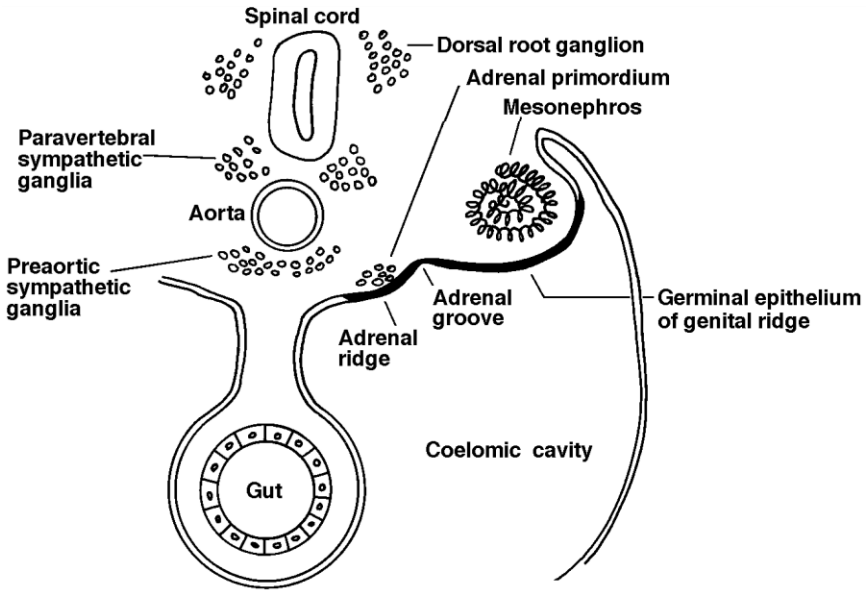
Embryology
Development of the endocrine system

Lect 17 **Dr.Enas Fadhil**

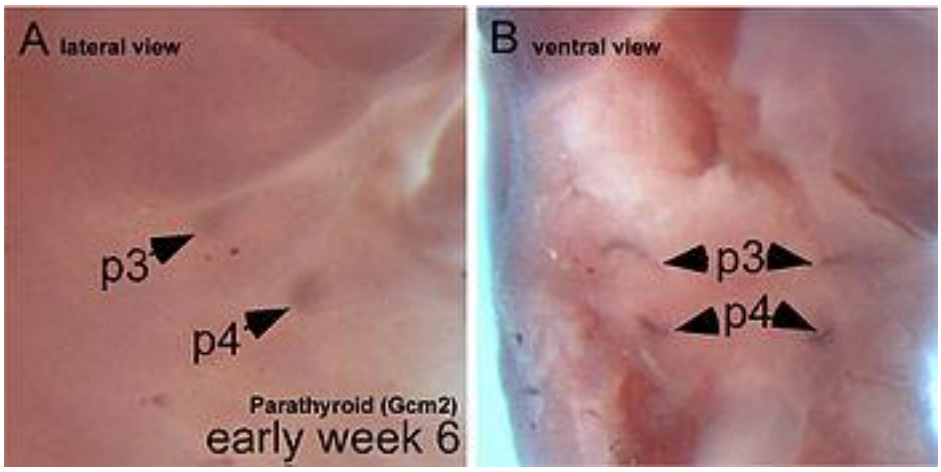
Adrenal glands

The fetal adrenal cortex can be identified within four weeks of gestation. The adrenal cortex originates from the thickening of the intermediate mesoderm. At five to six weeks of gestation, the mesonephros differentiates into a tissue known as the gonadal ridge. The gonadal ridge produces the steroidogenic cells for both the gonads and the adrenal cortex.

The adrenal medulla is derived from ectodermal cells. Cells that will become adrenal tissue move retroperitoneally to the upper portion of the mesonephros. At seven weeks of gestation, the adrenal cells are joined by sympathetic cells that originate from the neural crest to form the adrenal medulla. At the end of the eighth week, the adrenal glands have been encapsulated and have formed a distinct organ above the developing kidneys. At birth, the adrenal glands weight approximately eight to nine grams (twice that of the adult adrenal glands) and are 0.5% of the total body weight. At 25 weeks, the adult adrenal cortex zone develops and is responsible for the primary synthesis of steroids during the early postnatal weeks.

