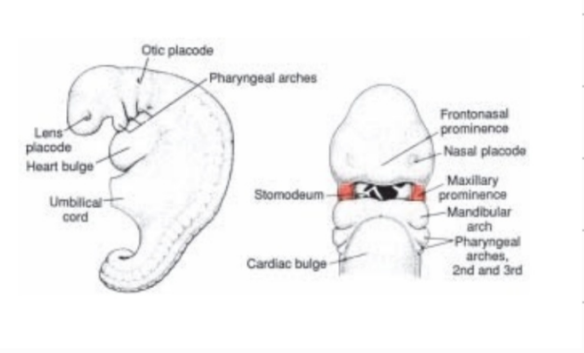
# EMBERIOLOGY

LEC 1+2

# LEC-1

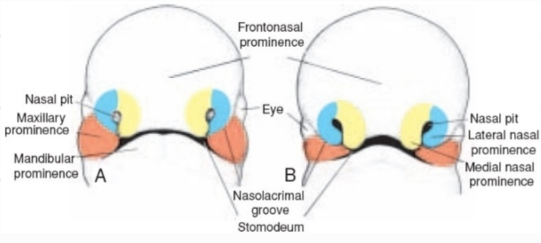
## Nose and palat

- Nasal placode (Olfactory): the point where the Nose and Nasal opening will start their development
- Below forehead




- Origin of placodes : Ectoderm

① Nasal placode will make invagination and form nasal pits (Nostril).
② More invagination → forms the vestibule




Facial promenences : Mesenchyme

1- Frontonasal prominance from frontal bone and descends to form the nasal septum + medial and lateral nasal prominances

Nasal promenances : Lateral and Medial

- Medial : Growth near the medline → participat in formation of septum, + tip of the nose.
  + Philtrum of upper lip + medial ⅓ of upper lip. → while the lateral is made from the maxillary prominance.
- After the 5th → The maxillary grow upward to meet the medial nasal and fuse with it to form the upper lip.

☆ If did not fuse → Cleft lip & cithe uni or bilateral

- Lateral : Form the Ala of the nose + lateral wall of the nose

TABLE 15.2 Structures Contributing to Formation of the Face

| Prominence | Structures Formed |
|---|---|
| Frontonasal[a] | Forehead, bridge of nose, medial and lateral nasal prominences |
| Maxillary | Cheeks, lateral portion of upper lip |
| Medial nasal | Philtrum of upper lip, crest and tip of nose |
| Lateral nasal | Alae of nose |
| Mandibular | Lower lip |

[a] The frontonasal prominence is a single unpaired structure; the other prominences are paired.

# Nasal Cavity

☆ The nasal pits → More invagination → Mesenchymal cells undergo more proliferation → then Canalization → form the cavity above the the oronasal membrane.

☆ The posterior part of the cavity is the primitive Choana.

- Oronasal membrane : separates the oral cavity from nasal cavity then rupture and the palat will form in it's place (primary palat).

→ The diffinitive choana and secound ary palat will form

☆ The lateral wall is also formed.

# Paranasal Air Sinuses

- Ther formation starts from the lateral wall of Nasal cavity, from the opening of the sinus starts the proliferation of cells the proliferation will form the duct → when reaching the bone will form radementary cavity that are small in size → with the growth of facial bones the cavities will grow and become in the Adult size. (Sinuses)

- Same for all the paranasal sinuses.

# Palate

## Primary palate

- Hard palat : formed of two parts. ① palatine process of Maxilla
  ② Horizontal process of palatine
- During Development: the maxillary process and medial nasal prominance grow toward the midline and they fuse together and form

## Intermaxillary segment

☆ Inter maxillary segment gives : ① labial components (upper lip + philtrum)
② primary palate
③ upper jaw components (upper 4 incisors).

☆ Primary palate is triangular in shape with an apex and communicate with the septum to form the 2 nasal cavities.

## Secondary palate

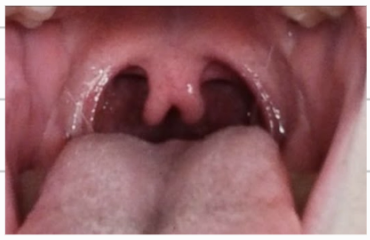
* from the maxillary prominance (palatine shelflike outgrowth).
- A shelf origenate from the maxillary prominance from the side to midline
  - At the sixth week.
  - Directly above the tongue to form the oral cavity.
  - 2 shelves one from right and one from left.

☆ Then the Secondary fuses with the primary to form the Hard palate.

- Incissive foramen : After the infusion between the primary and the secondary a small opening will remain persistant for passage of greater palatine nerve and Artery.

