

The Endocrine System



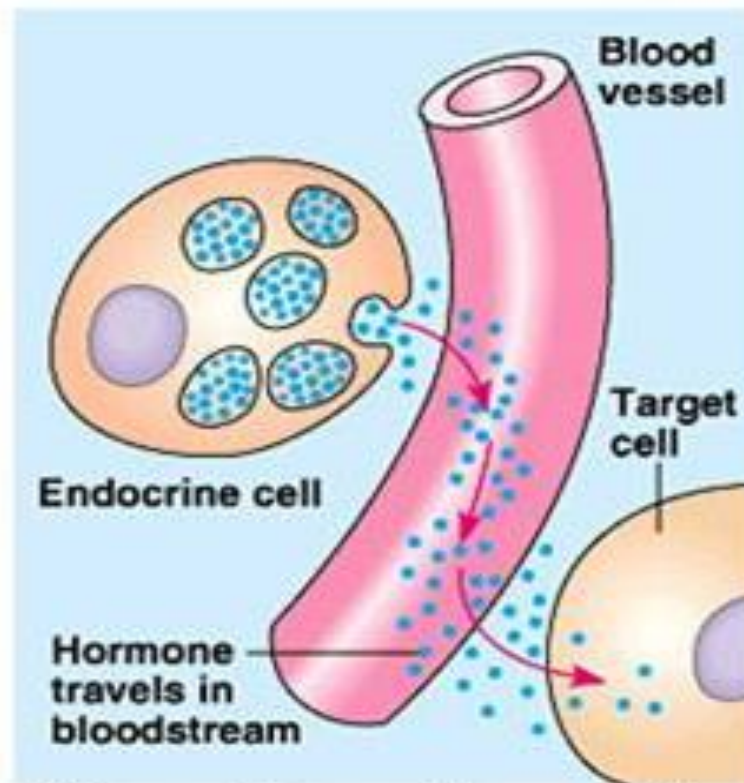
What is the system?

1. Made up of glands that produce and secrete hormones (chemical messengers)
2. Regulation of growth, metabolism, sexual development
3. Responses to stress and injury
4. Internal balance of body systems (homeostasis)



BIG IDEA:

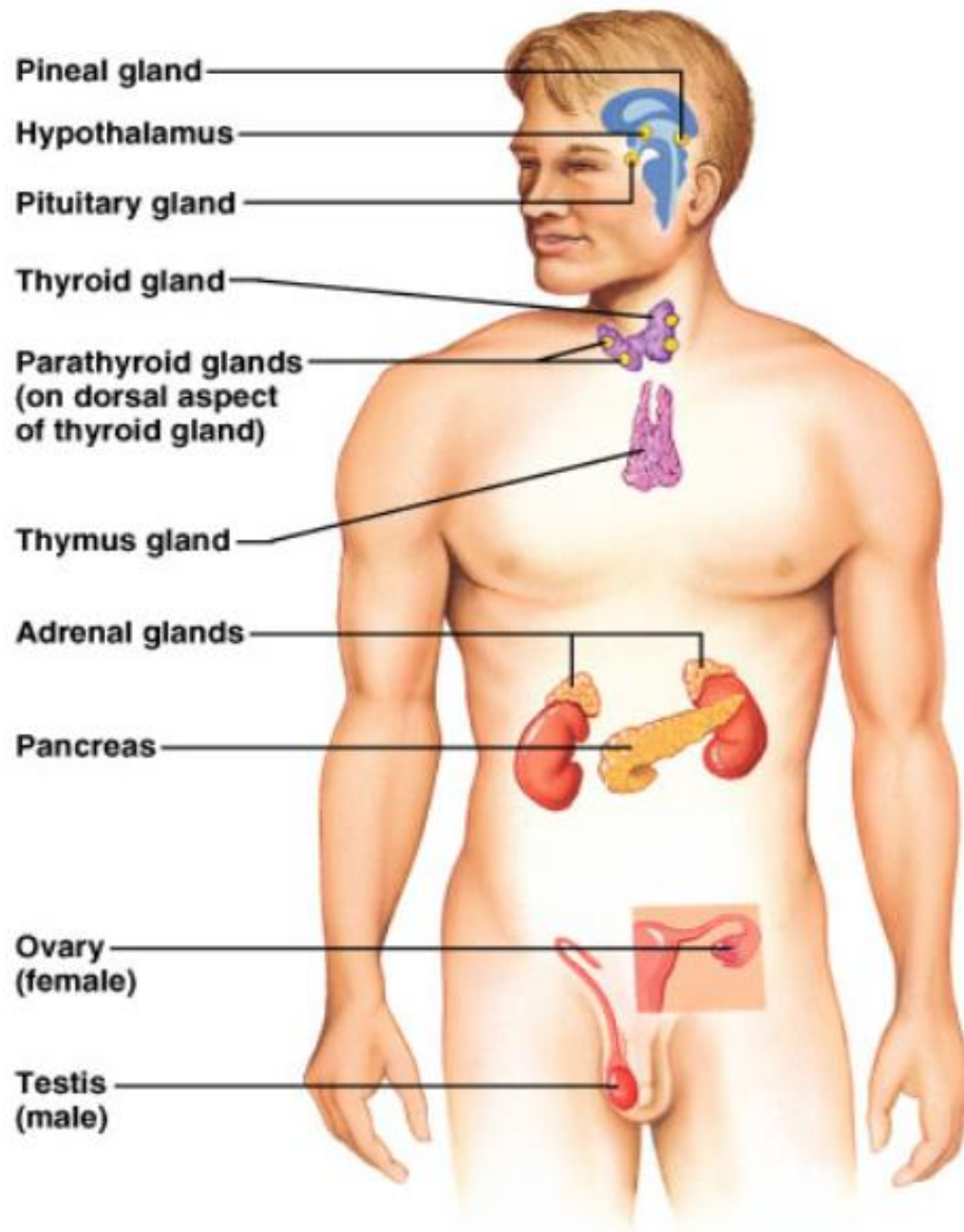
HORMONES are chemical messengers that act on target cells



(b) Long distance (hormonal) signaling

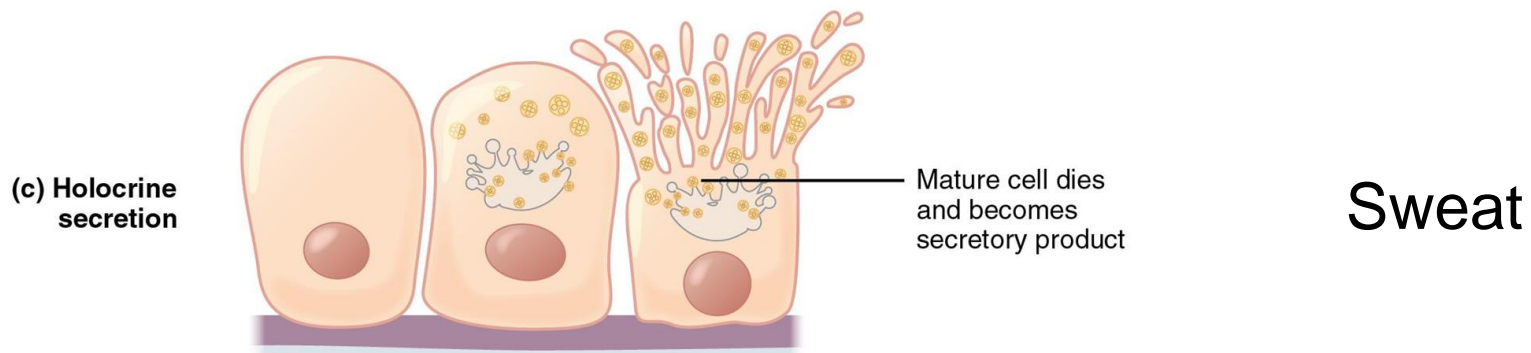
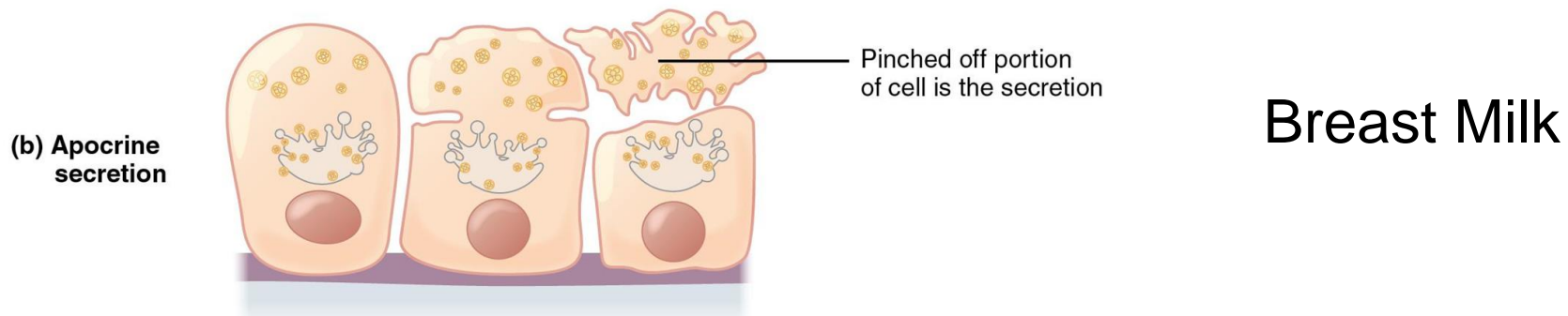
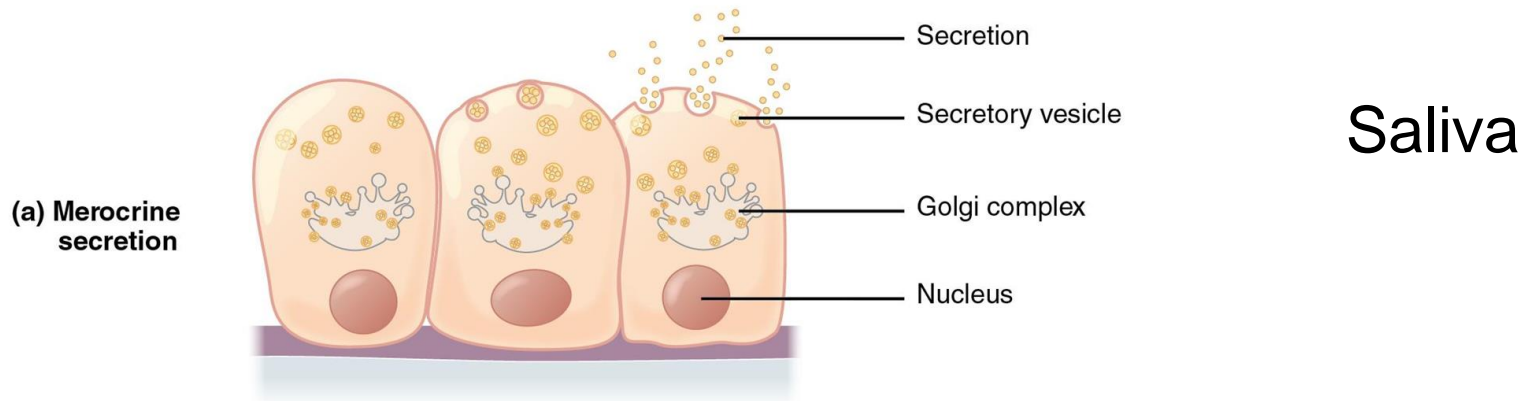
endocrine signaling

Major Structures



Endocrine – secretions inside the body

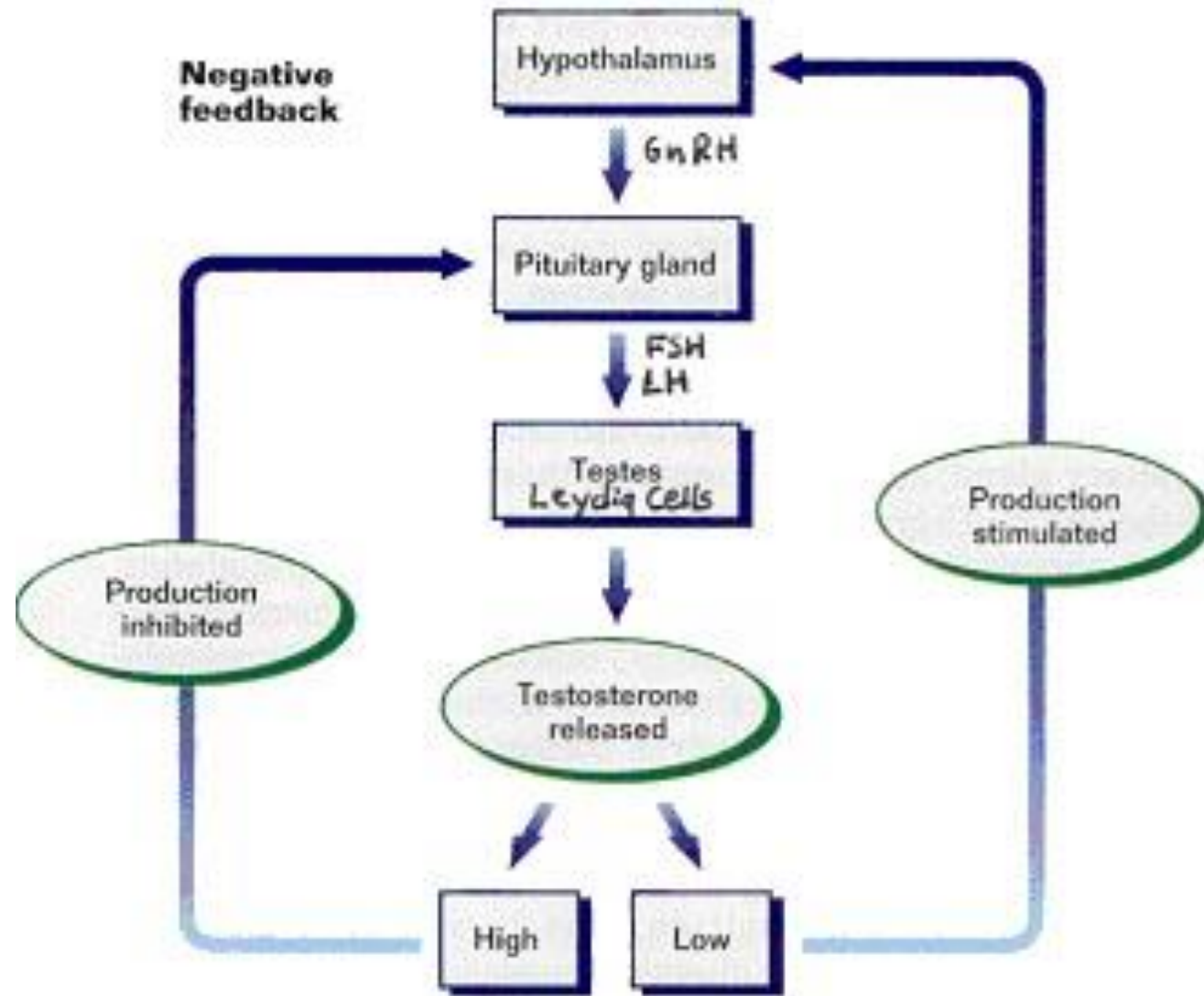
Exocrine – secretions outside the body (sweat)



