Embryonic and postembryonic development

EMBRYONIC DEVELOPMENT – from fertilisation until leaving the egg membrane

Taking into consideration where embryogenesis happens:

1. **oviparous**

- Female lays eggs (aquatic invertebrates, insects, some fish, amphibians, reptiles, birds)

2. **ovoviviparous**

- Females produce eggs rich in nutrients, after fertilisation, until hatching, eggs are in the part of oviduct („uterus") (some arthropods, snails, sharks, some reptiles, monotremes)

3. **viviparous**

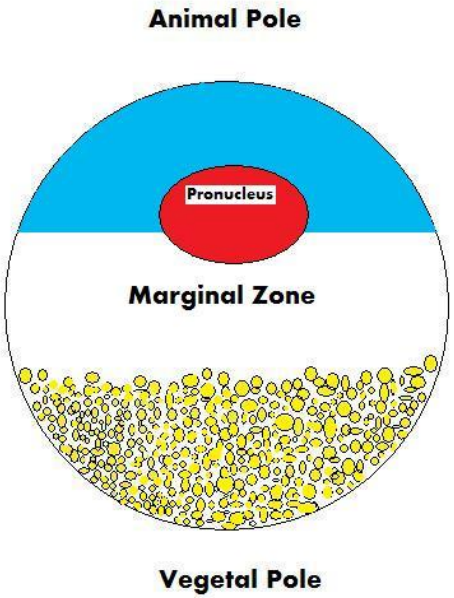
- Females produce small eggs, embryo develops in uterus and feed through placenta (mammals)

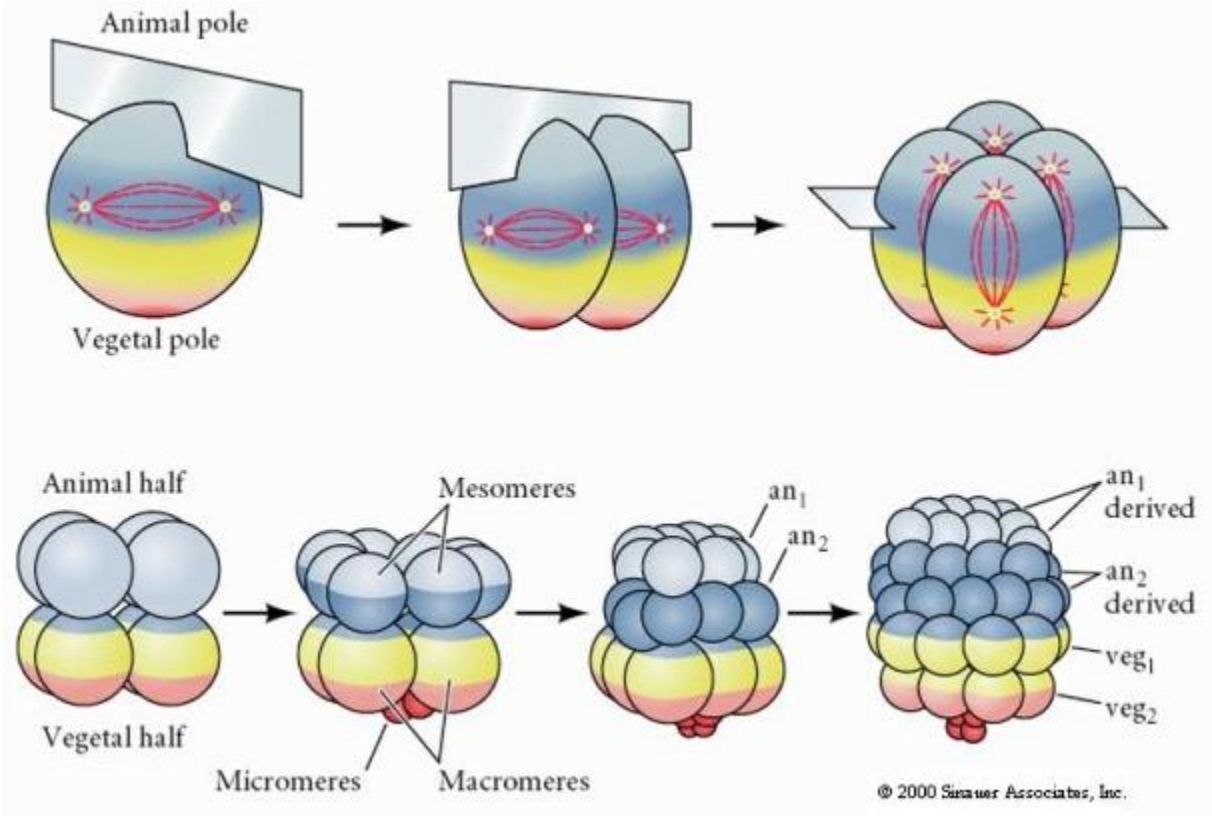
after fertilisation – cleavage (depends on the concentration of yolk in the egg):

- **holoblastic (total or entire cleavage)** or
- **meroblastic (partial cleavage**)

vegetal pole - The pole of the egg with the highest concentration of yolk

animal pole- the opposite



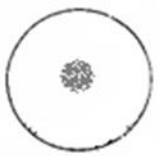


Egg cells (ova)

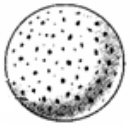
1. **Telolecithal** - refers to the uneven distribution of yolk in the cytoplasm of ova found in birds, reptiles, fish, and monotremes. The yolk is concentrated at one pole of the egg separate from the developing embryo



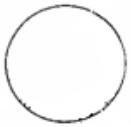
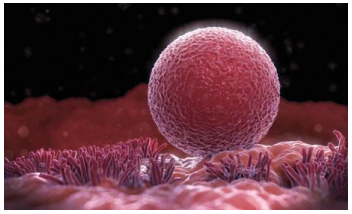
2. **Centrolecithal** - describes the placement of the yolk in the centre of the cytoplasm of ova. Many arthropod eggs are centrolecithal




3. **Isolecithal** - refers to the even distribution of yolk in the cytoplasm of ova of mammals and other vertebrates



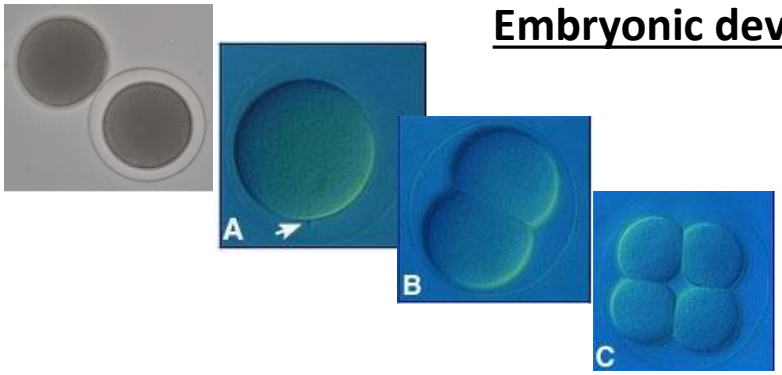

4. **Alecithal** – no yolk (mammals with placenta)

