Development of endocrine system

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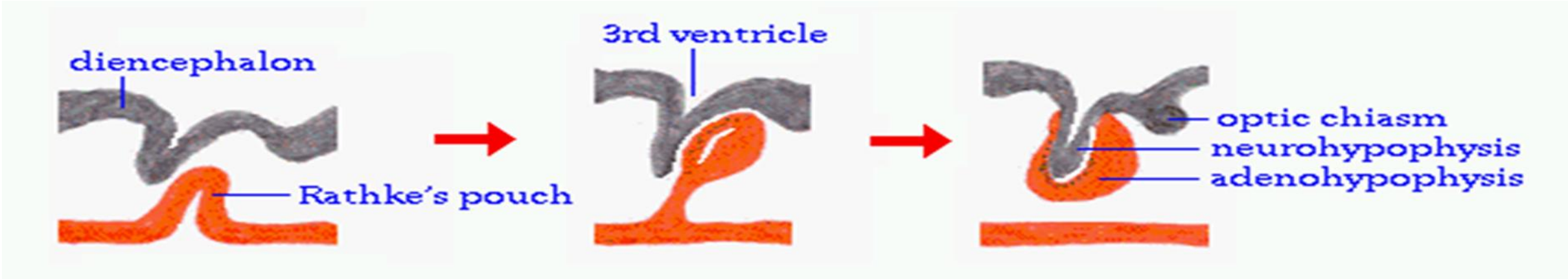
1-Development of the Pituitary Gland

- The hypophysis is an amalgam of two tissues. Early in gestation a bud of ectoderm grows upward from the roof of the mouth. This protrusion is called *Rathke's pouch* and will develop into the anterior pituitary or adenohypophysis.
- At the same time another bud of neuroectodermal tissue evaginates ventrally from the diencephalon of the developing brain. This extension of the ventral brain will become the posterior pituitary or neurohypophysis. Ultimately, the two tissues grow into one another and become tightly apposed, but their structure remains distinctly different, reflecting their differing embryological origins.



Development:

1- Buccal primordium:

*Rathke's pouch→ grows DORSALLY→ Rathke's stalk→ degenerates.

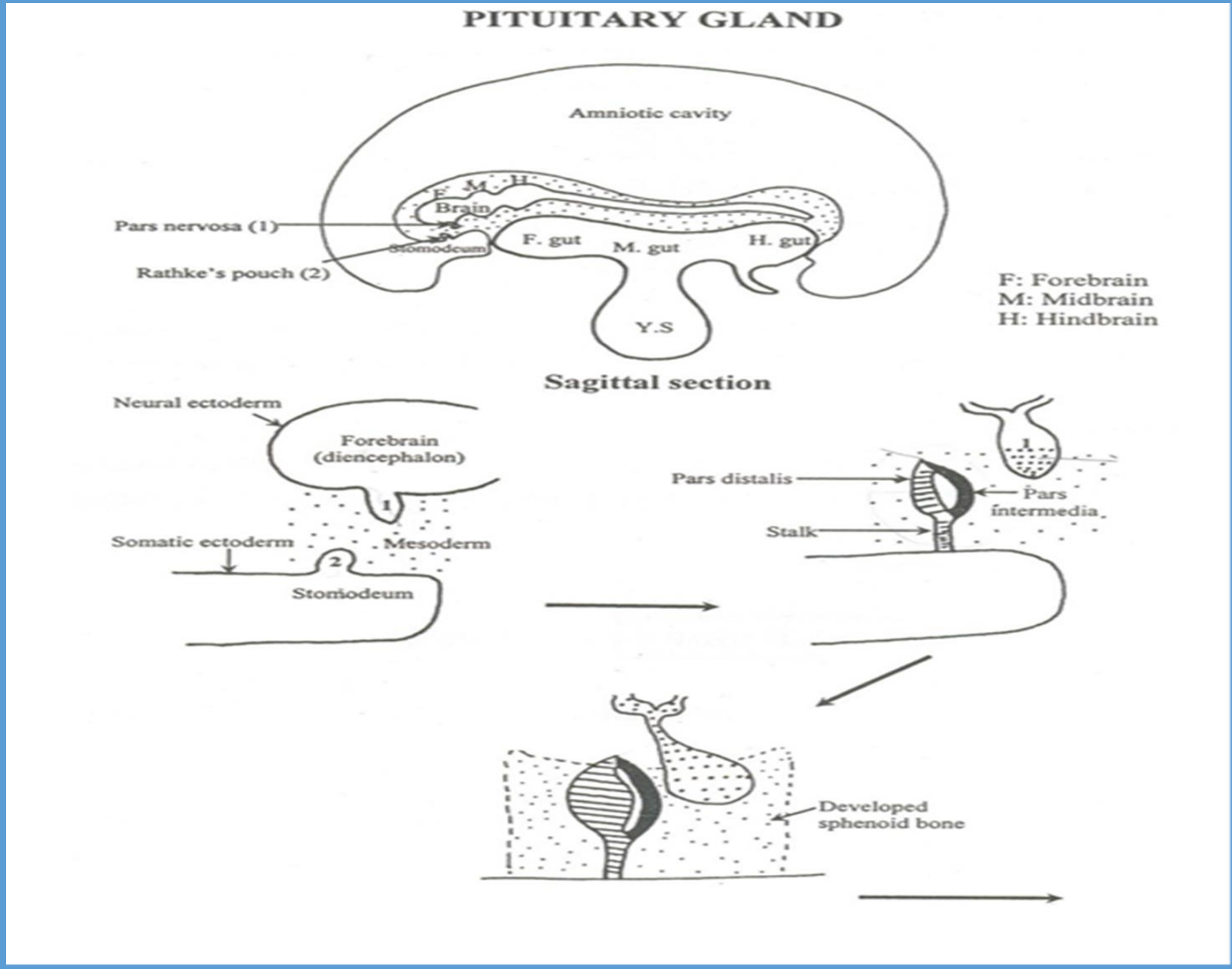
* The anterior wall of the pouch→ thickened→ pars distalis

the posterior wall → thinner → pars intermedia.

* Pars distalis→ pars tuberalis.

2- Cranial primordium:

*Pars nervosa grows caudally behind Rathke's pouch. Its stalk is called infundibulum.



Adenohypohysis:

Pars distalis - the largest section

Pars tuberalis - a collar of tissue that usually surrounds the infundibular stalk

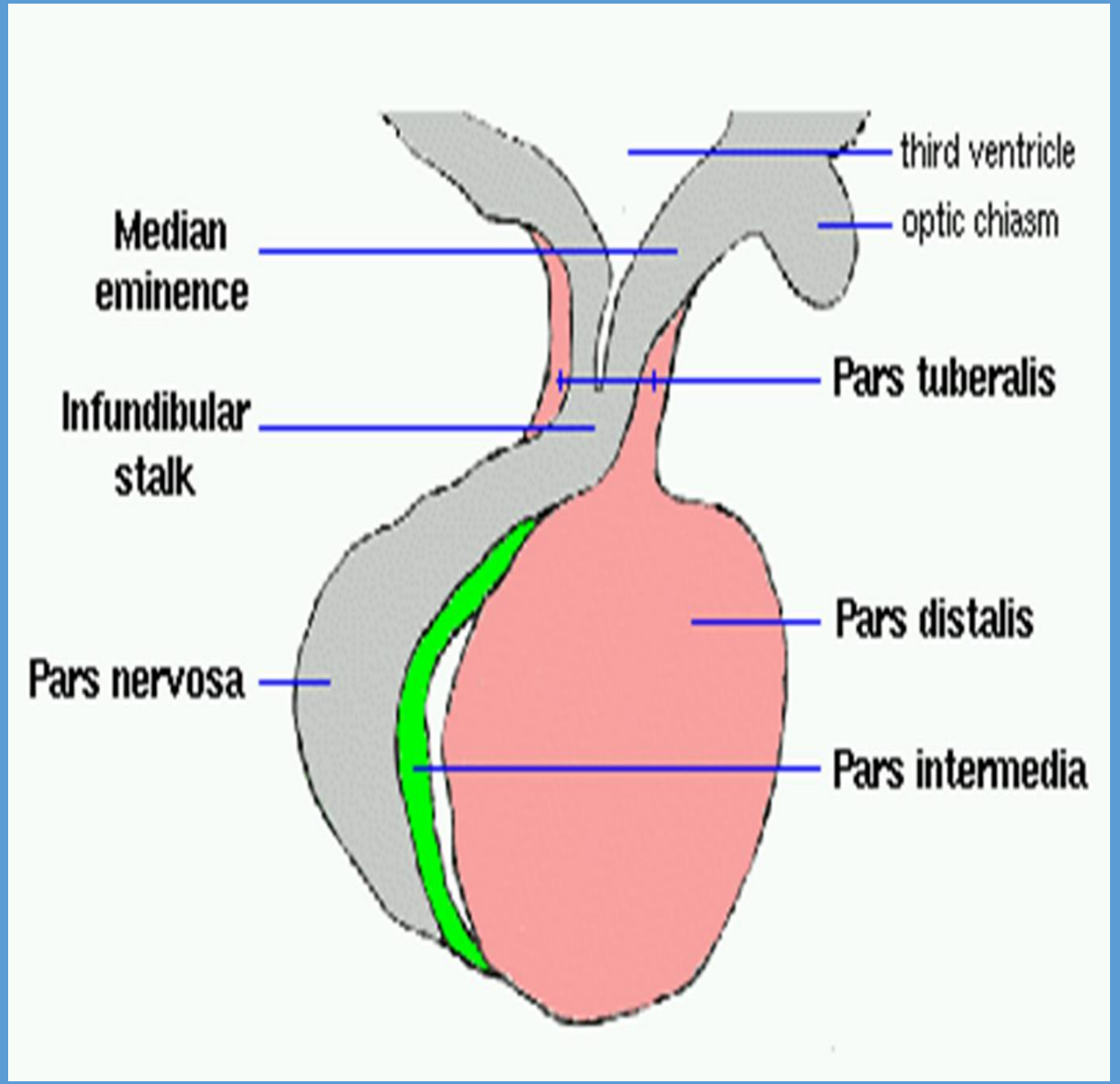
Pars intermedia - a narrow band that is usually separated from the pars distalis by a hypophyseal cleft

