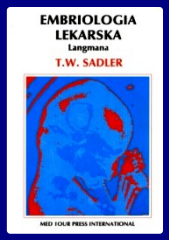
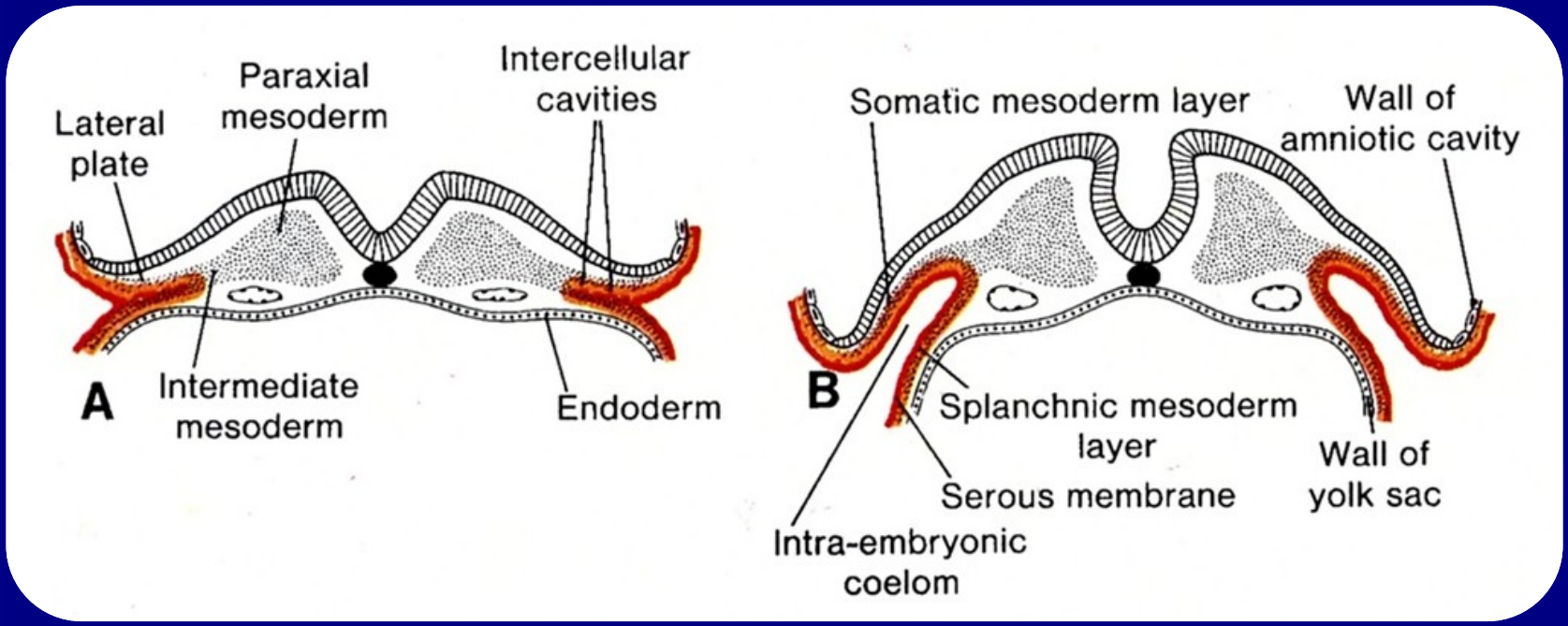
Rozwój jam ciała i układu oddechowego



Przy końcu 3. tygodnia leżąca po obu stronach linii pośrodkowej mezoderma wewnątrzzarodkowa różnicuje się na część przyosiową, pośrodkową i boczną.

Z chwilą pojawienia się w mezodermie bocznej rozstępów komórkowych – mezoderma rozdziela się na ścienną i trzewną.

Trzewna przechodzi w mezodermę ściany pęcherzyka żółtkowego.