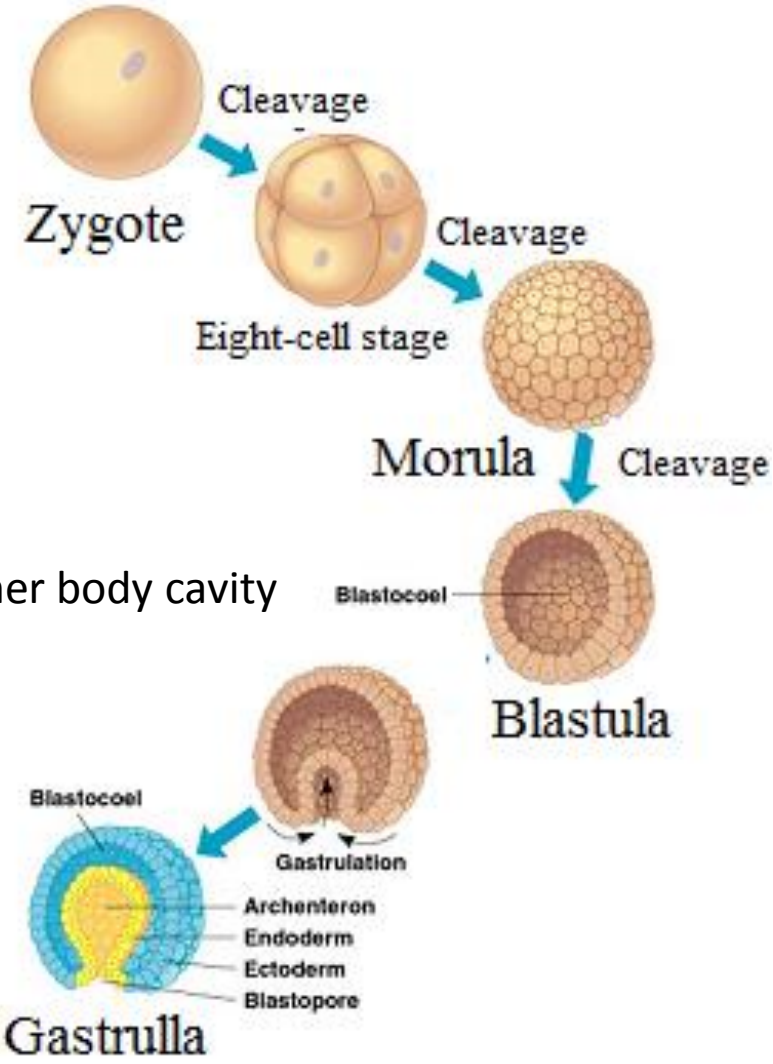



Embryonic development of isolecital egg

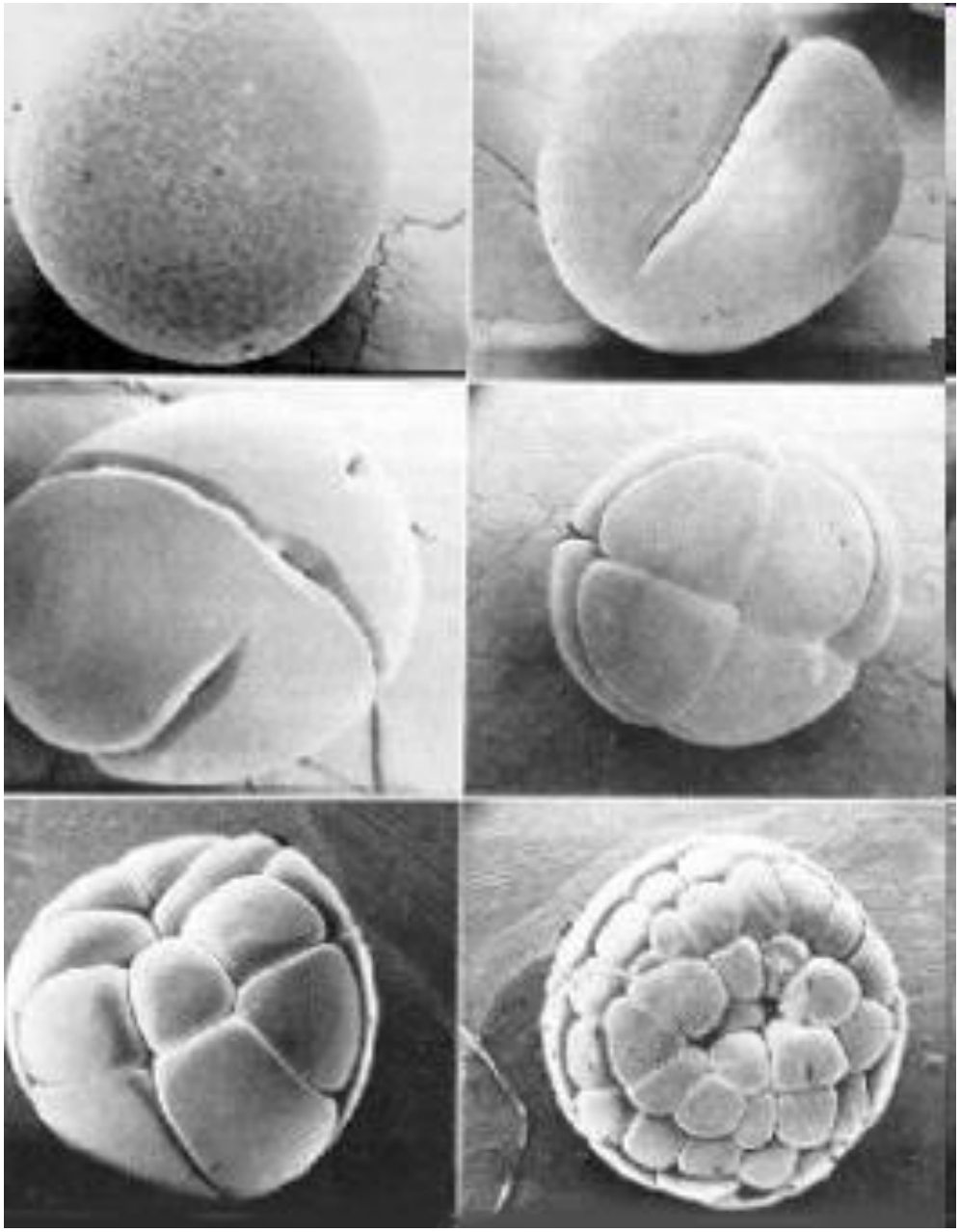
a) Unfertilised egg

b) Fertilised egg

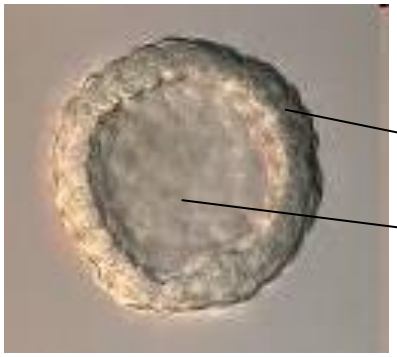




Primer body cavity



MORULA



BLASTULA

blastoderm

blastocoel

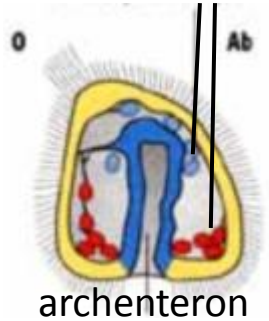
GASTRULLA

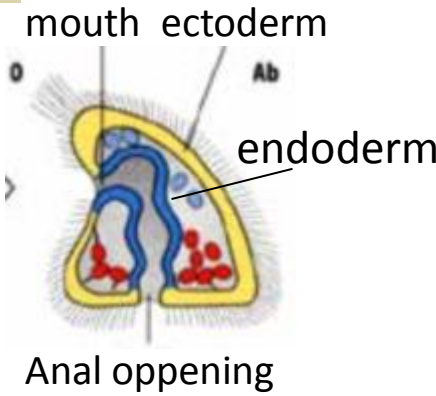
ectoderm

endoderm

archenteron

blastoporus





POSTEMBRYONIC development – from leaving the egg until sexual maturity :

I. **DIRECT**

- **Juvenile looks like parent**
- During postembryonic development it grows, matures sexually and achievies secondary sexual features

II. **INDIRECT**

- Out of egg **LARVAE – normally different from parent**
- Larvae passes through METAMORPHOSIS – similar to parents, normally sexually mature

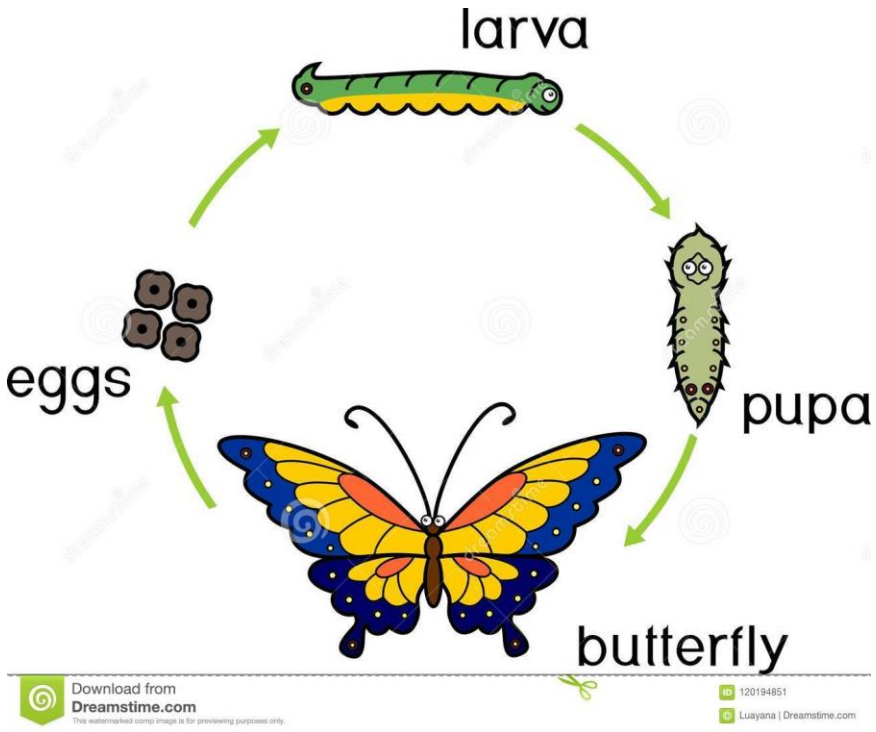
(e.g., tadpole ⇒ metamorphosis ⇒ adult frog)

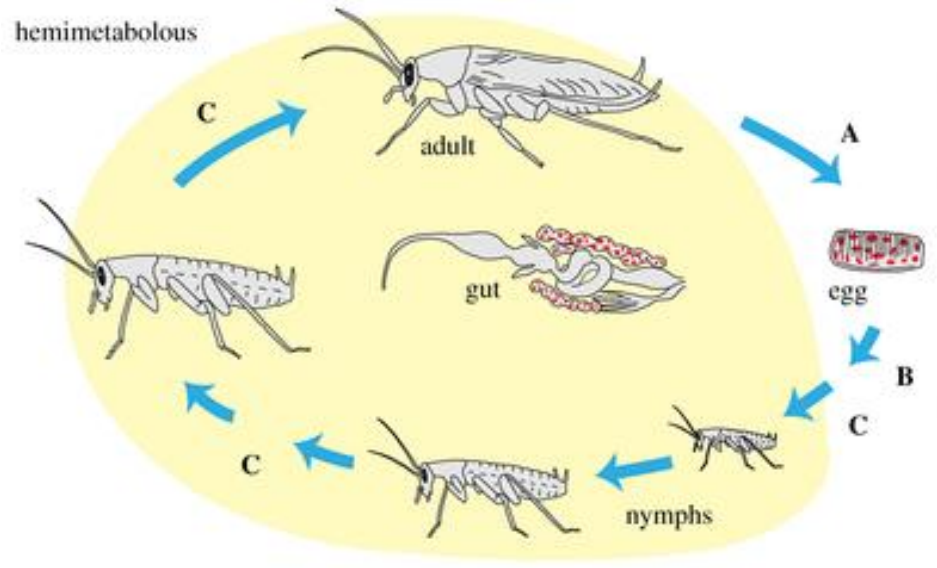
INSECTS

- **larvae** (eating stage) passes through **metamorphosis** to become **adult (imago)** (reproductive stage)
  - **metamorphosis**

