

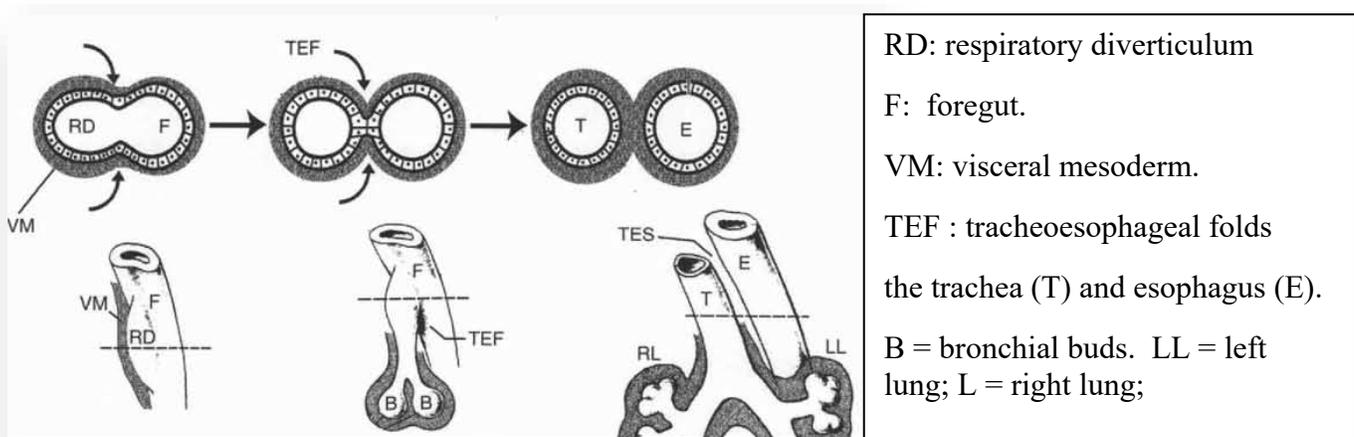
Respiratory System

1-Upper Respiratory System:

The upper respiratory system consists of the **nose, nasopharynx, and oropharynx.**

2-Lower Respiratory system: The lower respiratory system consists of the **larynx, trachea, bronchi, and lungs.**

The first sign of development is the formation of the **respiratory diverticulum** in the ventral wall of the primitive foregut during week 4. The distal end of the respiratory diverticulum enlarges to form the lung bud. The lung bud divides into two bronchial buds that branch into the primary, **secondary**, tertiary, and subsegmental bronchi. The respiratory diverticulum initially is in open communication with the foregut, but eventually they become separated by mesoderm (**tracheoesophageal folds**). When the tracheoesophageal folds fuse in the midline to form the tracheoesophageal septum, the foregut is divided into the trachea ventrally and esophagus dorsally.



Development of Individual Parts of the Respiratory System

Larynx

The larynx develops from the cranial part of laryngotracheal diverticulum. The opening of the respiratory diverticulum into the foregut becomes the laryngeal orifice. The mesenchyme (of fourth and sixth pharyngeal arches) surrounding the laryngeal orifice proliferates. As a result, the slit-like laryngeal orifice becomes T shaped. Subsequently laryngeal orifice acquires a characteristic adult shape.

The lining epithelium of larynx develops from endoderm of this diverticulum. At first the endodermal cells proliferate and completely obliterate lumen of larynx. Later the cells breakdown and recanalization of larynx take place.

*The muscles of the larynx develop from the mesoderm of 4th and 6th pharyngeal arches.

