Embryology, Lect.4 2024 د. عذراء

The Embryonic Period

The **embryonic period** or period of **organogenesis,** occurs from the **third to the eighth weeks** of development and is the time when each of the three germ layers, **ectoderm, mesoderm,** and **endoderm,** gives rise to a number of specific tissues and organs.

Ectodermal Germ Layer

At the beginning of the third week of development, the ectodermal germ layer has the shape of a disc then induction has occurred, the elongated, slipper-shaped form **neural plate.** By the end of the third week, the lateral edges of the neural plate become more elevated to form **neural folds,** and the depressed mid region forms the **neural groove ,** at the lateral border of the fold cells from neuroectoderm begin to dissociate from their neighbors. This cell population, the **neural crest cell(NCC) ,**will undergo an epithelial-to-mesenchymal transition(mean its origin from neuroectoderm but it reside or present in mesenchymal tissue). **Then fusion** of edge of neural fold to **form neural tube.**

Derivatives of Ectoderm germ layer

(*a*) the central nervous system.

(*b*) the peripheral nervous system;

(*c*) the sensory epithelium of the ear, nose, and eye

(*d*) the epidermis, including the hair and nails. In addition,

it gives rise to subcutaneous glands, the mammary glands, the pituitary gland, and enamel of the teeth.

Derivatives of Neural Crest

***Connective tissue and bones of the face and skull**

***Cranial nerve ganglia .**

***C cells of the thyroid gland**

***Conotruncal septum in the heart**

***Odontoblasts**

***Dermis in face and neck**

***Spinal (dorsal root) ganglia**

***Sympathetic chain and preaortic ganglia**

***Parasympathetic ganglia of the gastrointestinal tract**

***Adrenal medulla**

***Schwann cells**
***Glial cells**
***Arachnoid and pia mater (leptomeninges)**
***Melanocytes**

Derivatives of the Mesodermal Germ Layer

Important components of the **mesodermal germ layer** are **paraxial, intermediate,** and **lateral plate** mesoderm. Paraxial mesoderm forms **somitomeres,** which give rise to mesenchyme of the head and organize into **somites** in occipital and caudal segments. Somites give rise to the **myotome** (muscle tissue), **sclerotome** (cartilage and bone), and **dermatome** (dermis tissue of the skin), which are **all supporting tissues of the body.**

Mesoderm also gives rise to the

1. Vascular system, that is, the **heart, arteries, veins, lymph vessels, and all blood and lymph cells**.

2. Urogenital system: kidneys, gonads, and their ducts (but not the bladder).

3.Spleen and **cortex of the suprarenal glands** are mesodermal derivatives.

Derivatives of the Endodermal Germ Layer

1.epithelial lining of the **gastrointestinal tract, respiratory tract,** and **urinary bladder.**

2.parenchyma of the **thyroid, parathyroids, liver,** and **pancreas.** Finally, **3.**the **epithelial lining of the tympanic cavity** and **auditory tube** originate in the endodermal germ layer.

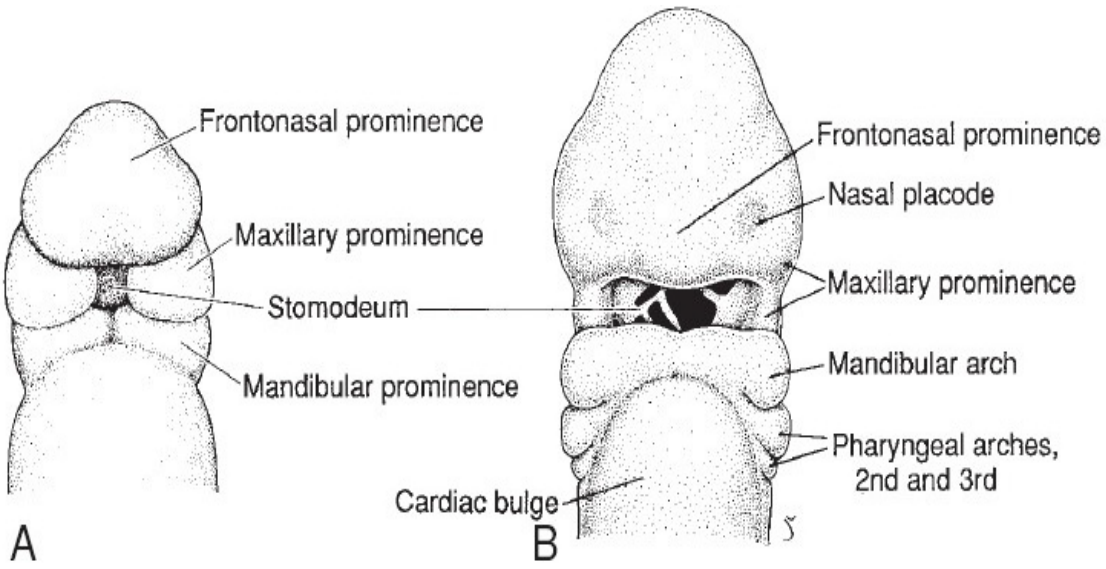
Development of Head and Neck

The most typical feature in development of the head and neck is

formed by the **pharyngeal** or **branchial arches.** These arches are **5 pairs** in number **(first,second,third,fourth and sixth),**the fifth is rodumentary. The **arch appear in the fourth weeks** of development and contribute to the characteristic external appearance of the embryo Initially, they consist of bars of mesenchymal tissue separated by deep clefts known as **pharyngeal** (**branchial**) **clefts** ,with development of the arches and clefts, a number of outpocketings, the **pharyngeal pouches,** appear along the lateral walls of the pharyngeal gut.