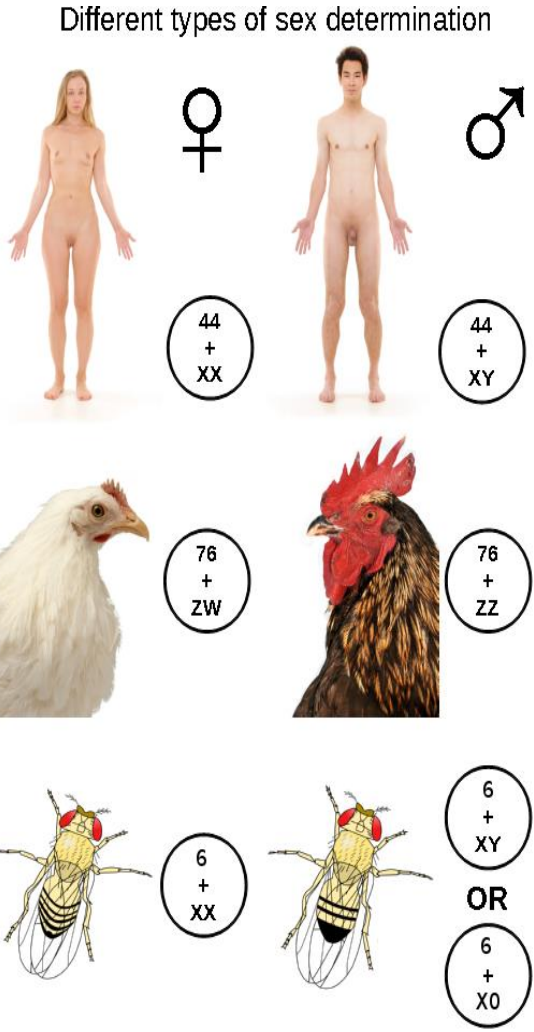
  Some tissues within larvae disappear – new ones appear (governed by hormones)

    - **Metamorphosis could be complete (includes stage of PUPA)=HOLOMETABOLOUS or incomplete (no PUPA)=HEMIMETABOLOUS**





Sex determination:



I genetic – sex is consequence of genotype

► diplogenetic

majority of taxa (including humans) – sex is determined in both haploid and diploid phase

sex is determined by **sex chromosomes X & Y**

*mainly male carries Y chromosome

(males 2n+XY & females 2n+XX)

* sometimes females posses two different chromosomes (e.g., 2n+ZW - birds, some reptiles, fish, some insects)

► haplogenetic

sex is visible only in gametes (haploid phase), while diploid phase is hermaphroditic – protists

II under influence of environment – nothing to do with genotype

FOOD – all individuals have the same genetic inheritance, but after fed by specific food – they develop sexual features

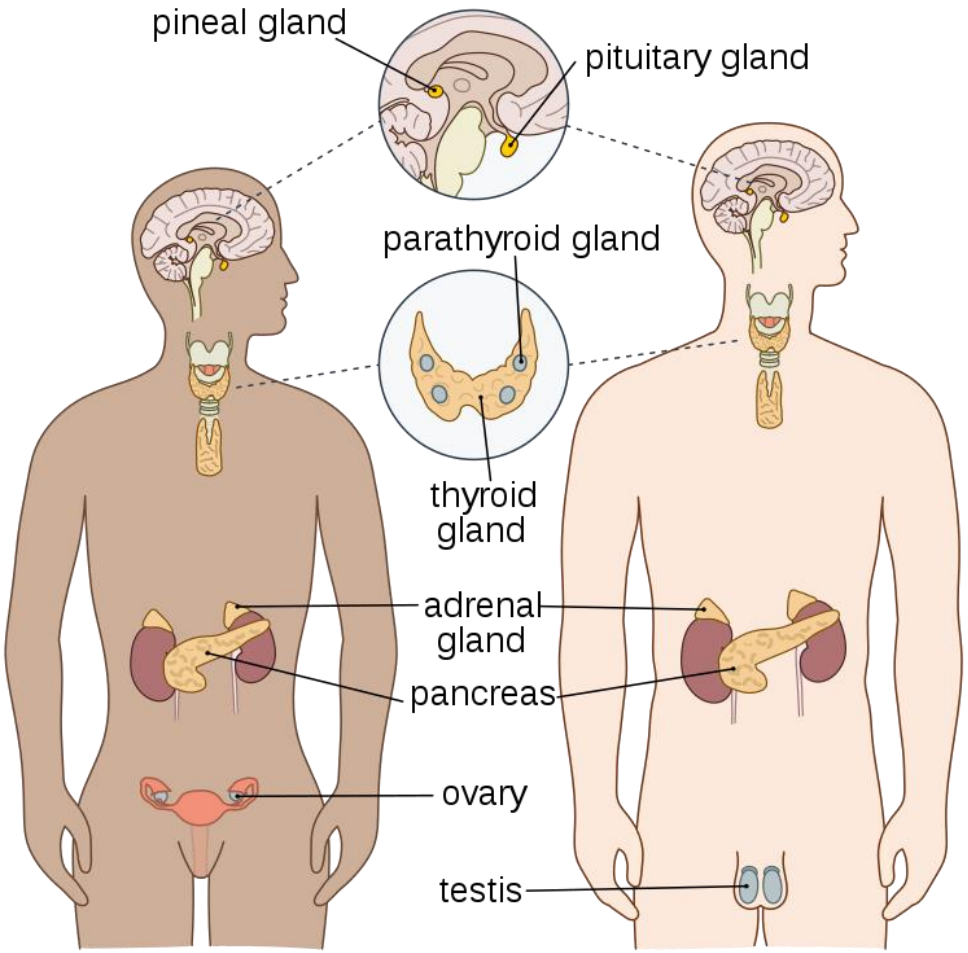
e.g. when queen dies (ants and termites) – each larvae (that would normally develop into worker of soldier) could develop into queen if fed by special food

TEMPERATURE AND UV

alligators – egg < 31,5°C - females,
32,5 - 33°C males,
cca 32°C 50:50

Hormonal system

- also called the **endocrine system**,
- a **network of glands and organs** in the body that **produces hormones**.
- several glands make hormones, including the pituitary gland, the pineal gland, the thyroid gland, the parathyroid glands, the adrenal glands, the pancreas, ovaries and testes.



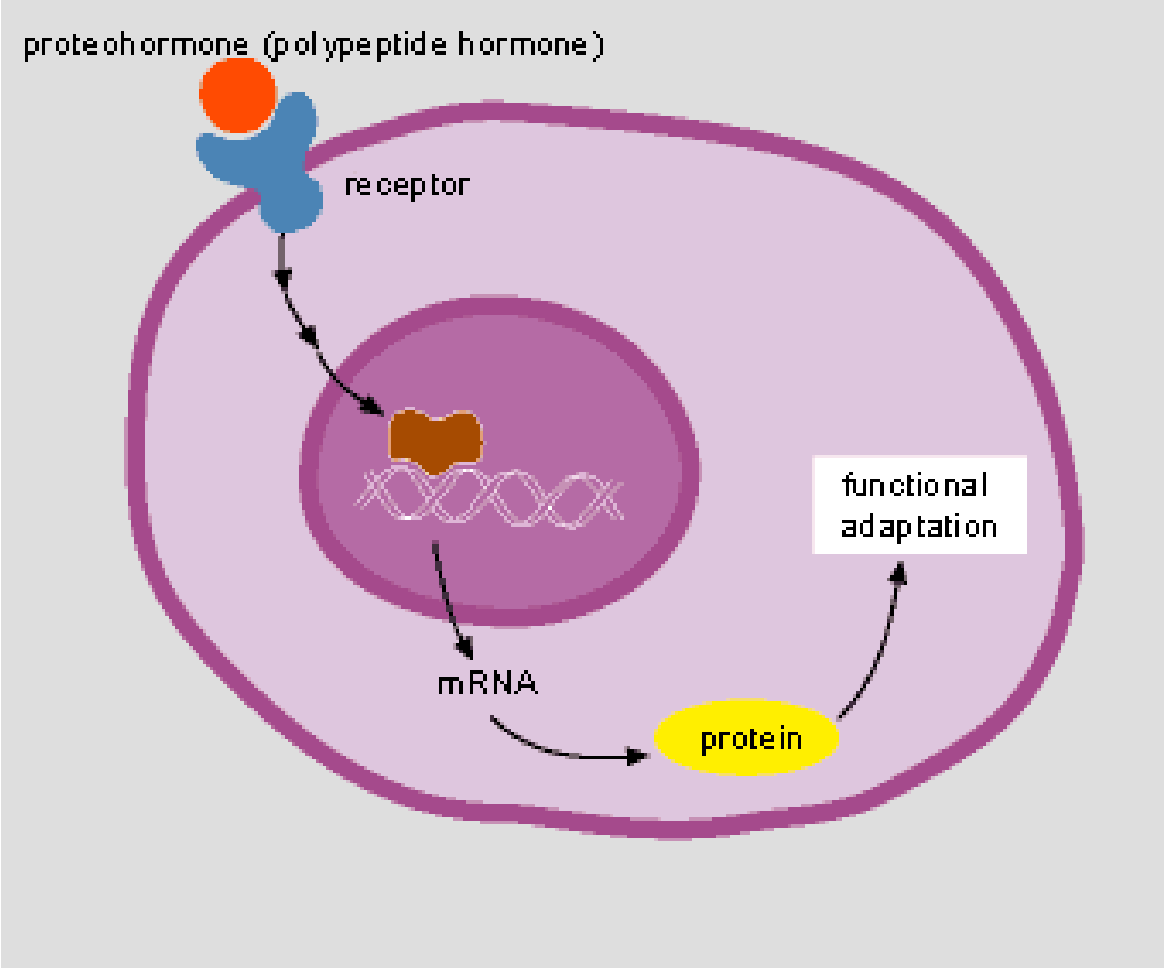
role: a **messenger system** comprising feedback loops of the hormones released by internal glands of an organism directly into the circulatory system, **regulating distant target organs and many functions in the body**.