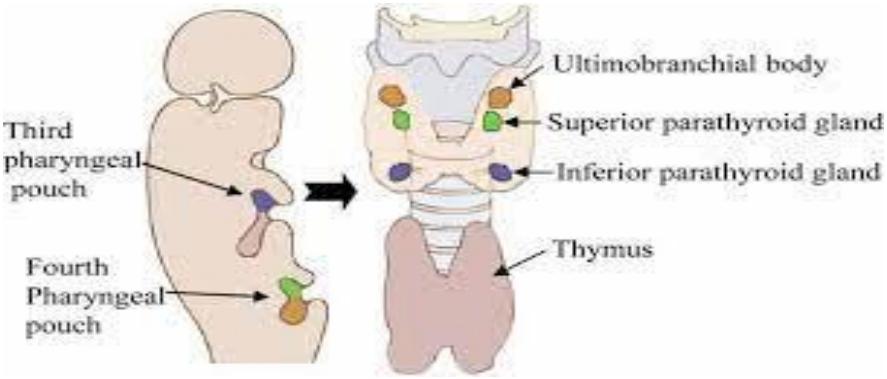


Parathyroid glands



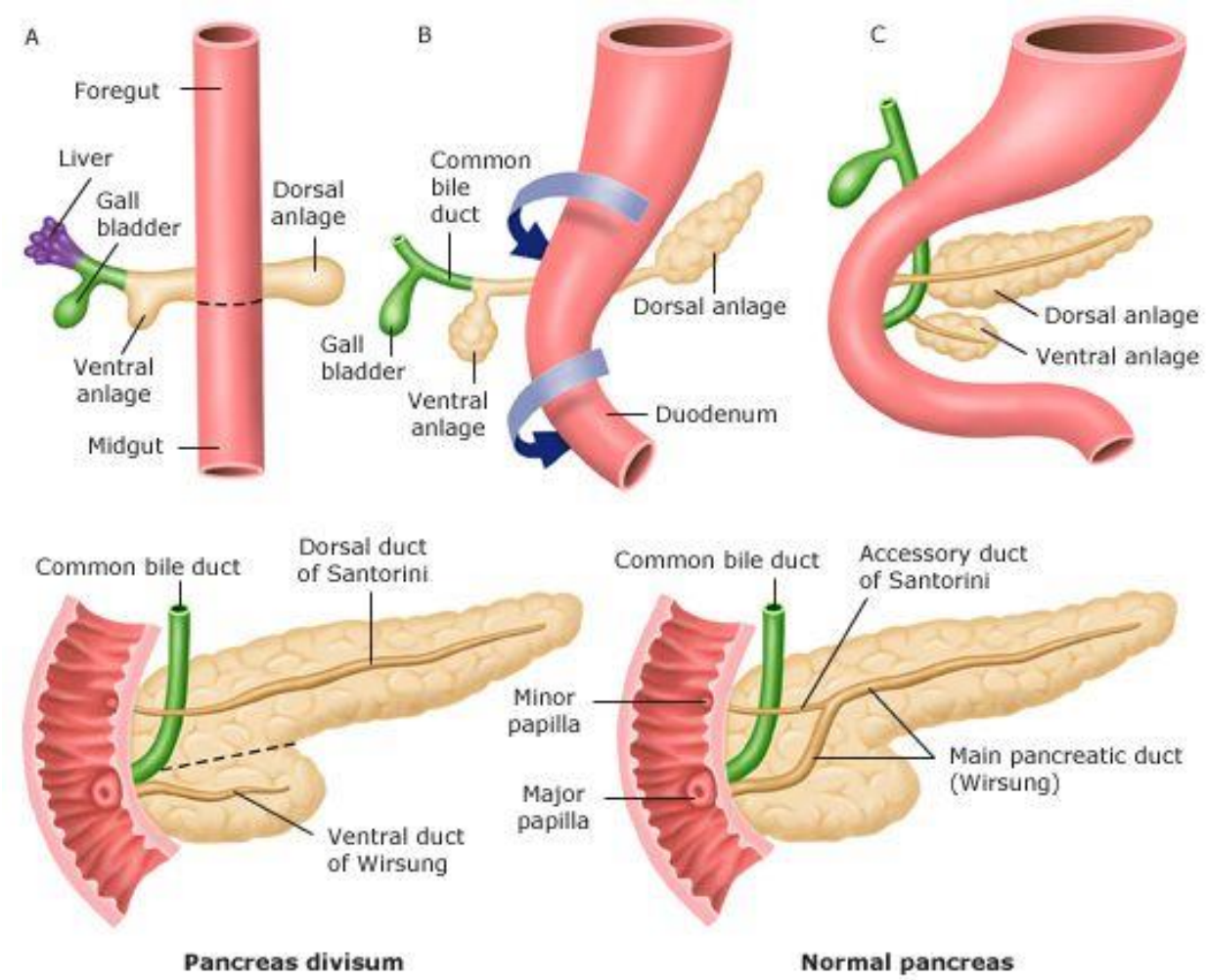
A lateral and ventral view of an embryo showing the third (inferior) and fourth (superior) parathyroid glands during the 6th week of embryogenesis

