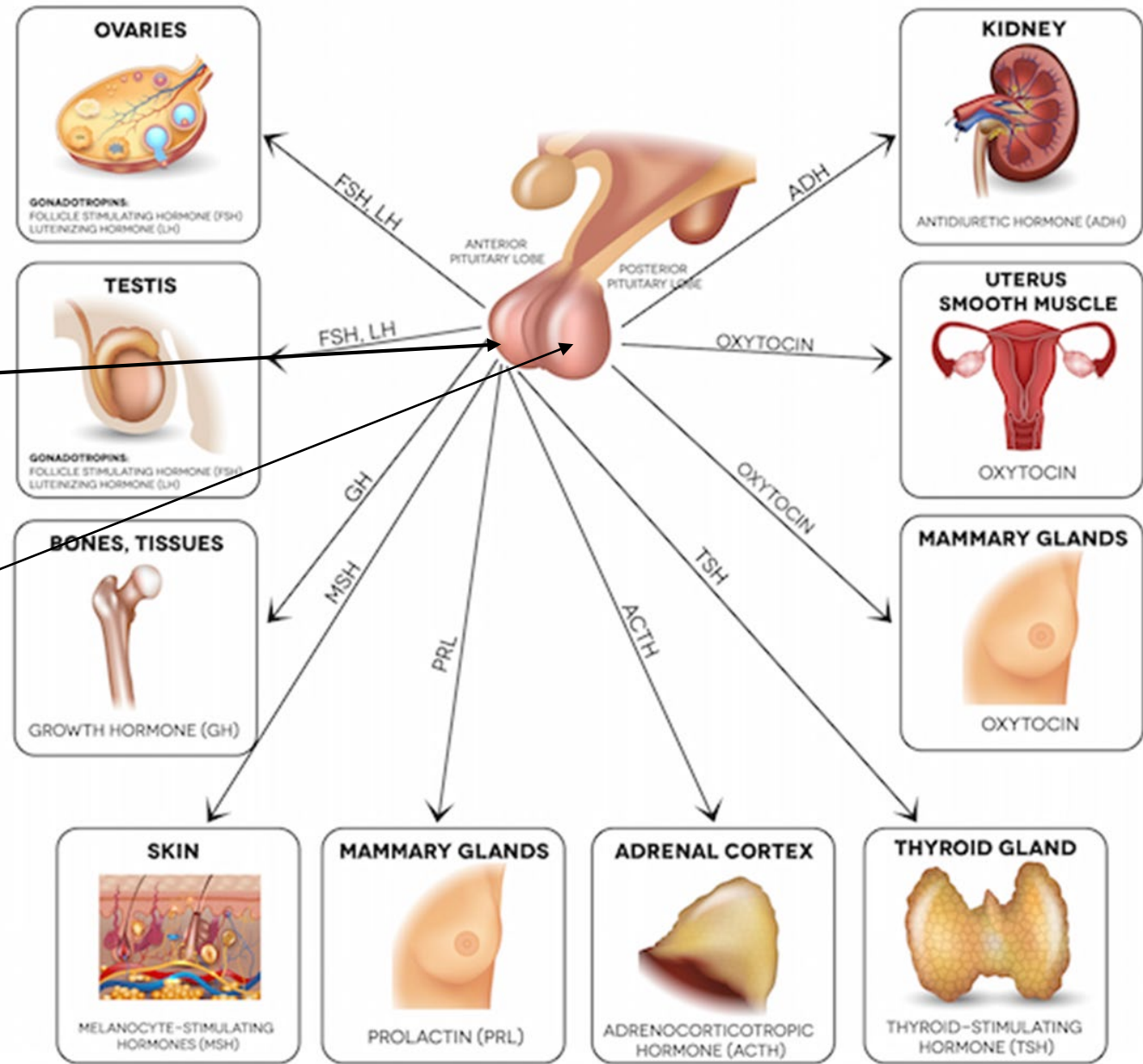
It is actually two distinct glands in one.

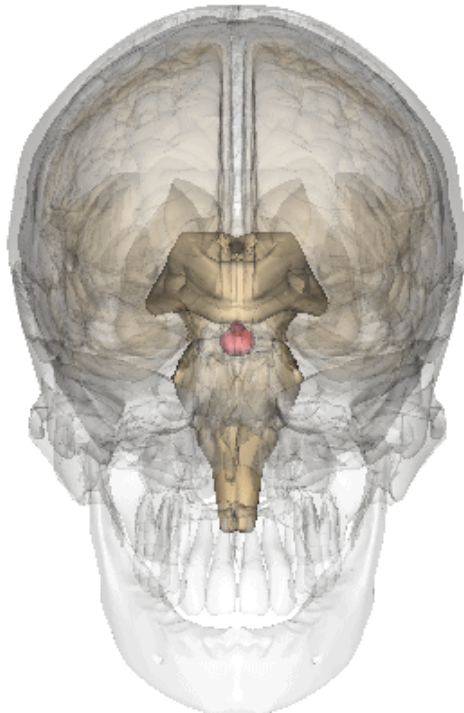
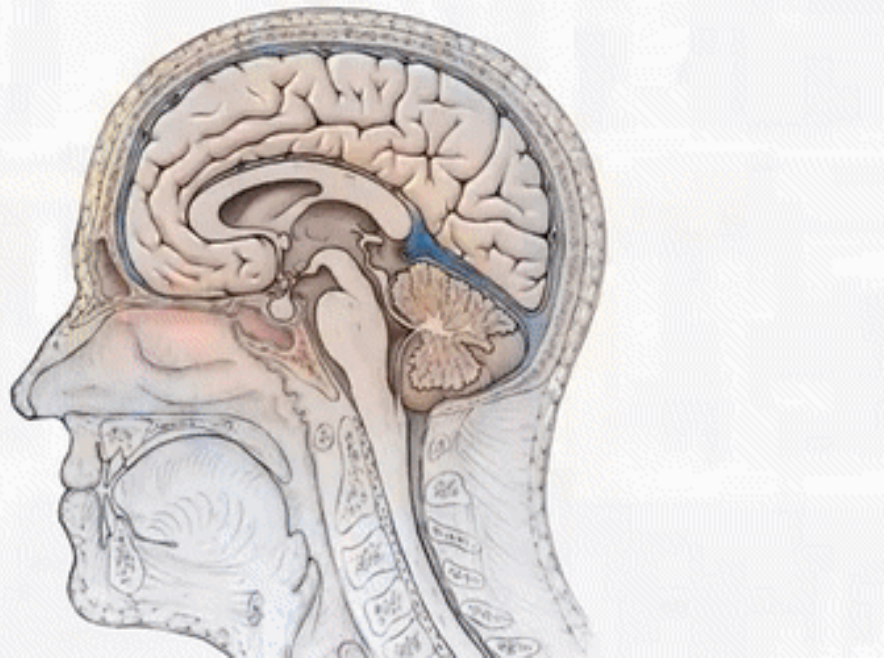
Its front, or anterior lobe manufactures 7 major hormones and releases them into the bloodstream.

Behind it is the posterior (back) lobe which receives its two main hormones from the hypothalamus, which lies above it and then it releases 3 hormones, as shown.