According to chemical structure:

- steroids
- amines (from amino acids)
- proteohormones (polypeptides)

proteohormones & amines:

- hydro soluble, **can't pass** through cell membrane
- Receptor brings it in



steroids:

• lipo soluble, **can pass** through membrane

• connect to receptors in cytoplasm – into nucleus – transcription of genes

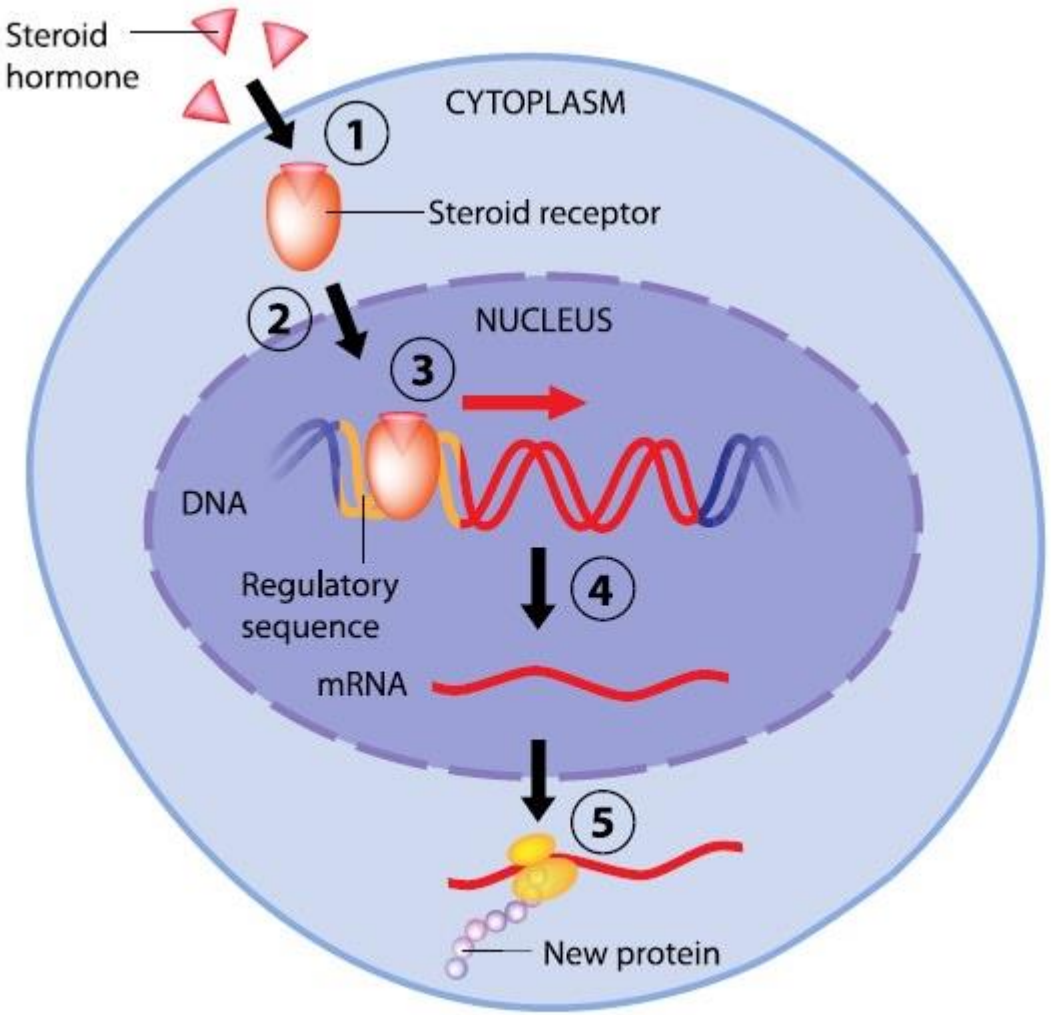
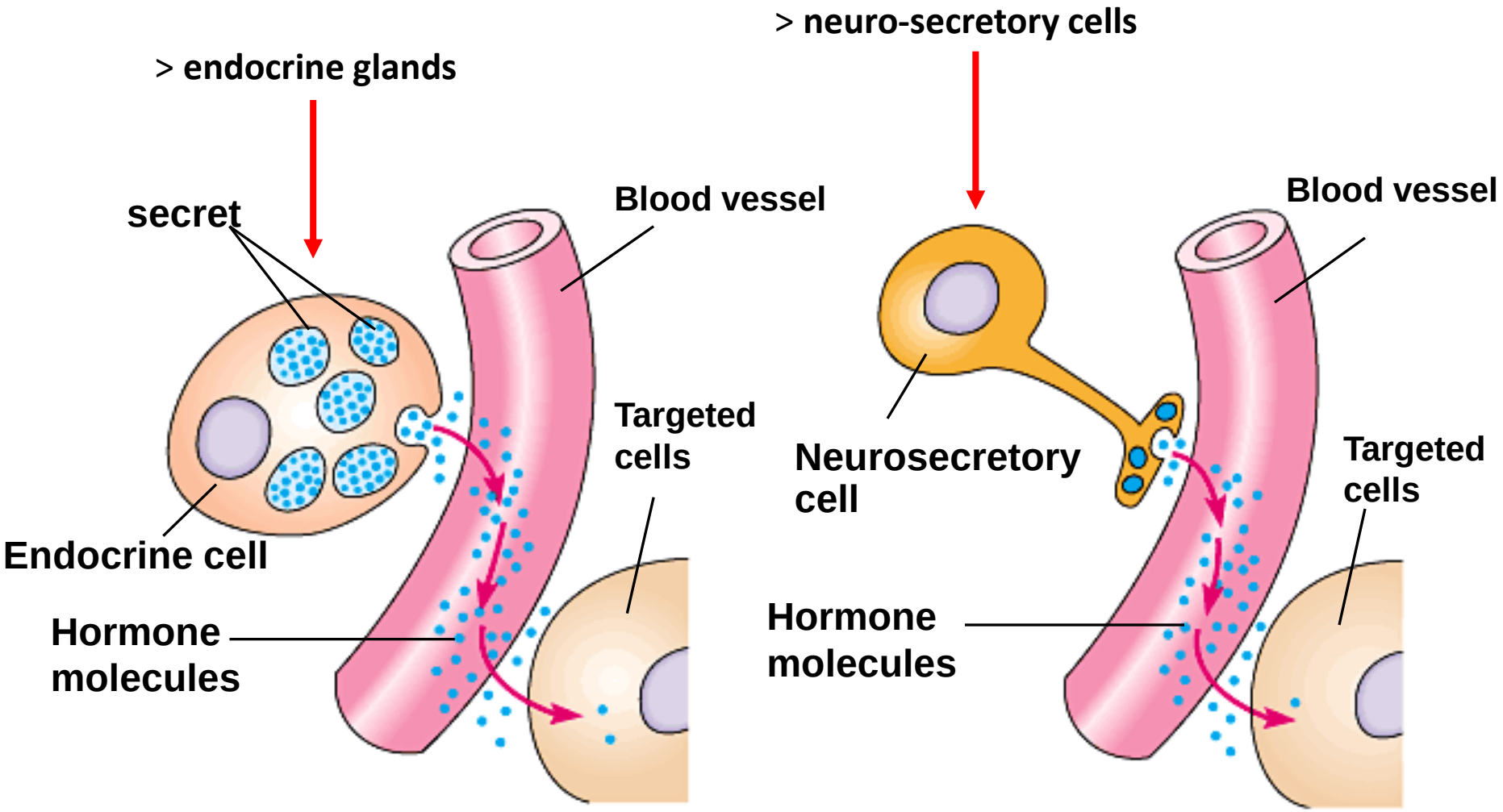


Figure 11.18: Mechanism of steroid hormone action

hormones are produced and send into blood by:



- **INVERTEBRATES** – neuro-secretion ***neuro-hormones***
- **VERTEBRATES** – mainly ***endocrine glands***

OVERVIEW

protists:
- no real hormones

invertebrates:

Cnidarians – neurosecretory cells (regeneration, budding, growing)

Platyhelminthes - neurosecretory cells (regeneration, reproduction)

Nematodes - neurosecretory cells (moulting)

Molluscs- neurosecretory cells (pigmentation of the skin) + **1. hormonal glands** (for ovary development)

Annelids - neurosecretory cells (regeneration, reproduction, growth)

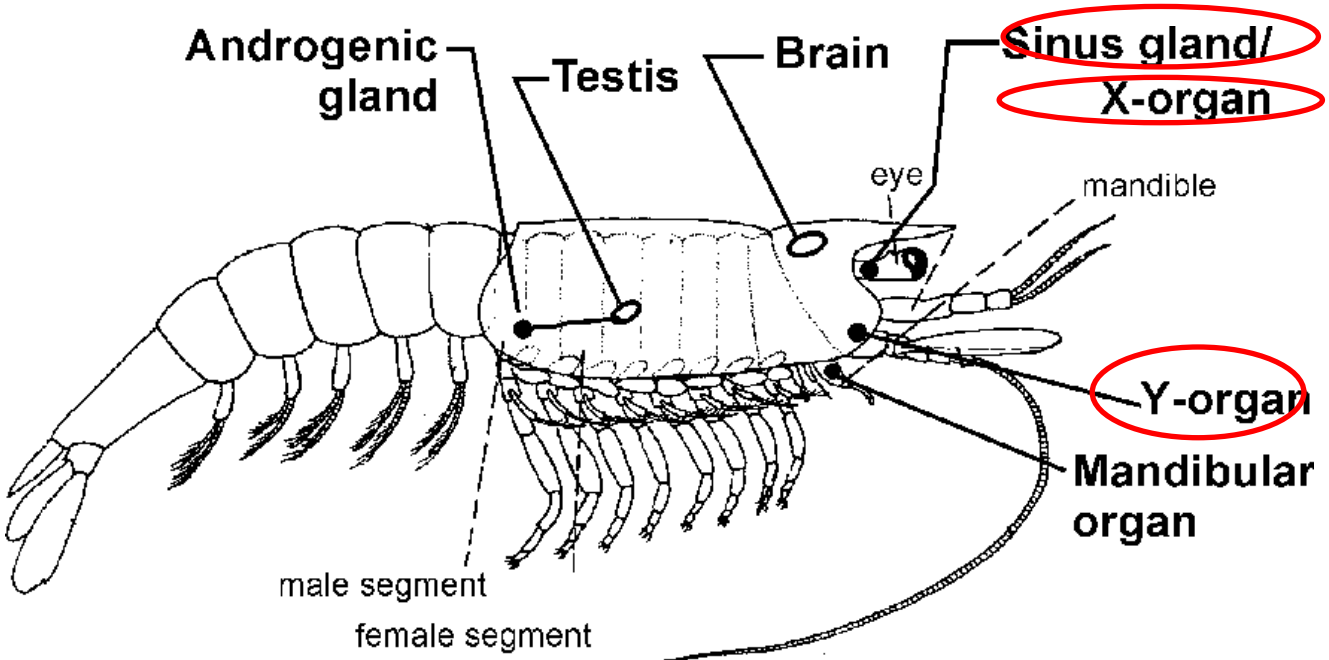
Crustaceans - 3 structures connected to hormonal :