Neurohypohysis:

Pars nervosa - the bulk of the posterior pituitary

Median emminence - the upper section of the neurohypophysis above the pars tuberalis

Infundibular stalk - the "stem" that connects the pars nervosa to the base of the brain



Congenital anomalies:

1-Craniopharyngeal canal:

Due to failure of degeneration of the Rathk's stalk→ communication between the nasopharynx and hypophyseal fossa→ infection of the brain (fatal).

2- Pharyngeal pituitary gland:

Due to failure of ascend of buccal pituitary→present in the roof of nasopharynx→ may be removed during adenoidectomy.

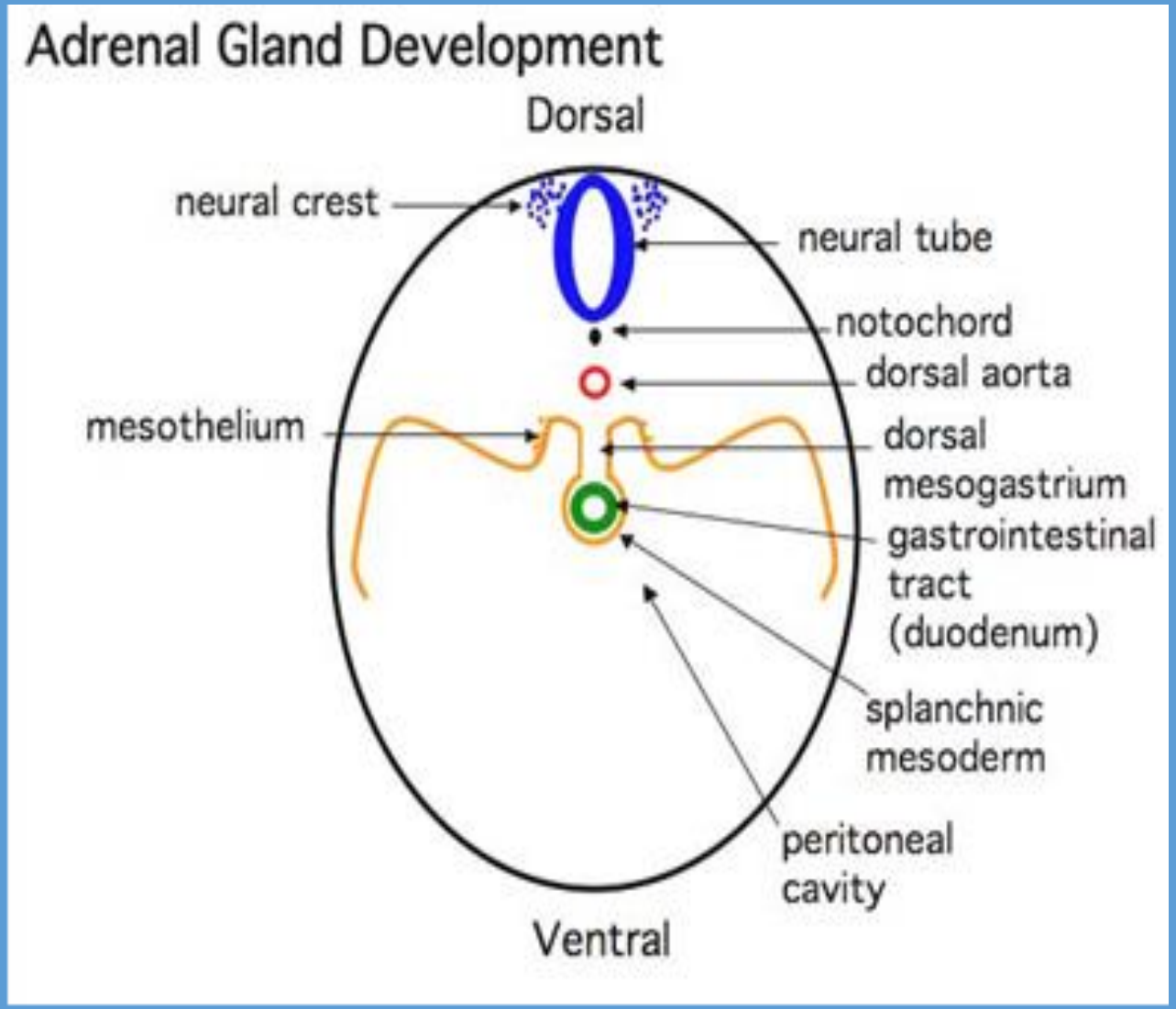
3- Agenesis of the gland

2-Development of suprarenal gland

Origin:

1- Cortex from coelomic epithelium (mesoderm).

2- Medulla from the neural crest (neuroectoderm).



Development:

Cortex:

1- Proliferation of coelomic epithelium → foetal (1ry cortex) → invaded by the medulla.

2- 1ry cortex proliferates→ 2ry cortex→ covers 1ry cortex.At the end of 1st year→ 1ry cortex degenerates, 2ry cortex persists.