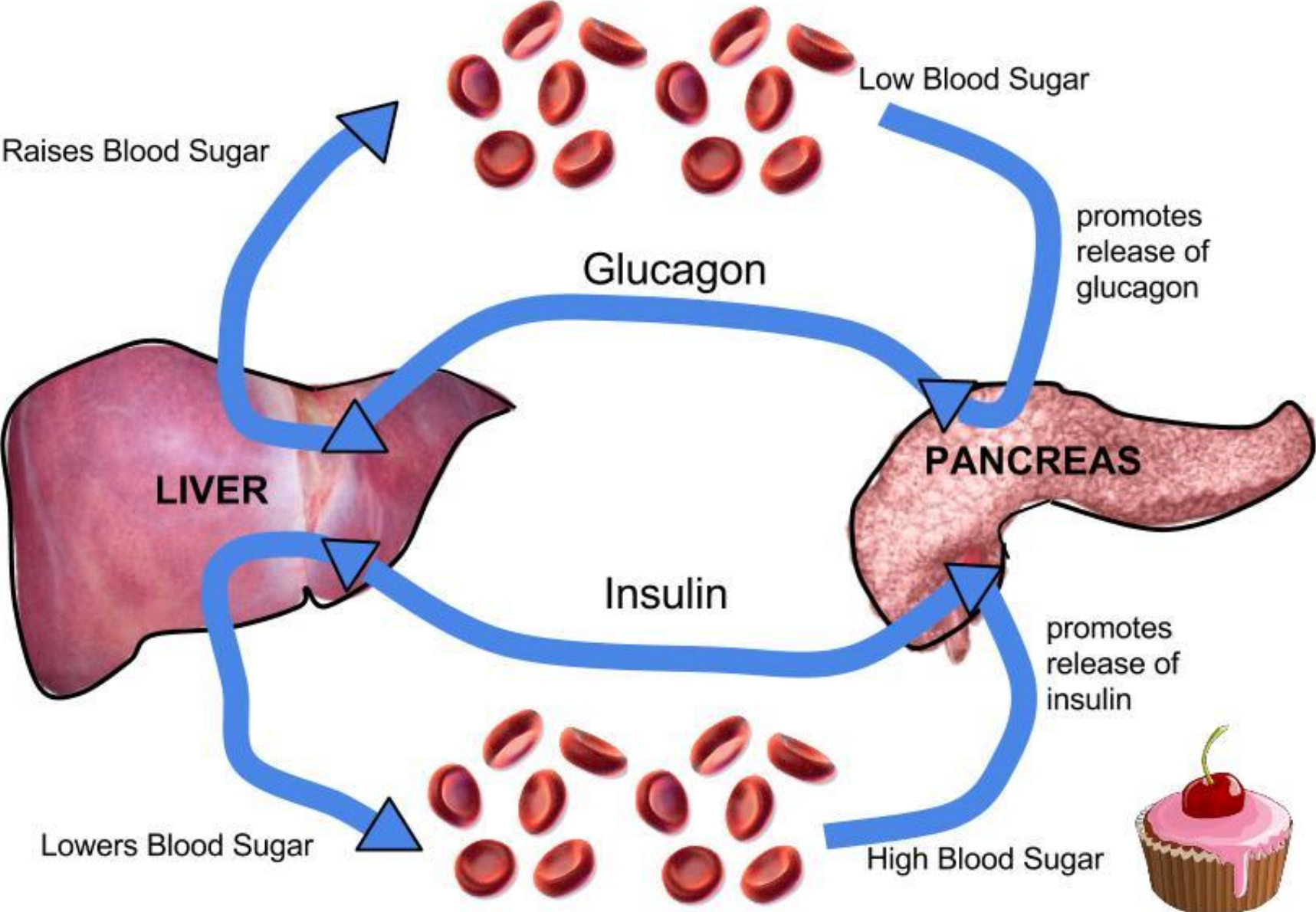
Control of Hormones

Negative feedback system

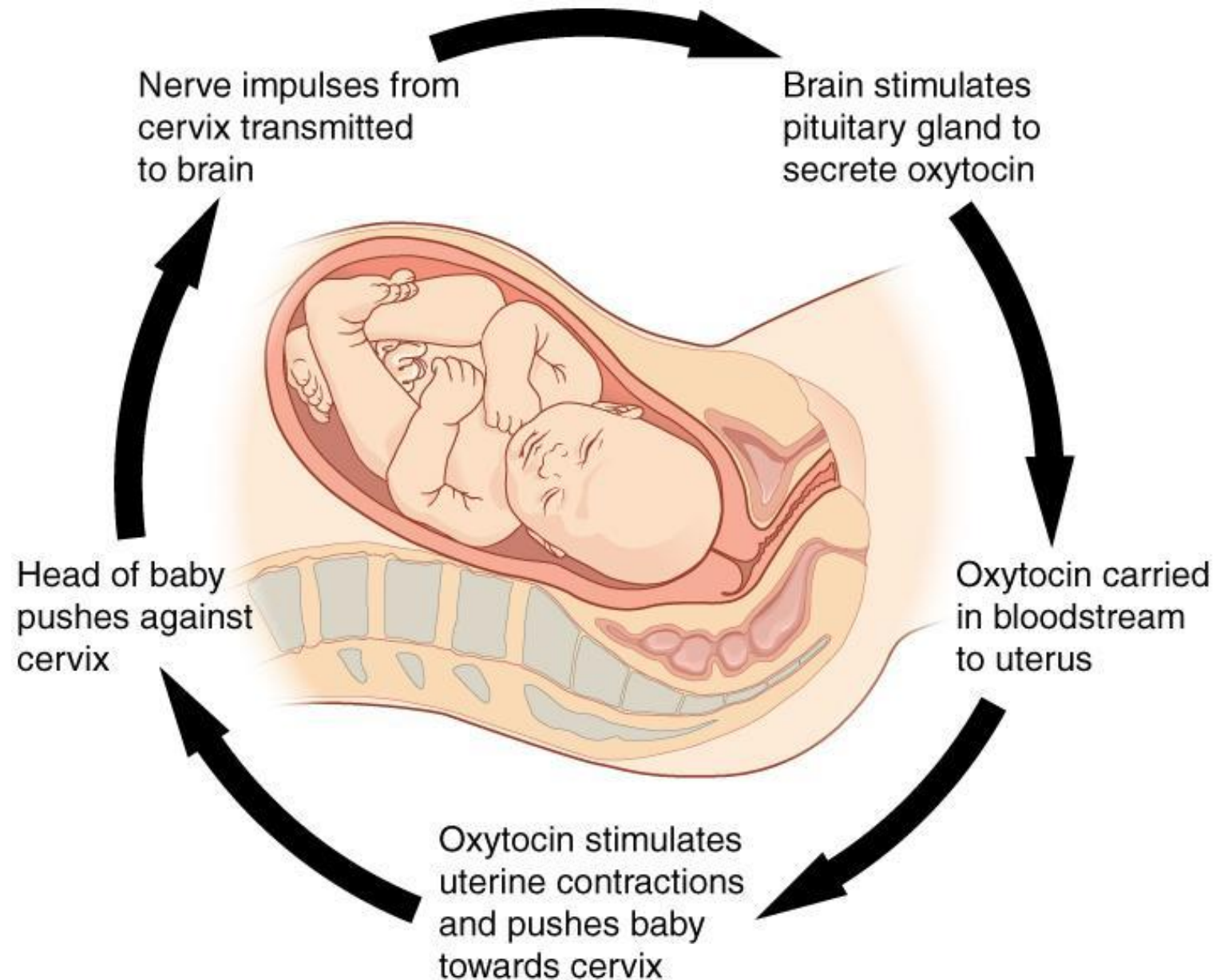
When the hormone levels rise, the organ that secretes the hormone is switched off