Y-organ - hormone ***ekdison*** **stimulate moulting**

X-organ – hormone that **stops moulting**

sinus gland – not gland
- **store hormones from X-organ that inhibit** Y-organ activity

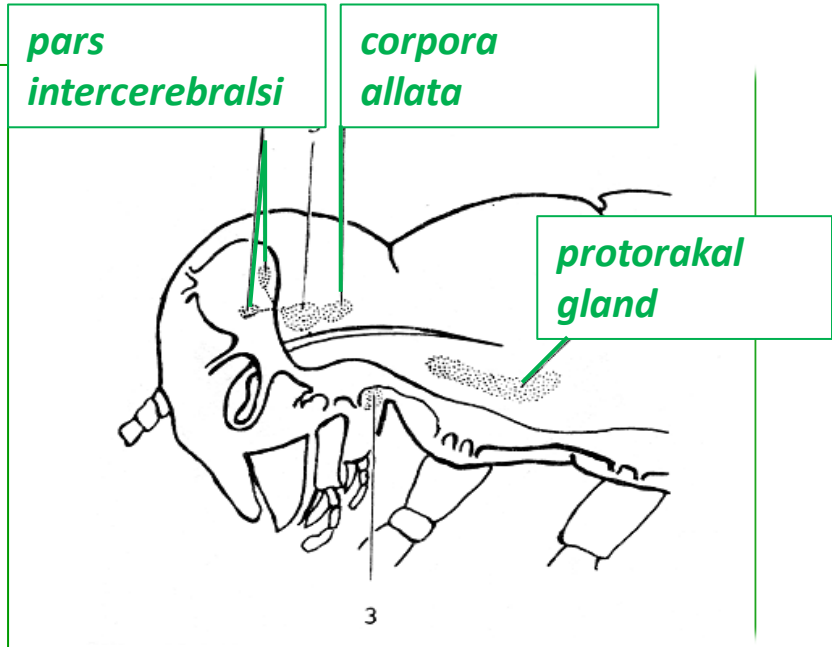
arthropods:

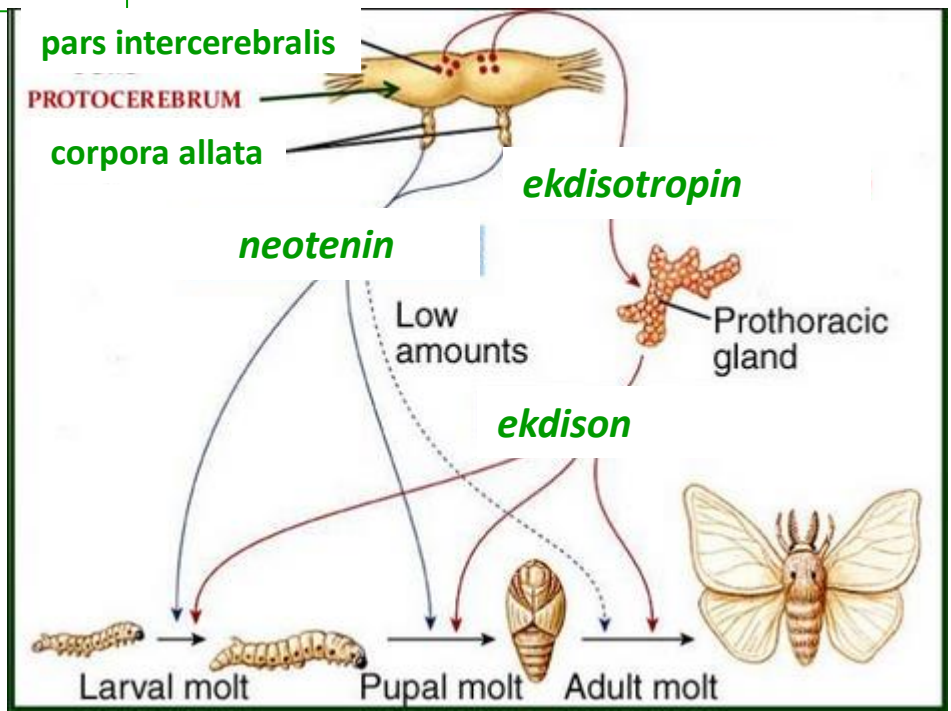


insects

- Moulting is regulated by brain cells (***pars intercerebralis***) - hormone (*ekdisotropin*) influences on **protorakal gland** that produce hormone ***ekdison*** (metamorphosis)

If with ekdison also juvenile hormone ***neotenin*** (produced by ***corpora allata***) = moulging, if there is a little amount neotenina = the last moulting)





vertebrates

endokrine glands make unique system

Thyroid gland - *gl. thyreoidea*

Parathyroid gland - *gl. parahyreoideae*

Thymus gland - *thymus*

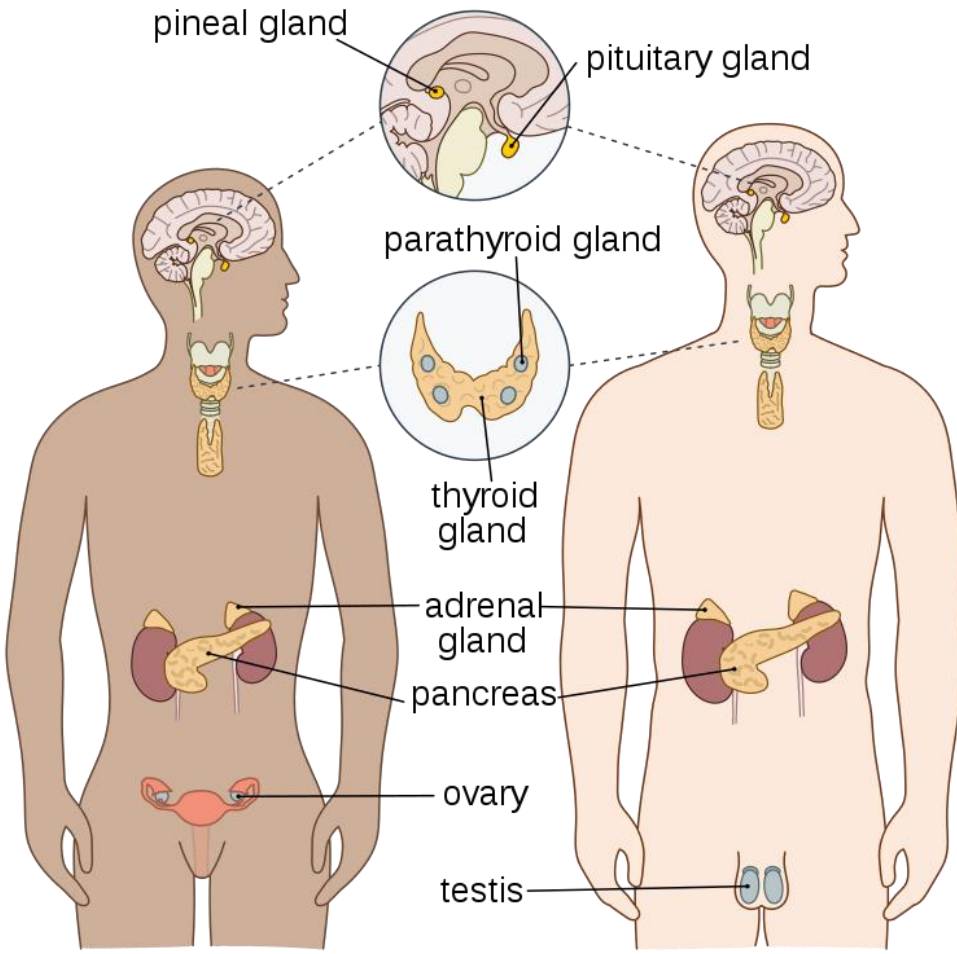
Hypophysis (pituitary gland) -*gl. pituitaris*