<https://www.visiblebody.com/learn/endocrine/hormones#anterior-pituitary>

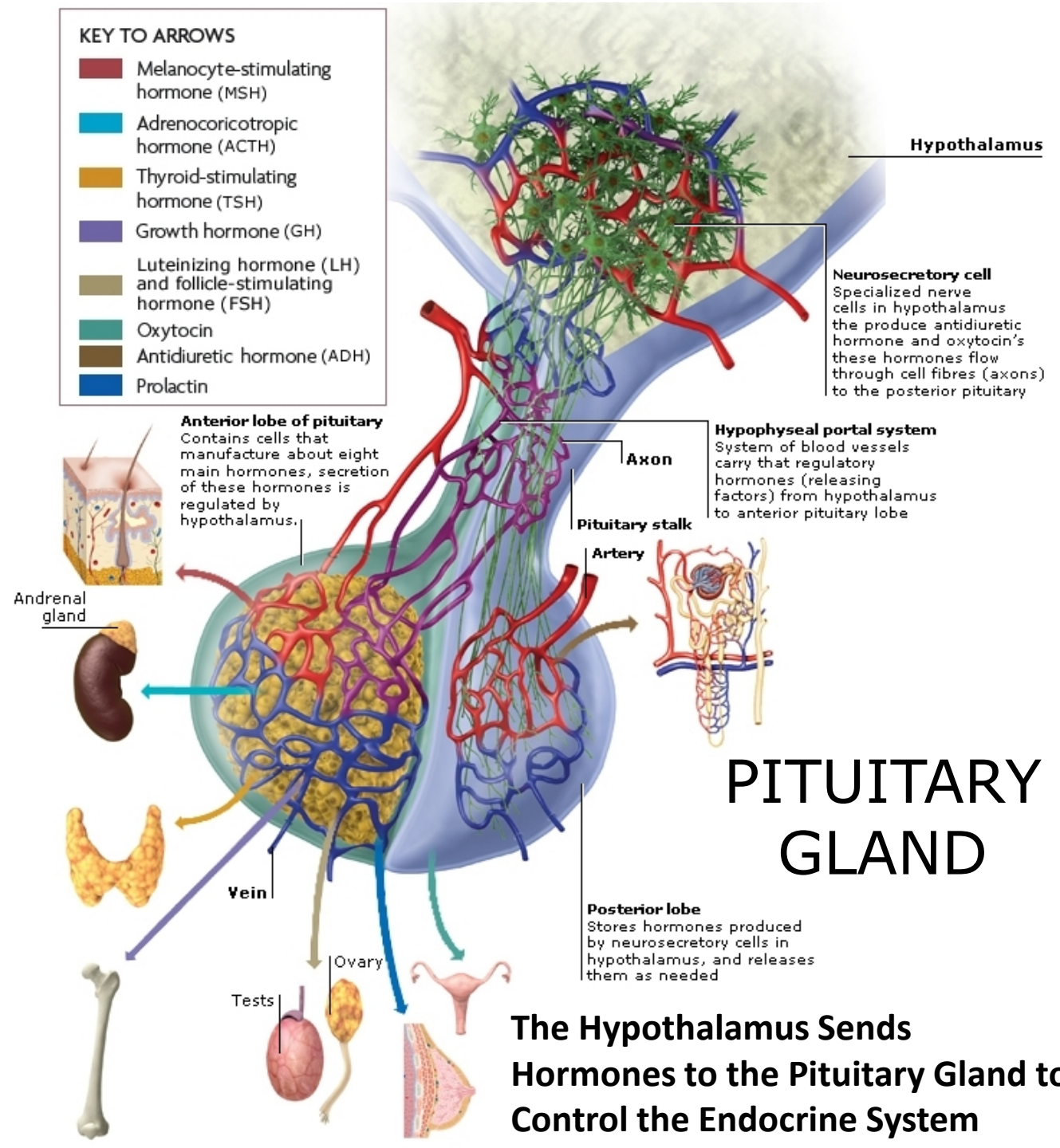
THE PITUITARY GLAND HORMONES

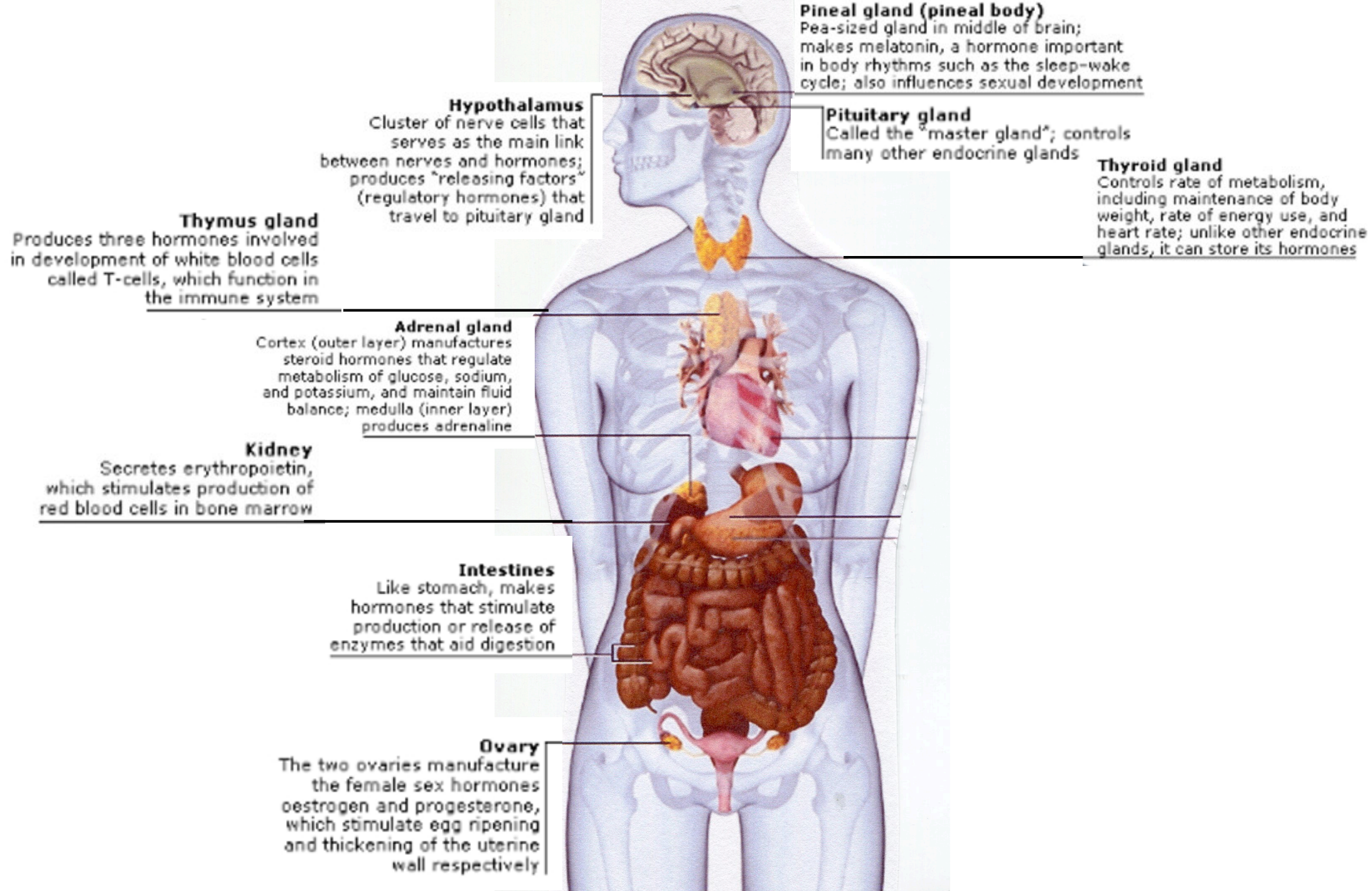




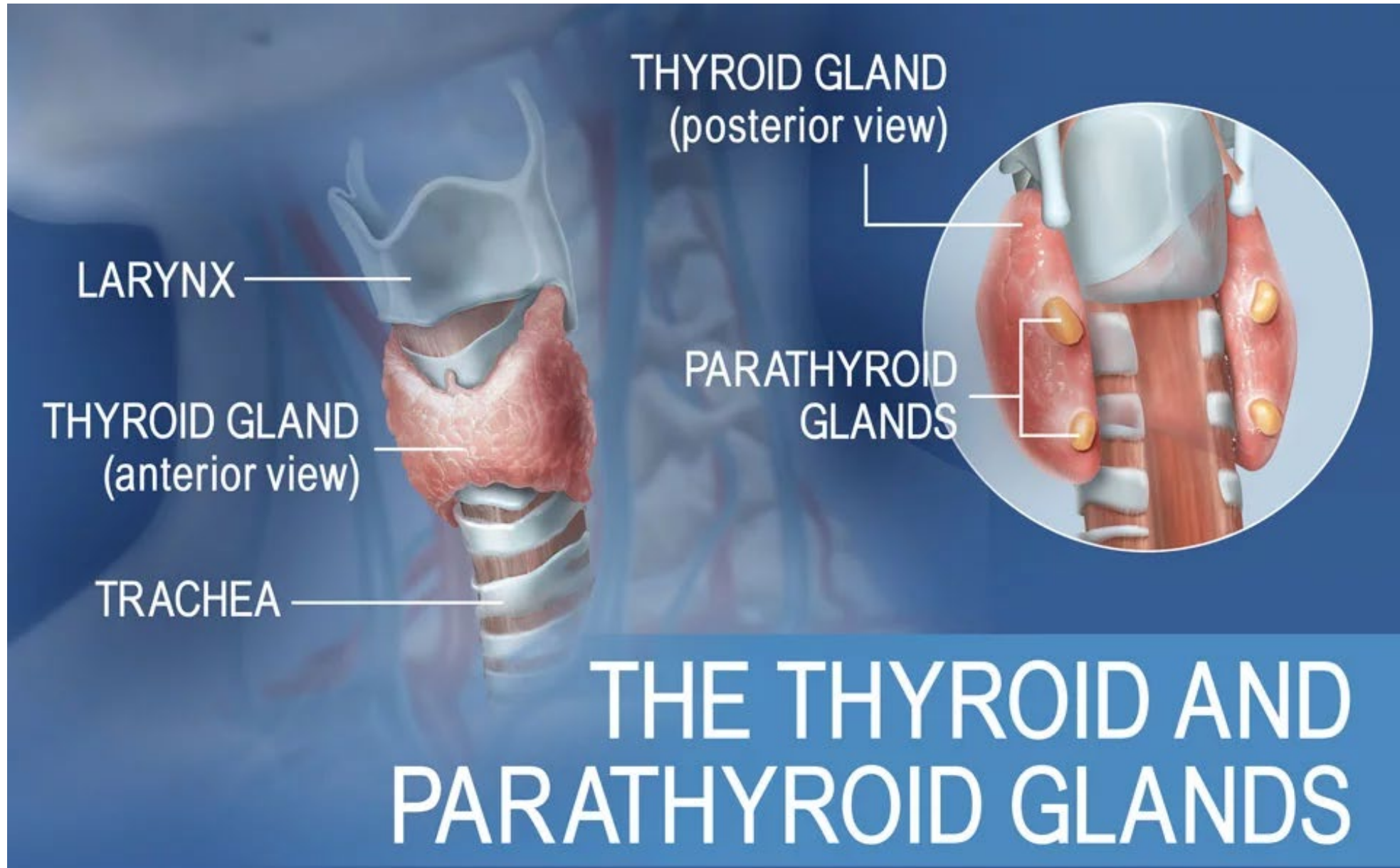
KEY TO ARROWS

- Melanocyte-stimulating hormone (MSH)
- Adrenocorticotropic hormone (ACTH)
- Thyroid-stimulating hormone (TSH)
- Growth hormone (GH)
- Luteinizing hormone (LH) and follicle-stimulating hormone (FSH)