At the end of the fourth week, the center of the face is formed by the **stomodeum(**primitive mouth), it's boundaries are

1. **mandibular prominences** caudally
2. **maxillary prominences** laterally
3. **frontonasal prominence,** cranially



1.Pharyngeal Arches

Each pharyngeal arch consists of

1. a core of mesenchymal tissue with neural crest cells

2. covered on the outside by surface ectoderm

3.lined inside by endoderm .

Each pharyngeal arch is characterized by its own **muscular components. cranial nerve and arterial component .**

TABLE 15.1 Derivatives of the Pharyngeal Arches and Their Innervation

Pharyngeal Arch	Nerve	Muscles	Skeleton
1 mandibular (maxillary and mandibular processes)	V. Trigeminal: maxillary and mandibular divisions	Mastication (temporal; masseter; medial, lateral pterygoids); mylohyoid; anterior belly of digastric; tensor palatine, tensor tympani	Premaxilla, maxilla, zygomatic bone, part of temporal bone, Meckel's cartilage, mandible malleus, incus, anterior ligament of malleus, sphenomandibular ligament
2 hyoid	VII. Facial	Facial expression (buccinator; auricularis; frontalis; platysma; orbicularis oris; orbicularis oculi); posterior belly of digastric; stylohyoid; stapedius	Stapes; styloid process; stylohyoid ligament; lesser horn and upper portion of body of hyoid bone
3	IX. Glossopharyngeal	Stylopharyngeus	Greater horn and lower portion of body of hyoid bone
4–6	X. Vagus · Superior laryngeal branch (nerve to fourth arch)	Cricothyroid; levator palatine; constrictors of pharynx	Laryngeal cartilages (thyroid, cricoid, arytenoid, corniculate, cuneiform)
	· Recurrent laryngeal branch (nerve to sixth arch)	Intrinsic muscles of larynx	

2.Pharyngeal Pouches

The human embryo has five pairs of pharyngeal pouches .

The last one of these is atypical and often considered as part of the fourth. Since the **epithelial endodermal lining** of the pouches gives rise to a number of important organs .

1.FIRST PHARYNGEAL POUCH gives rise to primitive tympanic or **middle ear cavity & auditory (eustachian) tube**

SECOND PHARYNGEAL POUCH gives rise to palatine tonsils

3.THIRD PHARYNGEAL POUCH gives rise to inferior parathyroid gland and thymus

4.FOURTH PHARYNGEAL POUCH gives rise to superior parathyroid gland

5.FIFTH PHARYNGEAL POUCH is usually considered to be a part of the fourth pouch. It **gives rise to** the **ultimobranchial body**. Cells of the ultimobranchial body give rise to the **parafollicular,** or **C, cells of the thyroid gland**. These cells secrete **calcitonin,** a hormone involved in regulation of the calcium level in the blood.

3.Pharyngeal Clefts

The 5-week embryo is characterized by the presence of **four pharyngeal clefts** of which only one contributes to the definitive structure of the embryo.

1.The **dorsal part of the first cleft** gives rise to the **external auditory meatus .**

2.the second, third, and fourth clefts form a cavity lined with ectodermal epithelium, called the **cervical sinus,** but with further development this sinus disappears. **If a remnants of the cervical sinus persist** a **lateral cervical cyst (branchial cyst)**may developed ,it is most often found **below the angle of the jaw** ,although they may be found **anywhere along the anterior border of the sternocleidomastoid muscle**. if the cyst make a contact with the surface by a narrow canal then it called **fistula**.