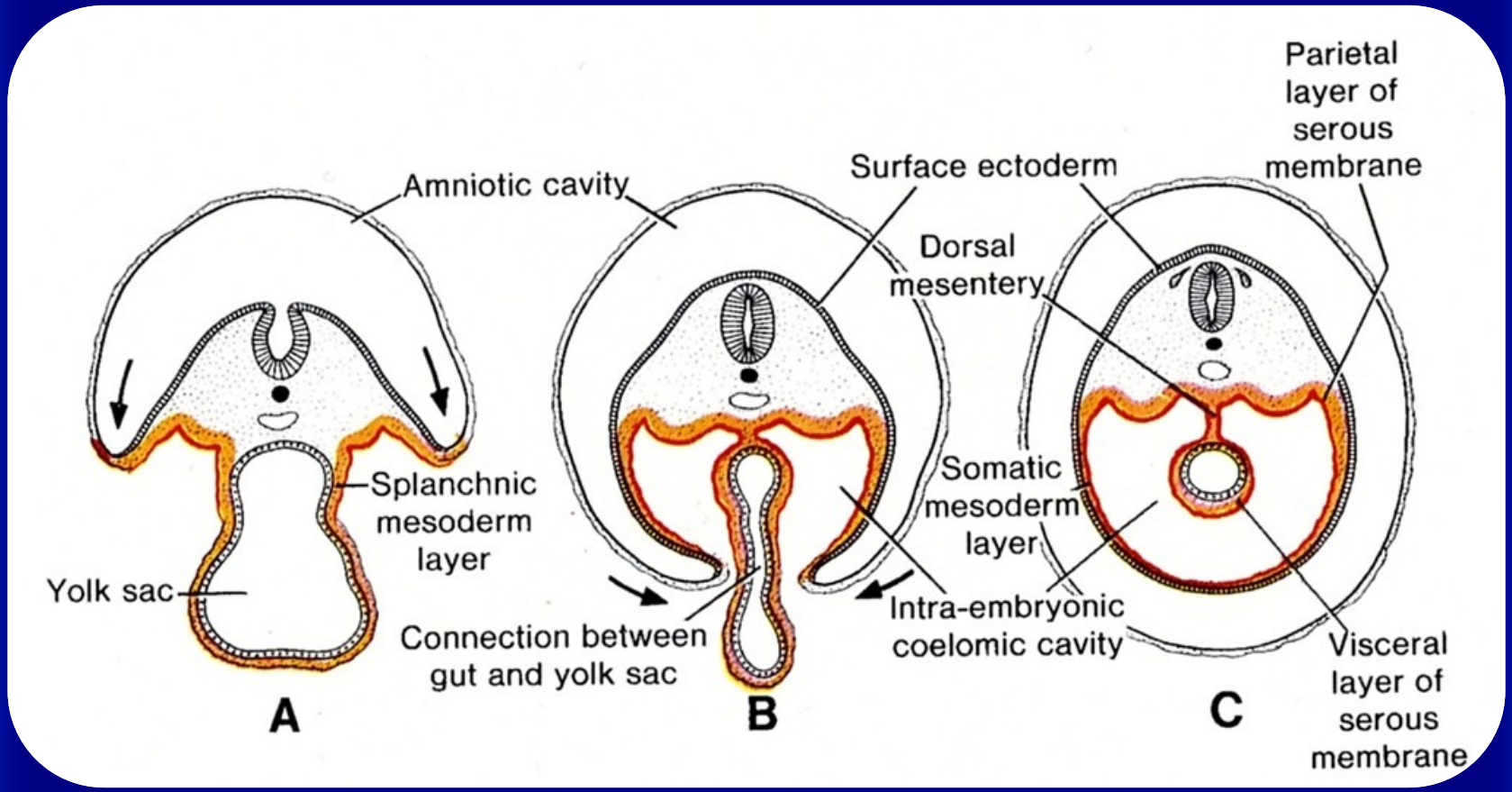

Lateral plate
Paraxial mesoderm
Intercellular cavities
A
Intermediate mesoderm
Endoderm
Somatic mesoderm layer
Wall of amniotic cavity
B
Splanchnic mesoderm layer
Wall of yolk sac
Serous membrane
Intra-embryonic coelom

Przestrzeń między mezodermą trzewną i ścienną

tworzy wewnątrzzarodkową jamę ciała.

Początkowo lewa i prawa strona wewnątrzzarodkowej jamy ciała łączą się na znacznej przestrzeni z zewnatrzzarodkową jamą ciała.

W momencie pofałdowania zarodka w kierunku głowowo-ogonowym oraz poprzecznym, połączenie to zanika.


Amniotic cavity
Splanchnic mesoderm layer
Yolk sac
A
Surface ectoderm
Dorsal mesentery
Connection between gut and yolk sac
B
Parietal layer of serous membrane
Somatic mesoderm layer
Intra-embryonic coelomic cavity
Visceral layer of serous membrane
C

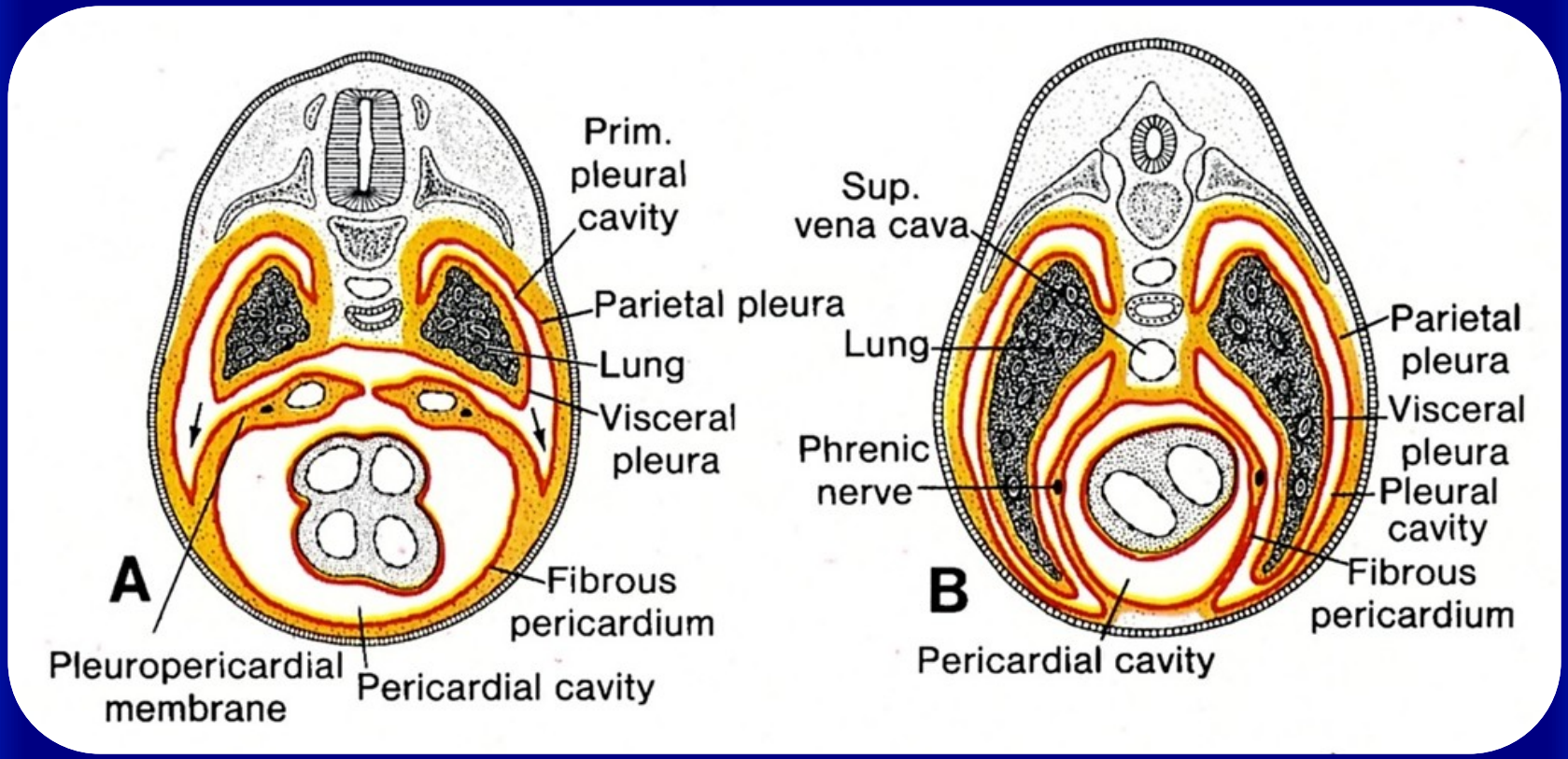
Wyścielające wewnątrzzarodkową jamę ciała komórki przekształcają się w mezotelium (nabłonek surowiczy) i tworzą blaszkę ścienną błon surowiczych, wyścielającą zewnętrzną warstwę jam: otrzewnej, opłucnej i osierdzia. Mezoderma trzewna tworzy warstwę wewnętrzną trzewną błon surowiczych.