Once the embryo reaches four weeks of gestation, the parathyroid glands begins to develop. The human embryo forms five sets of endoderm-lined pharyngeal pouches. The third and fourth pouch are responsible for developing into the inferior and superior parathyroid glands, respectively. The third pharyngeal pouch encounters the developing thyroid gland and they migrate down to the lower poles of the thyroid lobes. The fourth pharyngeal pouch later encounters the developing thyroid gland and migrates to the upper poles of the thyroid lobes. At 14 weeks of gestation, the parathyroid glands begin to enlarge from 0.1 mm in diameter to approximately 1 – 2 mm at birth. The developing parathyroid glands are physiologically functional beginning in the second trimester.



Pancreas

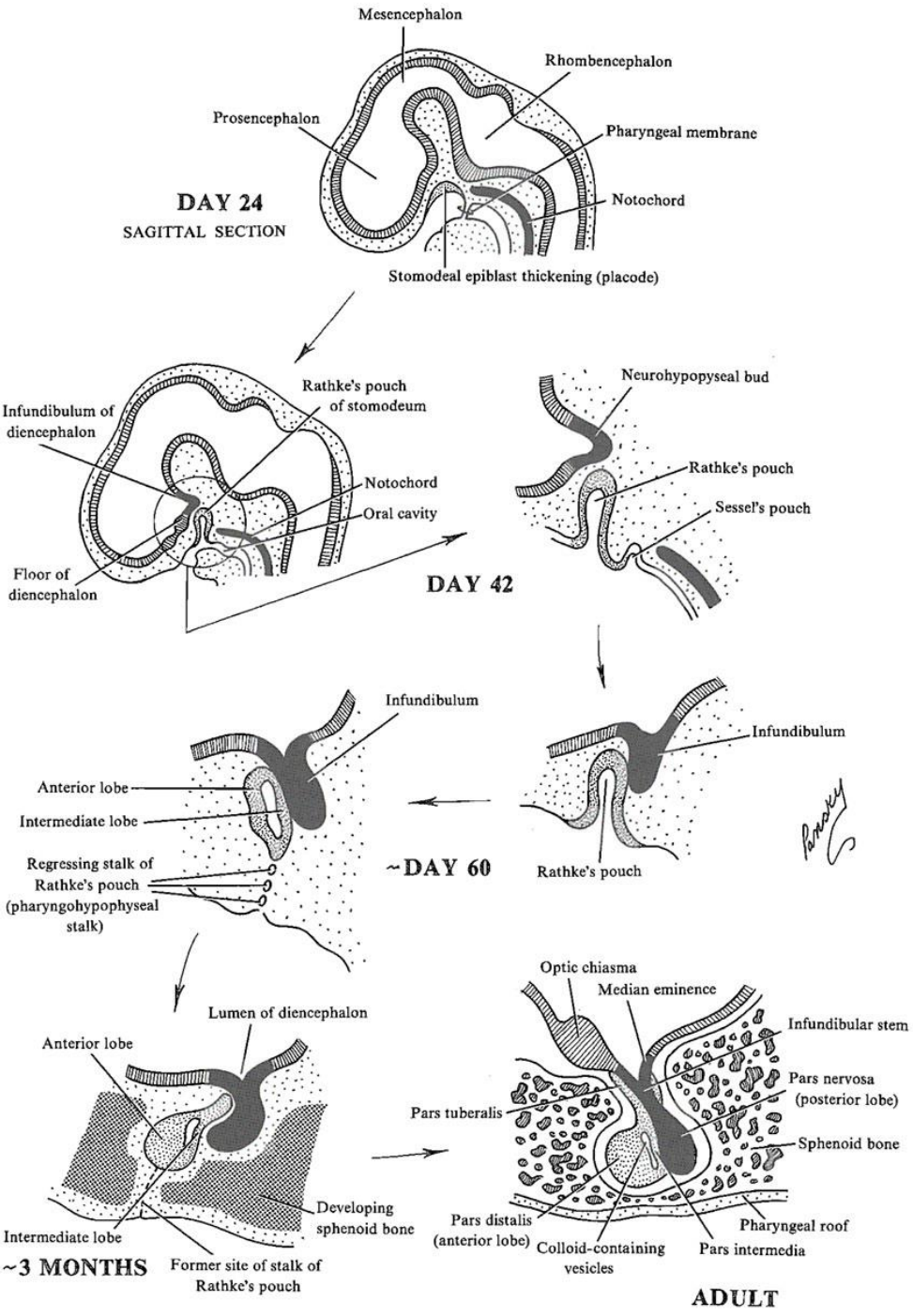
The human fetal pancreas begins to develop by the fourth week of gestation. Five weeks later, the pancreatic alpha and beta cells have begun to emerge. Reaching eight to ten weeks into development, the pancreas start producing insulin, glucagon, somatostatin, and pancreatic polypeptide. During the early stages of fetal development, the number of pancreatic alpha cells outnumbers the number of pancreatic beta cells. The alpha cells reach their peak in the middle stage of gestation. The endocrine cells have dispersed throughout the body within 10 weeks. At 31 weeks of development, the islets of Langerhans have differentiated.



Pituitary gland

The pituitary gland is formed within the rostral neural plate. The Rathke's pouch, a cavity of ectodermal cells of the oropharynx, forms between the fourth and fifth