- The posterior edge of Secondary palate ; the edge of palat process will grow backword to form the Soft palat and uvula.
  two sides right and left fuse together
- Soft palat : week 8 uvula : week 11

- Rarly: people may have a separated uvula due to failer of fusion



# Primitive Gut

1- Pharyngeal gut: from the bucopharyngeal membrane and forms the pharynx
2- Foregut: Esophigus → liver buds (middle of duodenum. Celiac Trunk
3- Midgut: Liver buds → Junction between proximal 2/3 and distal 1/3 of transverse colon Superior Mesinteric A.
4- Hindgut & distal 1/3 of transverse colon → upper 1/2 of anal canal. Inferior Mesenteric A.

# Respiratory Diverticulum

- Depends on fibroblast growth factor (FGF).
- FGF released in the 4th week of gestation stimulates the endodermal anterior wall of the foregut → proliferation of cells → form the Respiratory diverticulum → Continue to grow to form the trachea then primary bronchi then Secondary → Alveoli.

- Origin: Endoderm
- Origin of cartilages and muscles: splanchic Mesoderm.

☆ Trachioesophageal ridge (4th week): Makes constriction between respiratory and digestive → Increase in growth become Tracheo-esophageal Septum and the trachea is anterior and esophegus posterior (5th week).
→ The only remain communication between trachea and esophagus is through laryngeal pharynx and Inlet of larynx.

- The larynx at first: it's a slit like opening.
→ when the cartilages are formed (cricoid and thyroid mainly) it become T-Shaped.
→ when the epiglottis is formed → The permanant adult shape is formed.

# Esophagus

- when it's formed it's short
- with the development of the heart and lungs it will elongate and descends.
- Muscular tube : upper part : Striated muscles — innervated by Vagus
  lower part : Smooth muscles — innervated by splanchnic plexus of nerves (Autonomic)

# Anomalies of Trachea : Tracheoesophageal Fistula (TEF). And Atresia

*Atresia : blind end of esophagus usually proximal.
* fistula : connection between esophagus and trachea.
- The most common form : proximal Atresia with distal fistula
  ↳ 1/3000 births.
- There are other forms, see the slides.

☆ Clinicall picture of proximal Atresia with distal fistula :

① During pregnancy : polyhydramnios (Excess of Amniotic fluid).
- Must be a constant amount and undergo secretion and absorbtion
→ It's absorbed into the GI tract then secreted again through urination. In case of Atresia all the fluid will go back to the amniotic cavity → Excess Amniotic fluid.

② After delivery : Each time the mother tries to feed the baby the milk will come back out (regergetation). (Atresia)

③ When the baby cries : Air will enter the stomach → Abdomen will become distended and bloated. (Fistula)

④ Chronic infections in the Respiratory tract : when a material from the GIT enters the Respiratory.

→ Treatment: uregent operation closes the fistula and reconnect the esophagus.

☆ Common Anomalis compined with Atresias

1- Cardiac Anomalies : - Intra-Atrial Septa defect
- Intra-Ventricular Septal defect
- Fallots tetralogy.

2- Vertebral Anomalies

3- Anal Atresia

4- limb defect

5- Renal Anomalies.

# Tracheal Atresia and Stenosis

- Block in the trachea due to formation of an abnormal tissue -very rare

# Larynx

- Internally : Endoderm
- Cartilage and Muscles : splanchnic mesoderm.

☆ Formed from the 4th and the 6th pharyngeal arches

- The opening when it's firstly formed it's split like then when the cartilages are formed it become T-shaped. (Inlet of larynx)

- Proliferation of epithelial cells → Oclusion of larynx (It was a cavity → then became occluded with cells).

→ Then Vacuolation and Recanalization (the cells that have been formed will be reabsorbed). Why did all that happen?
-To form the Ventricles.

* When ventricles are formed that means:
① True vocal cords ② False vocal cords ③ The sacule are all formed

- Muscles of larynx: All are internal except the Cricothyroid, External.
  ↳ All innervated by reccurant laryngeal nerve except Cricothyroid by External laryngeal → why? due to their origin from pharyngeal arches

→ Superior laryngeal Nerve devides into internal and external laryngeal.
The external laryngeal go the 4th pharyngeal arch that gives the Cricothyroid.
While the reccurent laryngeal Nerve go to the 6th pharyngeal that will give rise to all the muscles.
- Cricothyroid: 4th pharyngeal Arch.
- All muscles: 6th pharyngeal Arch.

# Anomalies of Larynx

- Atresia (Rare) → Obstruction of upper airway passage.
  ↳ known as: Congenital High Airway Obstruction Syndrome.
  → Enlargment of lung to compensate
  → production of abnormal tissue, echoes (echogenic)
  → The diaphragm won't have two Cupulla → It will be flattened → Ascites will form which is accumulation of fluid in the abdomen.

- Diagnosis: Ultrasonography.

# Trachea, Bronchi and Lungs

- Formed by the growth of lung buds.
- Trachea will be formed first and when it reaches T4 it will devide into two main bronchi

→ More development will form the secondary bronchi: → 3 in right, → 2 in left

→ Then the tertiary 10 in Right + 8 in Left.