Przepona dzieli jamę ciała na jamę klatki piersiowej i jamę otrzewnej.

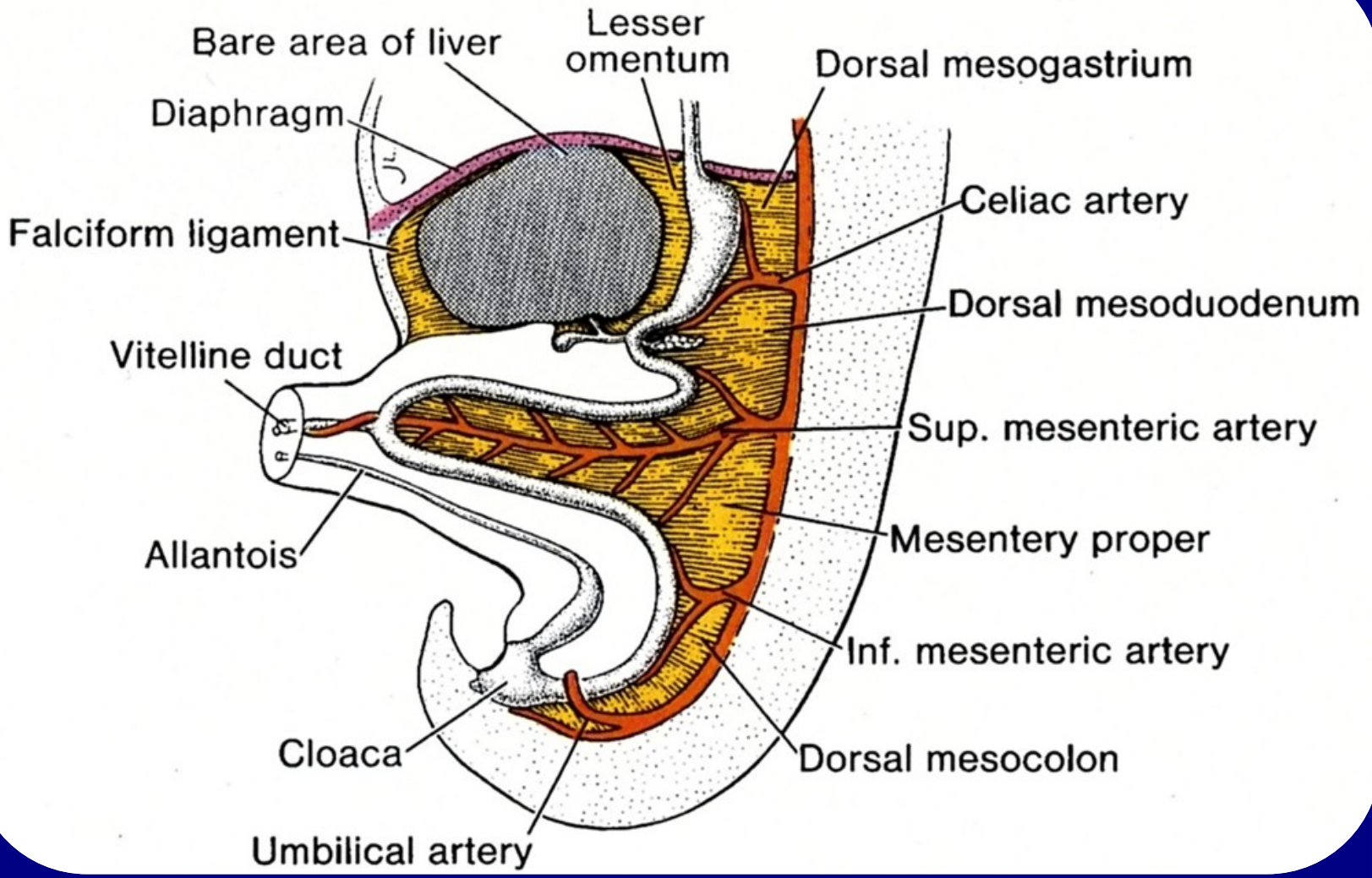
Powstaje z czterech elementów:

- przegrody poprzecznej
- błon otrzewnowo-opłucnowych
- krezki grzbietowej przełyku
- komórek mięśniowych ze ściany ciała

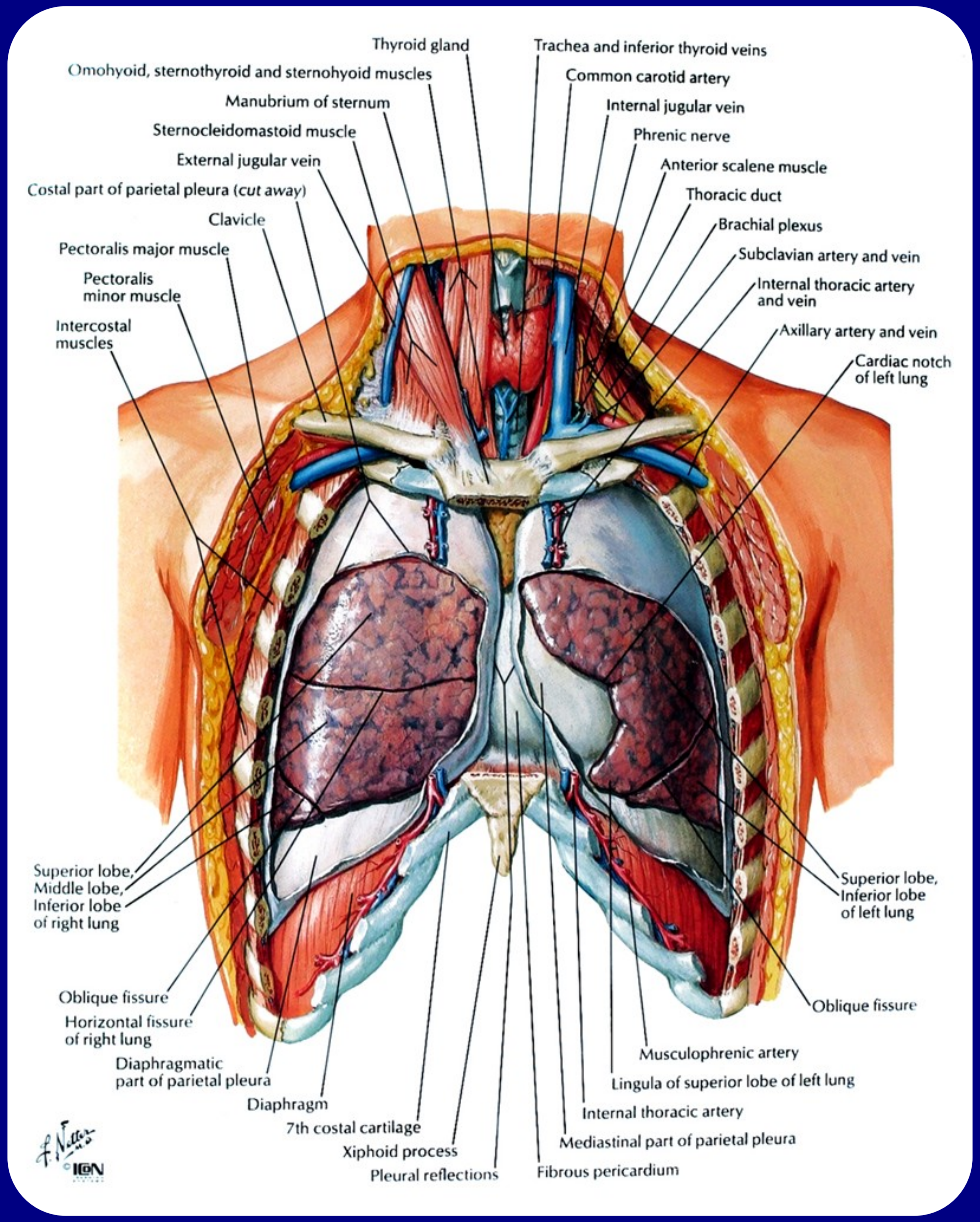
Jama klatki piersiowej zostaje podzielona przez błony opłucnowo-osierdziowe na jamę osierdzia i dwie jamy opłucnej.