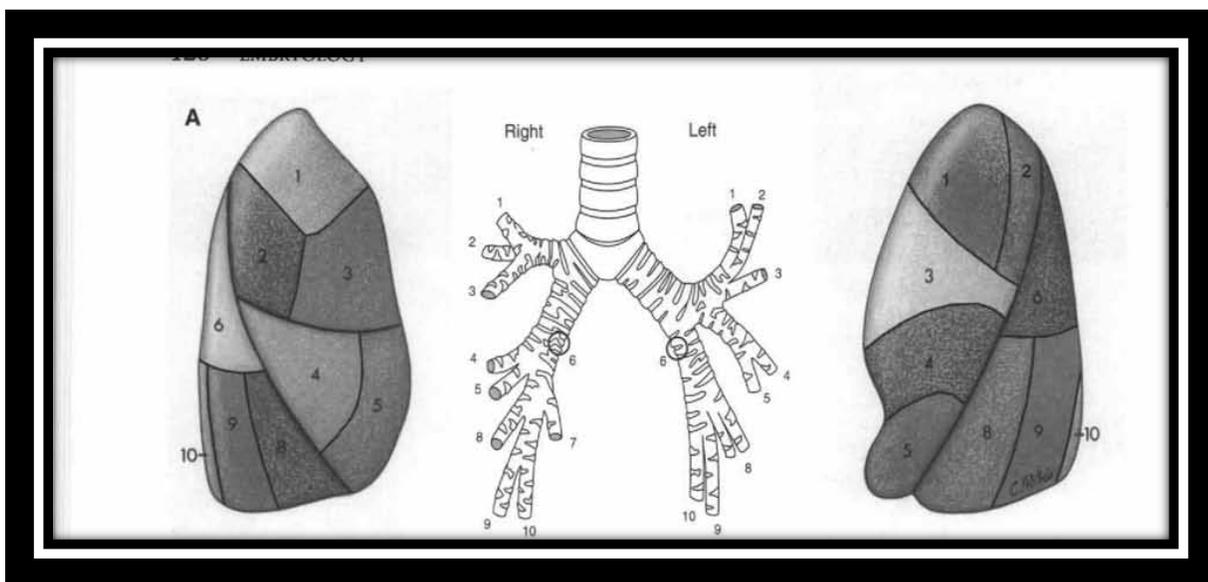
* All the cartilages of the larynx except epiglottis develop from mesenchyme of fourth and sixth pharyngeal arch, which is derived from neural crest cells. The epiglottis develops from the caudal part of hypobranchial eminence

Trachea

The trachea develops from part of the laryngotracheal diverticulum (respiratory diverticulum), which lies between the larynx and point of division of the diverticulum into bronchial buds. The endoderm of laryngotracheal diverticulum forms the lining epithelium and glands of the trachea. The cartilage, muscle, and connective tissue of trachea develop from surrounding mesoderm surrounding laryngotracheal groove.

Bronchi

- 1-The lung bud divides into two bronchial buds.
2. In week 5 of development, bronchial buds enlarge to form primary bronchi. The right primary bronchus is larger and more vertical than the left primary bronchus; this relationship persists throughout adult life and accounts for the greater likelihood of foreign bodies lodging on the right side than on the left.
3. Primary bronchi further subdivide into secondary bronchi (three on the right side and two on the left side, corresponding to the lobes of the adult lung).
4. Secondary bronchi further subdivide into tertiary (or segmental) bronchi.
5. As the bronchi develop, they expand laterally and caudally into a space known as the primitive pleural cavity; visceral mesoderm covering the outside of the bronchi develops into visceral pleura, and somatic mesoderm covering the inside of the body wall develops into parietal pleura.



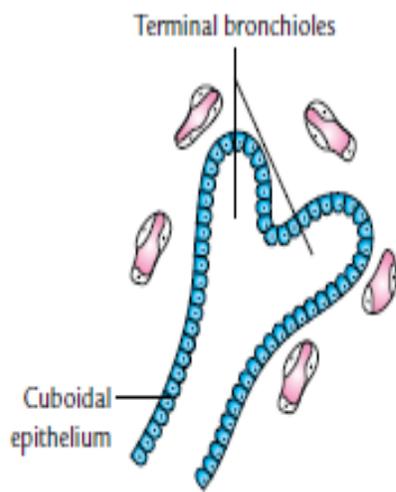
Maturation of the Lungs

1. Pseudoglandular stage/period: During this period, histologically the appearance of the lung resembles a developing exocrine gland. The divisions of bronchi are reached up to terminal bronchioles (i.e., all major elements of the lung are formed), but respiratory elements (e.g., respiratory bronchioles and alveoli) that are involved in respiration are not formed. Hence fetus born during this period cannot survive.