week of gestationand upon full development, it gives rise to the anterior pituitary gland. By seven weeks of gestation, the anterior pituitary vascular system begins to develop. During the first 12 weeks of gestation, the anterior pituitary undergoes cellular differentiation. At 20 weeks of gestation, the hypophyseal portal system has developed. The Rathke's pouch grows towards the third ventricle and fuses with the diverticulum. This eliminates the lumen and the structure becomes Rathke's cleft. The posterior pituitary lobe is formed from the diverticulum. Portions of the pituitary tissue may remain in the nasopharyngeal midline. In rare cases this results in functioning ectopic hormone-secreting tumors in the nasopharynx.


Mesencephalon
Rhombencephalon
Prosencephalon
Pharyngeal membrane
DAY 24
SAGITTAL SECTION
Notochord
Stomodeal epiblast thickening (placode)
Rathke's pouch of stomodeum
Infundibulum of diencephalon
Notochord
Oral cavity
Floor of diencephalon
DAY 42
Neurohypopyseal bud
Rathke's pouch
Sessel's pouch
Infundibulum
Infundibulum
Anterior lobe
Intermediate lobe
Regressing stalk of Rathke's pouch (pharyngohypophyseal stalk)
~DAY 60
Rathke's pouch
Optic chiasma
Median eminence
Infundibular stem
Lumen of diencephalon
Anterior lobe
Pars nervosa (posterior lobe)
Pars tuberalis
Sphenoid bone
Developing sphenoid bone
Pharyngeal roof
Pars distalis (anterior lobe)
Colloid-containing vesicles
Pars intermedia
Intermediate lobe
~3 MONTHS
Former site of stalk of Rathke's pouch
ADULT