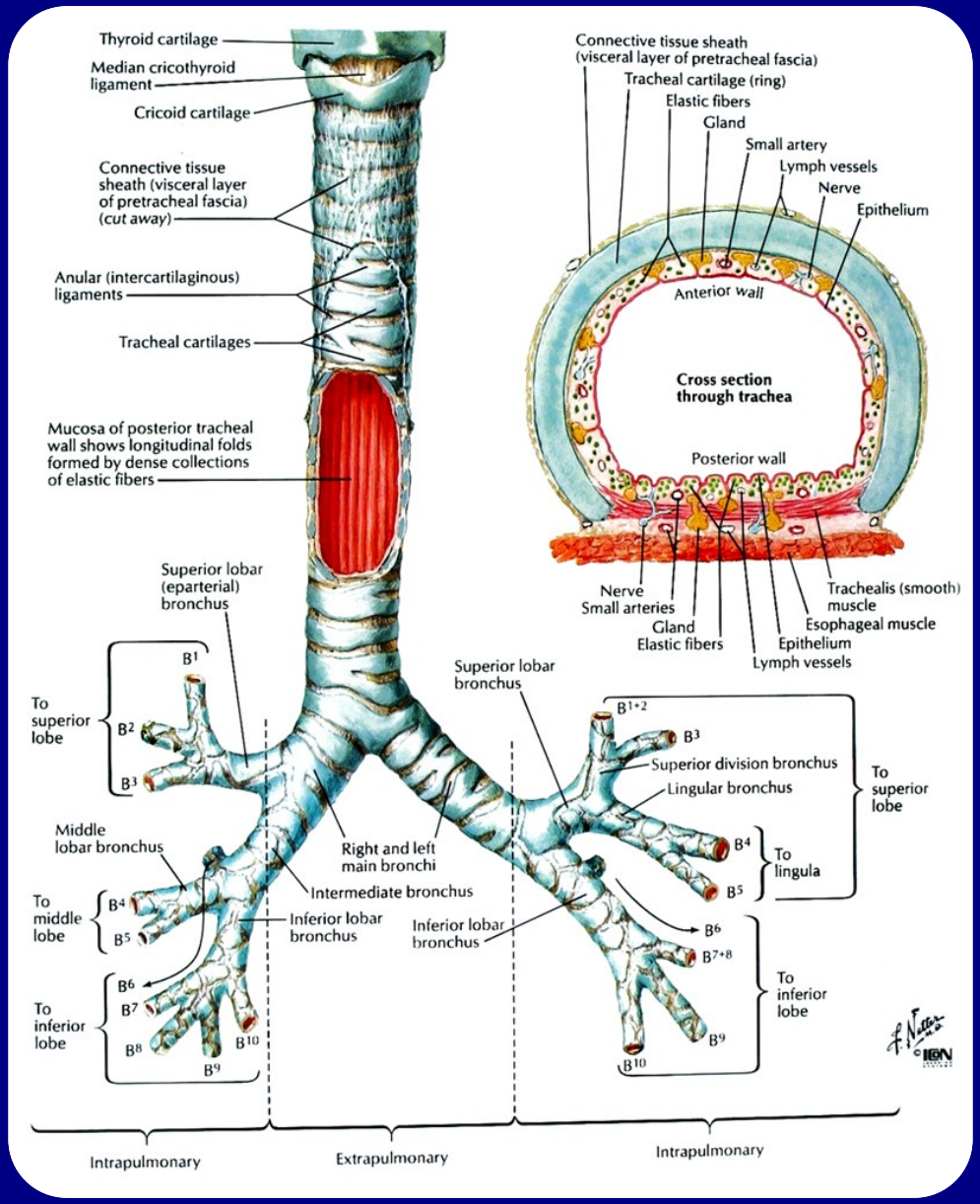

Prim.
pleural
cavity
Parietal pleura
Lung
Visceral
pleura
A
Fibrous
pericardium
Pleuropericardial
membrane
Pericardial cavity
Sup.
vena cava
Lung
Phrenic
nerve
Parietal
pleura
Visceral
pleura
Pleural
cavity
Fibrous
pericardium
B
Pericardial cavity

