

- Is accompanied by the pericardiophrenic branches of the internal thoracic vessels and descends between the mediastinal pleura and the pericardium.
- Innervates the fibrous pericardium, the mediastinal and diaphragmatic pleurae, and the diaphragm for motor and its central tendon for sensory functions.

CLINICAL CORRELATES

Ligation of the phrenic nerve does not always produce paralysis of the corresponding half of the diaphragm because the **accessory phrenic nerve**, derived from the fifth cervical nerve as a branch of the nerve to the subclavius, usually joins the phrenic nerve in the root of the neck or in the upper part of the thorax.

Hiccup is an **involuntary spasmodic sharp contraction of the diaphragm**, accompanied by the approximation of the vocal folds and closure of the glottis of the larynx. It may occur because of stimulation of nerve endings in the digestive tract or the diaphragm. When chronic, it can be stopped with pharmacologic therapy or by **phrenic nerve ablation**.

IX. DEVELOPMENT OF THE RESPIRATORY SYSTEM

A. Development of the trachea and bronchi

- Primordium for the lower respiratory system appears as a **laryngotracheal groove** in the ventral floor of the pharyngeal foregut. The groove evaginates to form the **laryngotracheal (respiratory) diverticulum**.
- The **laryngotracheal diverticulum** is soon separated from the foregut proper by the formation of a **tracheoesophageal septum**.
- The **tracheoesophageal septum** divides the foregut into a ventral portion, the **laryngotracheal tube** (primordium of the larynx, trachea, bronchi, and lungs), and a dorsal portion (primordium of the oropharynx and esophagus).
- **Lung buds** develop at the distal end of the laryngotracheal diverticulum and branch into the primary, secondary, and tertiary bronchi. The tertiary bronchi divide extensively to form bronchioles, terminal bronchioles, and respiratory bronchioles.

B. Derivations or sources

- Epithelium and glands in the trachea and bronchi are derived from endoderm, whereas smooth muscles, connective tissue, and cartilage of the trachea and bronchi are derived from visceral (splanchnic) lateral plate mesoderm.
- Visceral pleura is derived from visceral lateral plate mesoderm covering the surface of the lungs, whereas the parietal pleura is derived from somatic lateral plate mesoderm covering the inside of the body wall.

C. Development of lungs

- The lungs undergo five stages of development.
 - 1. Embryonic phase (prenatal 26 days to 6 weeks)**
 - The respiratory diverticulum forms as a ventral pouch of the foregut and undergoes preliminary branching.
 - 2. Pseudoglandular phase (prenatal weeks 6–16)**
 - The conducting (airway) system through the **terminal bronchioles** develops. Respiration is not possible.
 - 3. Canalicular phase (prenatal weeks 13–25)**
 - Luminal diameter of the conducting system increases, and **respiratory bronchioles**, alveolar ducts, and terminal sacs begin to appear. Premature fetuses born before week 20 rarely survive.
 - 4. Terminal sac phase (prenatal weeks 24 to birth)**
 - More **terminal sacs** form, and alveolar type I cells and **surfactant**-producing alveolar type II cells develop. Respiration is possible, and premature infants can survive with intensive care.
 - 5. Alveolar period (late fetal stage to 8 years)**
 - Respiratory bronchioles, terminal sacs, **alveolar ducts**, and **alveoli** increase in number.