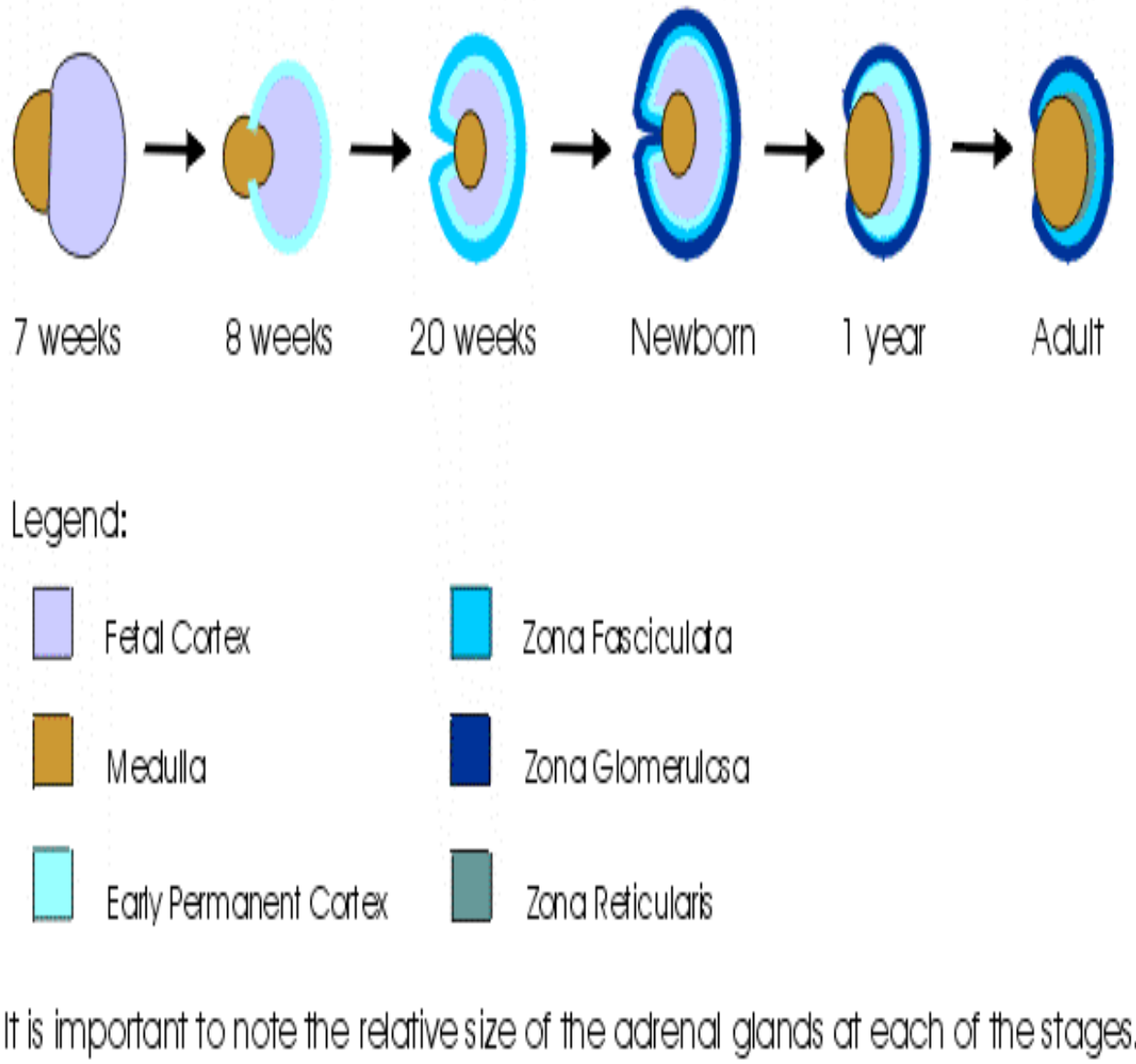
3-At 4th year→ 2ry cortex→ differentiates into:

Zona glomerulosa

Zona fasiculata

Zona reticularis

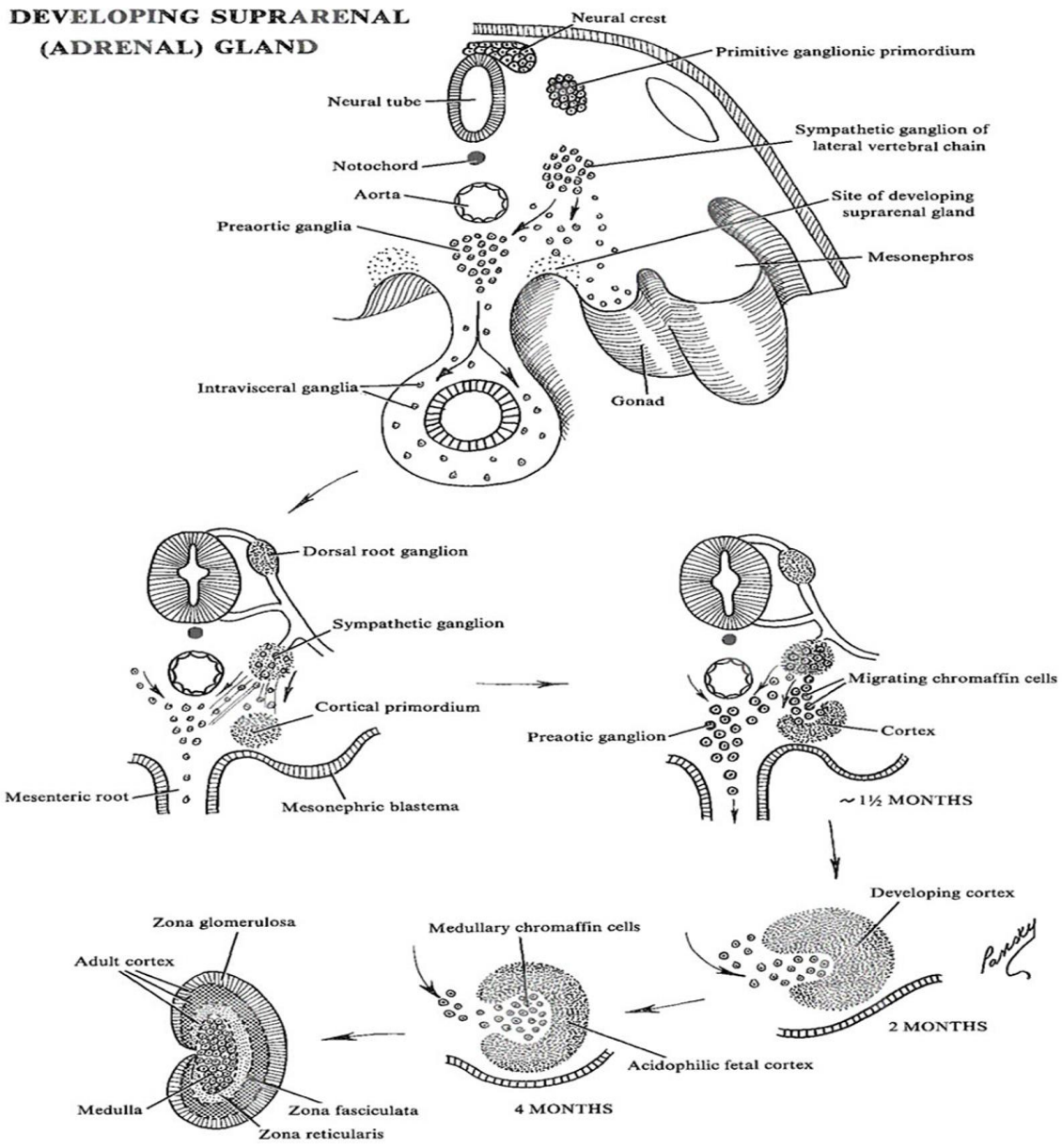
4- Mesoderm→ capsule, CT.



It is important to note the relative size of the adrenal glands at each of the stages.

- **Medulla:**

• Neural crest → neuroectodermal cells migrate → invade the 1ry cortex → give suprarenal medulla



Congenital anomalies:

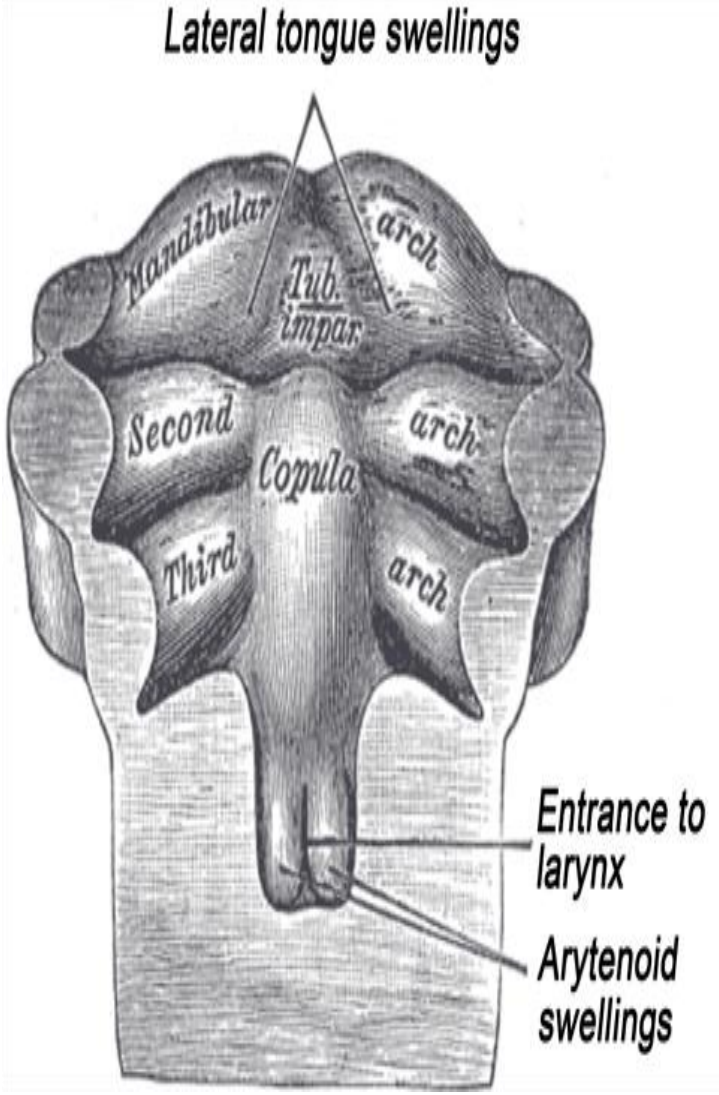
1- Ectopic suprarenal gland:
It may be found under the capsule of kidney.
2- Accessory medullary tissues.
Sympathetic ganglion → neuroectodermal cells→ beside the abdominal aorta or the sympathetic trunk.
3- Accessory cortical tissue:
Around the suprarenal gland
In broad ligament of uterus
In gastrosplenic ligament
4- Agenesis or hypoplasia.