Epiphysis (pineal gland) - *gl. pinealis*

Adrenal gland- *gl. suprarenalis**

Pancreas - *pancreas*

Gondads (ovary, testis) - *testis*, *ovarium**

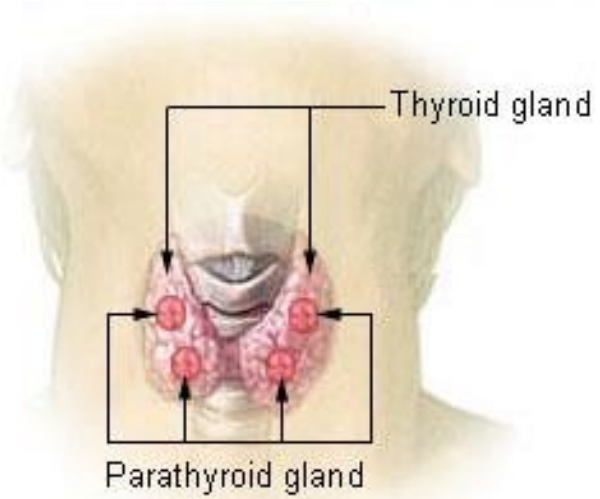


*steroid hormones, the rest are not steroid

➢**Thyroid gland** *glandula thyreoidea*

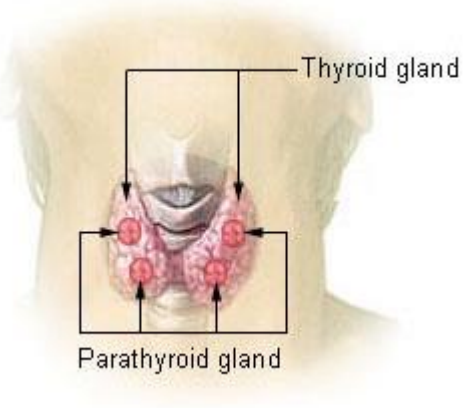
hormones: triiodothyronine (T3) and thyroxine (T4) and calcitonin

The thyroid gland is a vital hormone gland: It plays a major role in **the metabolism, growth and development of the human body, controlling heart, muscle and digestive function, brain development and bone maintenance**.
It helps to regulate many body functions by constantly releasing a steady amount of thyroid hormones into the bloodstream.



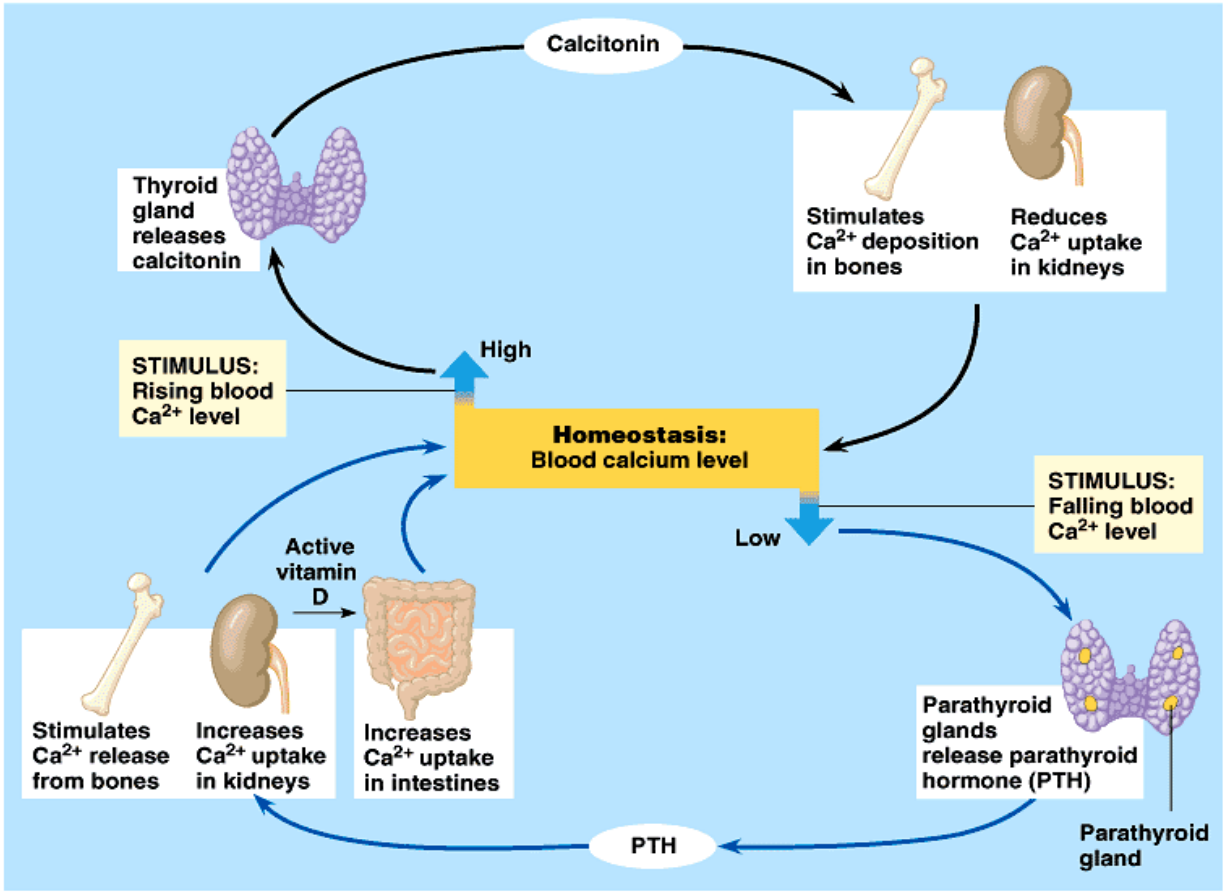
thyroxine (T4) – includes I_2 - human body requires 1 mg of it/day – no I_2 – Hypothyroidism – all kind of health problems

➢Parathyroid gland - gl. parahyreoideae



Together with **hormone calcitonin** it regulate metabolism of Ca in body

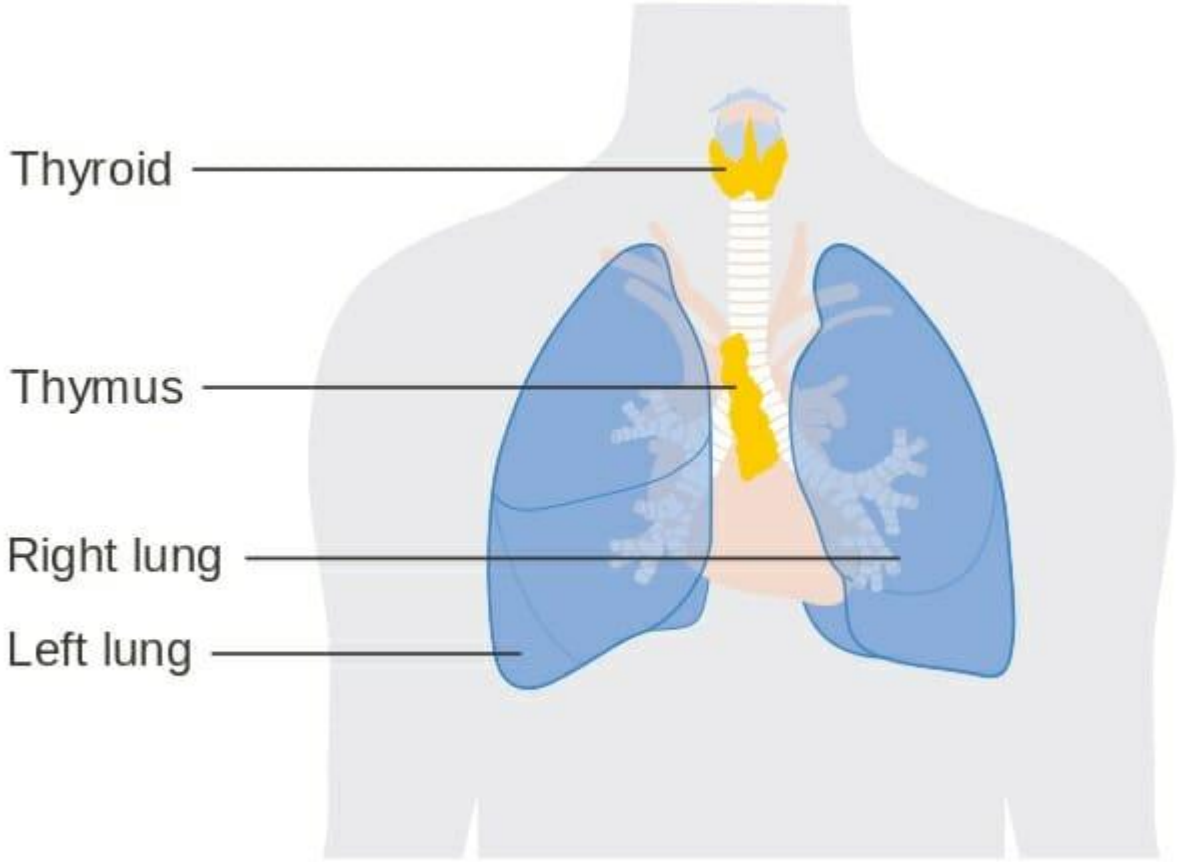
parathyroid hormone (PTH) – regulation of Ca and P in the blood