Example of Negative Feedback



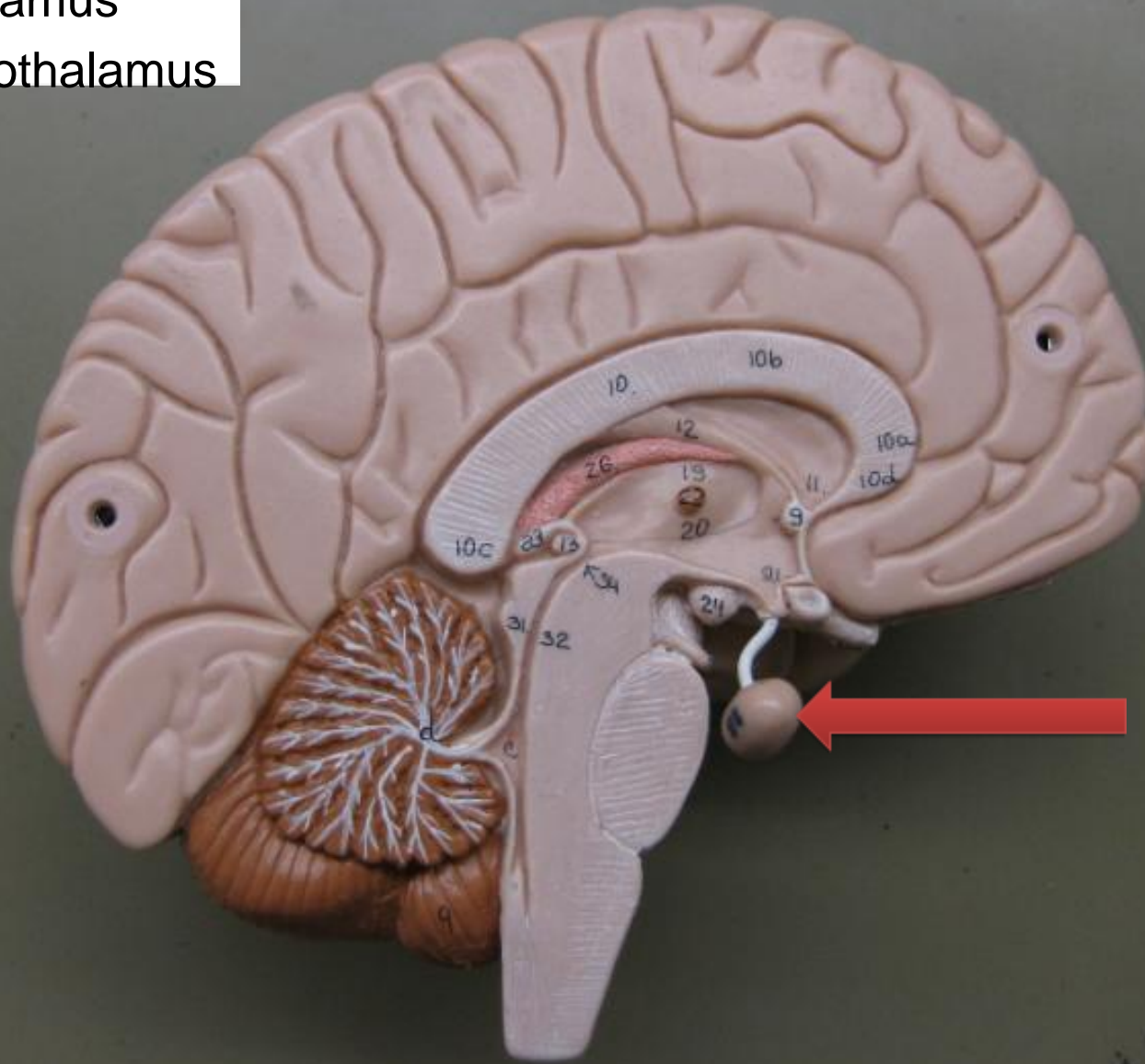
Positive Feedback System



11.5 Pituitary Gland

22 = Thalamus

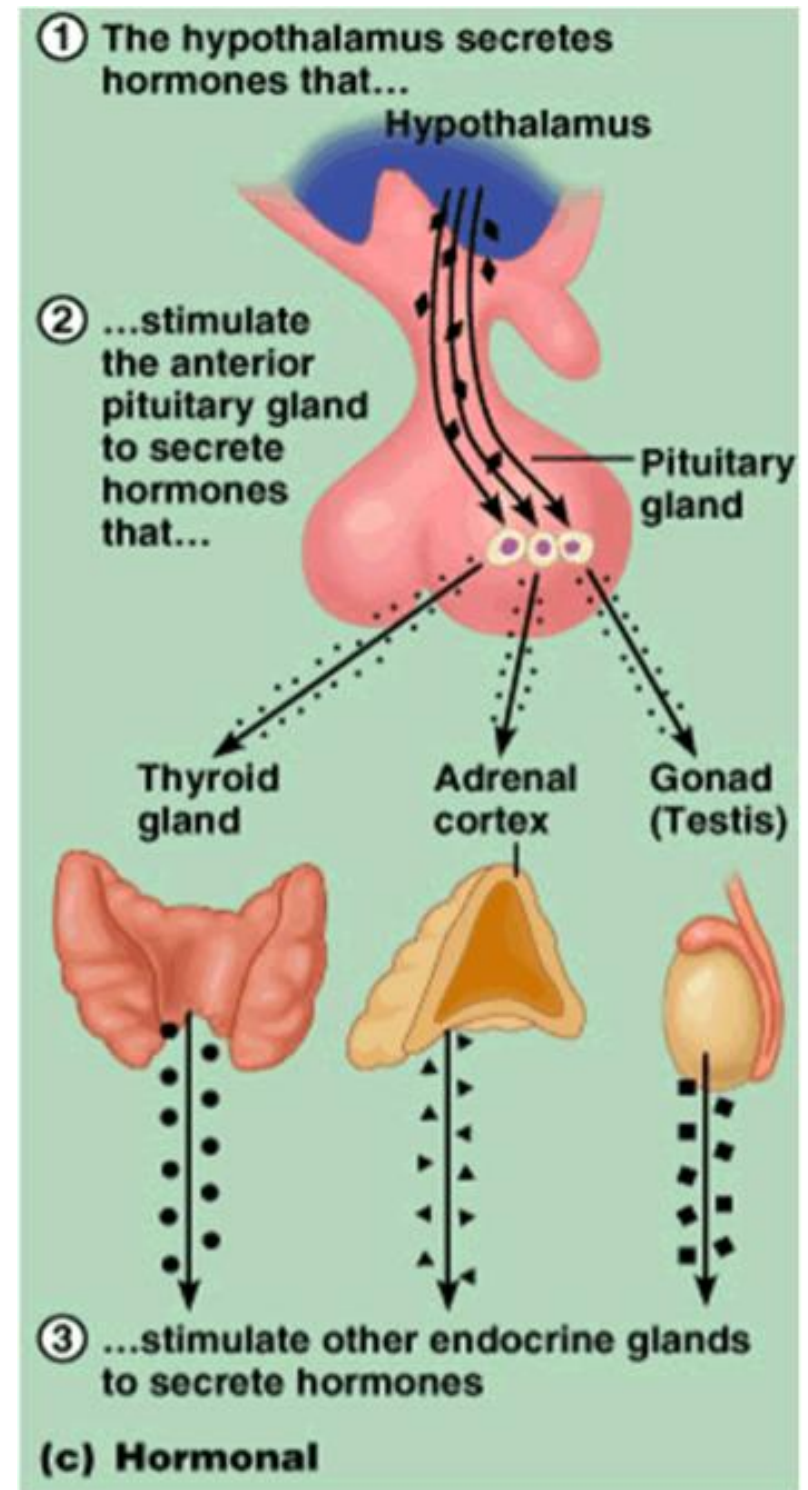
24 = Hypothalamus



Hormone Control

The pituitary is often called the “master gland” because it controls all of the other glands.

Its actions are controlled by the hypothalamus in the brain.



Anterior Pituitary Hormones

Prolactin or PRL - PRL stimulates milk production from a woman's breasts after childbirth and can affect sex hormone levels from the ovaries in women and the testes in men.

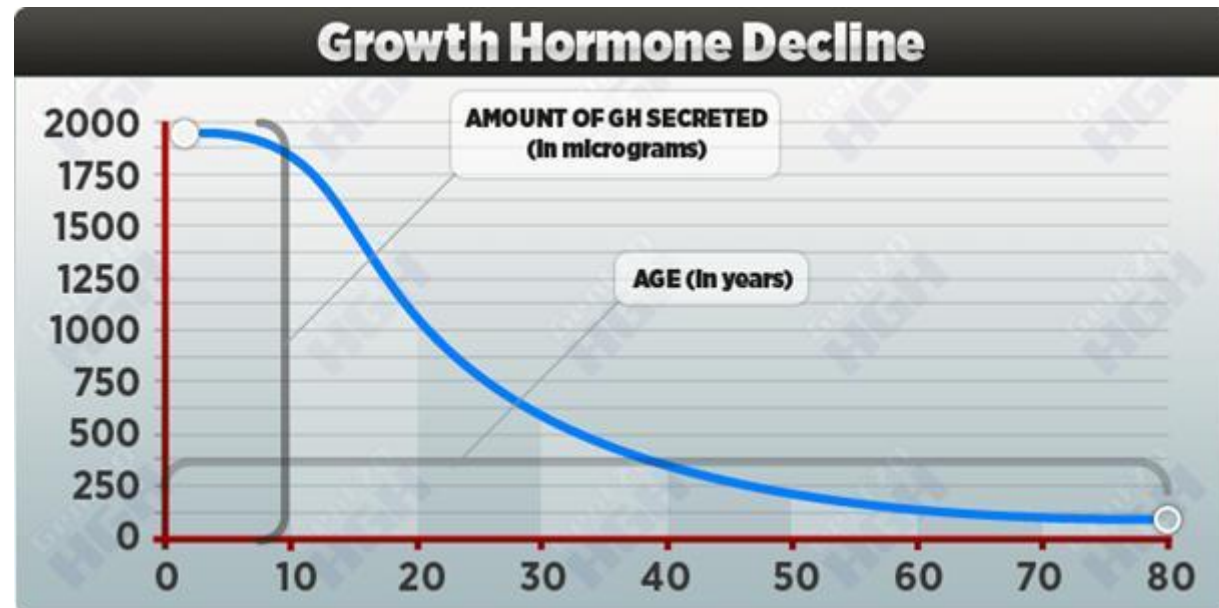


Check out this strange story of a drug that caused lactation in young boys.

<http://voices.yahoo.com/risperdal-causing-breast-development-children-as-3409314.html?cat=70>

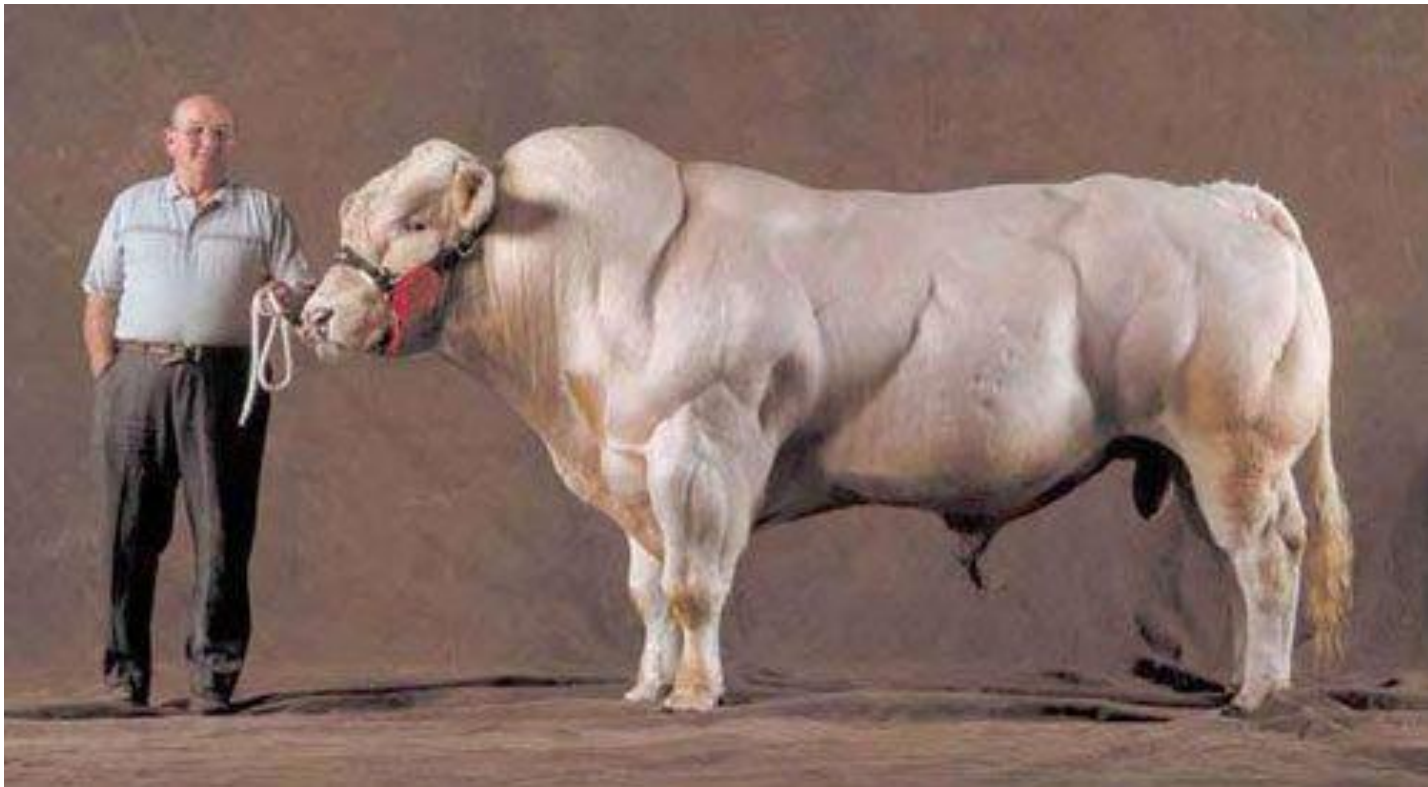
Growth hormone or GH - GH stimulates growth in childhood and is important for maintaining a healthy body composition. In adults it is also important for maintaining muscle mass and bone mass.

It can affect fat distribution in the body.



That's a bull of the Belgian Blue breed, which has a **genetic anomaly that suppresses the production of a hormone called myostatin that inhibits muscle growth** – hence the 'double muscling' seen above.

Myostatin inhibitor drugs are being developed with the intent of treating muscle-wasting diseases like muscular dystrophy in humans.





Primordial Dwarfism



Problems with the pituitary gland can result in Dwarfism



Or a person can grow too much.
These are pictures of the man known
as “The Alton Giant”, Robert Wadlow.
Robert was 8’11”



Adrenocorticotropin or ACTH - ACTH stimulates production of cortisol by the adrenal glands.

Cortisol, a so-called "stress hormone," is vital to survival. It helps maintain blood pressure and blood glucose levels.



Many diet aids claim that they block cortisol levels. Cortisol from stress may lead to fat deposits in the belly.

All-Natural "Feel Good Pill" Weight Loss Breakthrough

Is Stress Making You Fat?

Excess tummy flab is not your fault! That's the startling conclusion reached by scientists who discovered stress is the likely cause of belly bulge. But instead of simply identifying the problem... this time, they may have found the solution!

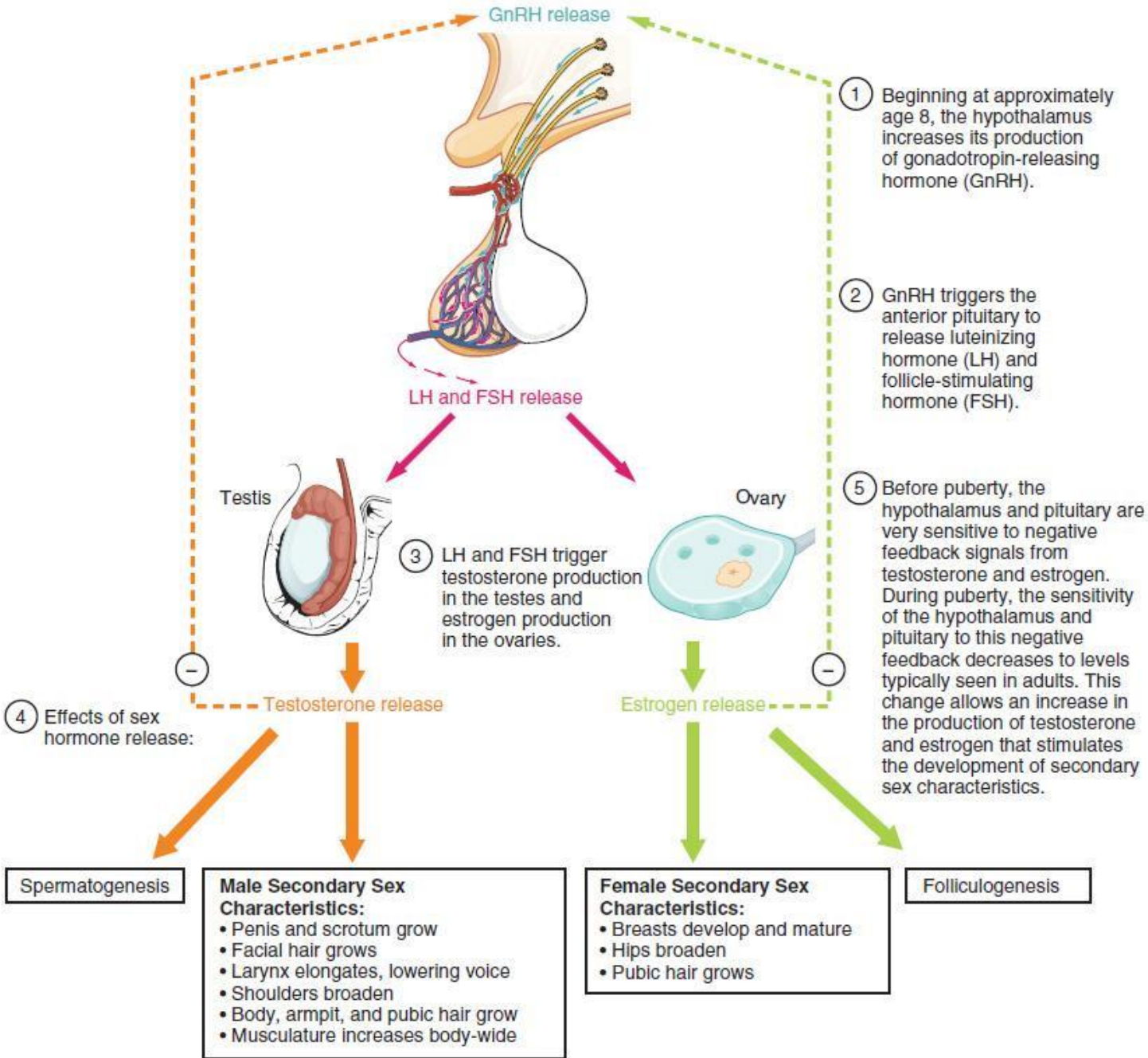


Thyroid-stimulating hormone or TSH - TSH

stimulates the thyroid gland to make thyroid hormones, which, in turn, control (regulate) the body's metabolism, energy, growth and development, and nervous system activity.