- Oxytocin
- Antidiuretic hormone (ADH)
- Prolactin





THE THYROID AND PARATHYROID GLANDS INCREASE METABOLISM AND REGULATE CALCIUM LEVELS





Manipal Hospitals
LIFE IS ON 

Trachea (Windpipe)

nucleus
LIFE IS ON 

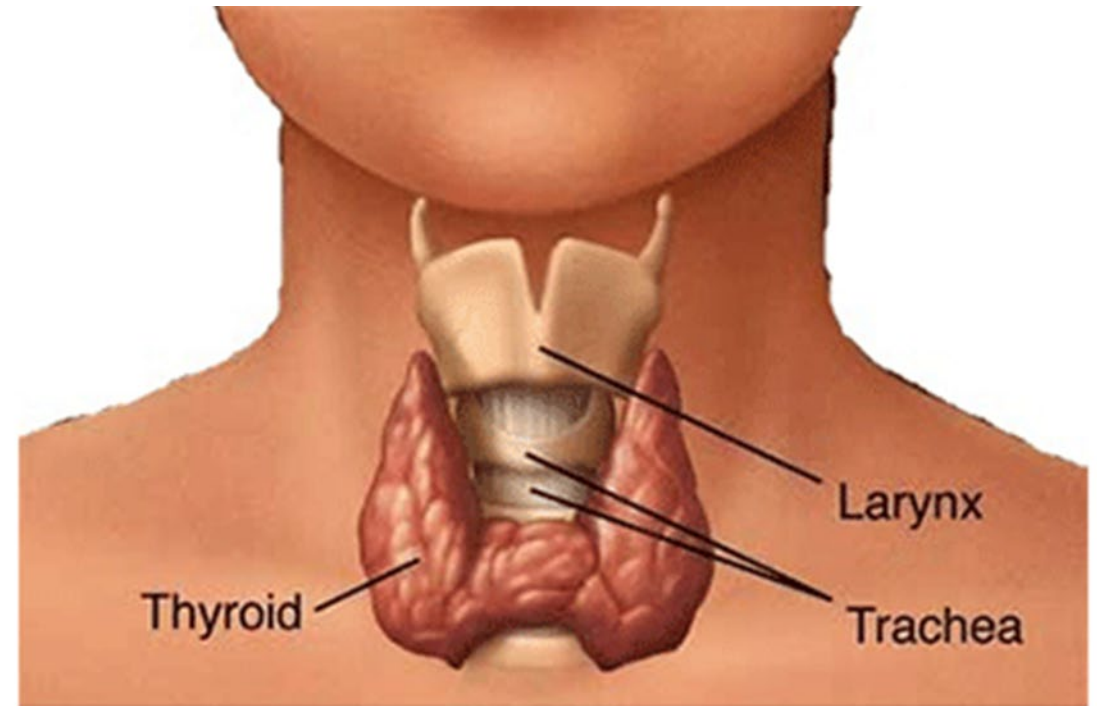
MakeAGIF.com

THYROID GLAND

The thyroid gland sits in the throat region, just below the larynx, served by large arteries with many branches and a dense network of capillaries.