↳ Remember Anatomy Lec-5.

# LEC - 2

**Dichotomous division of bronchioles** means:

Each bronchiole **splits into two smaller branches**, and each of those branches divides again in the same way, repeatedly.

- After the development of the segmental bronchi the bronchioles will develop. (Conducting + respiratory).
- Bronchiole develop through (Dichotomous devision). * زي أفرع الشجر
  → when going distally → more branches with smaller diameter.
  - These devisions occure in a space around the lung called pericardioperitoneal canal.
  ☆ pericardioperitoneal will form → pericardial cavity, peritoneal cavity
  ↳ then will have three cavities & ☆peritoneum will go toward the abdome to form peritoneal cavity
  ☆ pericardium will go toward the chest and become pleuropericardal cavity
  ☆ pleuropericardial will devide into pleural and pericardial cavities.

- Pleura is made of visceral and parietal pleura.
  - Visceral : Splancnic pleura from splancnic mesoderm.
  - parietal : Somatic pleura from Somatic mesoderm.

## Terminal Bronchioles

☆ by the end of sixth month approximately 17 generations of subdivisions have formed.
☆ In post natal life 6 additional division will form.
→ 23 divisions
→ Divisions occur due to fibroblast growth factor.

# Maturation of the lung

→ Means the formation of respiratory bronchioles + Alveolar duct and Alveolar sac + Alveoli

☆ Maturation of lungs is in 4 Stages:

TABLE 12.1 Maturation of the Lungs

→ Capilaries : No contact
→ Epithelium : Cuboidal

| | | |
|---|---|---|
| Pseudoglandular period | 5–16 weeks | Branching has continued to form terminal bronchioles. No respiratory bronchioles or alveoli are present. |
| Canalicular period | 16–26 weeks | Each terminal bronchiole divides into 2 or more respiratory bronchioles, which in turn divide into 3–6 alveolar ducts. → No respiratory membrane |
| Terminal sac period | 26 weeks to birth | Terminal sacs (primitive alveoli) form, and capillaries establish close contact. → Cells will change from cuboidal to Simple Respiratory membrane squamous. |
| Alveolar period | 8 months to childhood 10 years | Mature alveoli have well-developed epithelial endothelial (capillary) contacts. → well developed respiratory membrane. |

→ Most cells are now simple squamous
↳ type I cells + there are type II

→ few years befor any baby born befor the 6th month will die direct nowadays babies can live even when born at age 5½ months in the Premature incubator with oxygen supply and surfactant until completing the 9th month.

→ The number of Alveoli at birth is only ⅙ of it's number in adults and increas till reaching it's maximum at the age of 10.

→ Role of Surfactant : It decreases the surface tension so during Expiratio inflation of alveoli will occur

? If no Surfactant is present ⇒ Infant Respiratory Distress Syndrom (IRDS)
→ During expiration alveoli will shrink → Atelectasis of lungs.

→ Nowaday artificial surfactant can be given to the baby with IRDS.
or we may stimulate it's synthesis using Betamethazon (Cortizone)
or by thyroxine from thyroid gland.

→ After the secretion of surfactant a fluid will form in the lung: formed from surfactant and amniotic fluid.

☆ Amniotic fluid is very important in the development of the respiratory tract

→ In some cases when the baby is born the amniotic fluid and surfactant are blocking the respiratory tract.
↳ so we use a tube from the oral cavity to inlet of larynx for suction of the fluids

# Anomalies of the respiratory tract

☆ RDS: Common cause of death in premature infants (30% of neonatal diseases / 20% of neonatal deaths).
→ Cause: type II cells secreat low amount of surfactant.
→ Atelectasis with expiration.
☆ Also known as Hyaline membrane disease

☆ **Agenesis of One lung** : Born with one lung only while the other is not formed very rare.

☆ **Supernumerary lobules** : The lung is divided into more lobules.

☆ **Ectopic lung** : The lung is not in the chest → may be in the abdomen.

☆ **Congenital Cysts of the lung** : Multiple cysts filling the lung with honeycomb aperance.

- Complications: 1- Chronic infections
  2- Insufficiency of breathing
- Treatment : throug excesion

☆ **Lung Hypoplasia** : Shrinkage of lung due to 2 causes.

① Congenital diaphragmatic hernia : Common in left side.
↳ Small intestine herniate through the diaphragm and compresses the left lung → hypoplasia

② Oligohyramnios : Amniotic fluid is essential in lung Development → Decreased amniotic fluid will cause retardation of lung development.
↳ Decreased Amniotic fluid

# Lungs of Newborn Infants

- Fresh and healthy lungs contain some air so pulmonary samples float in water
- The lungs of the stillborn infants are firm and sink in water because they contain fluids not air.