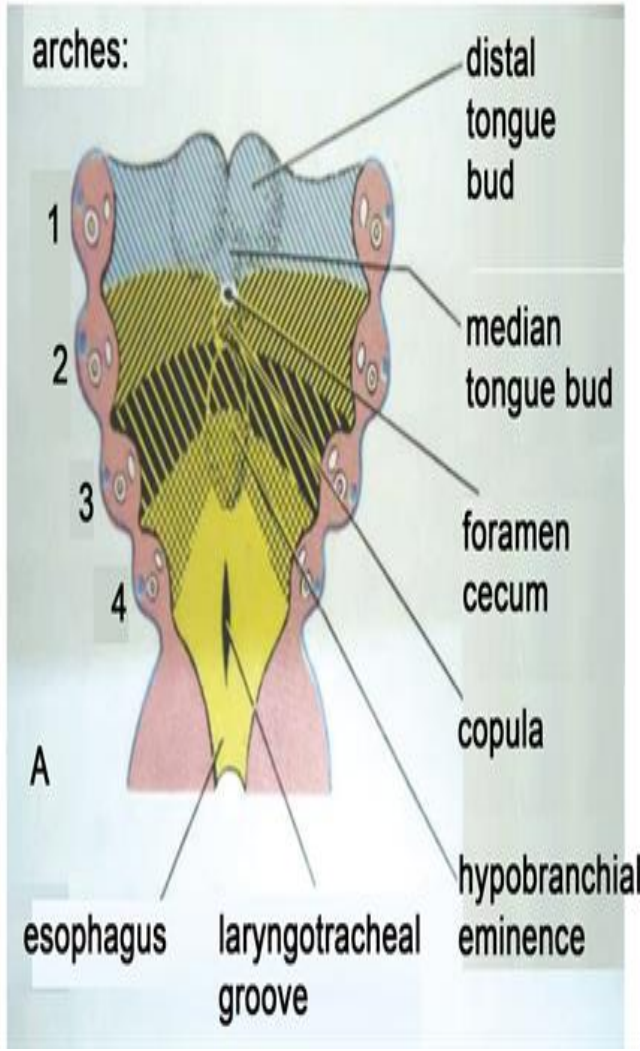
Hirsutism: It develop because adrenal glands make too much cortisol, or it can occur **Congenital adrenal hyperplasia.** This inherited condition is characterized by abnormal production of steroid hormones, including cortisol and androgen, by your adrenal glands.

Development of thyroid gland

- **Origin**

Thyroid bud develops as an endodermal diverticulum from the floor of the pharynx opposite the first pouch between tuberculum impar and the copula of His.





Development

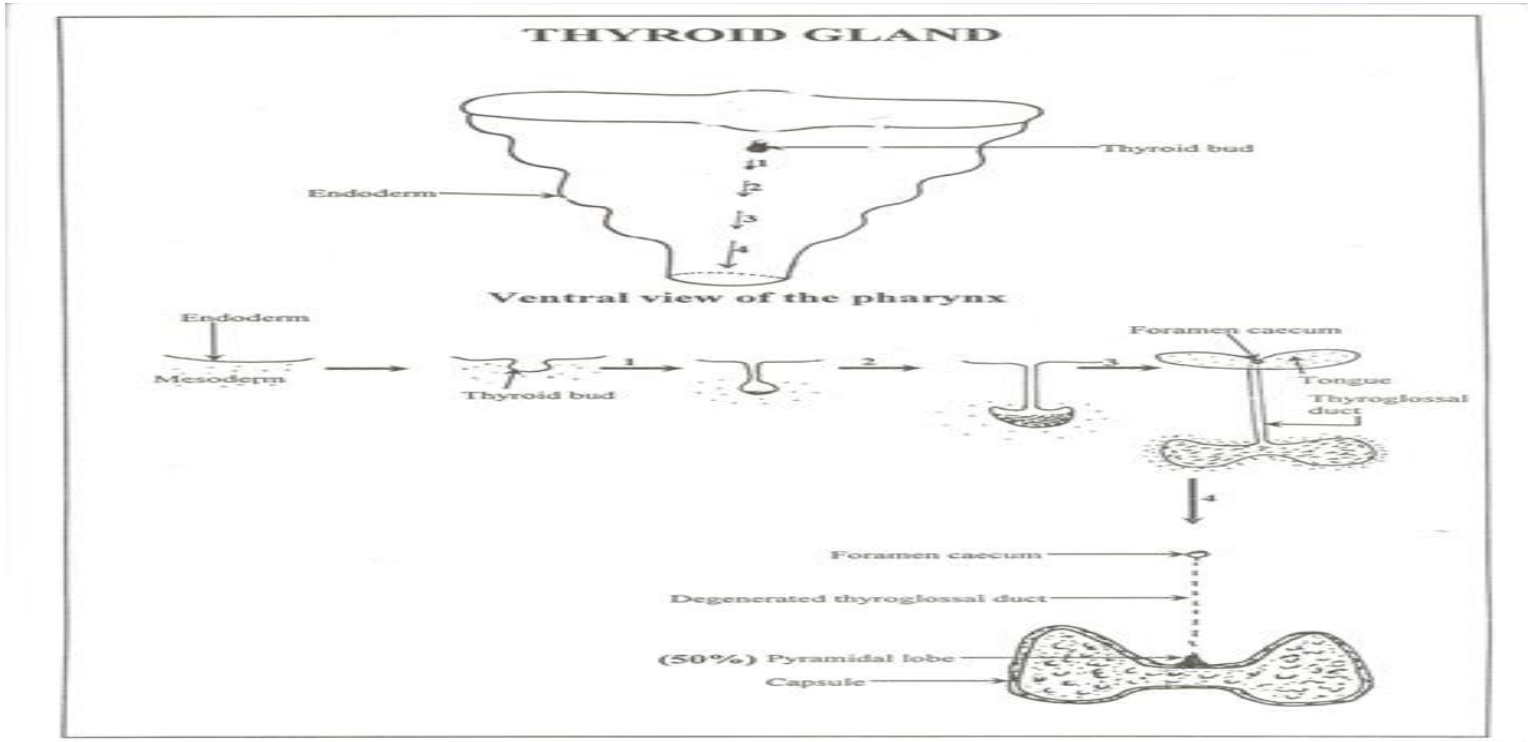
Blind end of thyroid bud→ dilates→ descend caudally to the level of ultimobranchial body (4th pouch) which prevents its further descend in the thorax.