The hormones it secretes, travel in the bloodstream throughout the body to:

- ❖ **Increase metabolism**
- ❖ **Regulate glucose use**
- ❖ **Protein synthesis**
- ❖ **Nervous system development.**
- ❖ **It also releases Calcitonin, which helps maintain blood calcium homeostasis by causing calcium to be removed from the blood and deposited into bones when blood (calcium) levels are too high.**



<https://www.visiblebody.com/learn/endocrine/glands>

Parathyroid Glands

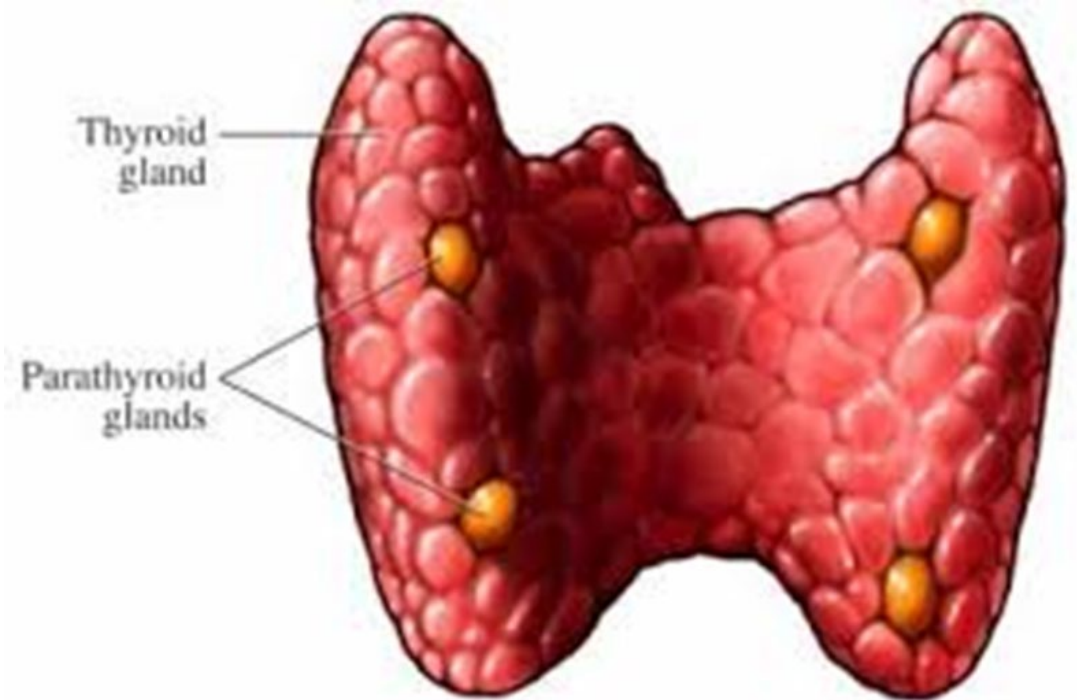
On the posterior (back) surface of the thyroid sit much smaller, separate glands: the **parathyroids**.

Typically there are four parathyroid glands, a superior and inferior pair on the left and right sides of the thyroid.

They secrete parathyroid hormone (PTH), which stimulates bones to release calcium into the blood when blood (calcium) levels are low.

PTH also causes the kidneys to reduce calcium secretion into urine to further elevate calcium levels in the blood.

Together, calcitonin and PTH act in complementary ways to maintain blood calcium homeostasis, which is one of the most tightly controlled physiological parameters in the body.



[Go to 50 sec](#)

<https://www.youtube.com/watch?v=qjHwOnV9K8A>

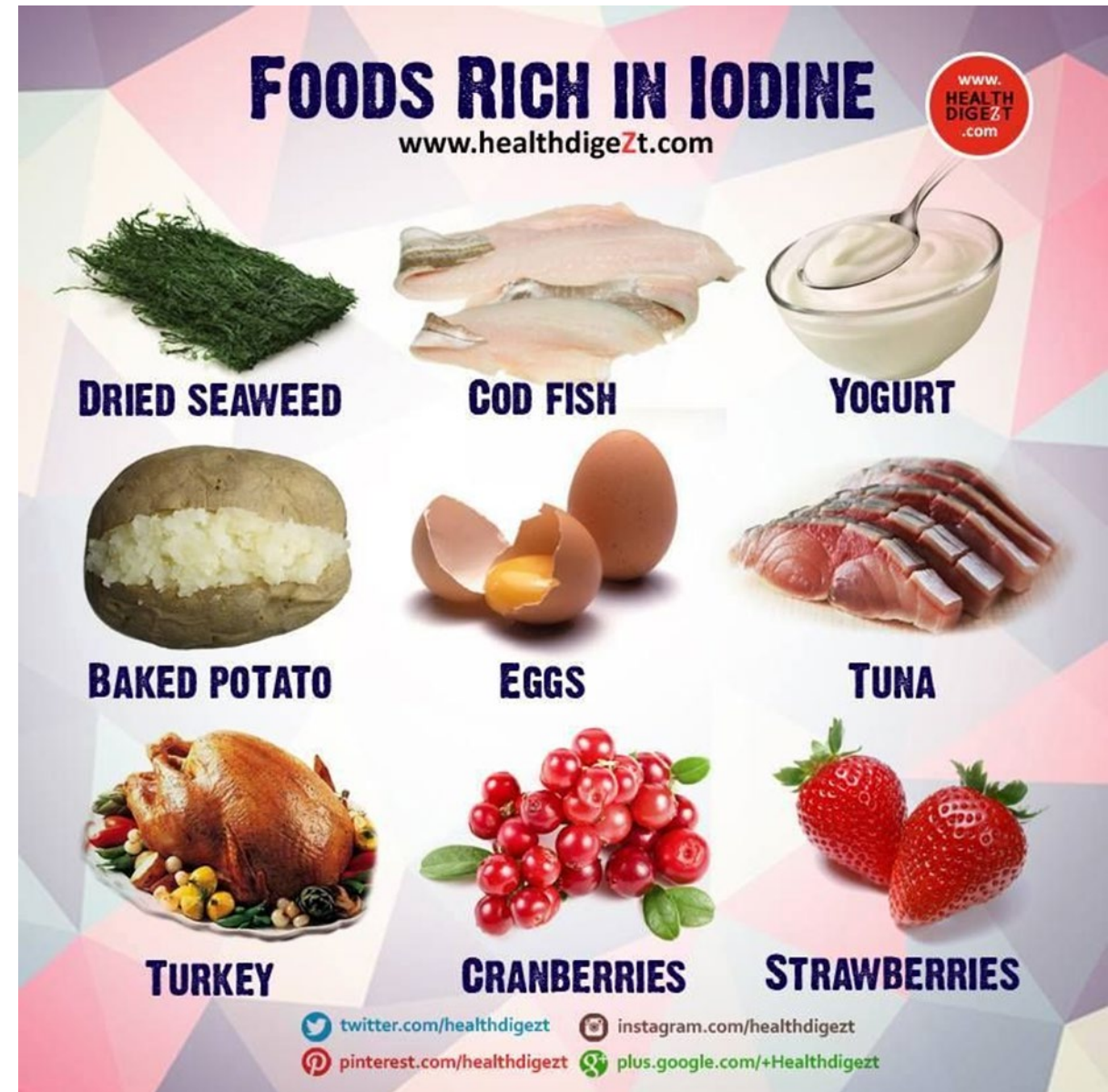
Iodine is an element that's required for the thyroid gland to produce thyroid hormones.