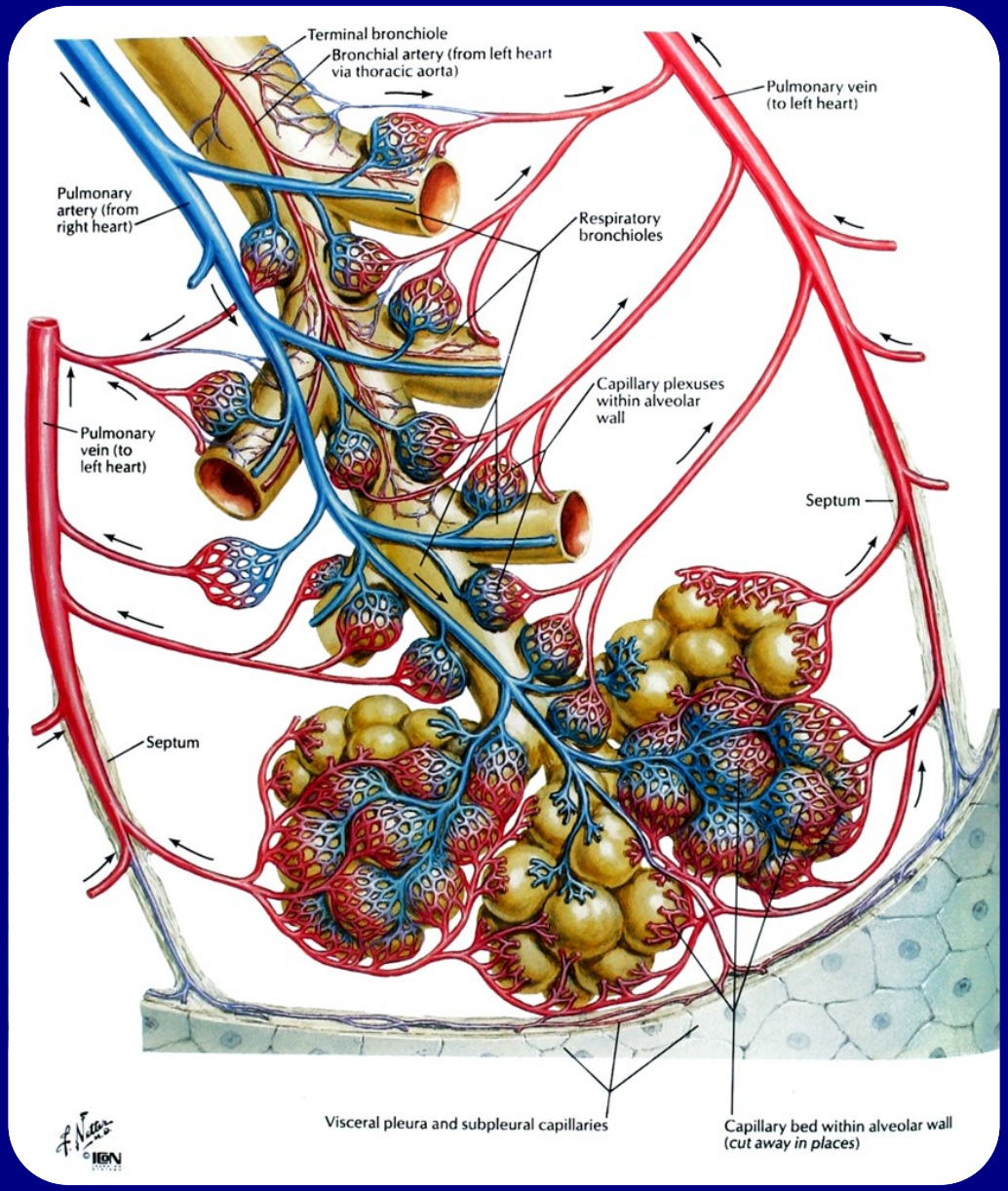
Wraz z fałdowaniem poprzecznym tarczy zarodkowej obie jej części boczne zbliżają się do siebie i łączą w linii pośrodkowej. Prajelito zostaje otoczone przez mezodermę trzewną.