➢Thymus gland - thymus

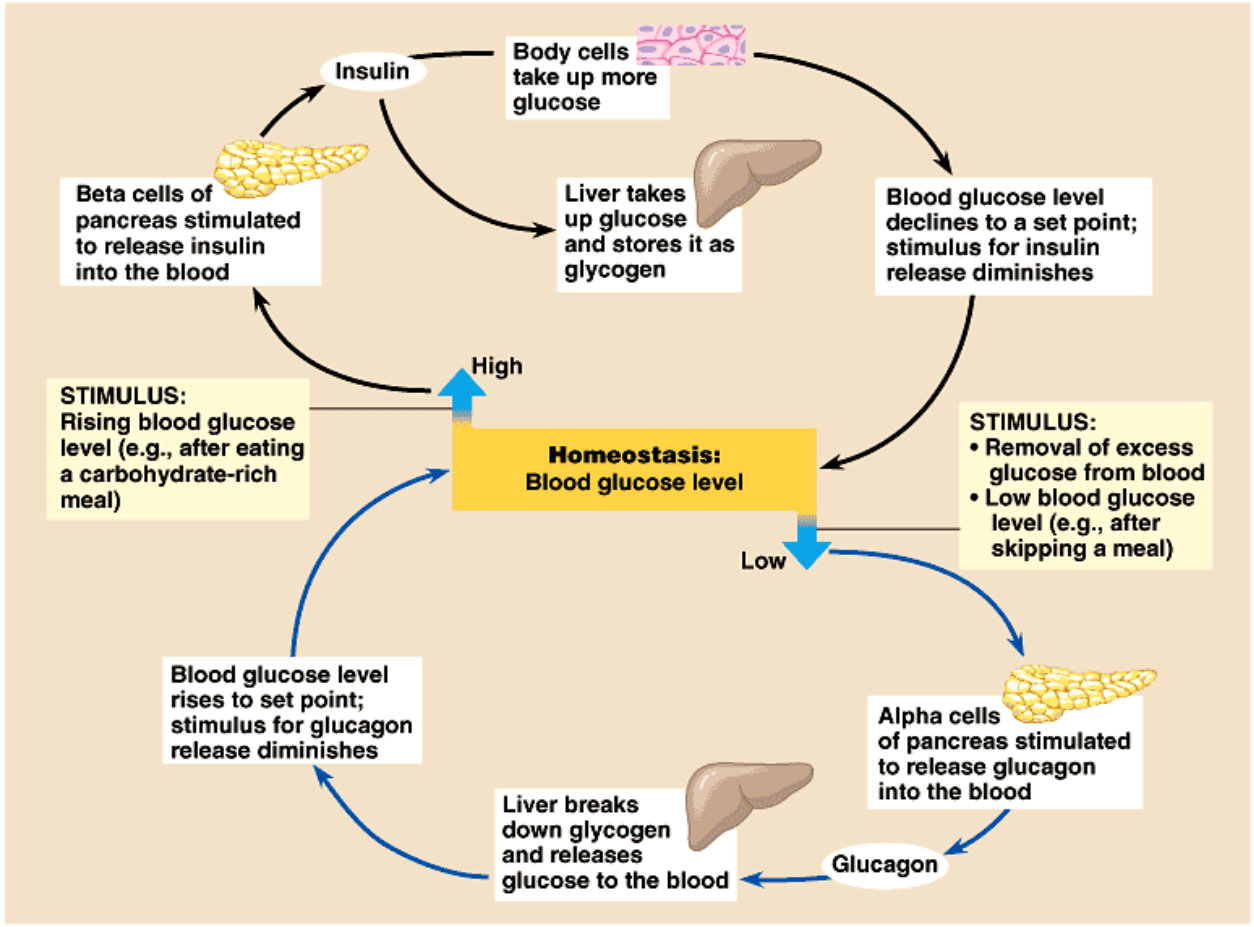
The biggest gland until puberty – then smaller and less important

It helps immuno-system to develop – production and maturation of lymphocytes (**T-*lymphocytes***), later lymphocytes are produced in spleen and lymph nodes

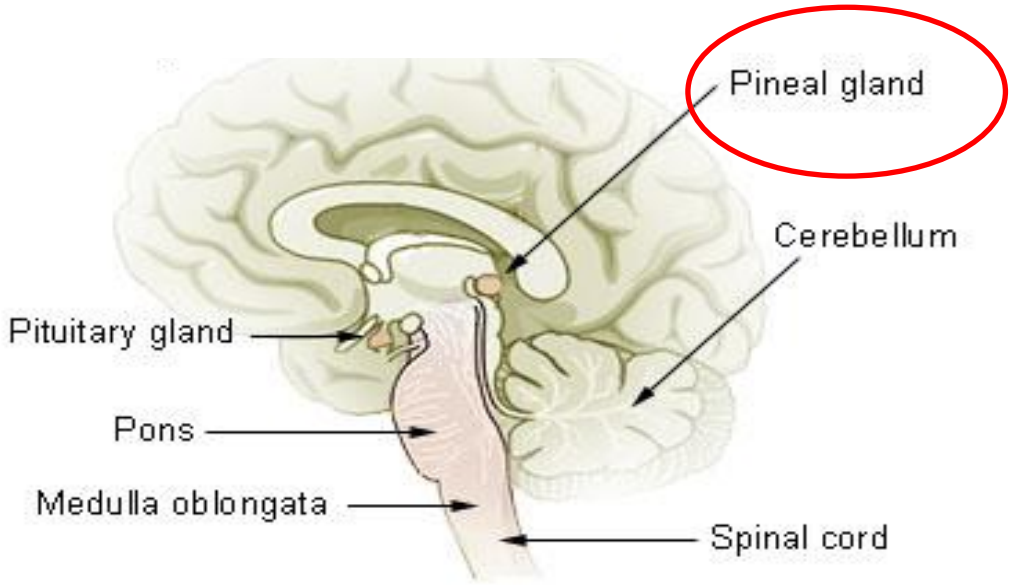


➢Pancreas - pancreas

insulin – indicates to cells to take glucose and store it as glycogen
glucagon – when no glucose in blood, it send signal that glycogen is broke into glucose



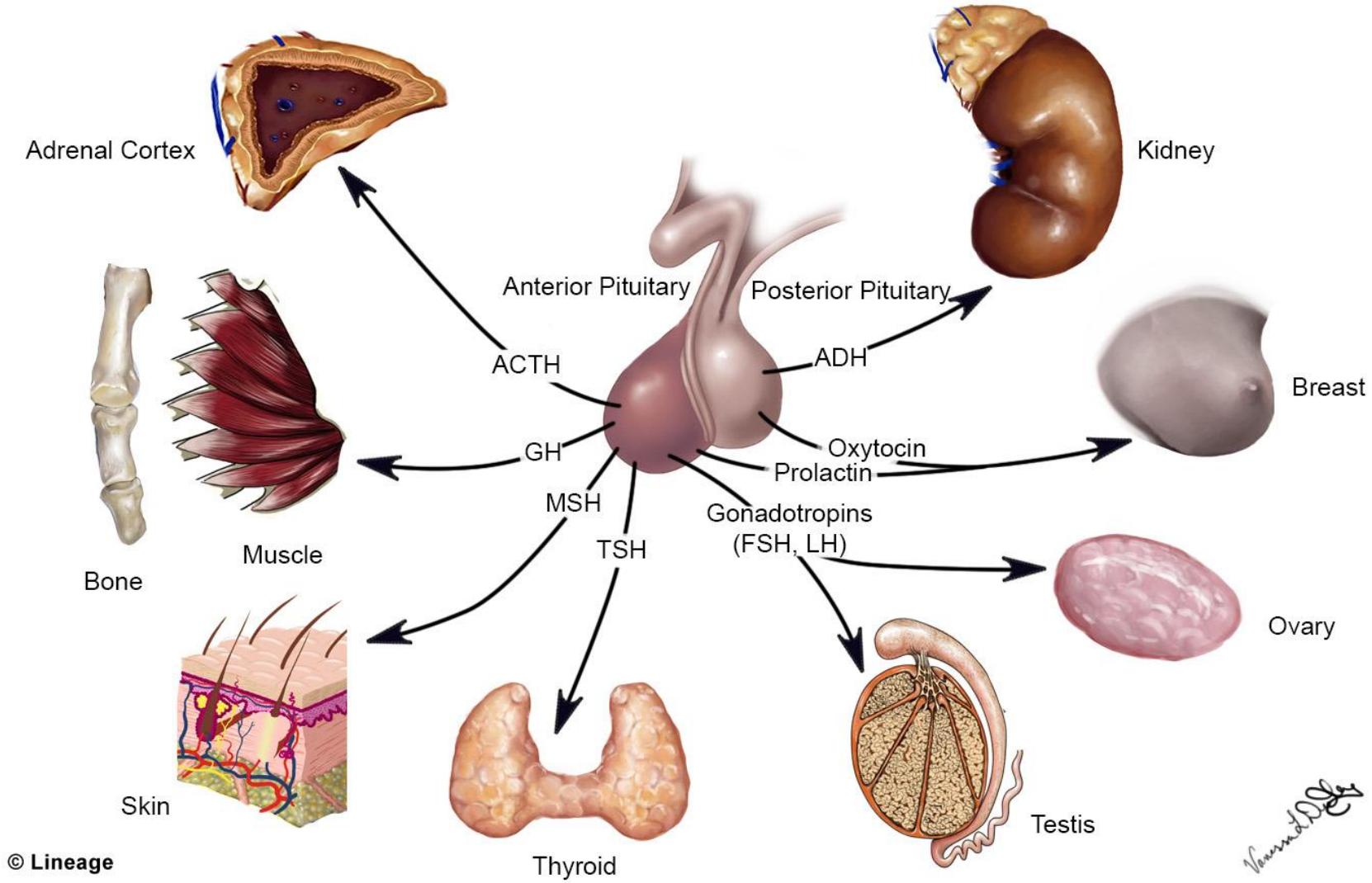
Epiphysis (pineal gland) - *gl. pinealis*



