



الدكتور محمد الفاضل
سنة ١٤٤١ هـ
بنك شيفت: -



Respiratory system

Development of respiratory system

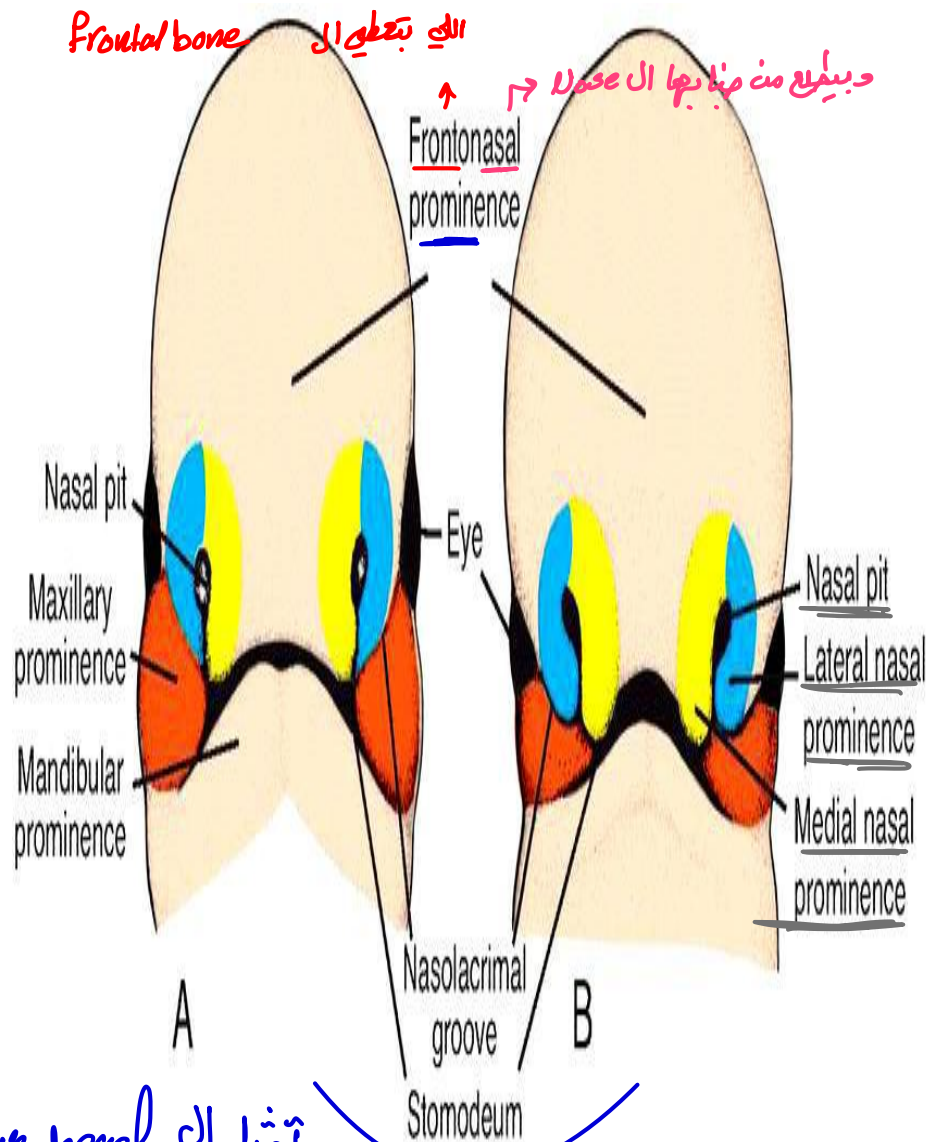
Dr. Mohamed Fathi

Assistant professor of Anatomy Department
Faculty of medicine

Development of RS Development of RS
 Development of RS Development of RS
 ال اسبوع الرابع ودباراً ال اسبوع الخامس

Development of the nose

- During the 5th week, two ^{skin} ectodermal thickenings called nasal placodes appear on each side of the frontonasal prominence.
- - Each placode becomes depressed at its center to form nasal pit. The margins of the placodes proliferate to form the medial and lateral nasal prominences.



Development stage of head Region in embryo primitive head

germinal layers ?

الطبقات الجذرية

inner most layer of cell in the

embryo during early development

الطبقات الجذرية three primary layer in embryo
الطبقات الجذرية Different tissue and organ

تتكون من

Ectoderm → skin, nervous system, hair
nail and tooth.

Mesoderm → Muscle, Bone, Blood vessel
heart / cartilage

Endoderm → glands or GIT



Development of Nose :-

ectodermal thickening (lateral Aspect) of the fronto-nasal prominence.

ectodermal vesicles (nasal placodes) form a depression called nasal pit.

nasal prominence of the embryo *

Nasal pit (Depression) is formed by medial and lateral prominences.

nasal prominence forms the nasal cavity.

nasal pit is formed by the invagination of the mesoderm. The cartilage of the nasal septum.



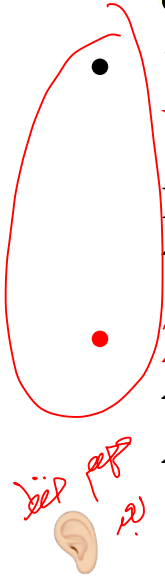
- Deepening of the nasal pits (by growth of the nasal folds and penetration into the underlying mesenchyme). forming 2 primitive nasal cavities which are separated from each other by a **nasal septum**.

mesodermal :- cartilage ←

(ectodermal mesodermal)

lateral wall ال جدار الجانبي
 nasal cavities . فتحة التجويف الأنفي
 meatus ال ممرات
 nasal conchae ال قوس الأنفية
 Passages ال ممرات
 air sinuses ال جيوفات الهوائية

- **3 conchae** develop as elevations on the lateral wall of the nasal cavity
- The **paranasal sinuses** develop as diverticula from the lateral wall of the nose. At birth, they are either very small or absent; their enlargement continues through childhood and contributes to the shape of the face.
- **1. The maxillary and ethmoid sinuses** are present **at birth**, but are small; the development of the maxillary is not completed until the eruption of all adult teeth; while the ethmoid is developed by about 8 years.
- **2. The frontal and sphenoid sinuses** develop postnatally; the **frontal** during the **7th year** & the **sphenoidal** around the **2nd year**.