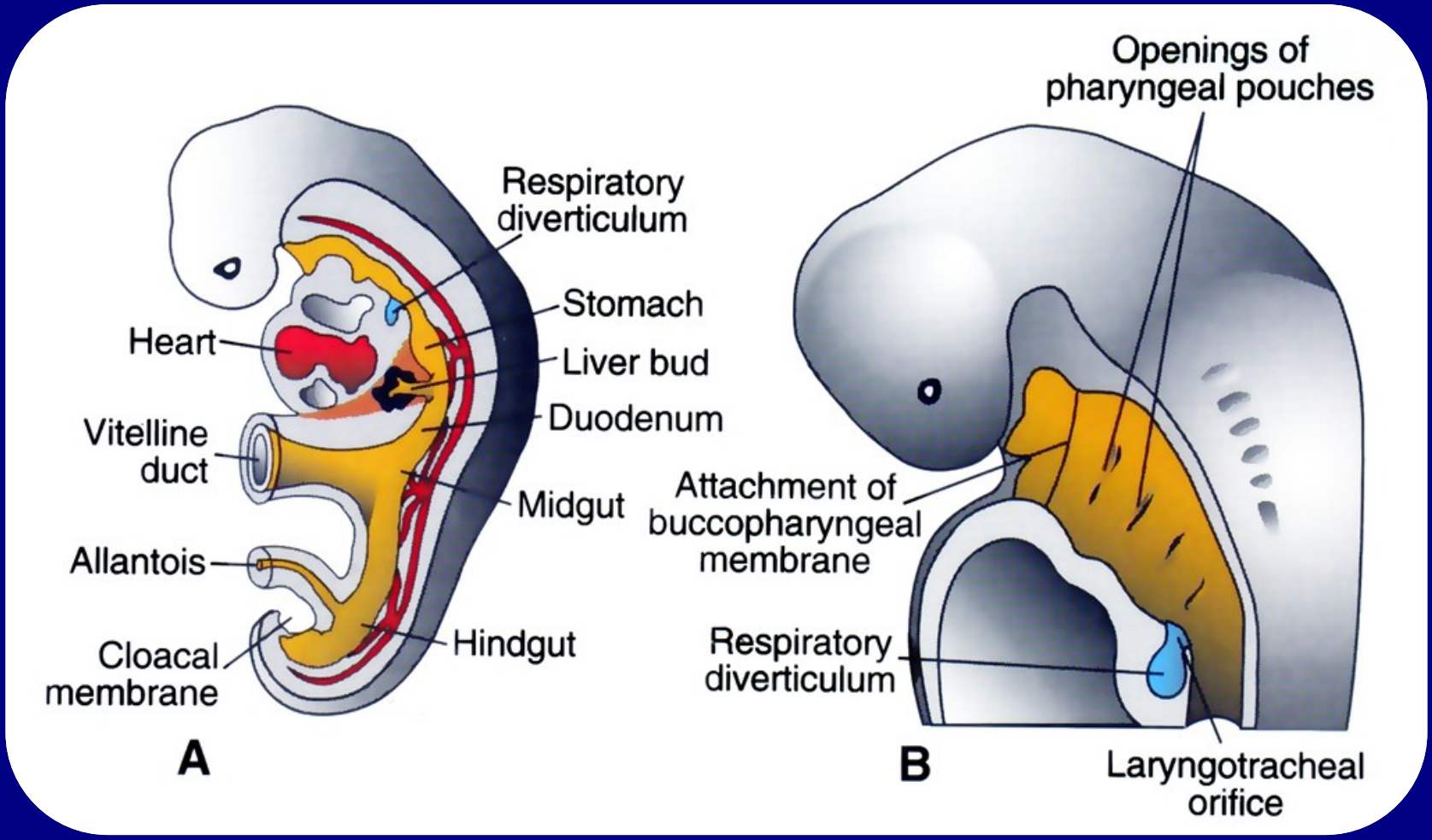

Bare area of liver
Lesser omentum
Dorsal mesogastrium
Diaphragm
Falciform ligament
Celiac artery
Dorsal mesoduodenum
Vitelline duct
Sup. mesenteric artery
Allantois
Mesentery proper
Inf. mesenteric artery
Cloaca
Dorsal mesocolon
Umbilical artery

Rozwój układu oddechowego

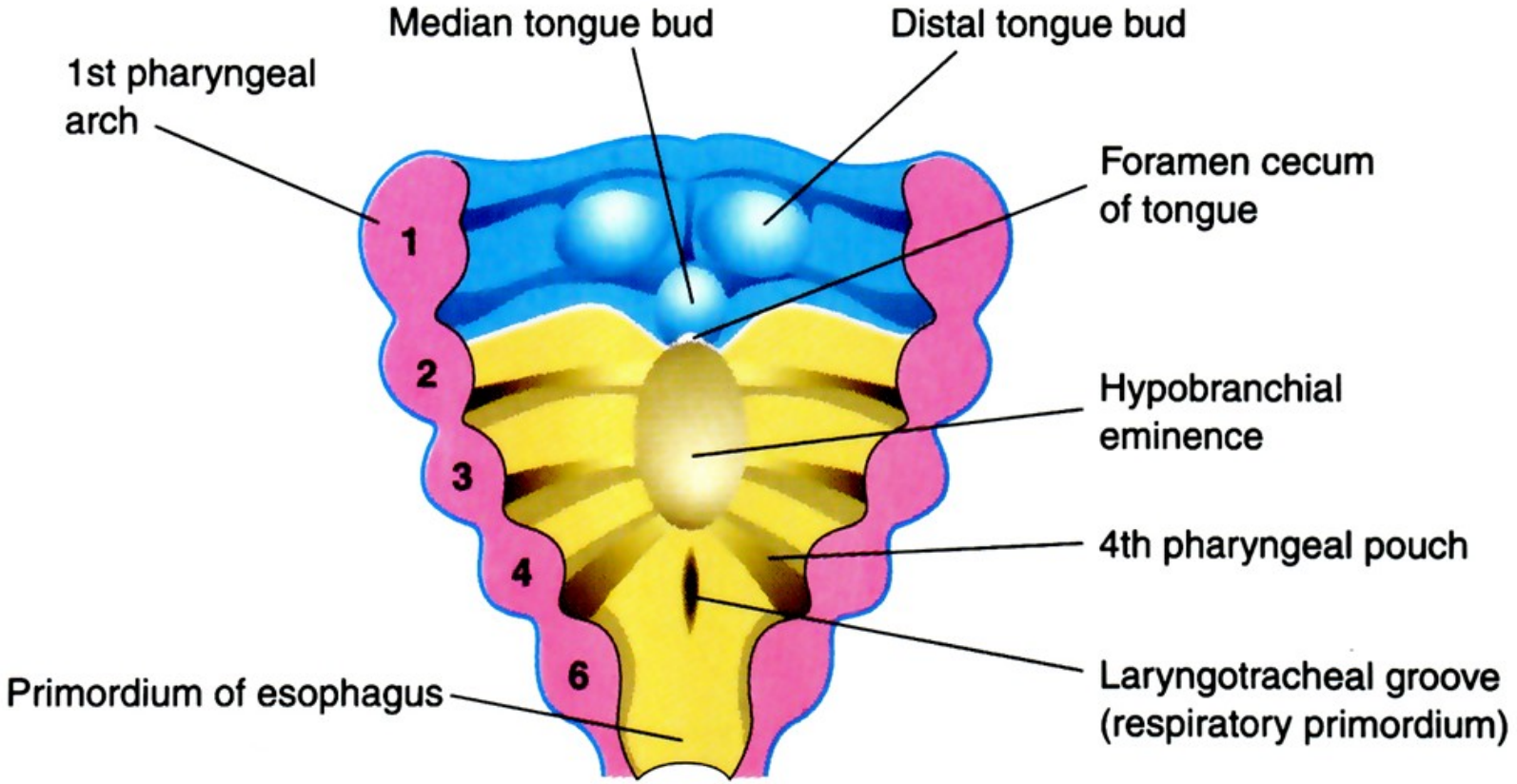

Thyroid gland
Trachea and inferior thyroid veins
Omohyoid, sternothyroid and sternohyoid muscles
Common carotid artery
Manubrium of sternum
Internal jugular vein
Sternocleidomastoid muscle
Phrenic nerve
External jugular vein
Anterior scalene muscle
Costal part of parietal pleura (cut away)
Thoracic duct
Clavicle
Brachial plexus
Pectoralis major muscle
Subclavian artery and vein
Pectoralis minor muscle
Internal thoracic artery and vein
Intercostal muscles
Axillary artery and vein
Cardiac notch of left lung
Superior lobe, Middle lobe, Inferior lobe of right lung
Superior lobe, Inferior lobe of left lung
Oblique fissure
Horizontal fissure of right lung
Oblique fissure
Musculophrenic artery
Diaphragmatic part of parietal pleura
Lingula of superior lobe of left lung
Diaphragm
Internal thoracic artery
7th costal cartilage
Mediastinal part of parietal pleura
Xiphoid process
Pleural reflections
Fibrous pericardium