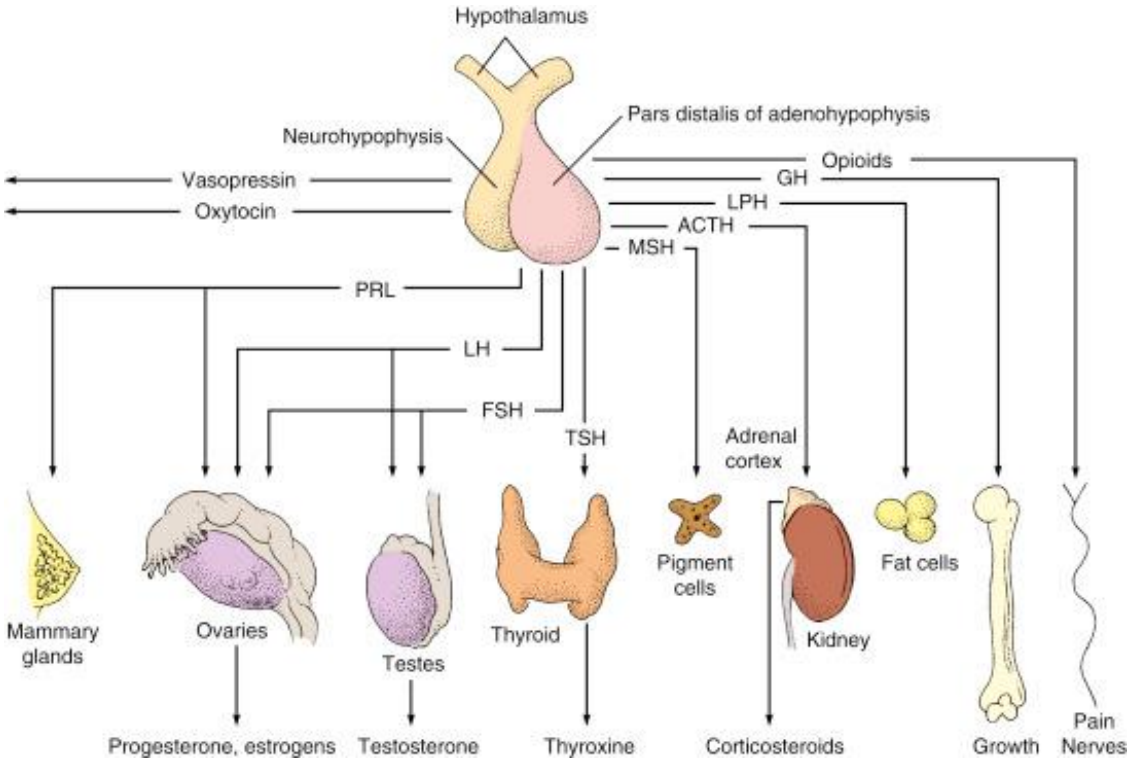
- The pineal gland is a **small, pea-shaped gland in the brain**.
- Its function isn't fully understood.
- Researchers do know that it produces and regulates some hormones, including **melatonin**.
- **Melatonin** is best known for the role it plays in regulating sleep patterns. Sleep patterns are also called circadian rhythms.

Hypophysis (pituitary gland) *-gl. pituitaris*

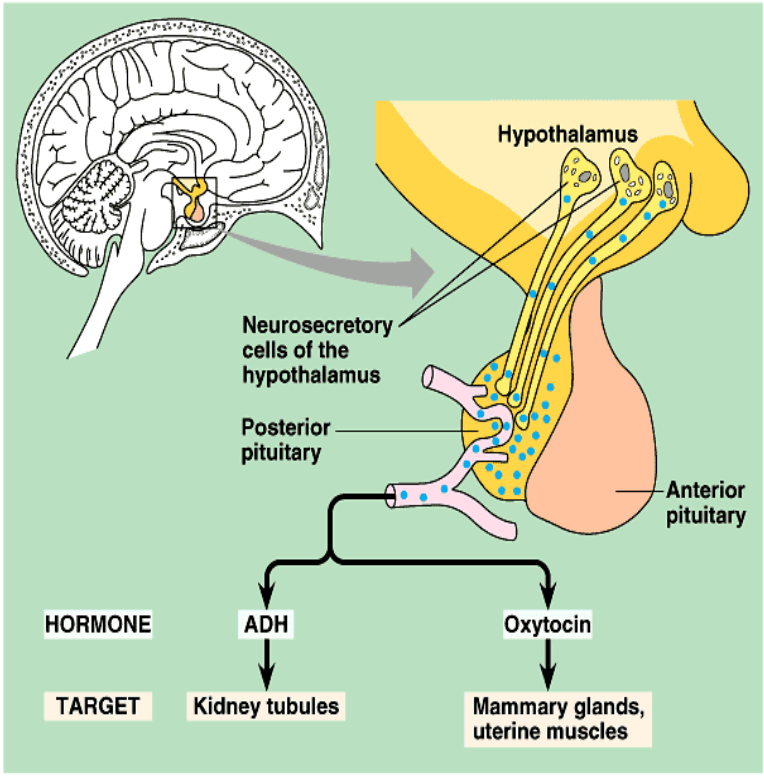
It is referred to as the body's '**master gland**' because it controls the activity of most other hormone-secreting glands.



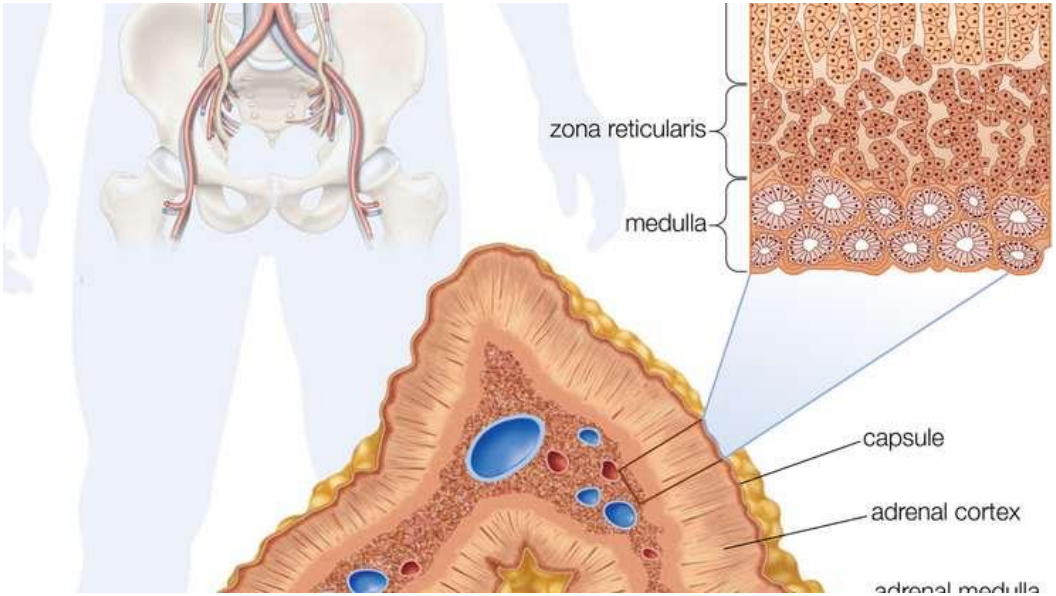
Adenohypophysis (anterior lobe)

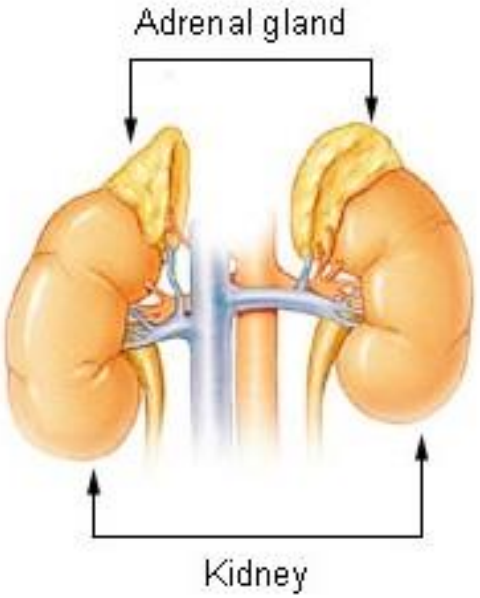


Neurohypohysis (posterior lobe)



➢**Adrenal gland** *glandula suprarenalis*





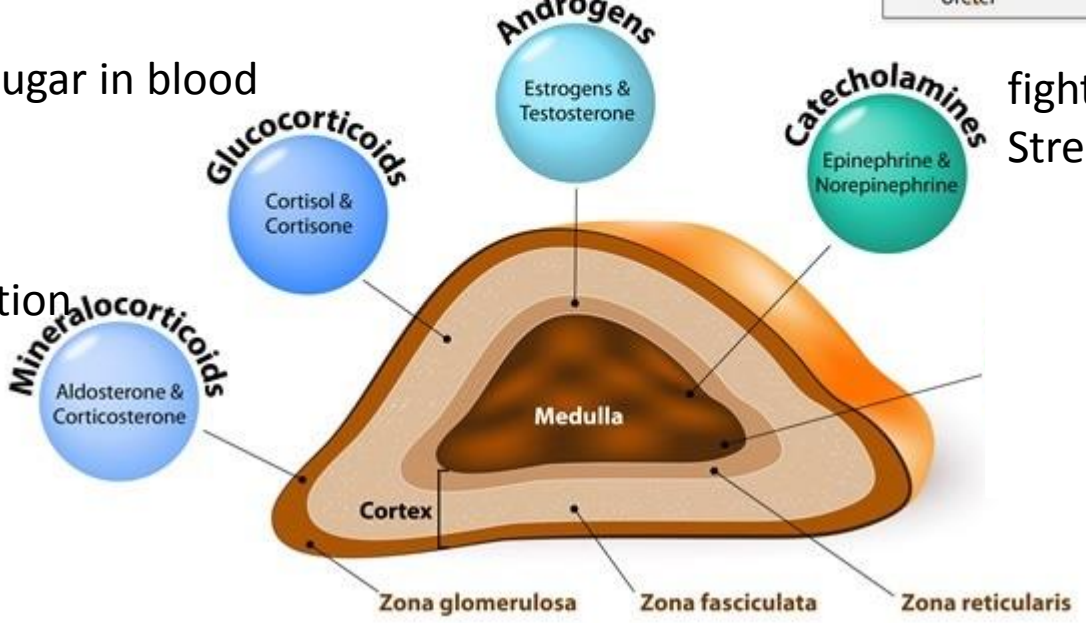
ADRENAL GLAND

(hormones)

Sugar in blood

fight or flight
Stress hormones

osmoregulation



➢Gonads

Gland	Principle hormones	Action
Male gonads The testes	Testosterone	Male secondary sexual characteristics
Female gonads The ovaries	Oestrogen (estrogen) Progesterone	• Female secondary sexual characteristics • Development of the endometrium • Maintenance of endometrium

That's all Girls