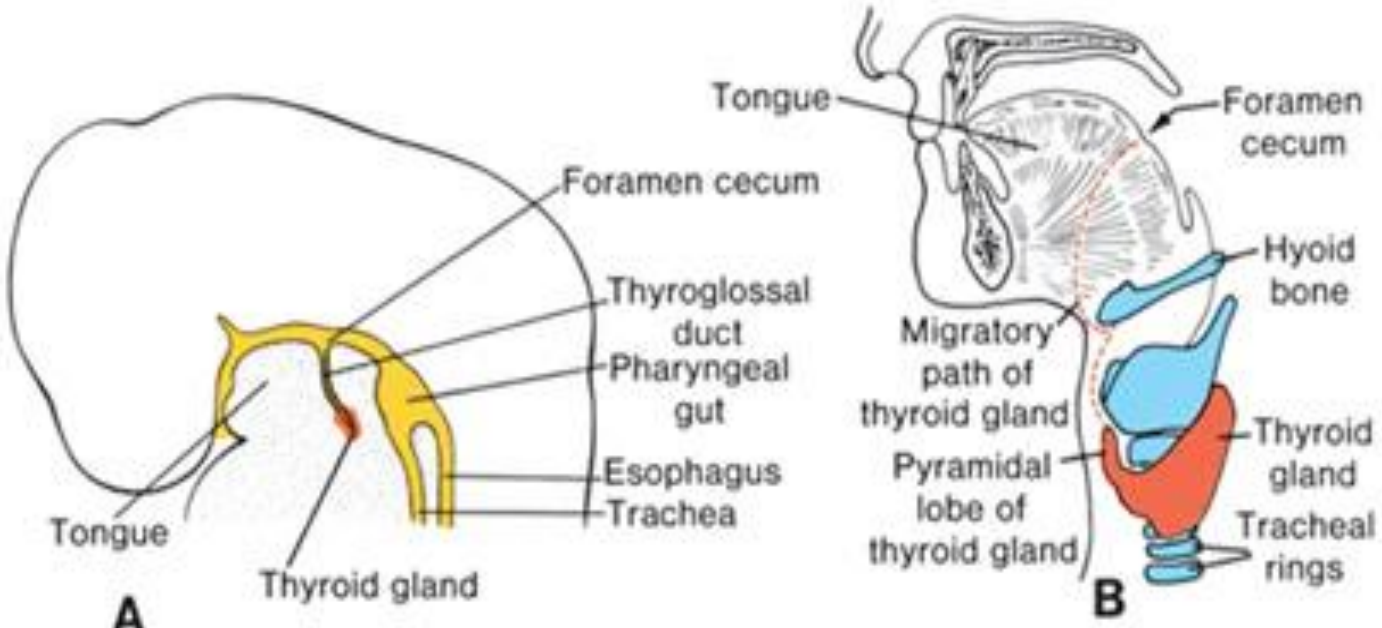
The hollow distal blind end→ solid flask shaped→ solid crescentic→ solid bilobed.

Endodermal cells of thyroid bud→ thyroid follicles (thyroxine).

Ultimobranchial body→ parafollicular cells (c- cells) → calcitonin.

Proximal part of the bud→ narrow→ stalk attached to the tongue(thyroglossal duct→ degenerate except at foramen caecum in the tongue.





Congenital anomalies of thyroid gland

1- Persistent thyroglossal duct:

a- Accessory thyroid tissue formed from remnants of the duct.

b- Thyroglossal cyst lies inferior to hyoid bone at the midline of the neck (movable with deglutition & painless).

c- Thyroglossal fistula: formed after rupture of the cyst.

2- Ectopic thyroid gland:

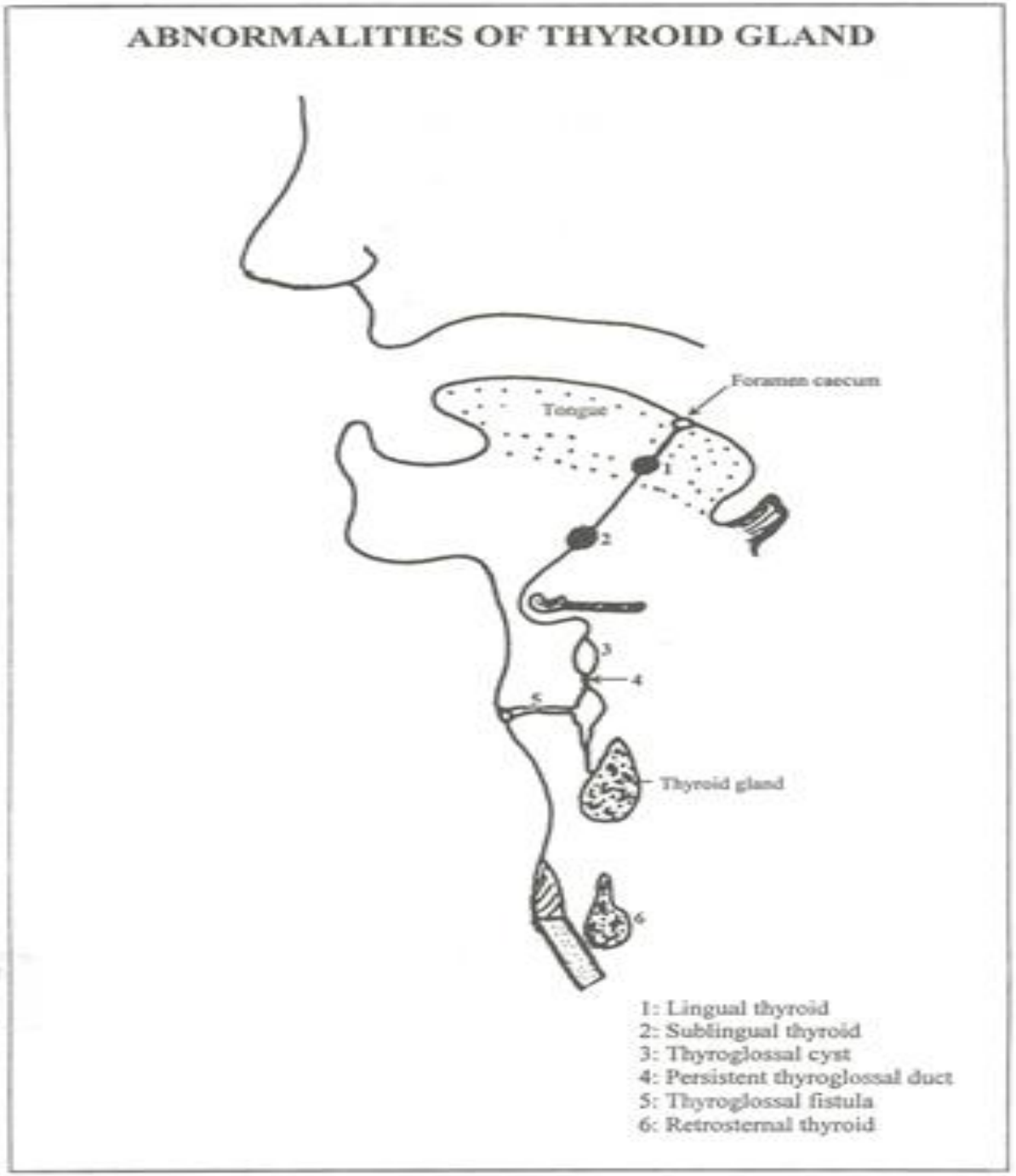
a- Lingual & sublingual thyroid due to incomplete descend→ development inside or under the tongue.

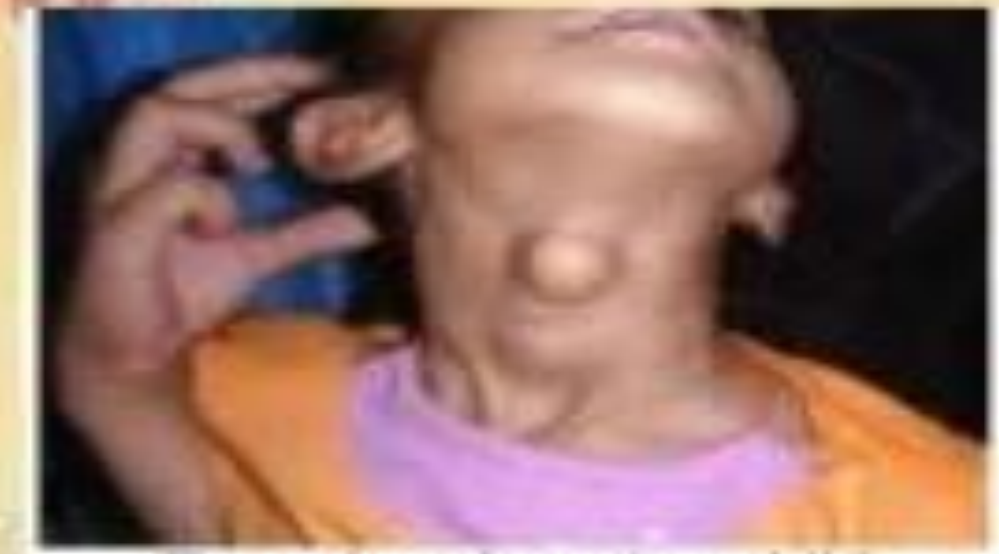
b- Retrosternal thyroid: due to excessive descend.