Luteinizing hormone or LH - LH regulates testosterone in men and estrogen in women. (gonadotropin)



Follicle-stimulating hormone or FSH -

FSH promotes sperm production in men and stimulates the ovaries to release eggs (ovulate) in women. LH and FSH work together to allow normal function of the ovaries or testes. (gonadotropin)



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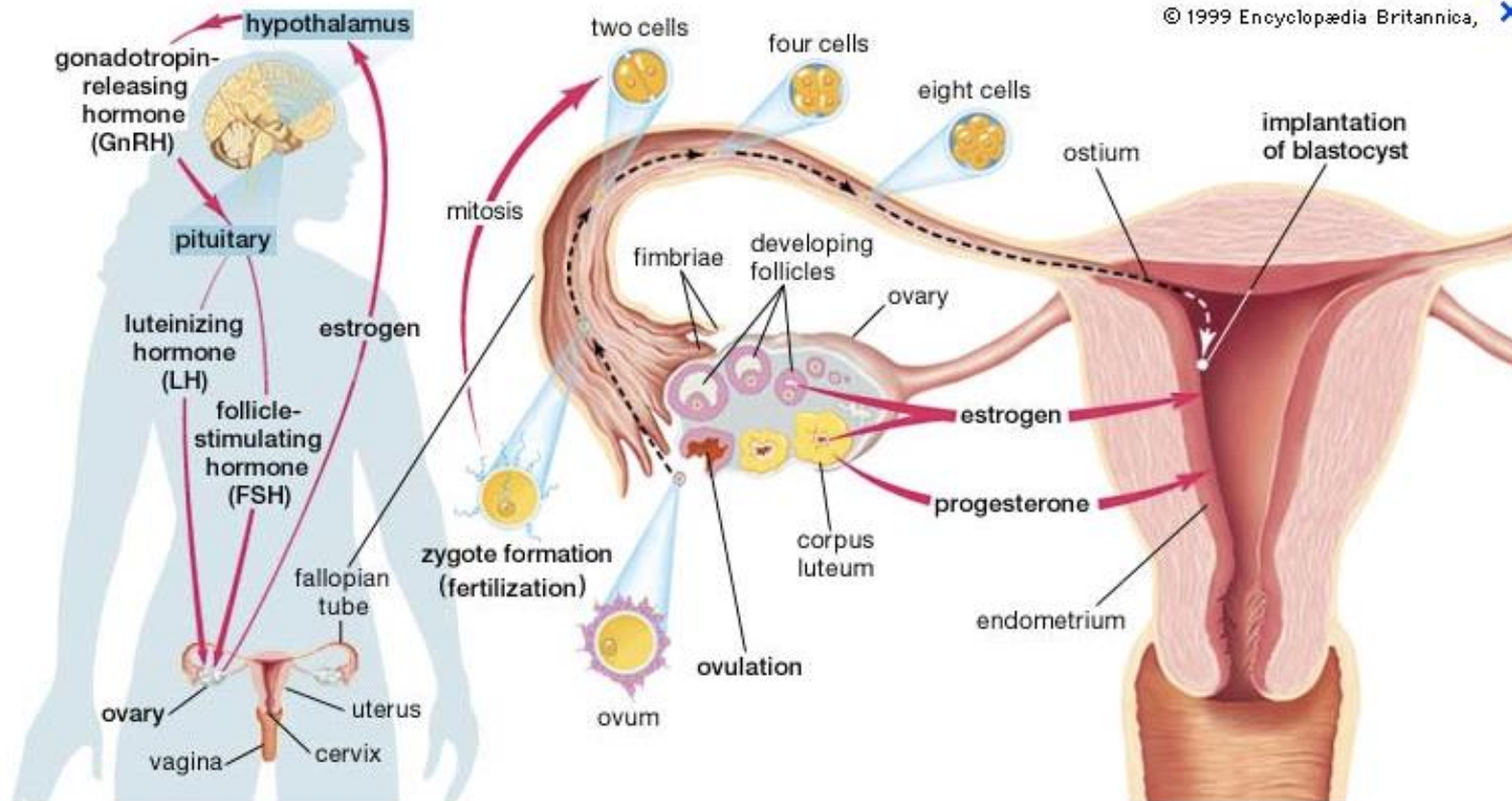




PHOTO: DISCOVERY HEALTH

JUST THE 10 OF US—The Gosselin Family.

Posterior Pituitary Hormones

Oxytocin - Oxytocin causes milk letdown in nursing mothers and contractions during childbirth.



Pitocin is another very **controversial** topic in childbearing today.

Oxytocin is a natural hormone produced by a woman's body that cause uterine contractions. Pitocin is the synthetic form of oxytocin.

Pitocin is generally used in two ways:

1) to induce labor, and 2) to augment (speed up) labor.



Antidiuretic hormone or ADH - ADH, also called vasopressin, is stored in the back part of the pituitary gland and regulates water balance.



Too much urination can lead to dehydration. When the body is dehydrated, ADH will cause the kidneys to conserve water.

- Diuretics – increase urine production

Many common foods and drinks contain chemicals that are diuretics (alcohol)



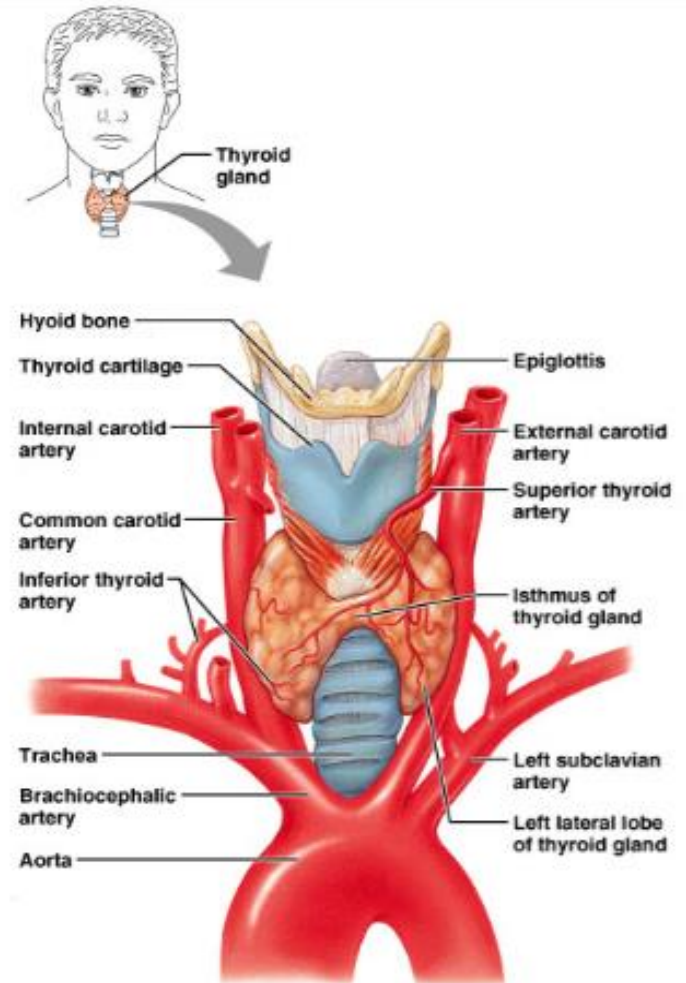
Midol relieves symptoms of bloating because it contains a diuretic that will make you urinate more

Active Ingredients: (in each caplet): Acetaminophen (500 mg) (Pain Reliever), Caffeine (60mg) (Diuretic, Stimulant), Pyrilamine Maleate (15 mg) (Diuretic)

Inactive Ingredients: Carnauba Wax, Croscarmellose Sodium, FD&C Blue 2, Hypromellose, Magnesium Stearate, Microcrystalline Cellulose, Pregelatinized Starch, Propylene Glycol, Shellac, Titanium Dioxide, Triacetin

THYROID GLAND

The thyroid hormones control your metabolism, which is the body's ability to break down food and store it as energy and release of energy



[TED-Ed Video on the Thyroid](#)

THYROID HORMONES

Thyroxin (T4) & Tri-iodothyronine (T3) - both increase the rate at which cells release energy from carbohydrates

Calcitonin – regulates the blood concentration of calcium

BMR – basal metabolic rate : how many calories the body must consume to maintain life

[BMR Calculator](#)

Problems with the Thyroid

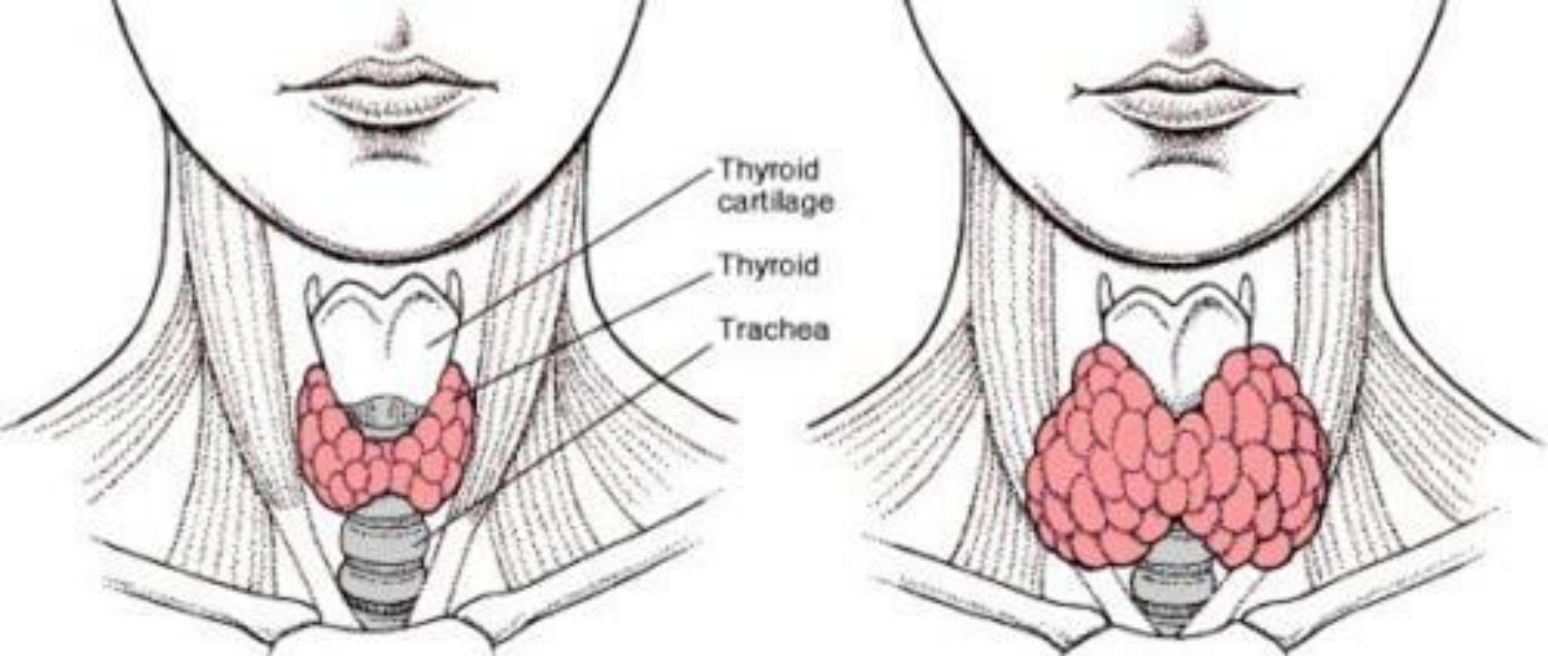
Iodine is essential for the formation of thyroxine.

Lack of iodine causes a swelling of the thyroid
→ **GOITER.**

Iodine is only found in seafood, so if salt wasn't iodized, a lot of people wouldn't get enough iodine, and there would be a lot of goiters.