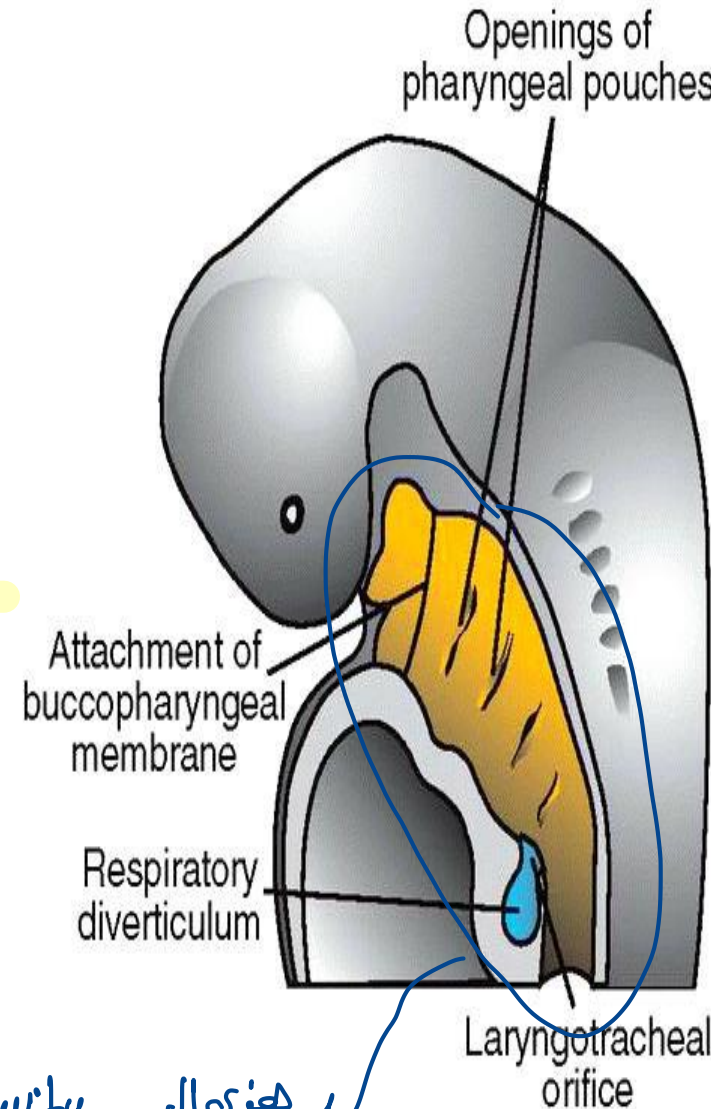


Milk teeth ال أسنان اللبنية
 Adult one ال أسنان الدائمة

Nose ال أنف

DEVELOPMENT OF THE RESPIRATORY SYSTEM

- Time: Middle of the 4th week.
- **Development:**
- **The laryngo-tracheal groove** appears as a median longitudinal groove in the floor of the primitive pharynx
- * The 2 margins of the laryngo-tracheal groove (called the *tracheo-oesophageal* folds or ridges) fuse together in a caudo-cranial direction forming the **tracheo-oesophageal septum** which separates the lumen of the primitive pharynx
- into 2 parts:
 - a. Dorsal part the pharynx & oesophagus. ↗ GIT tube
 - b. Ventral part called laryngo-tracheal tube. ↘ Respiratory Tube
- (أكبر) Primitive pharyngeal cavity الغرفة البدائية