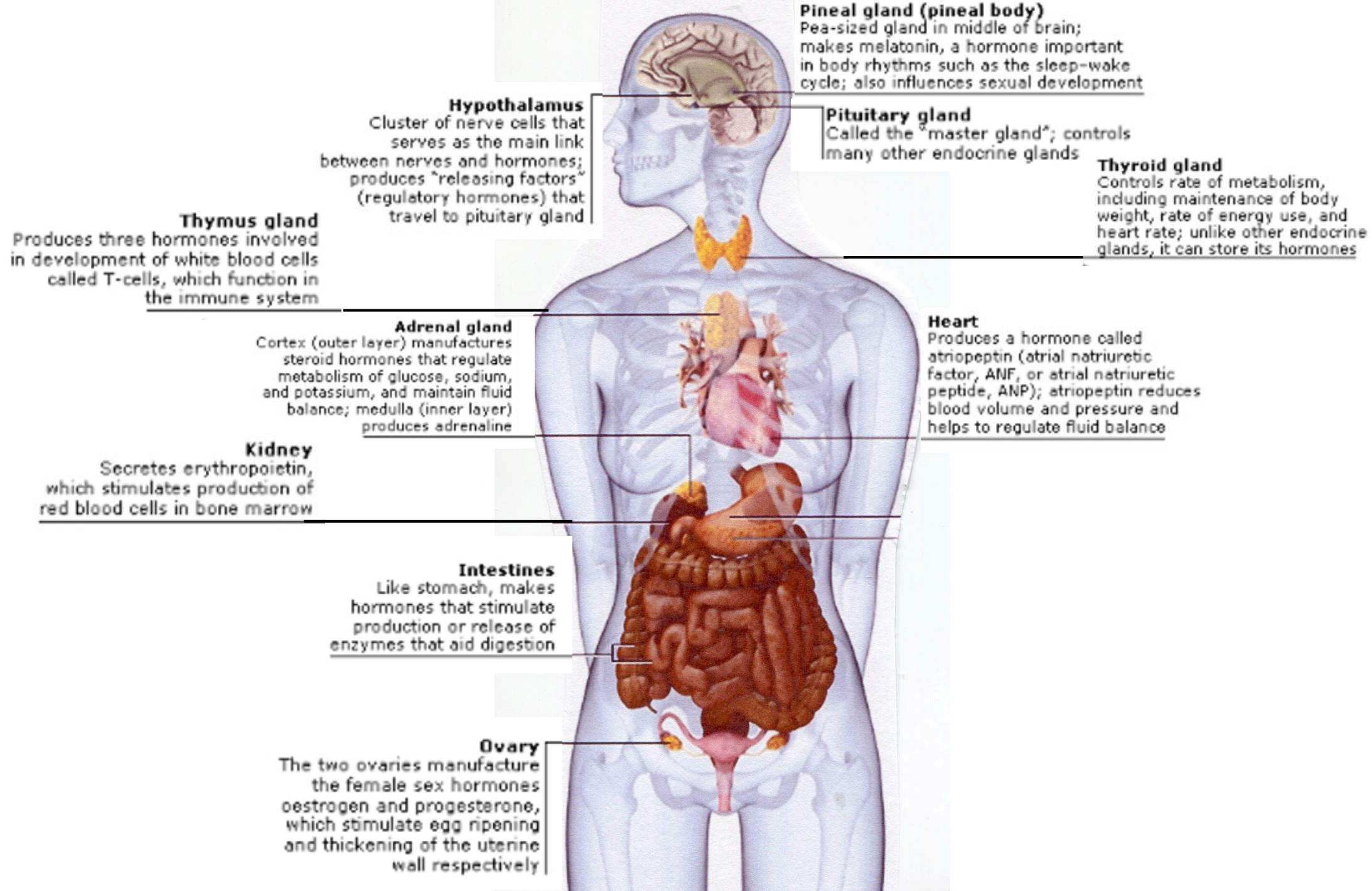
Since the body does not produce iodine on its own, it needs to come from dietary sources—and striking the right balance is key.

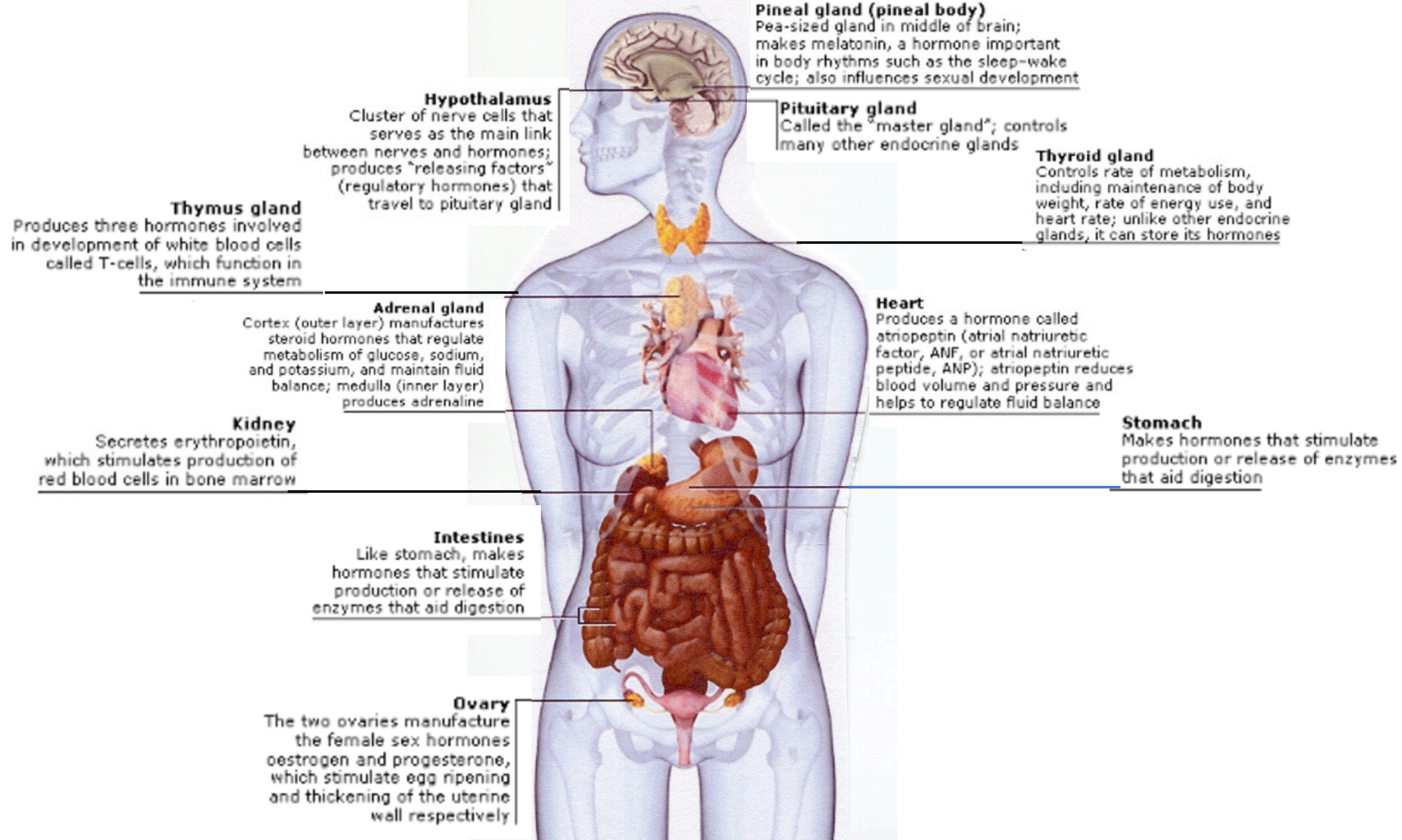
The Importance of Iodine

When you consume iodine, it is quickly absorbed and entered into your bloodstream.

Your thyroid, which has tiny cells that capture the circulating iodine, takes in and oxidizes it so it can begin to be used to create T3 and T4—thyroid hormones that make their way throughout the body to regulate metabolism and ensure healthy functioning of the heart, brain, and other organs.