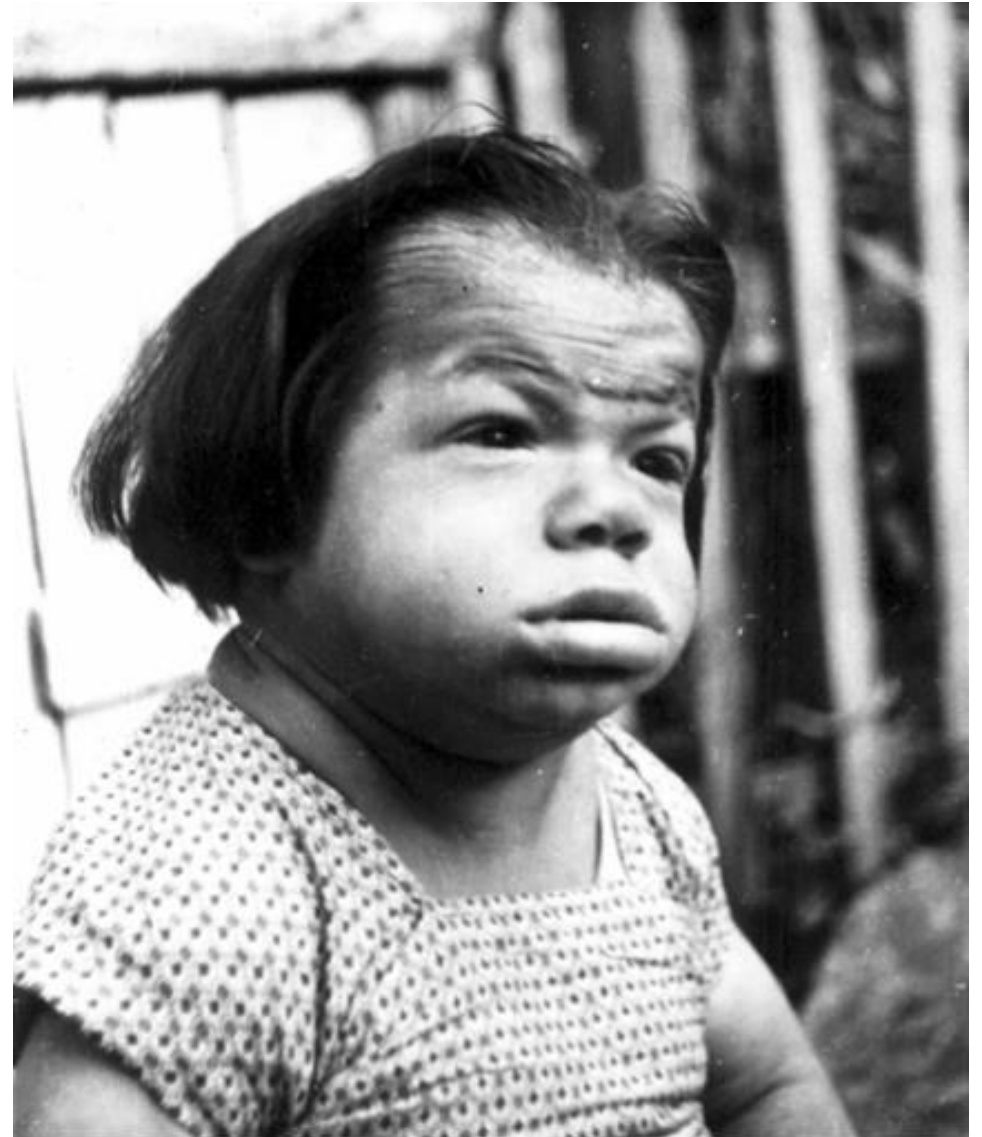
Goiter



Hypothyroidism Before and After Treatment



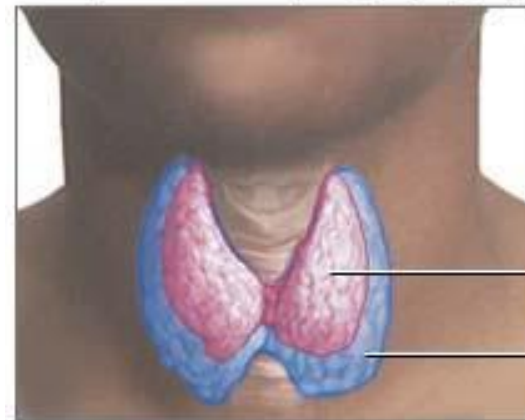
Cretinism (hypothyroidism in infants)



Hyperthyroidism (Grave's Disease)



Exophthalmos (bulging eyes)



Diffuse goiter

Graves' disease is a common cause of hyperthyroidism, an over-production of thyroid hormone, which causes enlargement of the thyroid and other symptoms such as exophthalmos, heat intolerance and anxiety

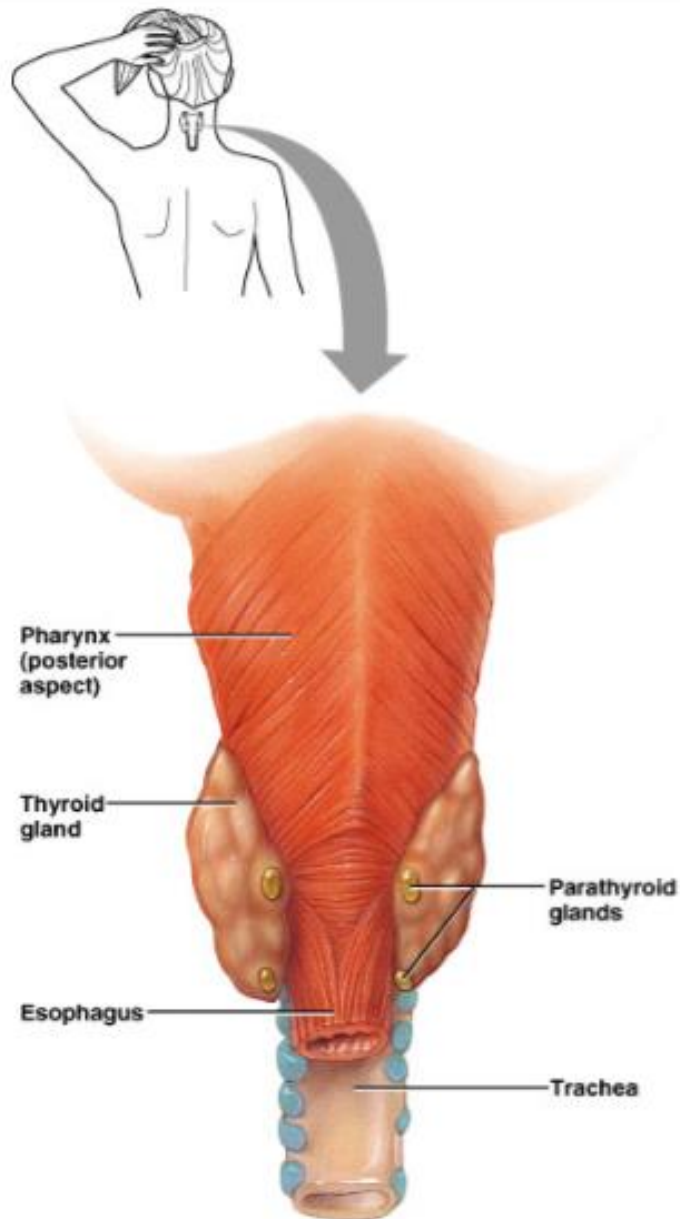
Normal thyroid

Enlarged thyroid

Exposure to [radioactive](#) iodine in childhood is also believed to be associated with thyroid cancer. Following the Chernobyl nuclear power plant explosion, there was an increase in thyroid cancer in children.

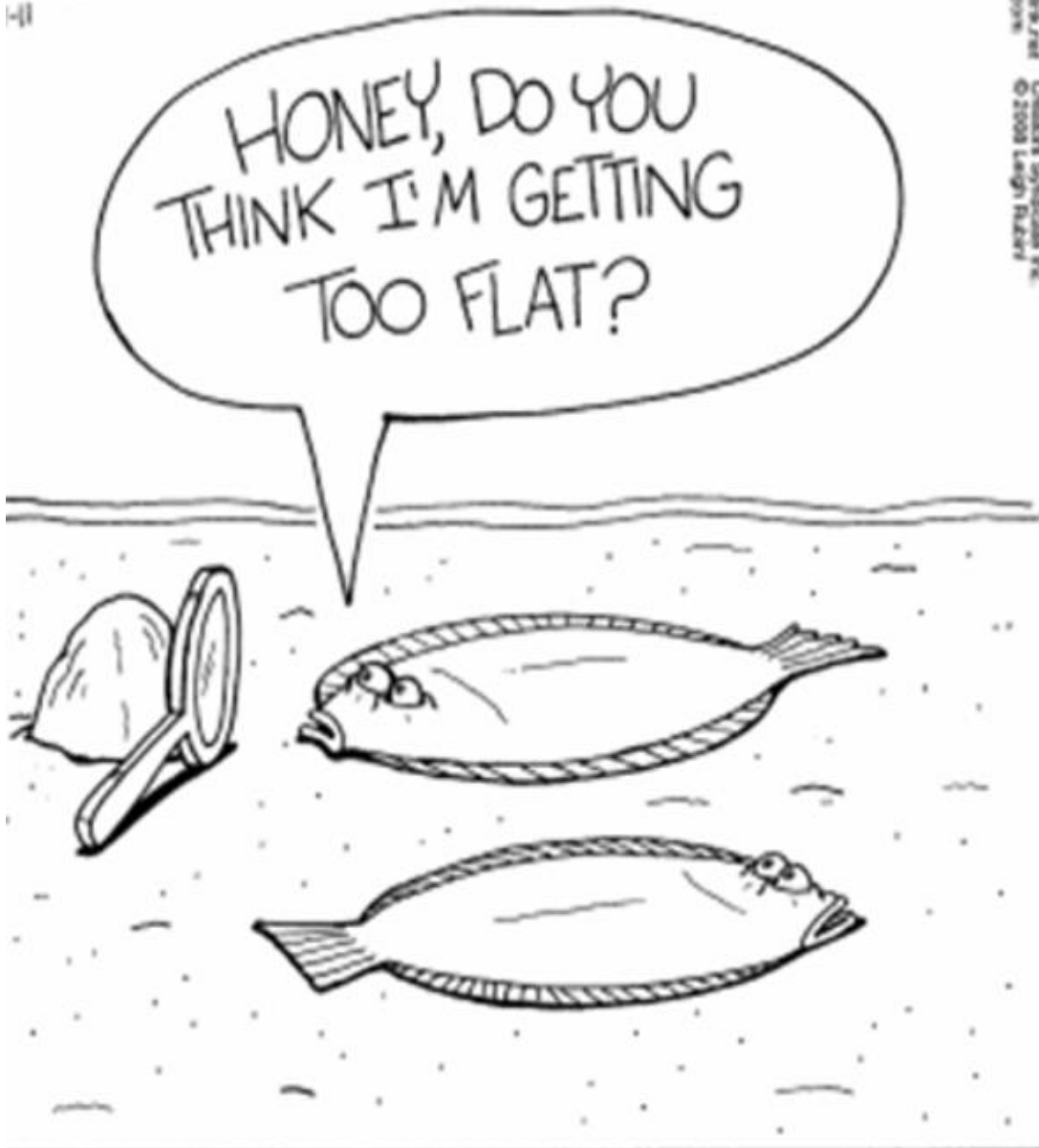


Parathyroid Glands



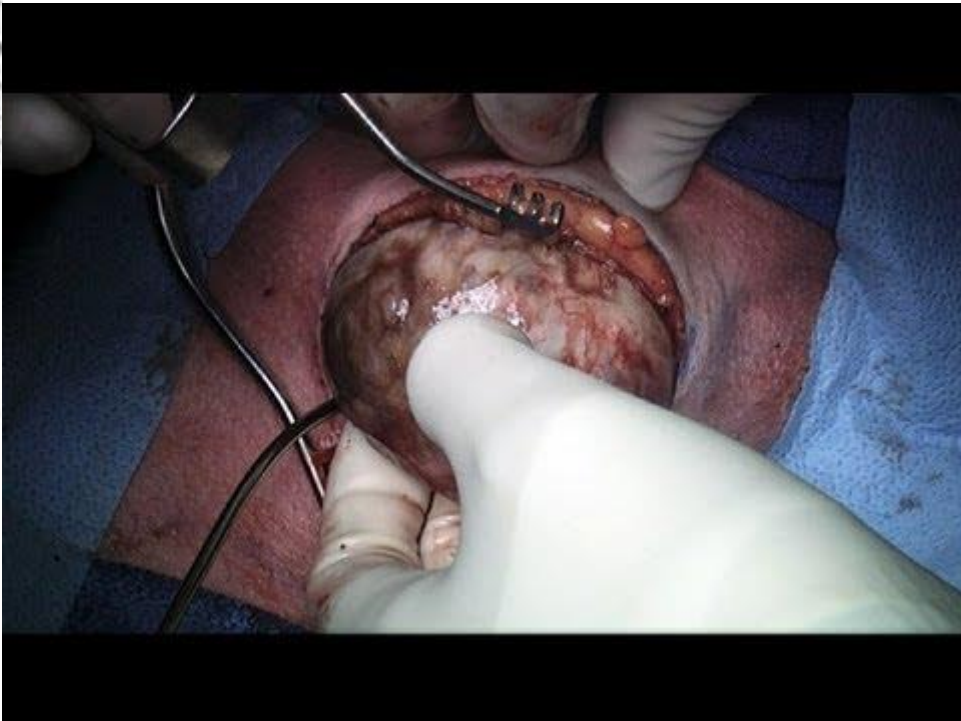
Located behind the thyroid, four tiny glands

Parathyroid Hormone (PTH) - takes calcium from the bones to make it available in the blood



Removal of a mass and thyroid gland:

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



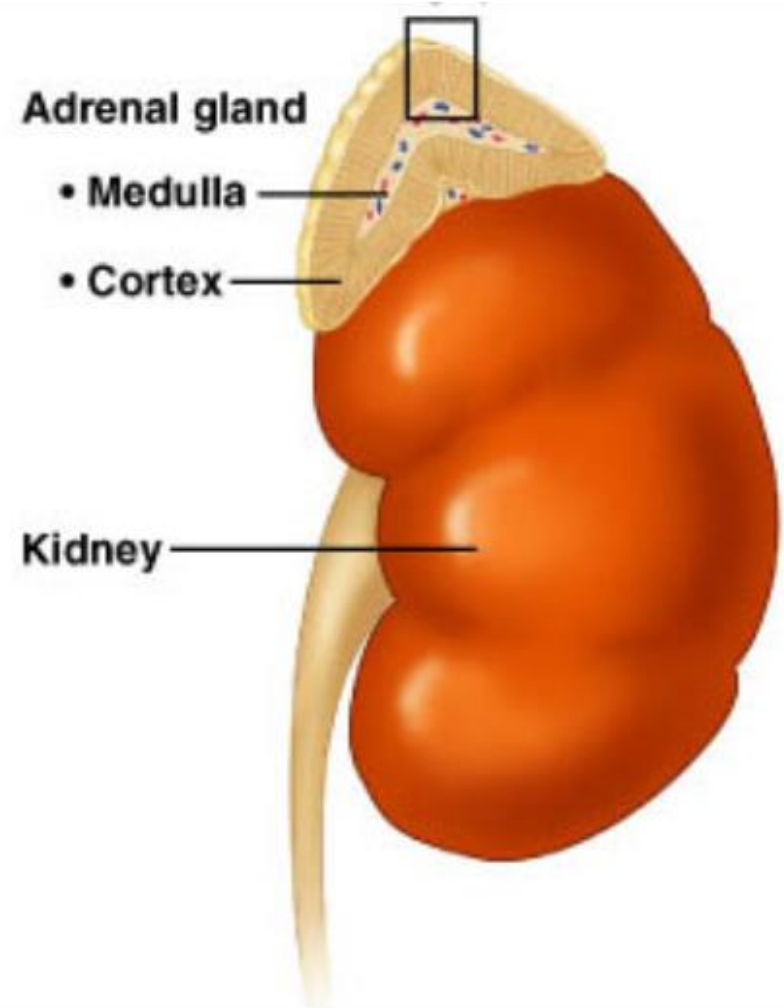
Adrenal Glands

Located at the top of the kidneys

Adrenal Cortex - outer area

Adrenal Medulla - inner area

Adrenal Glands = Adrenaline



Adrenal Medulla

Epinephrine & Norepinephrine – increased heart rate, breathing rate, elevated blood pressure (fight or flight, response to stress)