هنا بدأ بشرح عن هذی Primitive Pharynx

عبارة عن Cavity يثبت نظريا groove بالفتحة

وهو laryngo-tracheal groove ولكن عدتة هو

Tracho-esophageal groove أو

laryngo-esophageal groove والفتحة هنا تسمى وهاهنا نظره

لانه الفتحة نحو زی ماخرف ديكاتوري ← ههنا دكاترة ياتبع

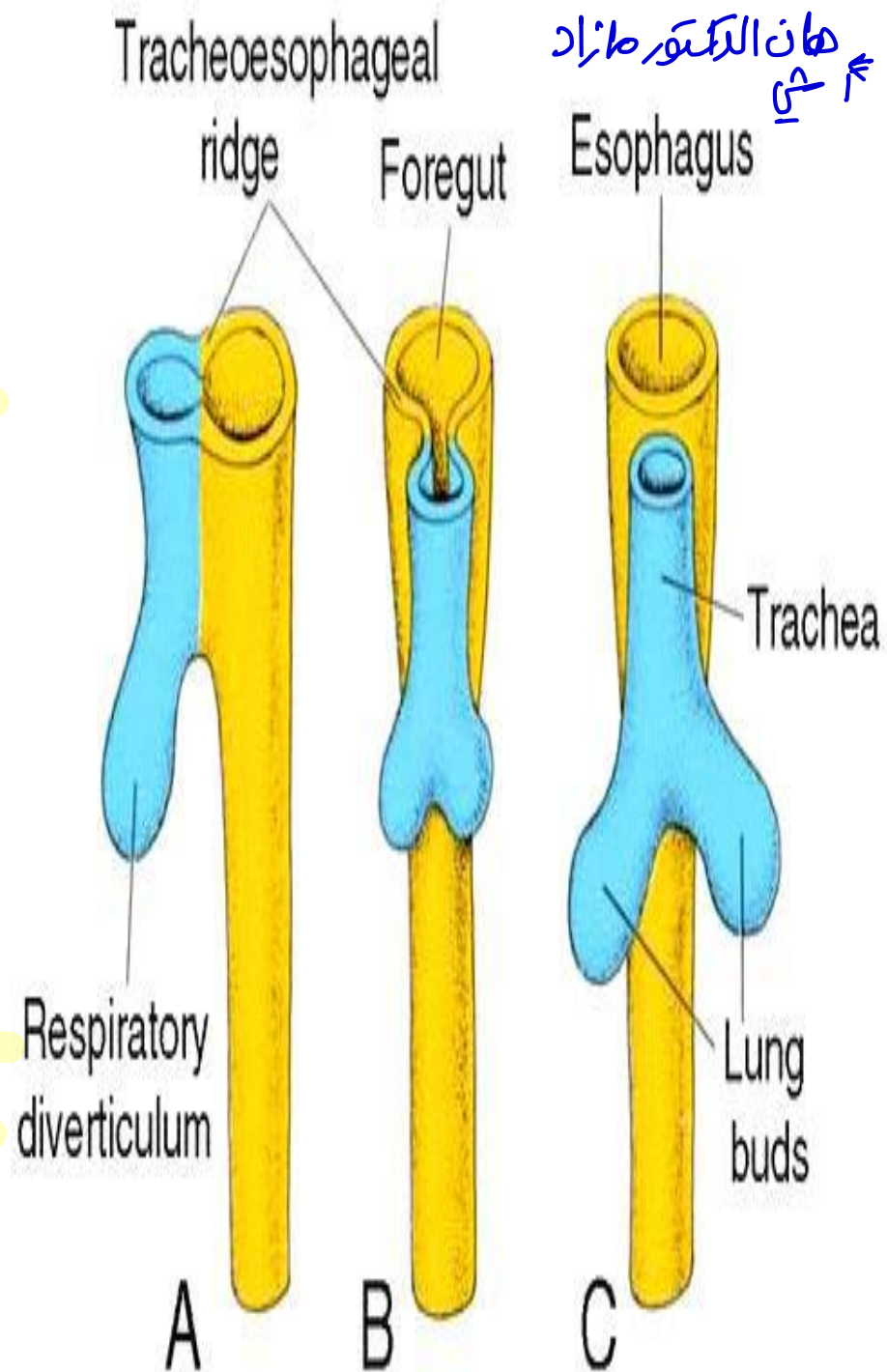
الانatomical ال larynx وال Trachea قدام وال Pharynx

وال esophageus ورا مفتحة ن هيك الفتحة بحسب هذی الاسماء .

ههنا الكتور شرح نفس الاشی بالاسلايد

• The laryngo-tracheal tube gives the lining epithelium of the larynx, trachea, bronchial tree and alveoli.

• The surrounding splanchnic mesoderm gives the cartilages, smooth muscles, connective tissue and blood vessels of the respiratory system.



• Fusion of the laryngo-tracheal folds stops cranially leaving a communication between the laryngo-tracheal tube and the pharynx. This opening is called the *laryngeal inlet*.

Handwritten notes:
Fold → الكتون ورا ال
septum → فاصلة
groove → حفرة
larynx → الحنجرة
sagittal section → مقطع عرضي مشافئ
Pharynx → البلعوم
laryngeal inlet is laryngopharynx → الحنجرة هي البلعوم الحنجري
Cnaso, oral, laryngeal → أنف، فم، حنجرة

• The *inlet* is a vertical slit which ends cranially opposite a median elevation in the floor of the pharynx, called the *copula* (epiglottis).

Handwritten note: * Canalization of larynx بعد 10 أسابيع

• Later, the inlet becomes T-shaped and is obliterated transiently between the 8th and 10th weeks.

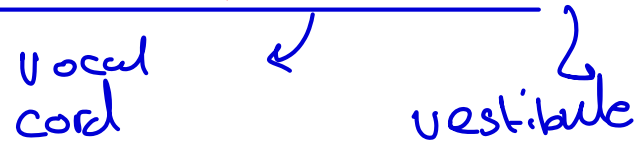
Handwritten note: → For laryngo-tracheal tube.

Handwritten notes:
* بعد 10 أسابيع الحنجرة تصبح أنف، فم، حنجرة
larynx → الحنجرة
Trachea → القصبة الهوائية
obliterated → محو
transiently → مؤقتاً
between → بين
the 8th and 10th weeks → بين الأسابيع 8 و 10

لحناء و عشاء و لحناء

الحناء و عشاء و لحناء
Canalization
Canalization
نظر ال*

- The laryngeal epithelium is derived from the endoderm of the cranial part of the laryngo-tracheal tube. During recanalization of the larynx, folds appear the *vocal cords* (true & false).



- The caudal end of the laryngo-tracheal tube grows down into the splanchnic mesoderm on the ventral aspect of the foregut, where it divides into right and left lung buds.