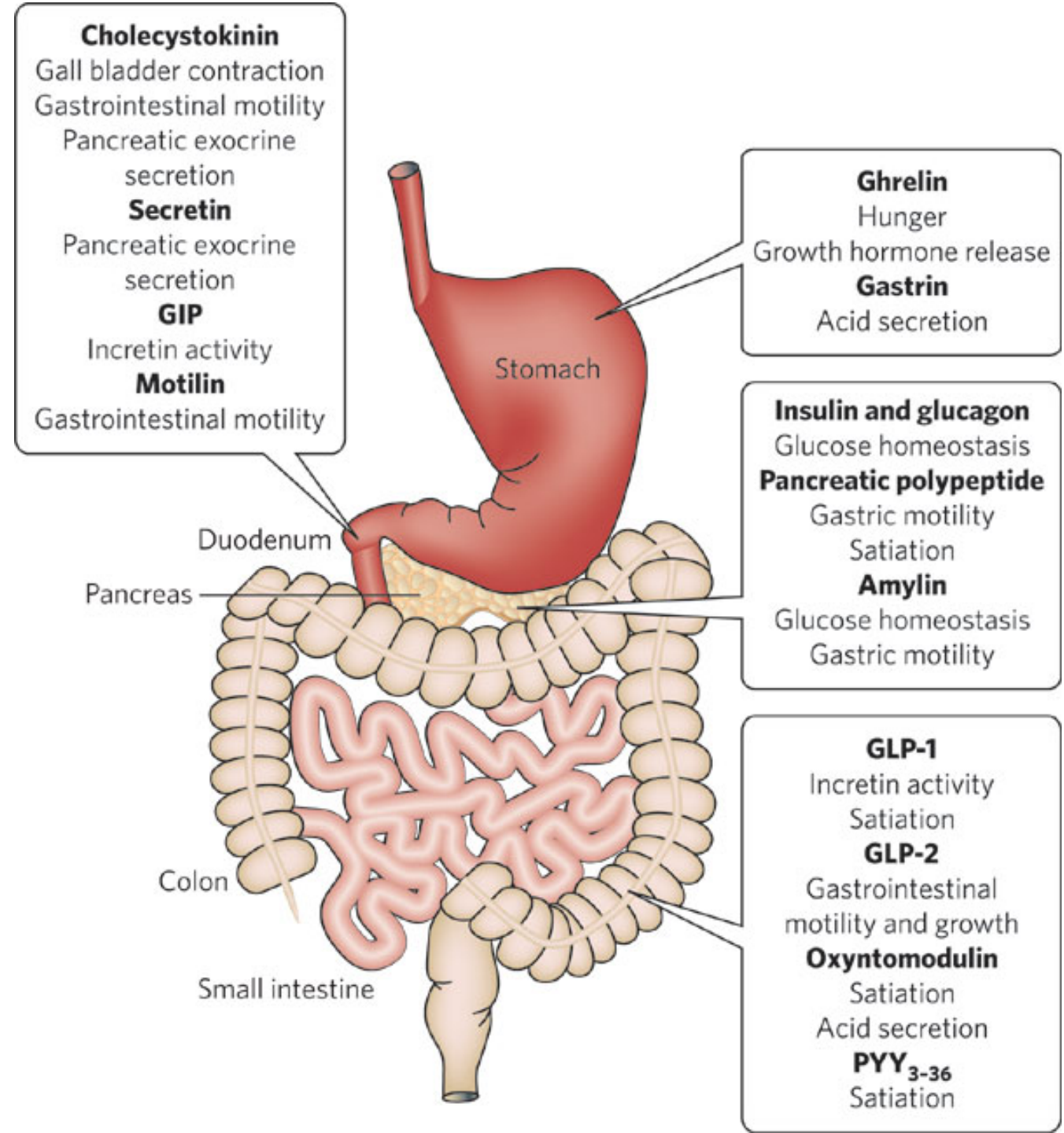


GUT HORMONES

The gut hormones work in association with the gut's extensive nervous system (enteric nervous system) and play a coordinating role in:

- ❖ The control of appetite
- ❖ The digestion of food
- ❖ The regulation of energy balance
- ❖ The maintenance of blood glucose levels.

The gut continuously sends information to the brain regarding the quality and quantity of the food that is consumed.



THE ROLE THAT SOME OF THESE HORMONES PLAY IS OUTLINED BELOW:

Ghrelin is produced in the stomach, and its function is to tell the brain that the body has to be fed. It increases appetite.

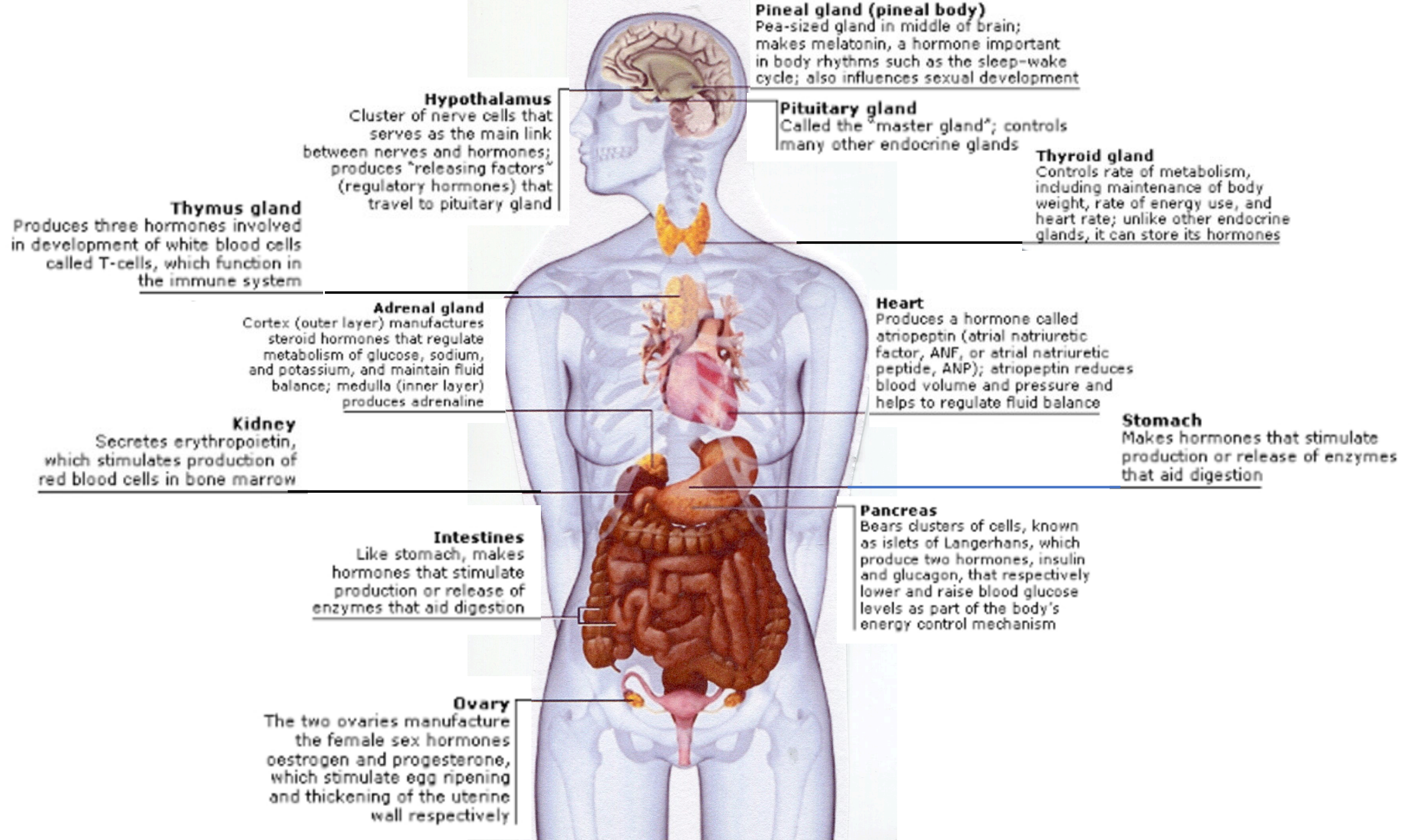
Gastrin is produced in the stomach when it is stretched. It stimulates the release of gastric juice rich in pepsin and hydrochloric acid.