3- Agenesis: due to failure of growth→ critinism.

4- Superficial thyroid: It lies superficial to infrahyoid muscles.

N.B.: In 50% part of the duct persists attached to the isthmus→ pyramidal lobe.

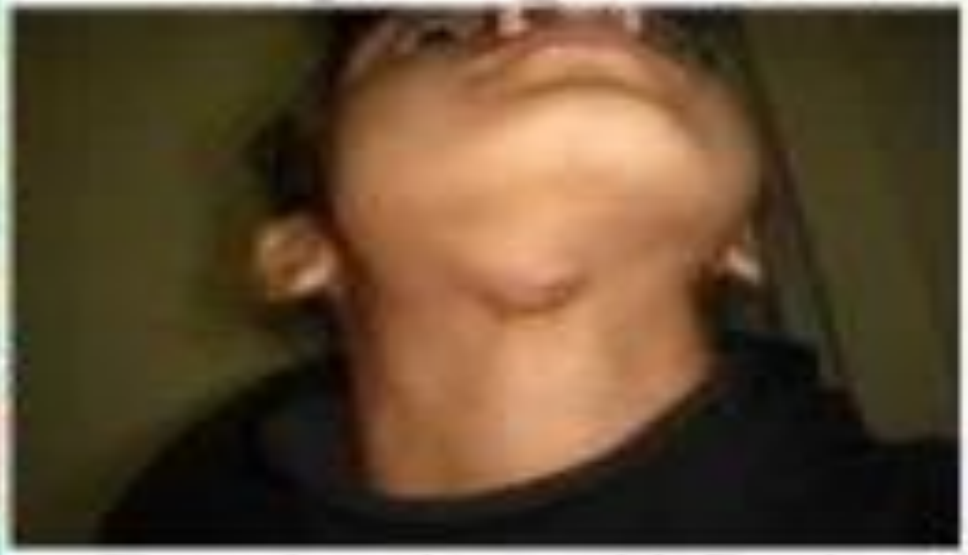




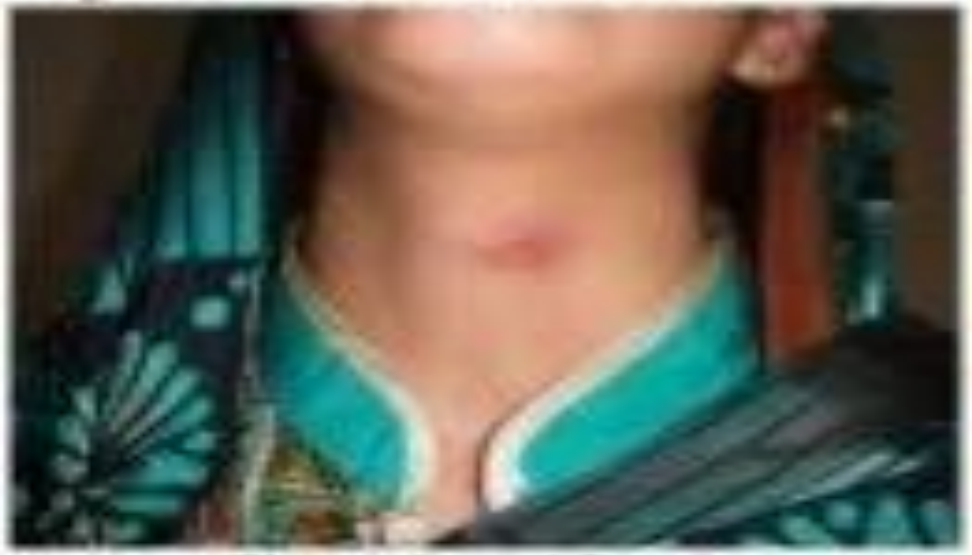
Thyroglossal cyst in a child

Thyroglossal cyst in an adult

Thyroglossal cyst & fistula



Thyroglossal cyst with fistula

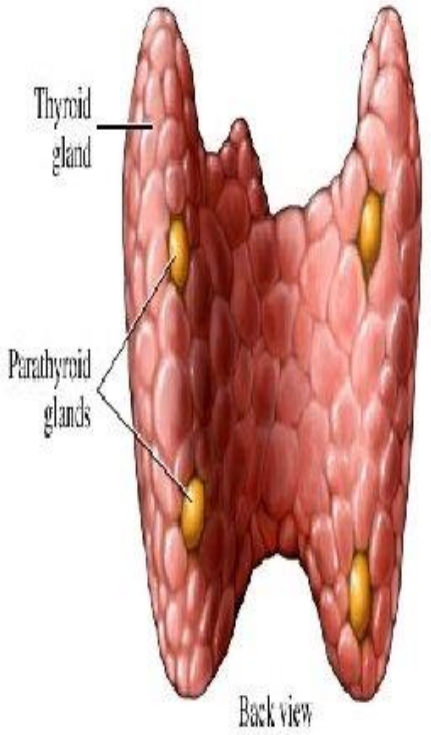


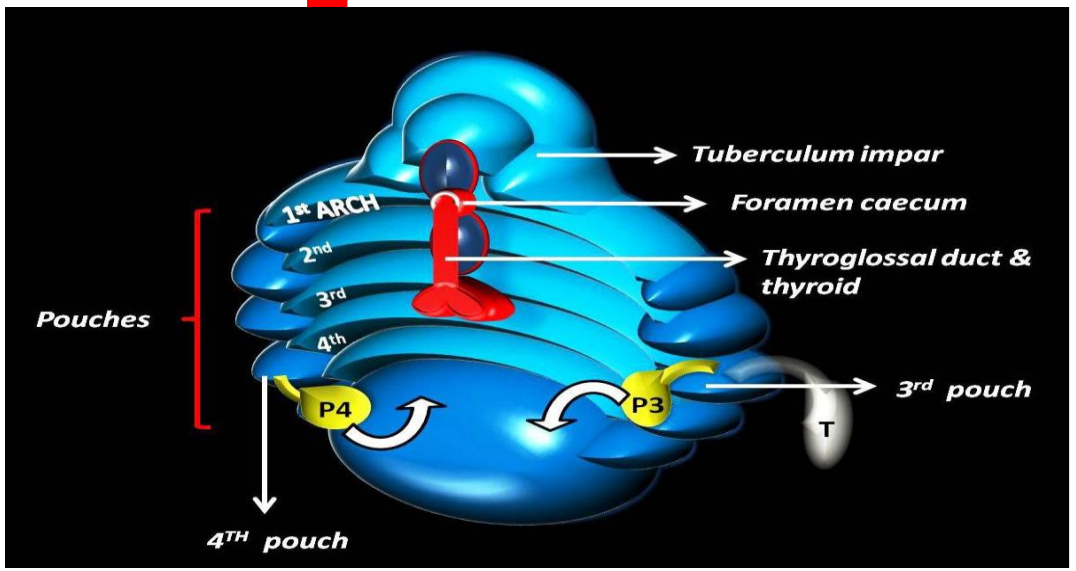
Thyroglossal fistula

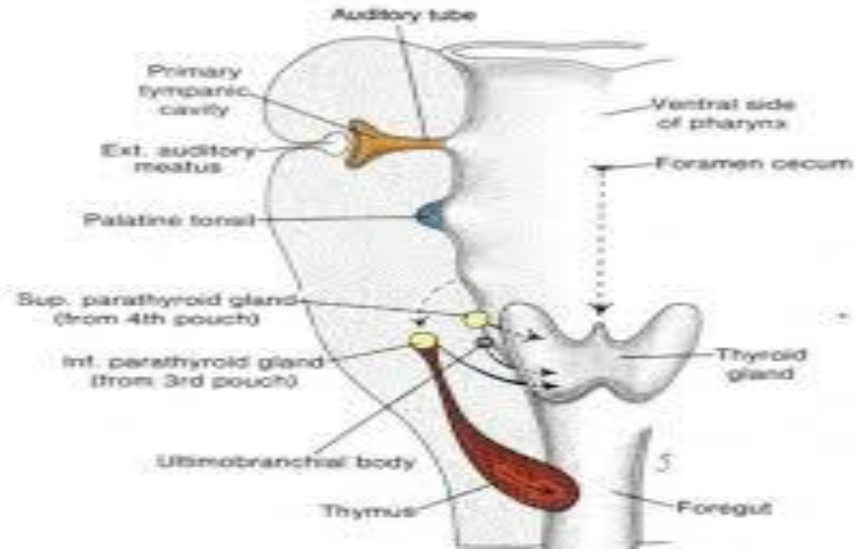
parathyroid gland development

DEVELOPMENT

- The parathyroid glands develop from the endoderm of the third and fourth pharyngeal pouches.
- The inferior parathyroid glands are derived from the dorsal part of the third pharyngeal pouch.
- The superior parathyroid glands are derived from the fourth pharyngeal pouch and migrate together with the ultimobranchial bodies.