الحناء و عشاء و لحناء
Caudal end

الحناء و عشاء و لحناء
mesoderm

الحناء و عشاء و لحناء
invasion of
primitive lung

الحناء و عشاء و لحناء
Bronchi

الحناء و عشاء و لحناء
Bronchi

الحناء و عشاء و لحناء
left & Right lung buds

التنفس المبكر

Primitive Pharynx ^{appear} → groove

Laryngo-Tracheal tube ^{Fuse} → caudo-

cranial → Tracheo-oesophageal septum

→ Laryngo-Tracheal tube في الأنبوب
pharynx and oesophagus tube 1/2 tube

communication

التواصل

Pharynx في laryngo-Tracheal tube

الفتحة في laryngeal inlet في

الارتفاع في floor of pharynx

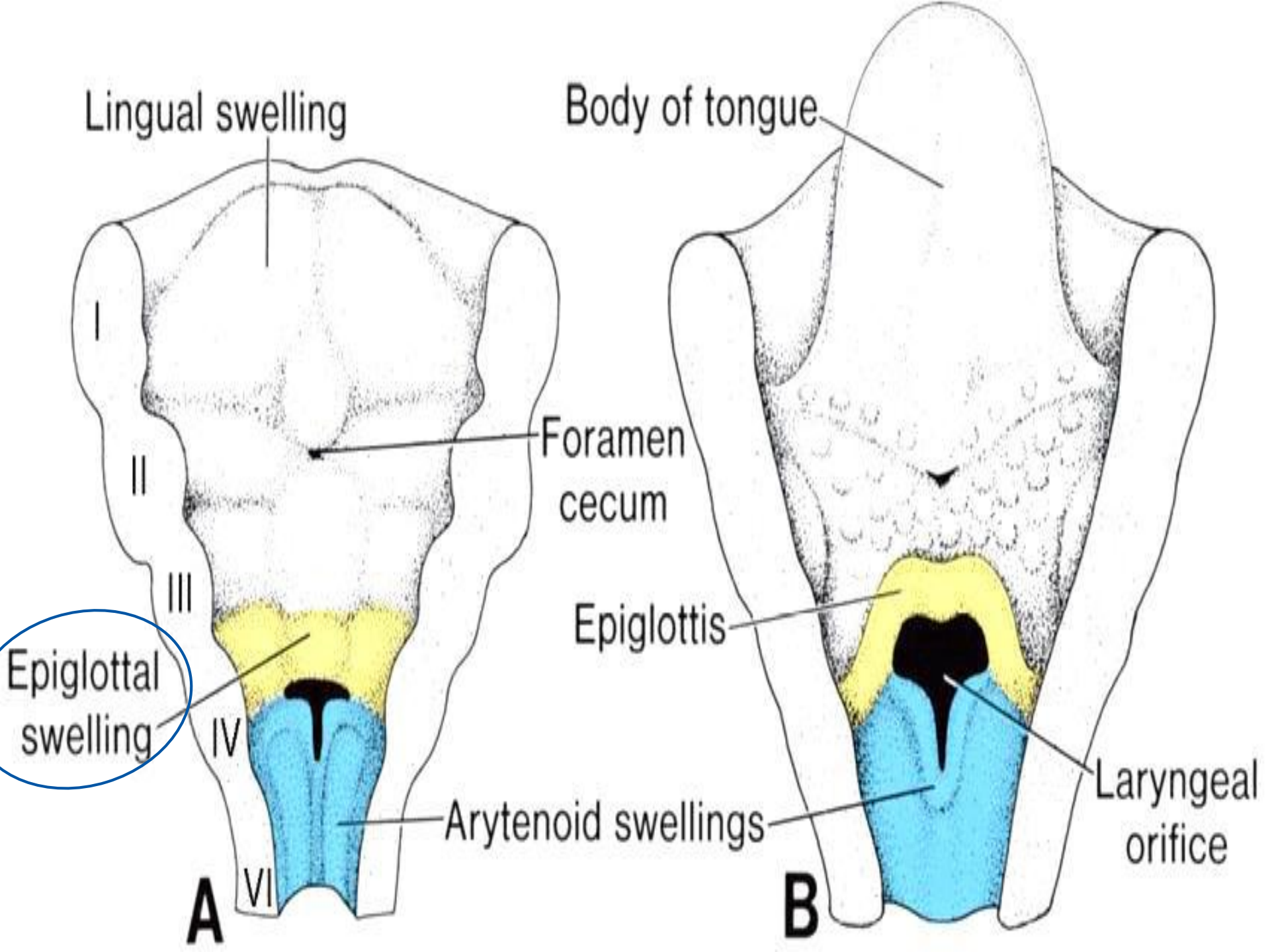
الأسبوع 8-10 في Copula (epiglottis)

obliterated of inlet then after 10 week

canalization occur and the vocal cord

appear then

The caudal end of the laryngo-tracheal tube grows down into the splanchnic mesoderm on the ventral aspect of the foregut, where it divides into right and left lung buds



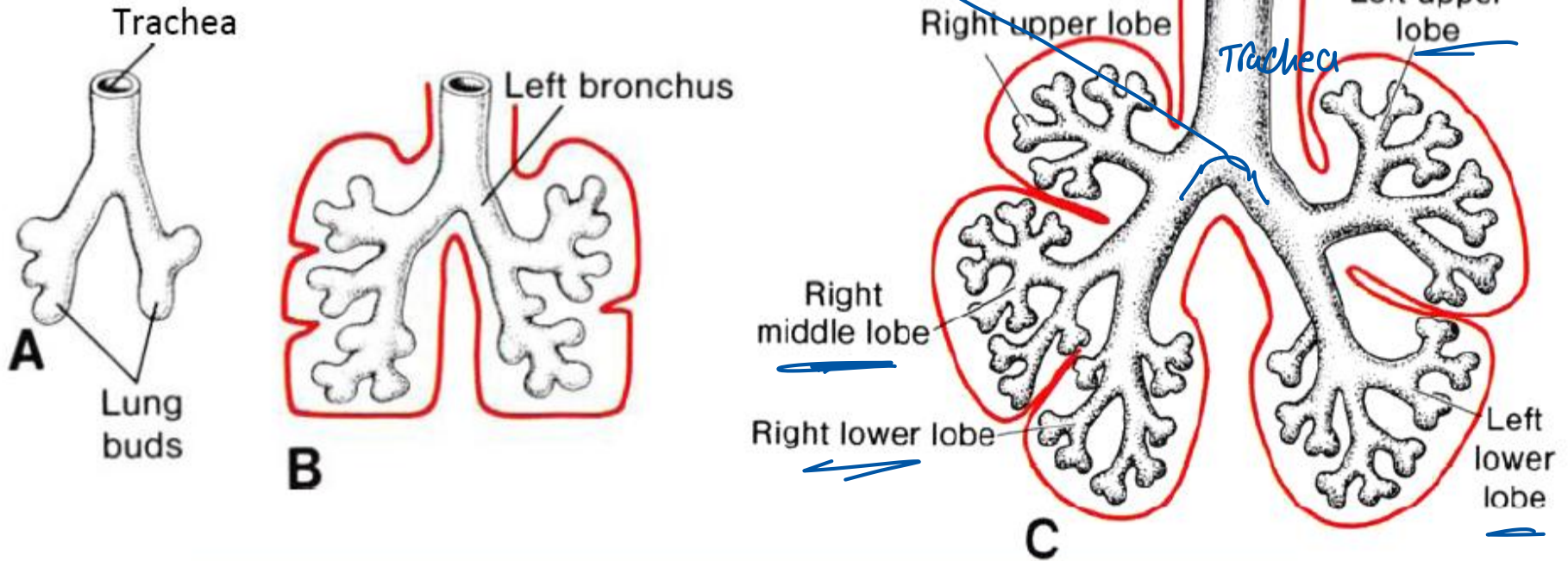
The lung buds undergo the following

Trachea → 2 main Bronchi → then each Bronchus will
Divides inside lung buds
A- Division:

- Each lung bud forms a *main bronchus*. The right bud is wider and more vertical than the left. Each main bronchus divides into *secondary* (lobar) bronchi (3 on the right side & 2 on the left side).
- The 2 *ry. bronchi* divide giving *tertiary* (segmental) bronchi, each becomes surrounded by a mass of splanchnic mesoderm a *broncho-pulmonary segment*.
Bronchus all blood supply at his tube ←
- Repeated division by the 6th Month to 17 orders of branches ending in *terminal bronchioles*.
- Further division continues for sometime after birth (up to 8 years) till the *respiratory bronchioles* and *alveoli* are formed after 7 *complete maturation of lung* additional orders of divisions (i.e., total of 24 orders).

B- The surrounding splanchnic mesoderm cartilaginous plates, smooth muscles, connective tissue & blood capillaries (bronchial & pulmonary).

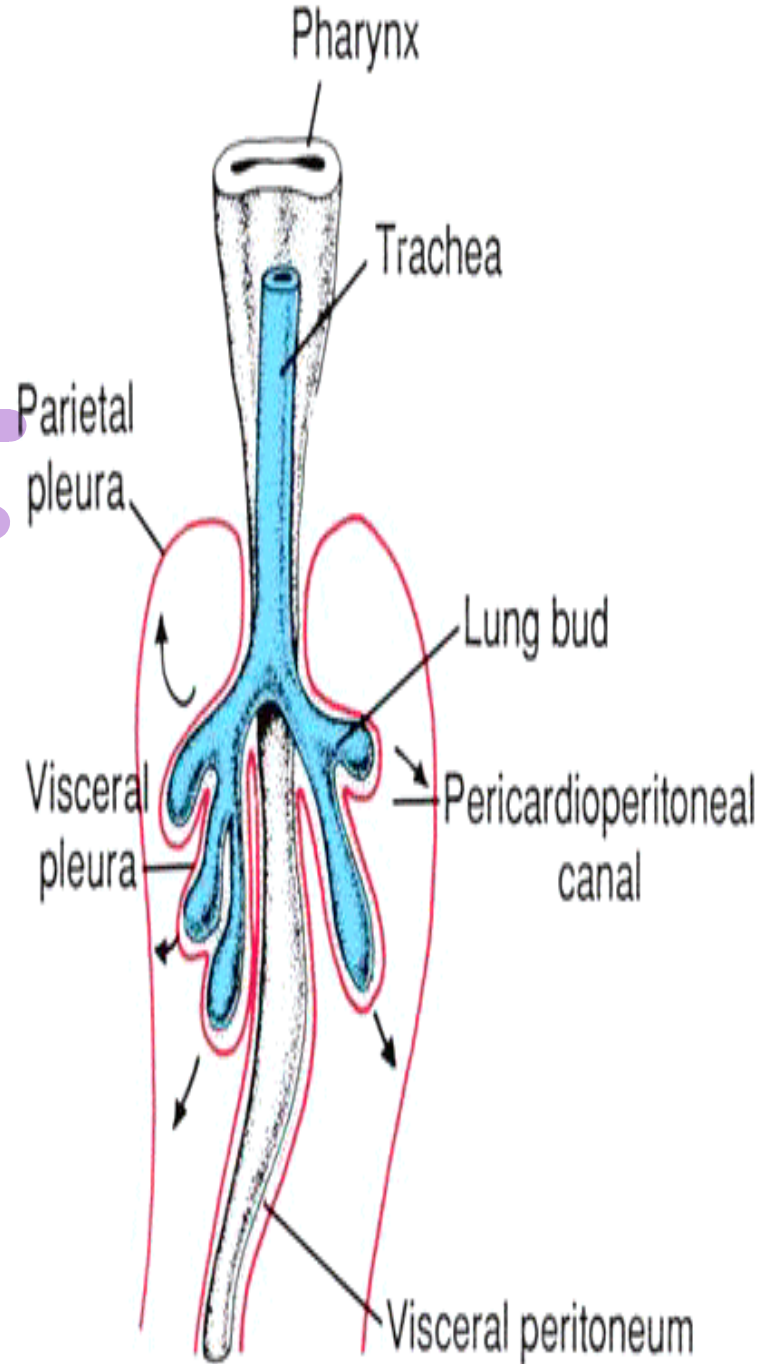
2 lung buds → main Bronchus.



(Fig.51): Development of trachea and lungs – A) 5 wks, B) 6 wks, C) 8 wks

C- Invasion of the pleura: each lung grows laterally around the foregut and invaginates the intraembryonic coelom, (i.e., the pericardio-^{mesoderm}peritoneal canal) which gives the pleural sac.

- The visceral pleura is derived from the splanchnic mesoderm (autonomic innervation), whereas the parietal pleura is derived from the somatic mesoderm (somatic innervation).