Secretin is produced in the duodenum and has the effect of stimulating the pancreas to produce alkaline secretions as well as slowing the emptying of the stomach.

Cholecystinin (CCK) is produced in the duodenum. It reduces appetite, slows down the emptying of the stomach and stimulates the release of bile from the gall bladder.

Peptide YY (PYY) is produced in the last part of the small intestine known as the ileum as well as parts of the large intestine. It plays a role in slowing down the passage of food along the gut, which increases the efficiency of digestion and nutrient absorption after meal.

Glucagon-like peptide 1 (GLP-1) is produced in the small intestine and colon and has multiple actions including inhibition of gastric emptying and appetite as well as the stimulation of insulin release.



Pineal gland (pineal body)
Pea-sized gland in middle of brain; makes melatonin, a hormone important in body rhythms such as the sleep-wake cycle; also influences sexual development

Pituitary gland
Called the "master gland"; controls many other endocrine glands

Thyroid gland
Controls rate of metabolism, including maintenance of body weight, rate of energy use, and heart rate; unlike other endocrine glands, it can store its hormones

Hypothalamus
Cluster of nerve cells that serves as the main link between nerves and hormones; produces "releasing factors" (regulatory hormones) that travel to pituitary gland

Thymus gland
Produces three hormones involved in development of white blood cells called T-cells, which function in the immune system

Adrenal gland
Cortex (outer layer) manufactures steroid hormones that regulate metabolism of glucose, sodium, and potassium, and maintain fluid balance; medulla (inner layer) produces adrenaline

Heart
Produces a hormone called atriopeptin (atrial natriuretic factor, ANF, or atrial natriuretic peptide, ANP); atriopeptin reduces blood volume and pressure and helps to regulate fluid balance

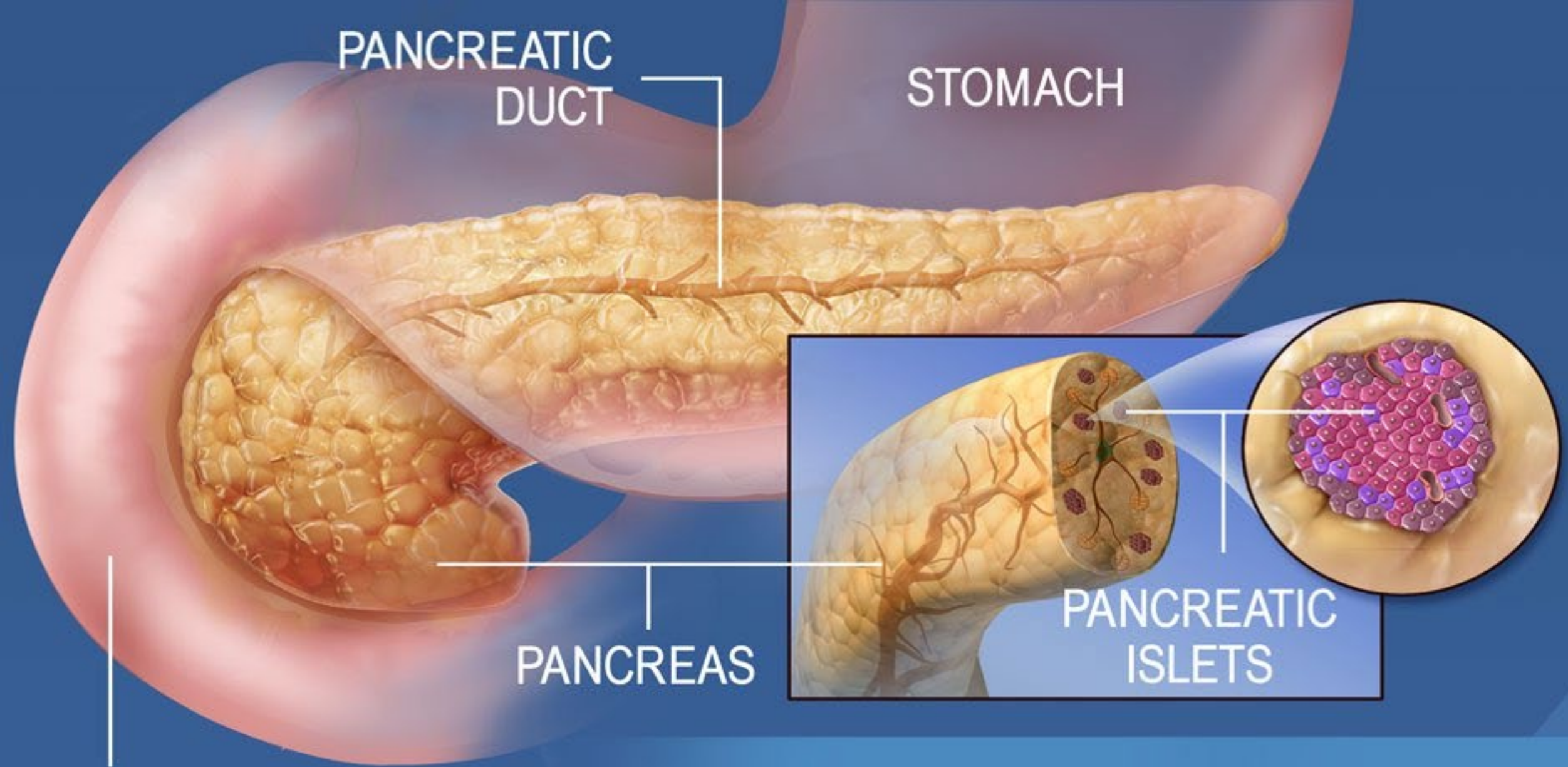
Kidney
Secretes erythropoietin, which stimulates production of red blood cells in bone marrow

Stomach
Makes hormones that stimulate production or release of enzymes that aid digestion

Intestines
Like stomach, makes hormones that stimulate production or release of enzymes that aid digestion

Pancreas
Bears clusters of cells, known as islets of Langerhans, which produce two hormones, insulin and glucagon, that respectively lower and raise blood glucose levels as part of the body's energy control mechanism

Ovary
The two ovaries manufacture the female sex hormones oestrogen and progesterone, which stimulate egg ripening and thickening of the uterine wall respectively



THE PANCREAS

PANCREAS – A DUAL-PURPOSE GLAND

It is also a part of the digestive system.