People with severe life threatening allergies often carry injectors



Adrenal Cortex

Aldosterone – helps kidneys conserve sodium and excrete potassium, maintaining blood pressure

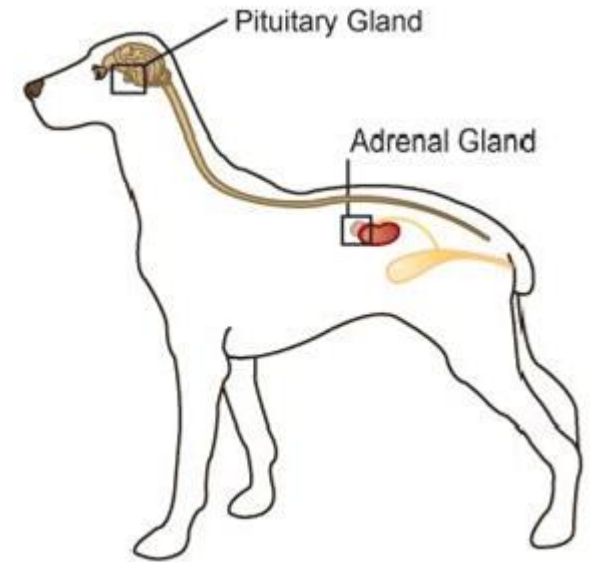
Cortisol – keeps blood glucose levels stable

Adrenal Sex Hormones - androgens (male) and estrogens (female)

Adrenal Gland Disorders

Cushing's Disease

Hyperadrenocorticism



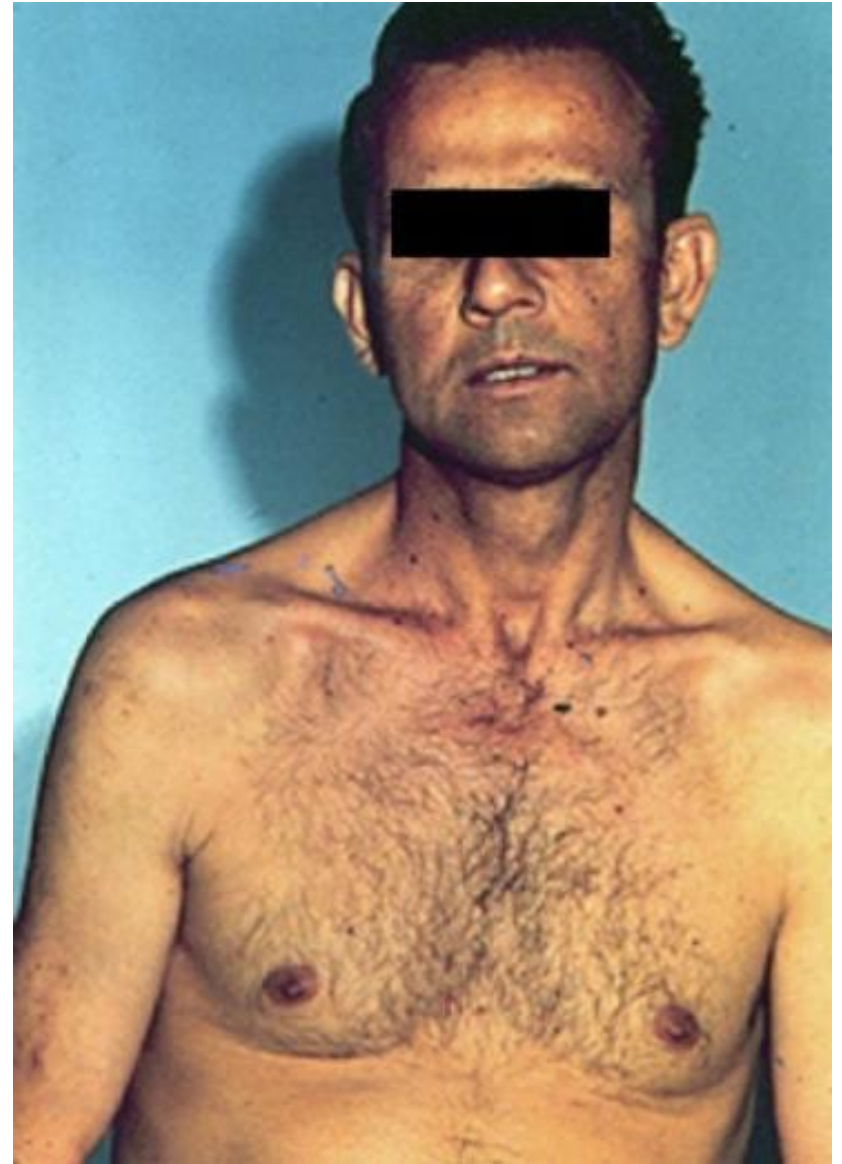
- Increased thirst and urination
- Increased hunger
- Increased panting
- Pot-bellied abdomen
- Obesity
- Loss of hair

Cushing's syndrome happens when the adrenal glands makes too much cortisol.

<https://www.vetdepot.com/article-images/cushings-disease.gif>

● Addison's disease

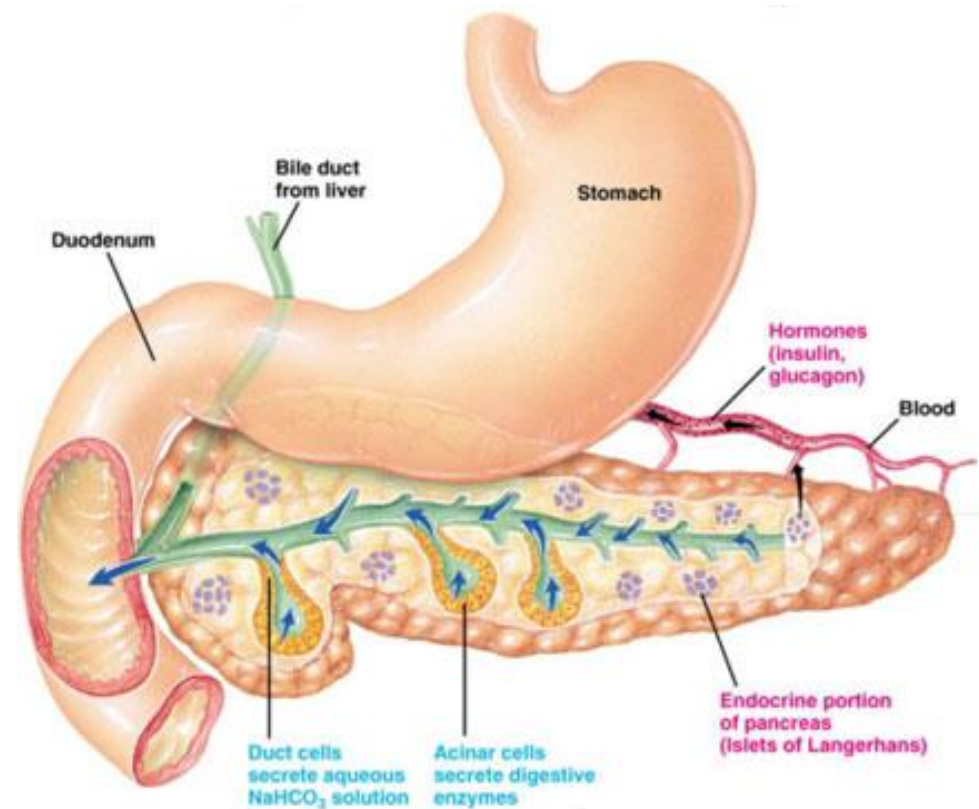
- Hyposecretion of cortisol
- Low blood pressure results
- Increased pigmentation



Pancreas

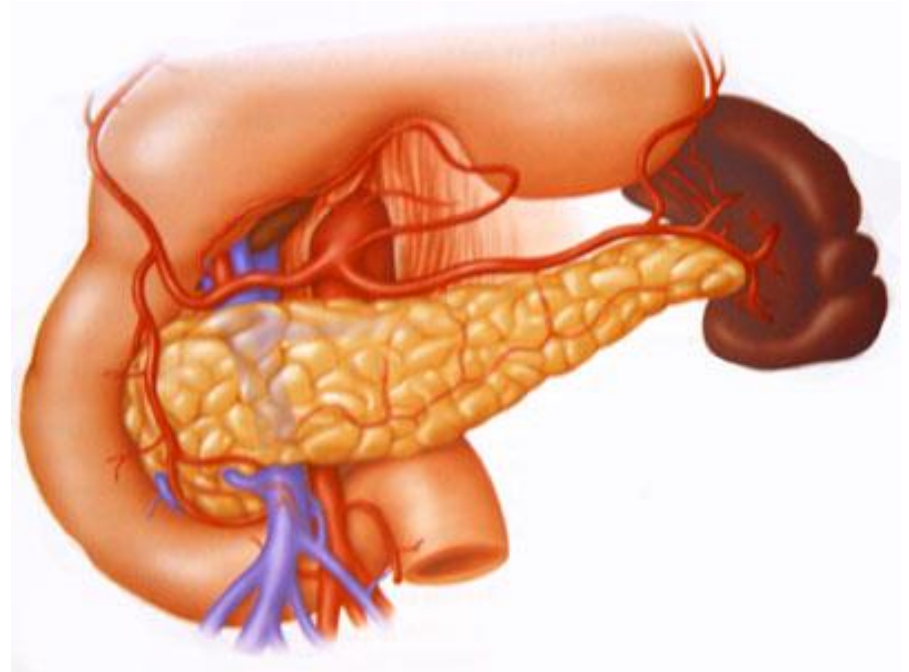
The pancreas is a large gland behind your stomach that helps the body to maintain healthy blood sugar (glucose) levels.

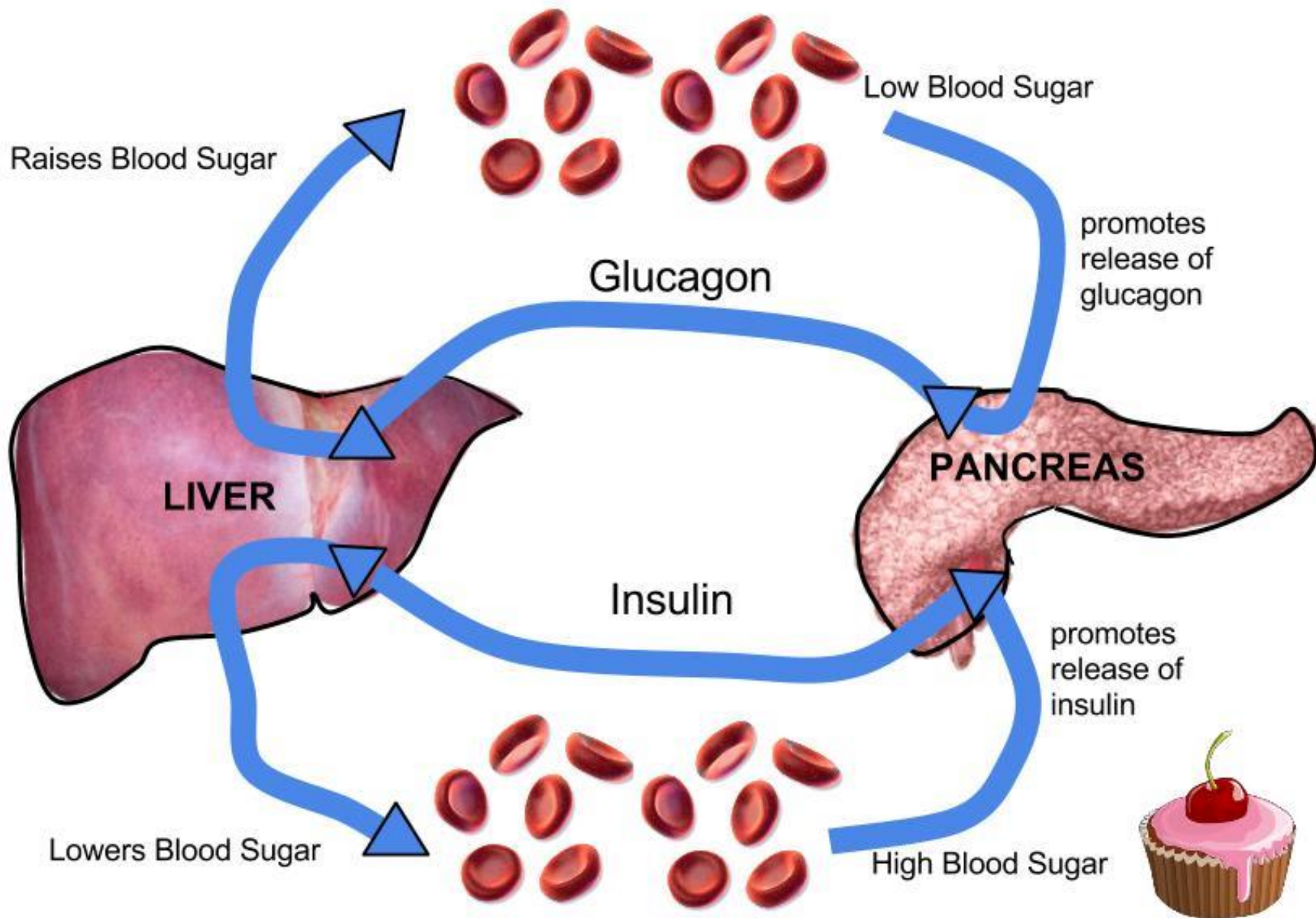
Contains islands of cells called the Islets of Langerhans which secrete glucagon and insulin



- **Glucagon** – stimulates the liver to break down glycogen, raises blood sugar concentration
- **Insulin** – decreases blood sugar concentrations, affects the uptake of glucose by cells

*Both hormones work together to maintain a balance in the blood sugar





Diabetes

- Diabetes Mellitus – results from an insulin deficiency, blood sugar rises (hyperglycemia) and excess is excreted in the urine.
- Type I - insulin dependent diabetes mellitus or juvenile onset diabetes, often caused by inherited immune disorder that destroys pancreatic cells

- Type II – mature onset diabetes (usually after the age of 40), often individuals are overweight, can be controlled with diet and exercise



Blood sugar test, device pricks the finger and measures the amount of sugar in the blood

Injection of insulin will lower the blood sugar levels

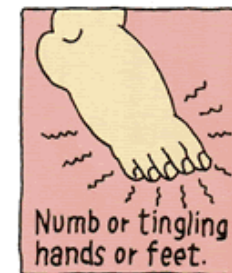
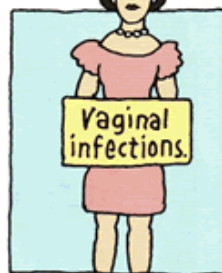
Hypoglycemia can occur if levels become too low, can be cured with direct injection of glucose or with eating something high in sugar. This is why diabetics often have candy.