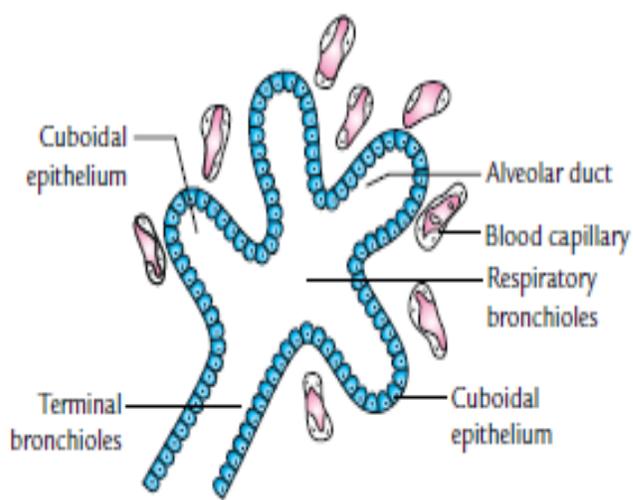
2. Canalicular stage: During this stage, lumens of terminal bronchioles dilate and there is a further subdivision of terminal bronchioles into respiratory bronchioles. The respiratory bronchioles divide into alveolar ducts. Few terminal sacs (primitive alveoli) may also be formed at the ends of respiratory bronchioles. The fetus born towards the end of this period may survive if given intensive care. The main thing that happens in this stage is that the lung tissue is well vascularized.

3. Terminal sac stage: During this period, a large number of terminal sacs (primitive alveoli) develop. The capillaries also proliferate and form a plexus around the terminal sacs. The wall (epithelium) of terminal sacs becomes very thin and capillaries bulge into these sacs. Terminal sacs are mainly lined by endodermal squamous cells called type I alveolar epithelial cells (type I pneumocytes) across which gaseous exchange takes place.

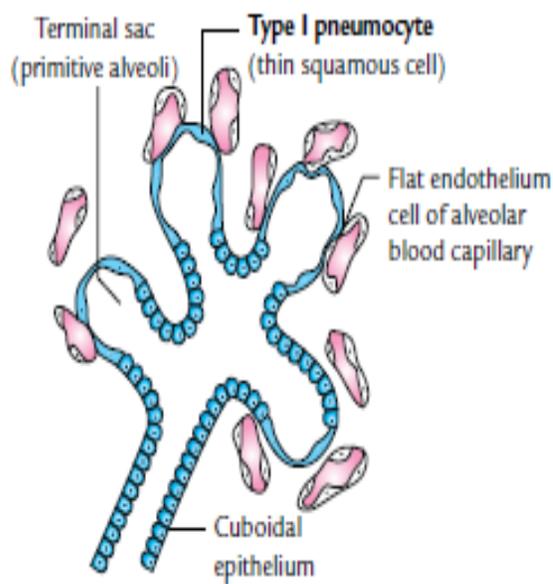
4. Alveolar stage: In this stage, the terminal sacs and respiratory bronchioles divide and form the alveolar ducts; at the end of alveolar ducts, the definitive (true) alveoli are formed. The formation of mature (true) alveoli continues even after birth.



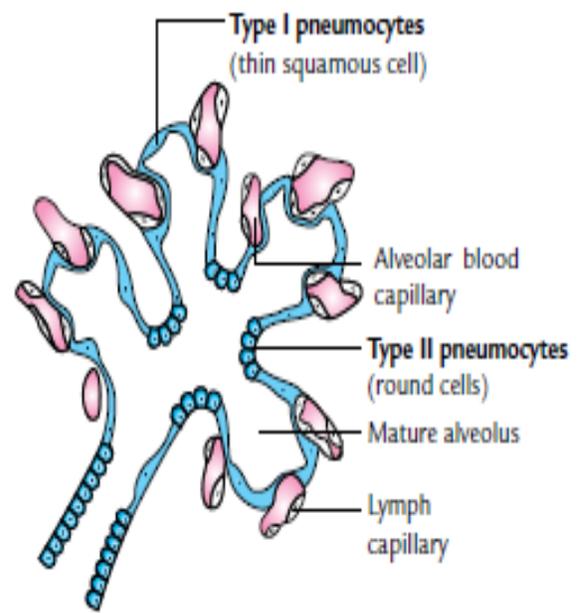
A Pseudoglandular stage



B Canalicular stage



C Saccular (terminal sac) stage



D Alveolar stage