Development of The Pituitary Gland

The **pituitary gland** (hypophysis) is a dual-origin endocrine gland crucial in regulating growth, metabolism, and reproduction. It arises from two distinct embryological tissues:

- **Oral ectoderm** (stomodeum): forms the **anterior pituitary** (adenohypophysis)
- **Neuroectoderm** (diencephalon): forms the **posterior pituitary** (neurohypophysis)

Embryological Origins and Sequence of Development

1. Stomodeum and Rathke's Pouch

- **Stomodeum**: A transient depression between the developing brain and pericardium in early embryogenesis; originates from **ectoderm**.
- Around **Week 3**, an **upgrowth** from the **roof of the stomodeum** forms the **hypophyseal diverticulum**, also called **Rathke's pouch**.
- **Rathke's pouch** elongates and narrows at its base, maintaining a temporary connection with the oral epithelium.
- The pouch grows dorsally toward the **infundibulum**, which is descending from the **neuroectoderm of the diencephalon**.

2. Formation of Adenohypophysis (Anterior Pituitary)

- By **Week 6**, the **connection with the oral cavity regresses**.
- Cells from **anterior wall of Rathke's pouch** proliferate and form:
    - **Pars distalis** – the main hormone-producing region.
    - **Pars tuberalis** – wraps around the **infundibular stalk**.
- **Posterior wall cells** of Rathke's pouch form a thin layer called the **pars intermedia**.

3. Formation of Neurohypophysis (Posterior Pituitary)

- A **downgrowth** from the **neuroectoderm of the diencephalon** forms the **neurohypophyseal diverticulum**.
- This structure gives rise to:
    - **Median eminence**
    - **Infundibular stalk**
    - **Pars nervosa**
- **Neuroepithelial cells** differentiate into **pituicytes** (glial-like support cells), and **axons** from hypothalamic neurons grow into the pars nervosa.

4. Fusion

- The **anterior and posterior lobes** of the pituitary gland come into contact, forming a single gland embedded in the **sella turcica** of the sphenoid bone.

Clinical Correlations

1. Pharyngeal Hypophysis

- A **remnant of Rathke’s pouch** persists in the roof of the **oropharynx**.
- Usually asymptomatic, but may appear as an incidental mass.

2. Craniopharyngioma

- **Benign tumor** derived from remnants of Rathke’s pouch.
- Common in children and young adults.
- Can compress the **optic chiasm**, causing **bitemporal hemianopsia**, and disrupt **pituitary function** (hypopituitarism).
- Often shows **calcifications on imaging**.
- Histology: adamantinomatous type (children), papillary type (adults).

High-Yield

- The **anterior pituitary** arises from **oral ectoderm**, not neuroectoderm.
- The **posterior pituitary** is an extension of the **hypothalamus**, containing **axon terminals** of neurosecretory neurons.
- **ADH and oxytocin** are synthesized in the **hypothalamus** and stored in the **posterior pituitary**.
- **Craniopharyngiomas** originate from **Rathke's pouch remnants** – important for differential diagnosis in pediatric brain tumors.
- **Rathke’s pouch** passes between **chondrification centers** of the sphenoid bone during development.