Diabetic neuropathies are a family of nerve disorders caused by diabetes. People with diabetes can develop nerve damage throughout the body. Symptoms include pain, tingling, or numbness-loss of feeling-in the hands, arms, feet, and legs. This can result in wounds that are slow to heal.

DIABETES

KNOW THE SYMPTOMS



If you have any of these symptoms, see your doctor. For more information about diabetes call Eli Lilly and Company at 1-800-545-5979 or Boehringer Mannheim Corporation at 1-800-858-8072.

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Diabetes Insipidus

Diabetes insipidus (DI) is an uncommon condition that occurs when the kidneys are unable to conserve water as they perform their function of filtering blood.

The amount of water conserved is controlled by antidiuretic hormone ([ADH](#)), also called vasopressin.

ADH is a hormone produced in a region of the brain called the hypothalamus.

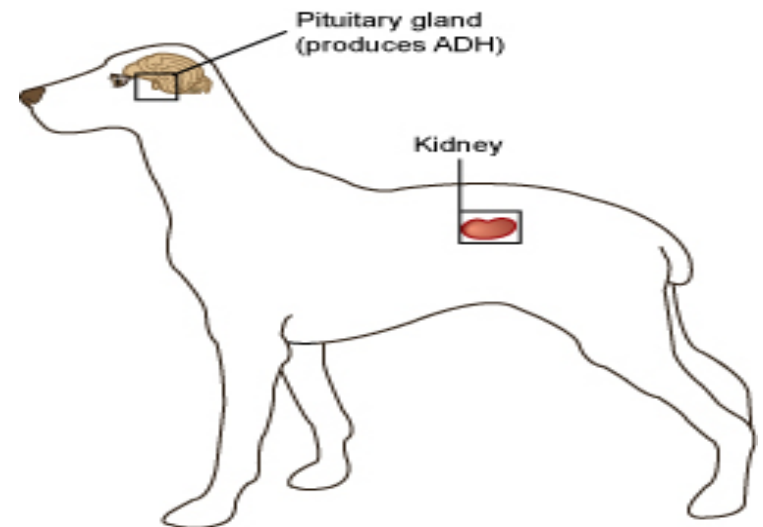
Symptoms

Excessive thirst

---May be intense or uncontrollable

----May involve a craving for ice water

Excessive urine volume



Gestational Diabetes

Pregnancy hormones can block insulin from doing its job. When this happens, glucose levels may increase in a pregnant woman's blood.



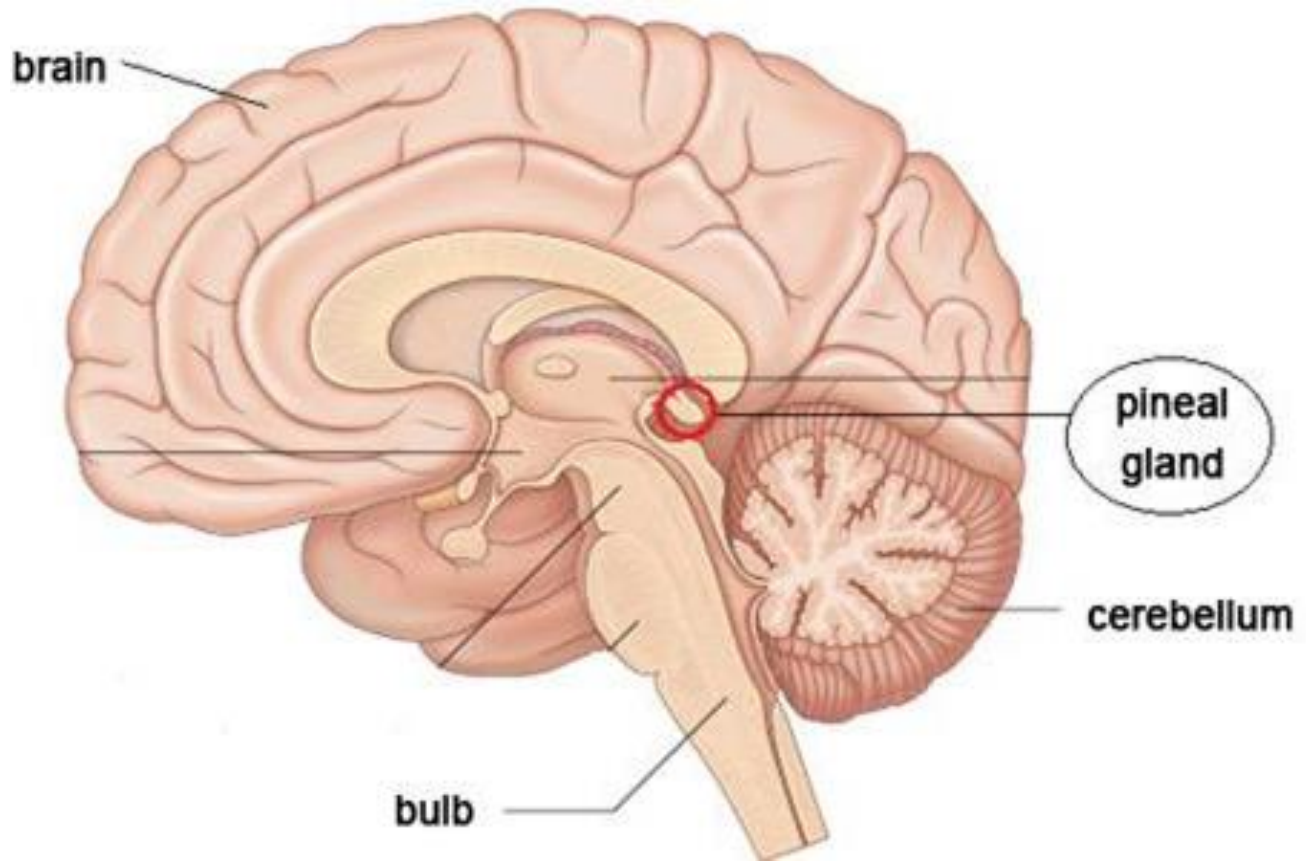
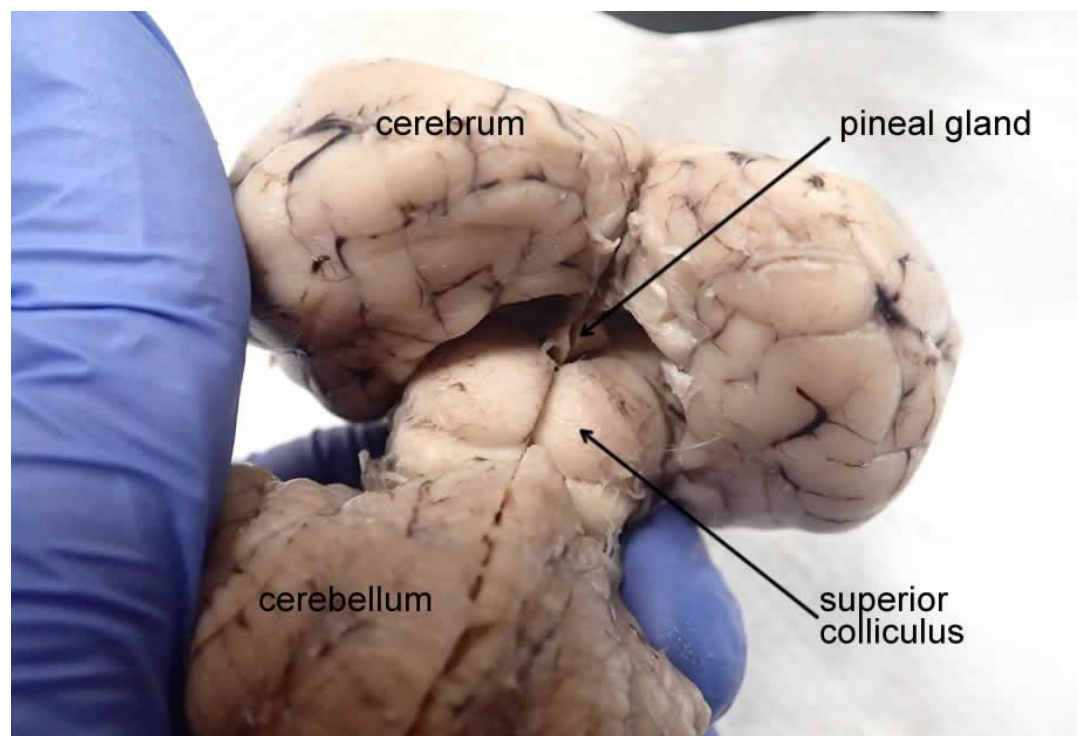
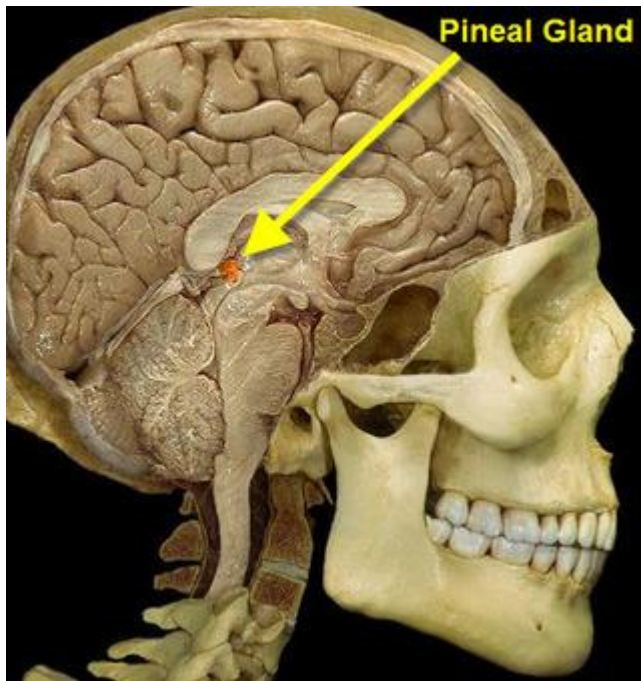
Gestational diabetes usually starts halfway through the pregnancy. All pregnant women should receive an oral glucose tolerance test between the 24th and 28th week of pregnancy to screen for the condition.

Other Endocrine Glands

Pineal Gland – located between the cerebral hemispheres,

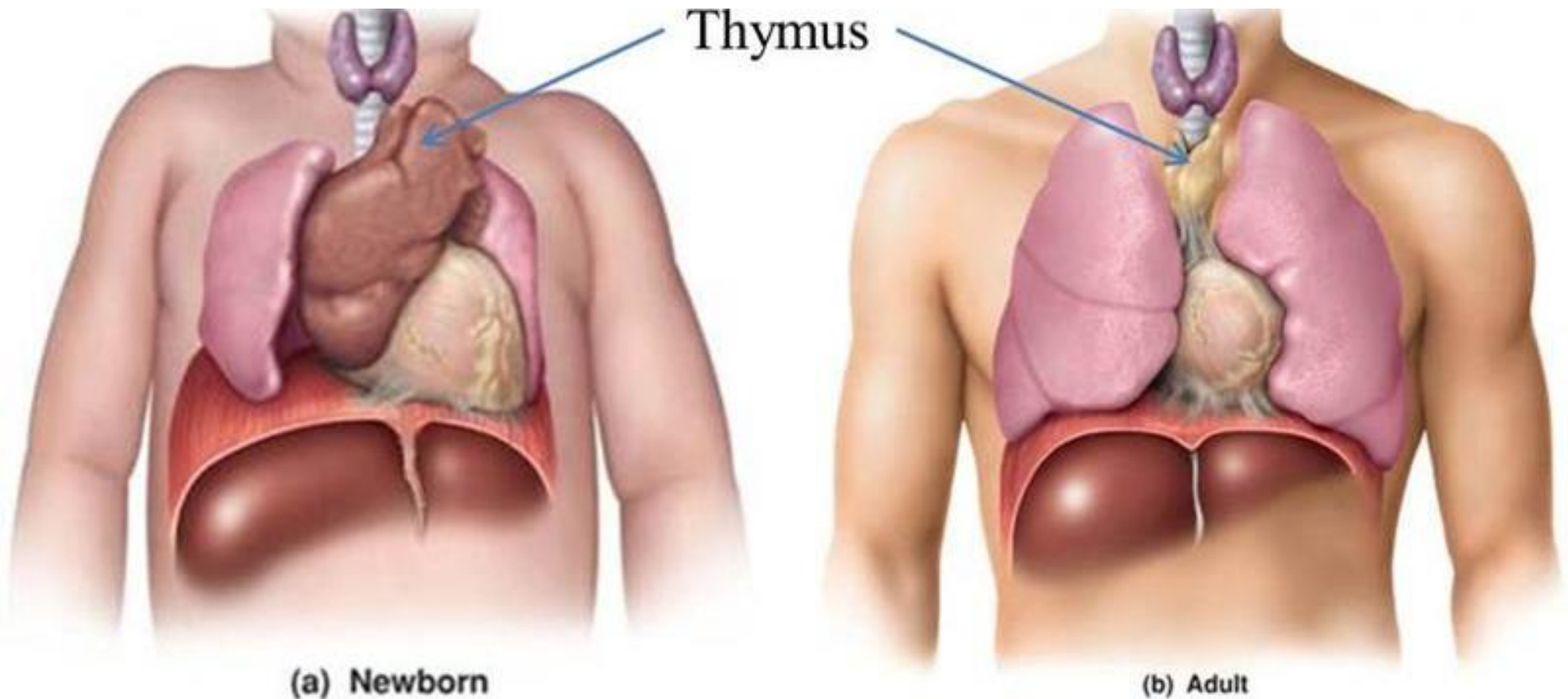
- secretes melatonin, maintains Circadian rhythms (light and dark activity)





Can you find the
hypothalamus?
Pituitary?