Stages of Lung maturation

Stage	time	Change formation	Baby survive
1- <u>Pseudo glandular</u>	<u>5 to 16 weeks</u>	Appear <u>Bronchi and terminal bronchioles</u>	<u>Not</u> (due to <u>no element of gases exchange</u>)
2- <u>Canalicular</u>	<u>17 to 24 weeks</u>	Appear of <u>respiratory bronchioles and alveolar ducts</u>	<u>Not</u> (no element of <u>gases exchange</u>)
3- <u>Terminal sac</u>	<u>24 to birth</u>	Appear of <u>alveoli lined by type I pneumocytes</u> Appear of <u>type II pneumocytes which secret surfactant</u> (begin of secretion from <u>20th week</u>)	<u>Can survive with intensive care</u>
4- <u>Alveolar period</u>	<u>From late perinatal period till 8 years after birth</u>	<u>The number of alveoli increases (95% of the alveoli develop after birth).</u>	<u>Survive</u>

← بياني ظهورها

الانواع كبة و هيك بس ايه انا بيت و هات
الرجل

←

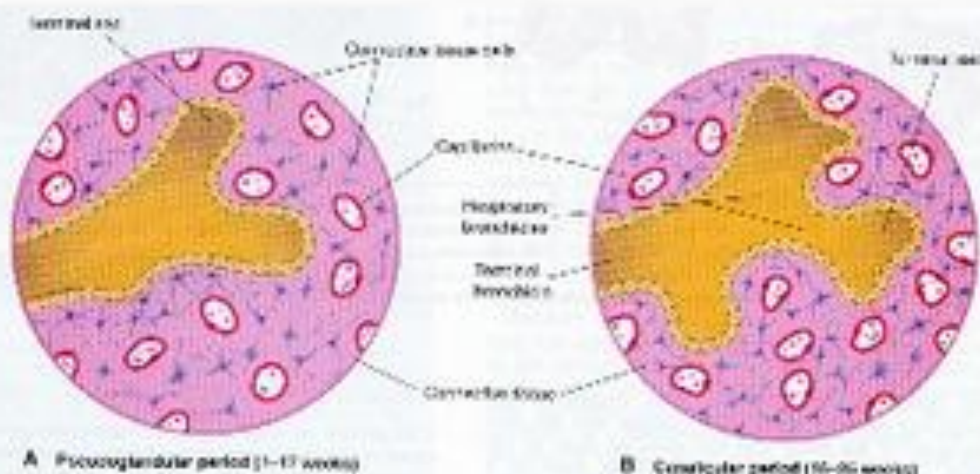
←

Pneumocytes Type II في Canalicular Stage

Stages of Maturation of the Lungs

Pseudoglandular Period (5-17 weeks):

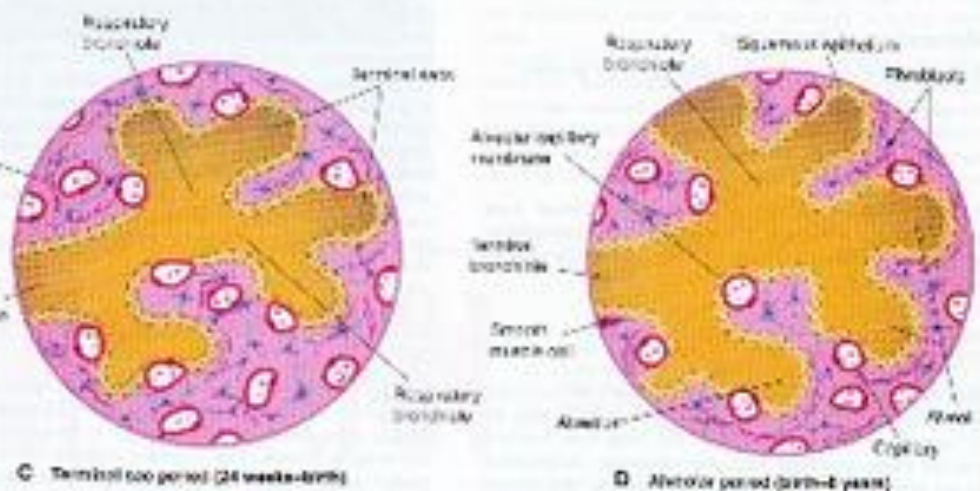
By 17 weeks, all major elements have formed, except those involved with gas exchange (fetuses unable to survive if born at this stage).



A Pseudoglandular period (5-17 weeks)

Canalicular Period (16-25 weeks):

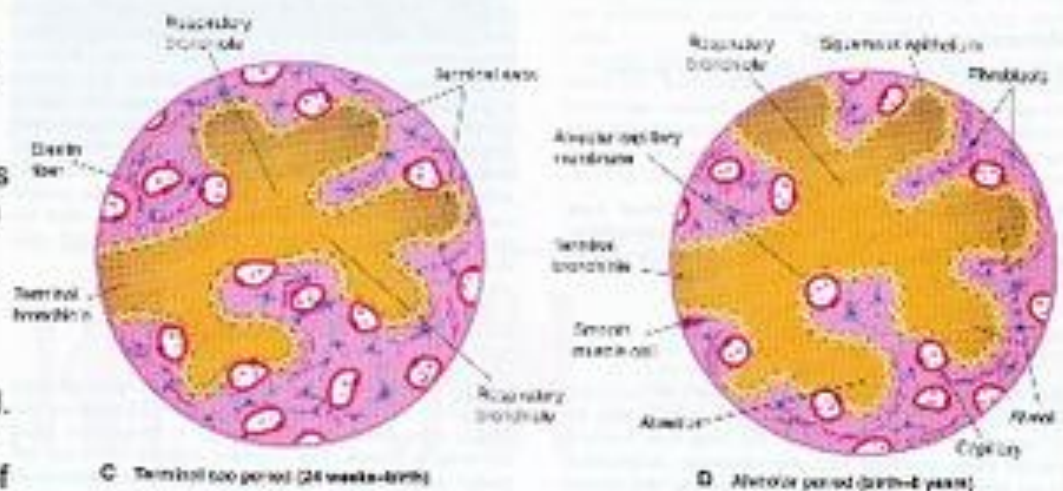
Bronchi, terminal bronchioles become larger, lung tissue becomes highly vascular. Alveolar ducts form by week 24. By end, some terminal sacs have formed so respiration is possible (small chance of survival at this stage).