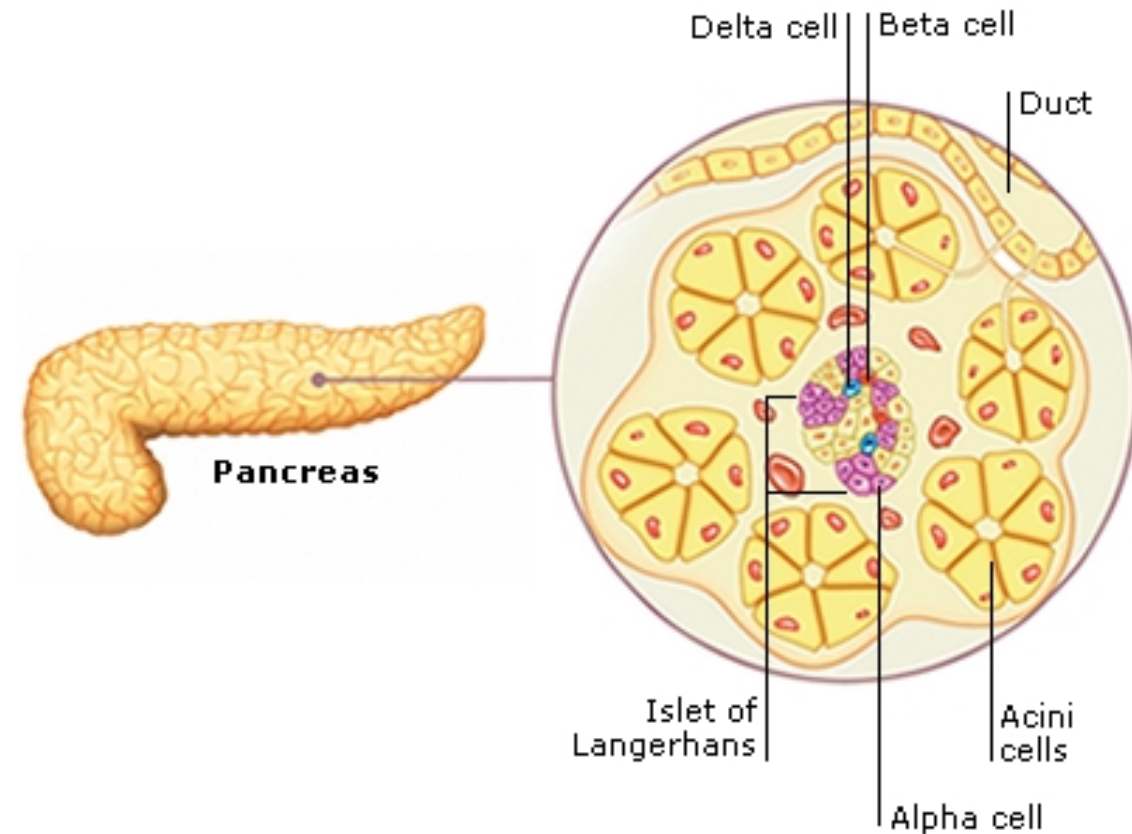
It excretes pancreatic juice into the small intestine via the pancreatic duct.

Scattered within the pancreas there are also tiny cell clusters called pancreatic islets (or islets of Langerhans) that release hormones into the bloodstream.

These islets make up less than 2% of pancreatic tissue, but their specialized cells regulate blood glucose levels (or blood sugar).

When blood sugar is low, alpha cells in the islets release glucagon. Glucagon spurs the liver to break down glycogen and release more glucose into the blood.

When blood sugar is high, beta cells in the islets release insulin, which increases glucose reuptake.

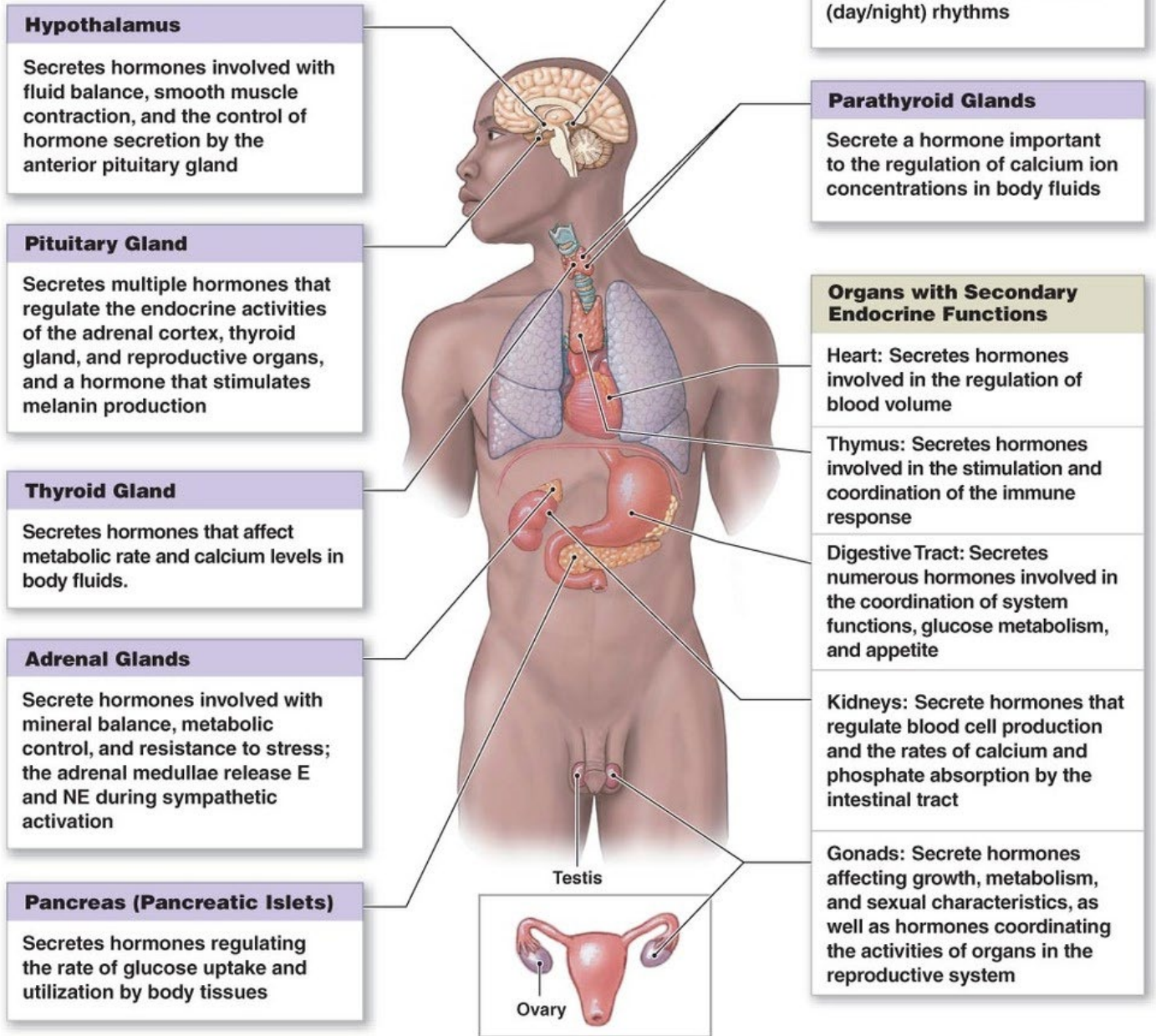


The Pancreas Regulates Blood Sugar

Surrounded by enzyme-producing acini cells, the tiny pancreatic islets contain three types of cells: alpha, beta, and delta. The secretions of the latter help regulate insulin and glucagon production.

A SUMMARY ABOUT THE ENDOCRINE SYSTEM

Organs of the endocrine system (purple) and other organs containing tissues that secrete hormones (tan)



<https://www.youtube.com/watch?v=nCwRX7seya0>

4.5 minutes

The background is a complex, multi-layered composition. At the center is a large, swirling vortex of colors, primarily purple and magenta, with streaks of teal and blue. This central element is surrounded by a dense, textured field of similar colors, creating a sense of depth and movement. The overall effect is reminiscent of a stylized, ethereal forest or a cosmic nebula.

THANK YOU