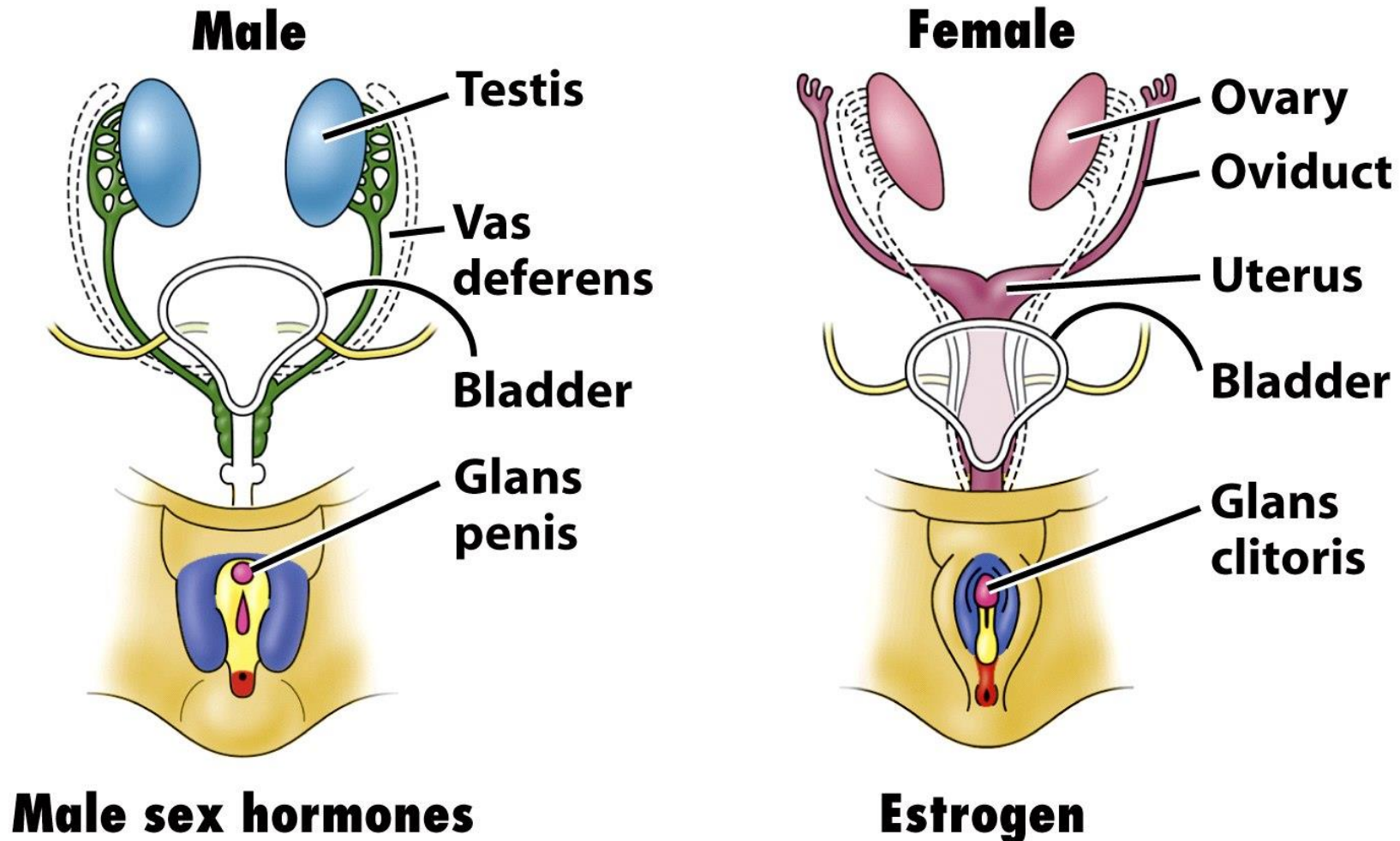
Thymus Gland – large in young children, gradually shrinks with age, secretes thymosins, important to immune function



Reproductive Glands – testes and ovaries – testosterone, progesterone, estrogen

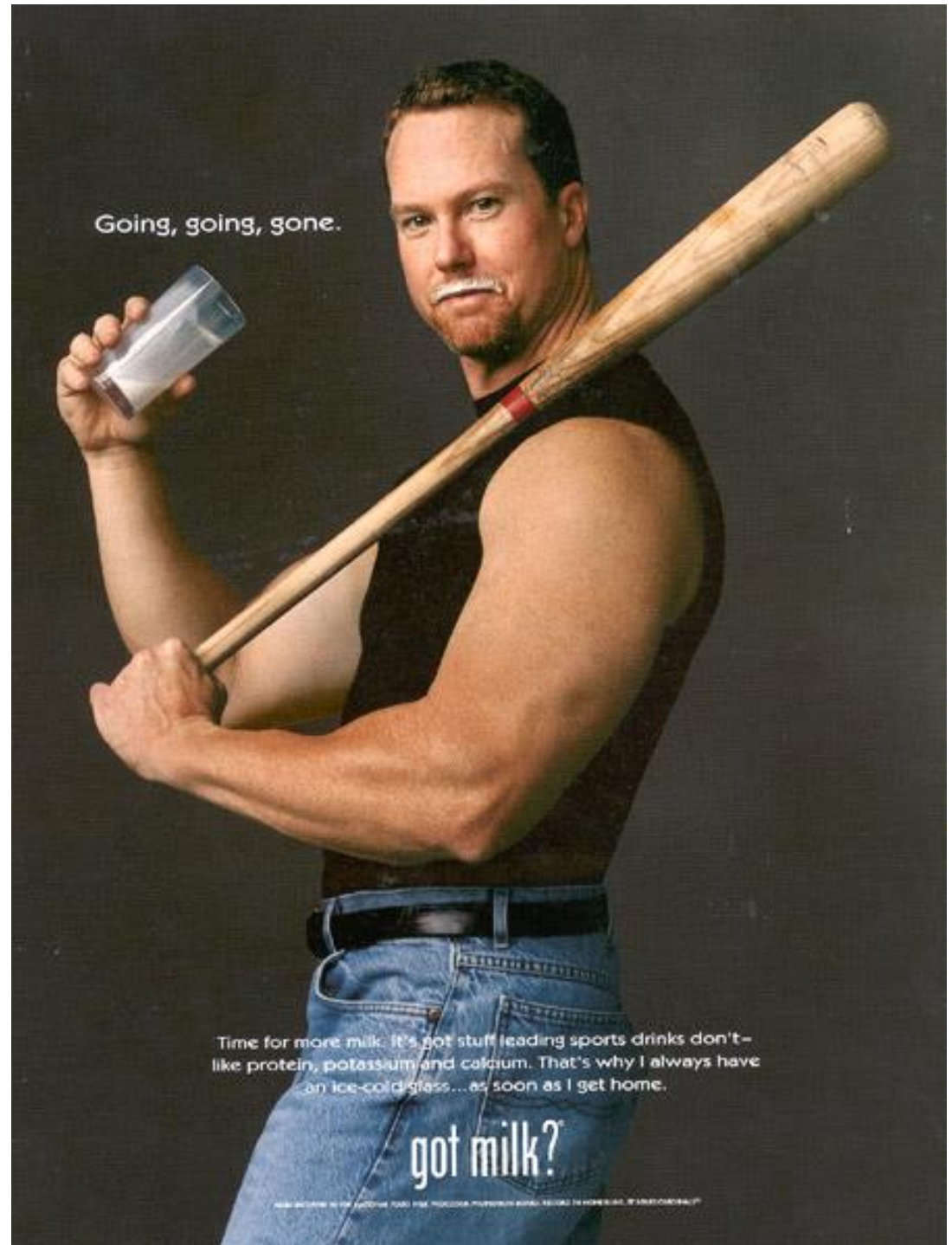


GONADOTROPINS - include any hormone that affect the gonads



Steroids

Anabolic steroids are artificially produced hormones that are the same as, or similar to, **androgens**, the male-type sex hormones in the body. There are more than 100 variations of anabolic steroids. The most powerful androgen is **testosterone**.



THE ENDOCRINE SYSTEM

HYPOTHALAMUS

Regulates hunger, thirst, sleep and wakefulness plus most of your involuntary mechanisms including body temperature.

PITUITARY GLAND

Controls all other endocrine glands; influences growth, metabolism and regeneration.

THYROID GLANDS

Regulates your energy and your metabolism.

PARATHYROID

Secretes the hormones necessary for calcium absorption.

PANCREAS

Aids in the digestion of protein, fats and carbohydrates. Produces insulin which controls blood sugar levels.

THYMUS

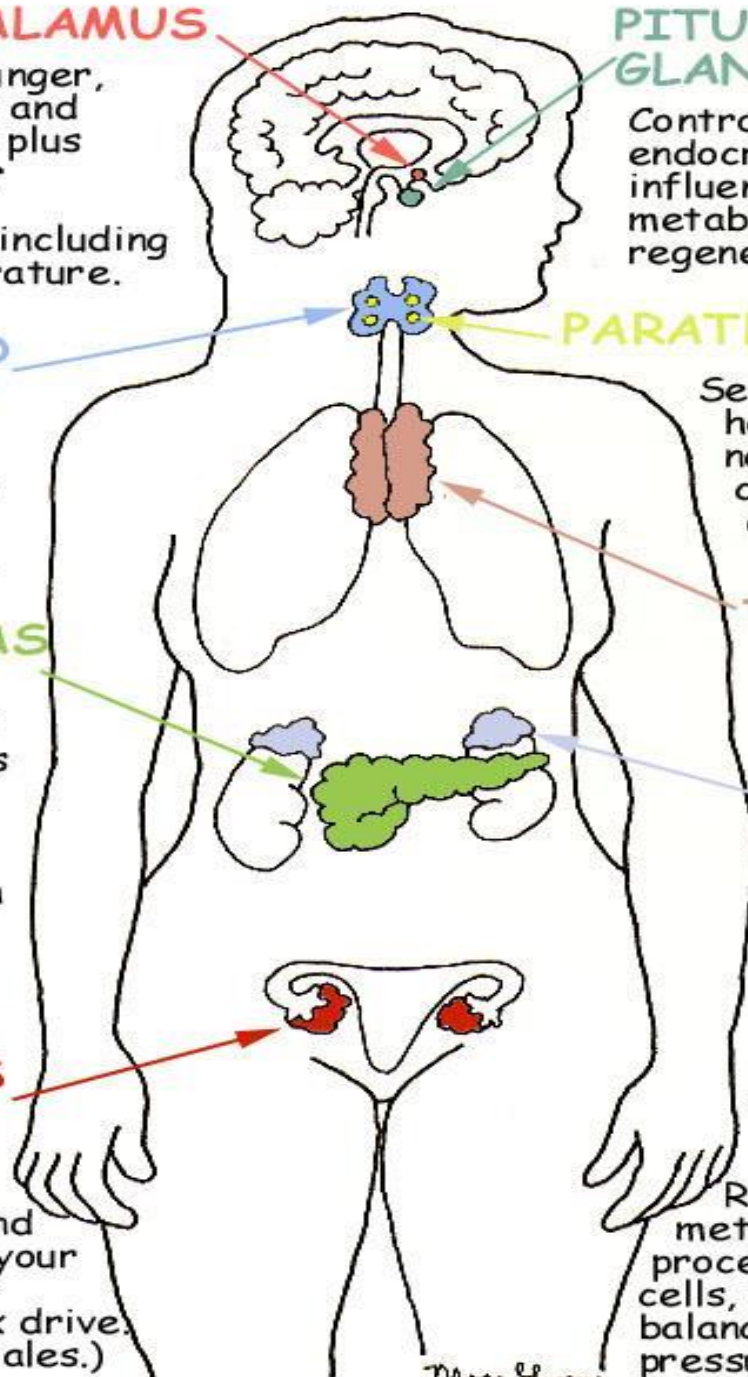
Helps build resistance to disease.

ADRENAL GLANDS

Secretes hundreds of compounds including cortisone & adrenaline which helps you react to emergencies. Regulates your metabolic processes in the cells, water balance, blood pressure, etc.

OVARIES

Influences how your blood circulates and determines your mental vigor and your sex drive. (Testes in males.)



METABOLISM - The conversion of nutrients into energy and building materials to meet your body's needs.