Development of pancreas

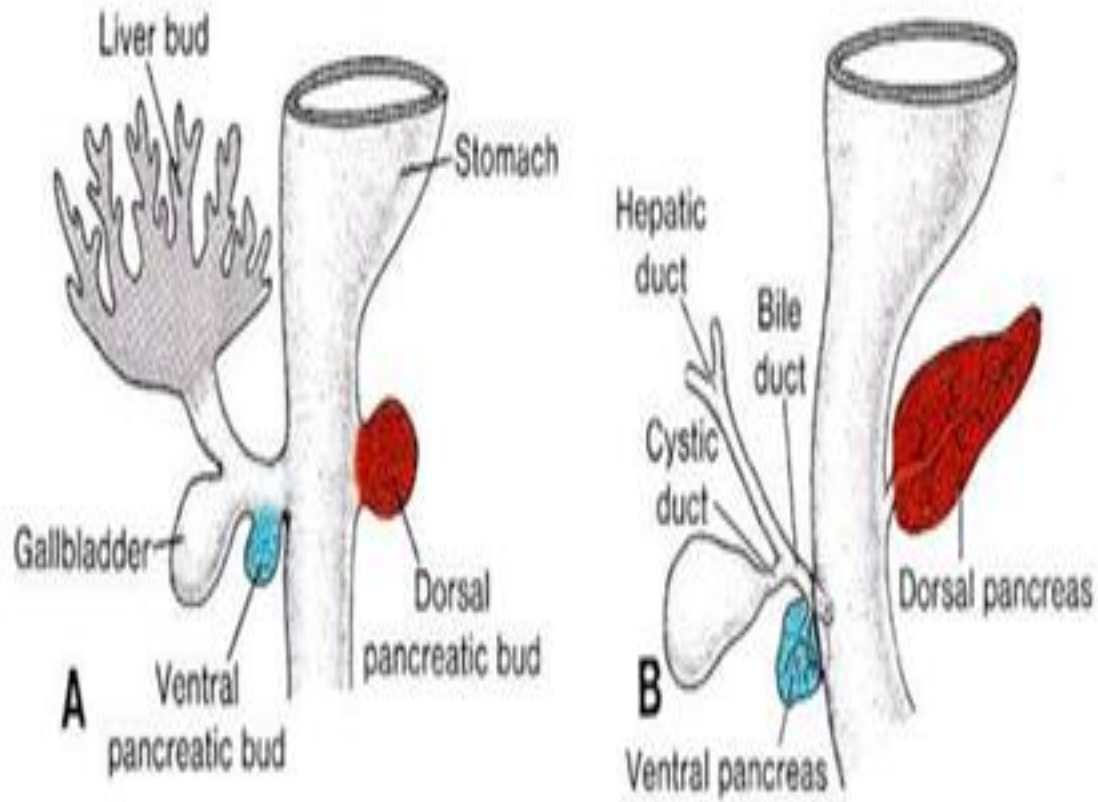
Origin:

The pancreas develops from dorsal and ventral pancreatic buds that arise from the caudal part of the foregut at the site of the duodenum.

Development:

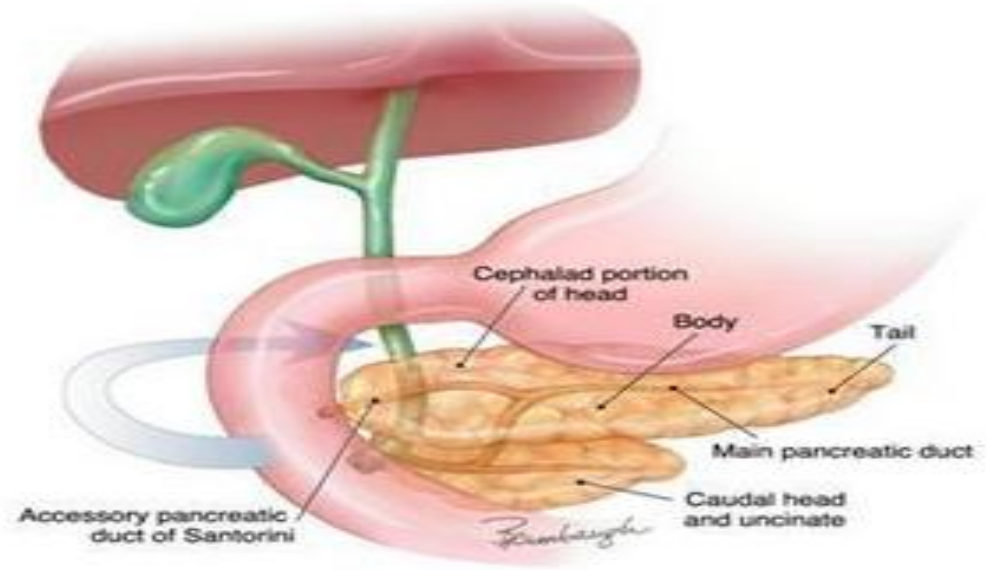
The dorsal pancreatic bud grows more rapidly than the ventral and soon extends dorsally behind the duodenum into the dorsal mesentery.

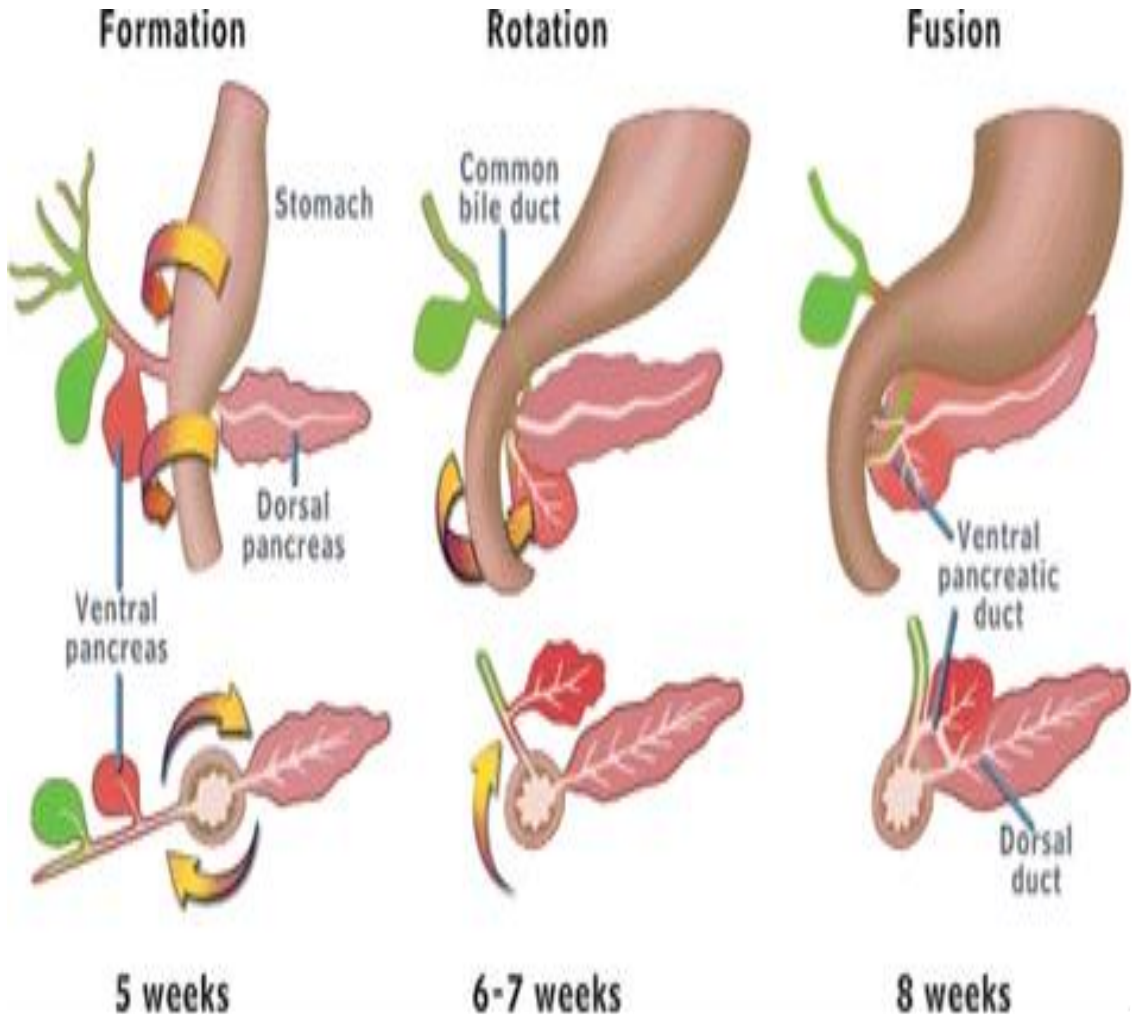
The duodenum grows and rotates to the right (clockwise) and carries the ventral pancreatic bud to the dorsal mesentery where it fuses with the dorsal bud during the seventh week.