B Canalicular period (16-25 weeks)

Terminal Sac Period (24 weeks to birth):

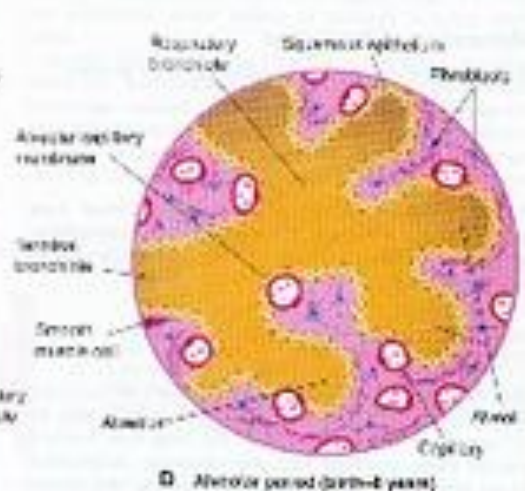
Many more terminal sacs develop, their epithelium becomes very thin and capillaries bulge into the developing alveoli. Blood-air barrier becomes well-developed. (By 26-28 wks, 1000 gr fetus has a sufficient # of sacs and surfactant to survive.)



C Terminal sac period (24 weeks to birth)

Alveolar Period (late fetal period to age 8):

Alveoli-like structures are present by 32 weeks. Epithelial lining of sacs attenuate to extremely thin squamous epithelia, capable of gas exchange. 95% of characteristic, mature alveoli develop after birth.



D Alveolar period (late fetal period to age 8)

هذه الحركات موجودة في الجنين قبل الولادة! العزوفات الـ Petus ما يتنفس بال ولما يوجد الدرع التنفسي عبر الـ Placenta

Breath Movements

انه فيه

• Before birth, they can be detected by ultrasonography.

As the lung is not a respiratory organ before birth, these prenatal breath movements cause:

1. Suction of amniotic fluid into the airway.

2. Training of the respiratory muscles.

* At birth, the fluid in the airways (amniotic fluid + bronchial secretions) becomes replaced by air via 2 mechanisms:

1. Some become expelled by pressure on the thorax during labour.

2. The majority is absorbed by pulmonary capillaries & more importantly by pulmonary lymphatics.

* احد ما يتنفسه الطفل دكتور النساء رافح الـ Baby دماغه لحد وجره فوقه (المايقه وجره) عشان ان لـ fluid بال Respiratory tube ينزل بال gravity ويطبخه

suction دُكِّدَ (سُجِّدَ) gentle suction دَوَّ

- **Medically, the lungs of a baby who was born alive & died after birth contain air, thus can *float* on water. On the other hand, the lungs of a still born baby *sink*.**

Anomalies of respiratory system

الطفل الذي عجز عن الحالة بعد ما الام تبصير يرضع
 projectile vomiting ← vomit الطفل تدرقي الطفل

يمكن فيه vomiting ولكن presented
 with Aspiration pneumonia →

بصولة
 من رئة
 vomit
 يرفد
 trachea
 عبر رئة
 lung
 و رئة
 Aspiration
 pneumonia

(1) Oesophageal atresia & tracheo-oesophageal fistula: (*Atresia* = obliteration & *fistula* = abnormal communication). The tracheo-oesophageal fistula results from *incomplete fusion* of the tracheo-oesophageal folds. Four varieties may occur (the most common is **atresia of the upper portion of esophagus & fistula of its lower portion with the trachea impossible feeding & aspiration of milk into the lungs.** (before birth, it causes polyhydramnios).

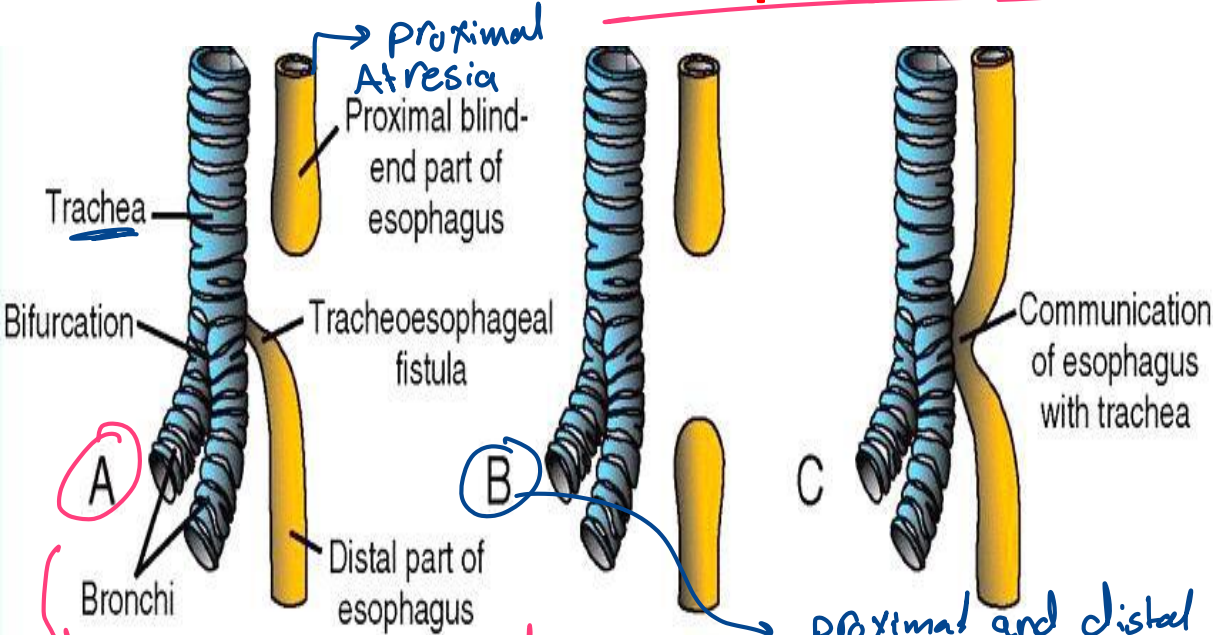
(2) Surfactant deficiency hyaline membrane disease (HMD) which is the major cause of respiratory distress syndrome (RDS). Thyroxin and cortisone increase surfactant production.

lung sick

(3) Other lung problems: include agenesis, hypoplasia (small lung), variation in lobes number, accessory lung, ectopic lung lobes (from the trachea or oesophagus) and congenital lung cyst.