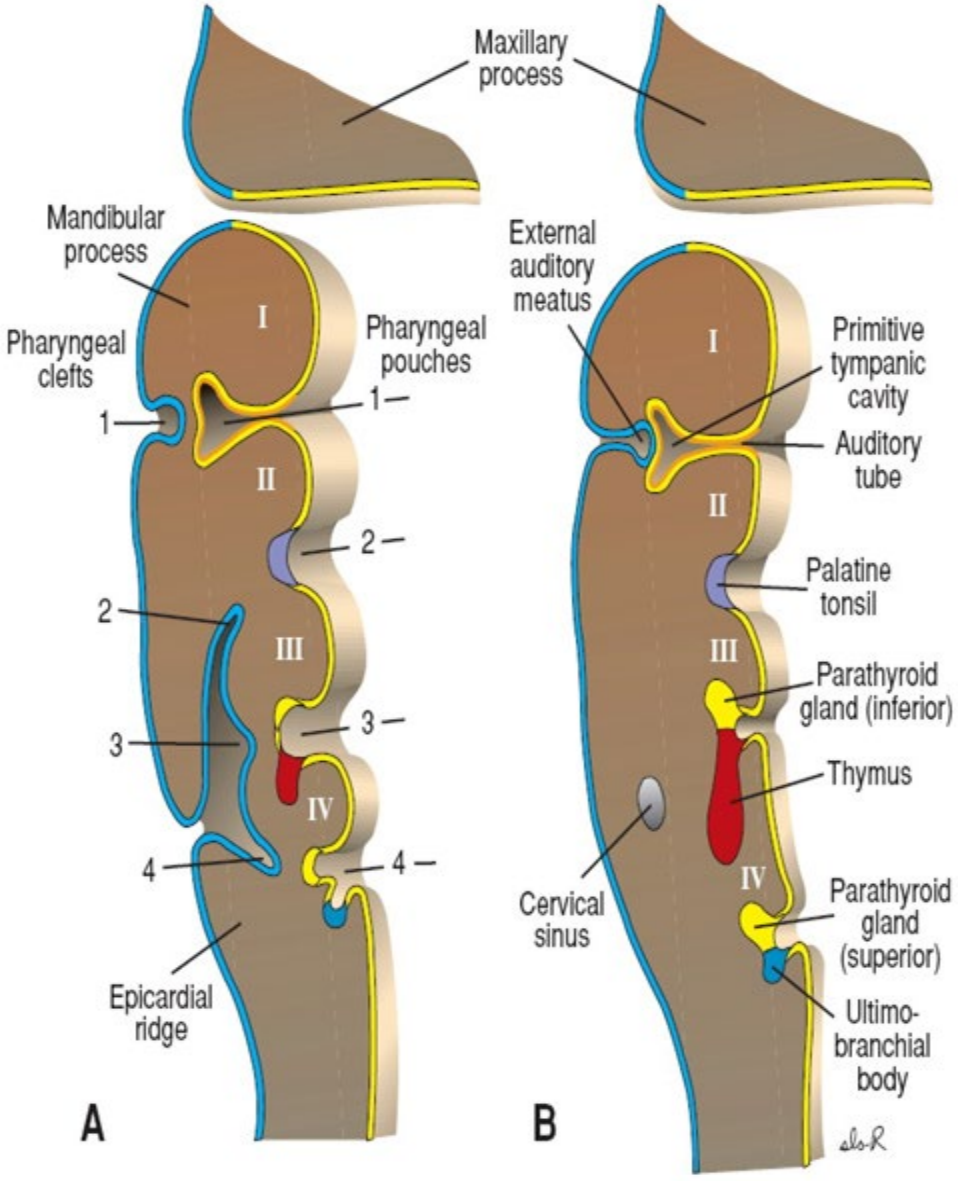
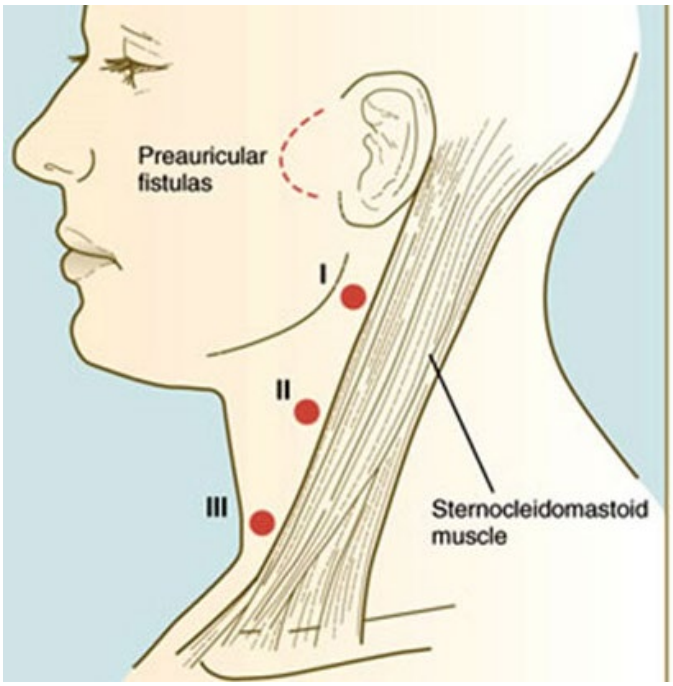


Figure 15.10 A. Development of the pharyngeal clefts and pouches. The second arch grows over the third and fourth arches, burying the second, third, and fourth pharyngeal clefts. **B.** Remnants of the second, third, and fourth pharyngeal clefts form the cervical sinus, which is normally obliterated. Note the structures formed by the various pharyngeal pouches.



lateral cervical cyst

Figure 15.15 Patient with a lateral cervical cyst. These cysts are always on the lateral side of the neck in front of the sternocleidomastoid muscle. They commonly lie under the angle of the mandible and do not enlarge until later in life.