Stages in development of the pancreas. **A.** 30 days (~5 mm). **B.** 35 days (~7 mm). Initially, the ventral pancreatic bud lies close to the liver bud, but later it moves posteriorly around the duodenum toward the dorsal pancreatic bud.

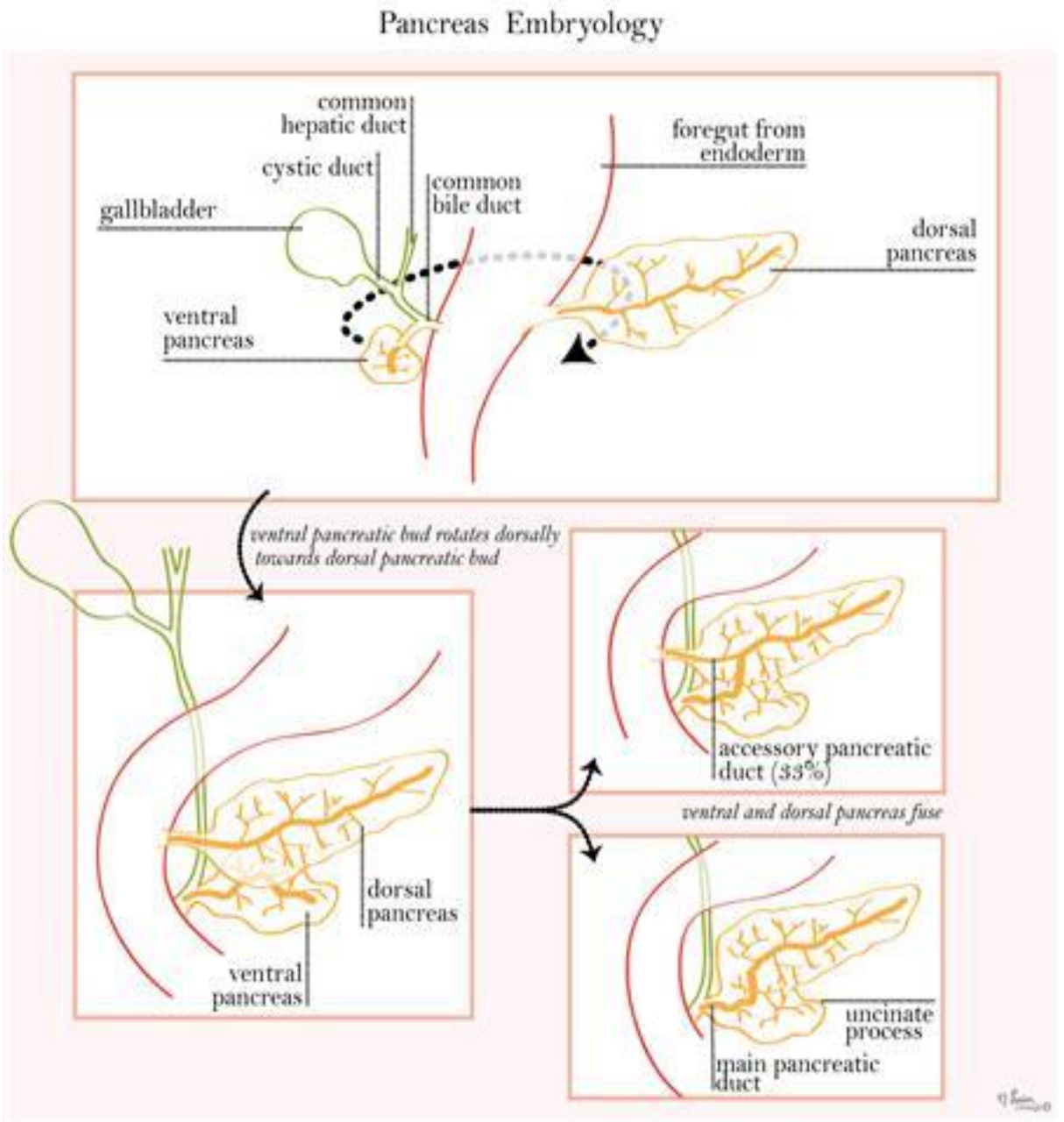
- The dorsal bud forms the upper part of the head the body and tail of the pancreas.
- Ventral bud forms the uncinate process and lower part of the head of the pancreas.





- **The main pancreatic duct is formed by the union of distal part of the duct of the dorsal bud with the duct of the ventral bud and the communication in between.**

- **The accessory pancreatic duct is formed from the proximal part of the duct of the dorsal bud.**
- **Each solid duct gives branches (ductules) which gives solid cell masses (acini) and solid cell masses without connection to duct system (Islets of Langerhans).**
- **The connective tissue of the gland develops from the splanchnic mesoderm.**
- **By the fifth month, insulin secretion begins.**



Congenital anomalies

- Several anatomical variants. Most are not clinically significant.
- Pancreatic divisum

  =>most common clinically(incidence is 3-10%)

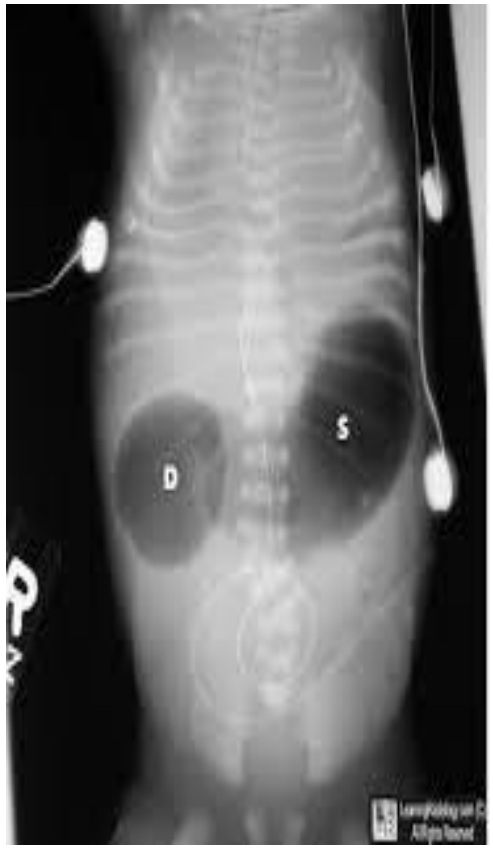
  =>Failure of fusion of the dorsal pancreatic primordium with the ventral primordium.

  =>the bulk of the pancreas drains through the minor sphincter

  =>Predisposes to chronic pancreatitis

The other congenital anomalies are very rare

- Agenesis (usually incompatible with life)
- Annular pancreas – abnormal fusion =>duodenal obstruction
- Ectopic pancreas – stomach, duodenum, jejunum, ileum and meckel diverticulum.- inflammation and mucosal bleeds.



Annual pancreas