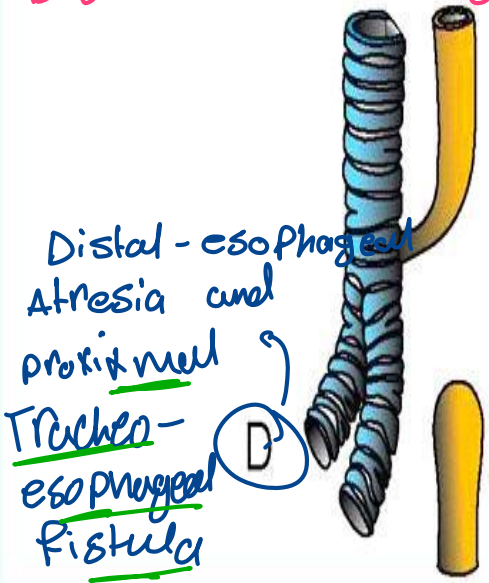
Thorax بال
 is رئة في
 lung ال
 ال

Tracheo- esophageal fistula → *Trachea* *فانج* *esophagus*

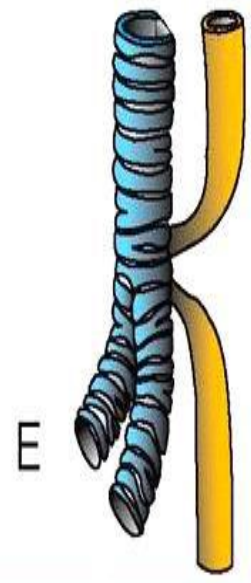


Proximal Atresia and Distal Tracheo-esophageal Fistula

proximal and distal Atresia

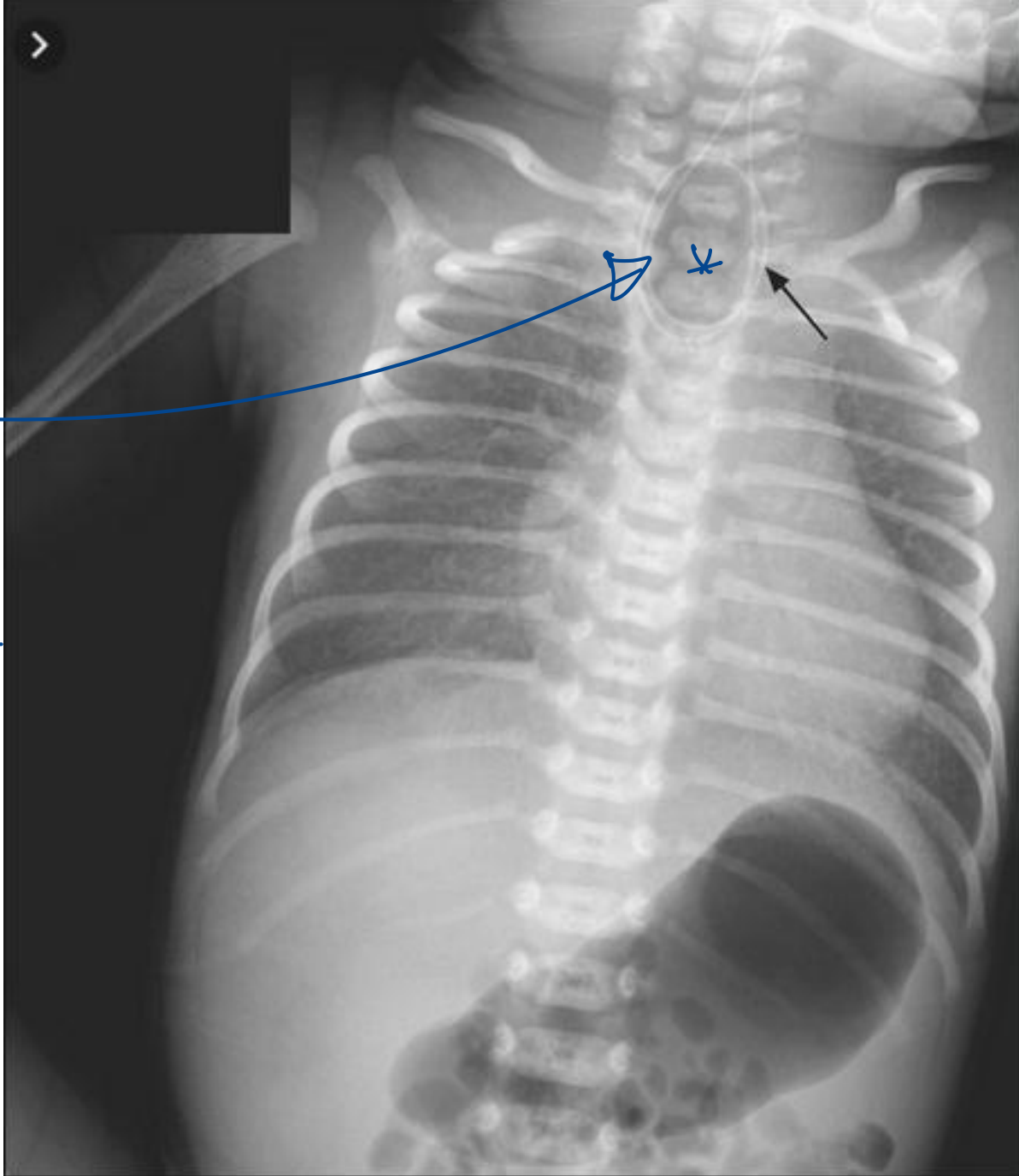


Proximal and Distal Tracheo-esophageal fistula



proximal Tracheo-esophageal fistula most common type → غالباً يكون بدون Atresia

**Radiological picture
of Tracheo-
esophageal fistula
"Coiled Ryle tube"**



في اجتهاد ام وتبكيك انه انهاكل
ما تدبته لسيفرخ ووزنه بقه انت
لماتوا حنونهم تدوع تحكي للرضية
ركبي Ryle tube الغروحن و
Normal تغذال esophagus
وتوجد ال Fundus of Stomach بس
هذه الحالة ال Ryle عن من esophagus
ال Trachea ولفن بها في العنظر *