Thyroid cartilage
Median cricothyroid ligament
Cricoid cartilage
Connective tissue sheath (visceral layer of pretracheal fascia) (cut away)
Anular (intercartilaginous) ligaments
Tracheal cartilages
Mucosa of posterior tracheal wall shows longitudinal folds formed by dense collections of elastic fibers
Connective tissue sheath (visceral layer of pretracheal fascia)
Tracheal cartilage (ring)
Elastic fibers
Gland
Small artery
Lymph vessels
Nerve
Epithelium
Anterior wall
Cross section through trachea
Posterior wall
Nerve
Small arteries
Gland
Elastic fibers
Epithelium
Lymph vessels
Trachealis (smooth) muscle
Esophageal muscle
Superior lobar (eparterial) bronchus
To superior lobe
B1
B2
B3
Middle lobar bronchus
To middle lobe
B4
B5
To inferior lobe
B6
B7
B8
B9
B10
Right and left main bronchi
Intermediate bronchus
Inferior lobar bronchus
Superior lobar bronchus
B1+2
B3
Superior division bronchus
Lingular bronchus
To superior lobe
B4
B5
To lingula
Inferior lobar bronchus
B6
B7+8
B9
B10
To inferior lobe
Intrapulmonary
Extrapulmonary
Intrapulmonary


Terminal bronchiole
Bronchial artery (from left heart via thoracic aorta)
Pulmonary vein (to left heart)
Pulmonary artery (from right heart)
Respiratory bronchioles
Capillary plexuses within alveolar wall
Pulmonary vein (to left heart)
Septum
Septum
Visceral pleura and subpleural capillaries
Capillary bed within alveolar wall (cut away in places)

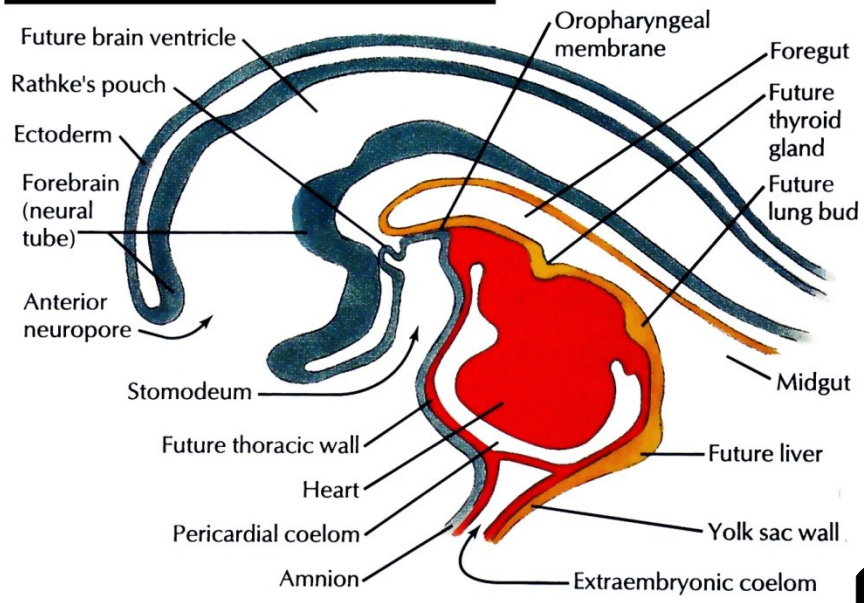


A – Embryo of approximately 25 days gestation showing the relation of the respiratory diverticulum to the heart, stomach, and liver. B – Sagittal section through the cephalic end of 5-week embryo showing the openings of the pharyngeal pouches and the laryngotracheal orifice.

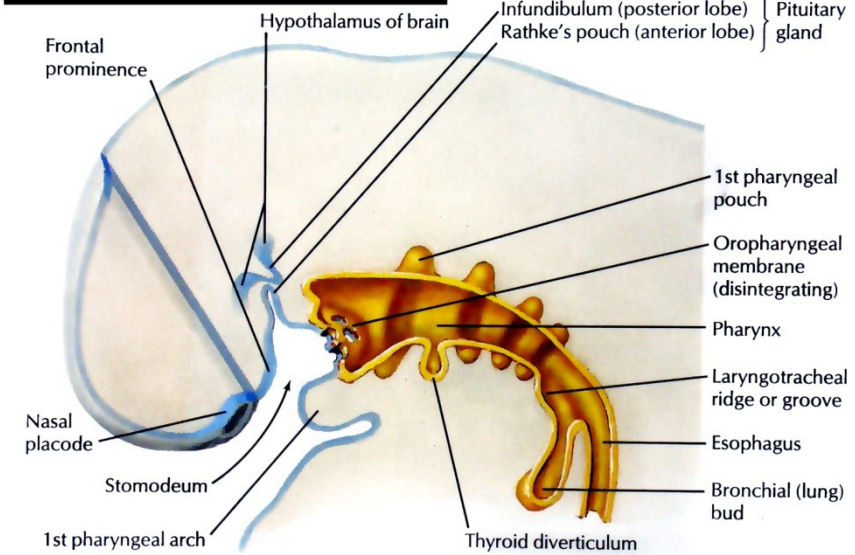


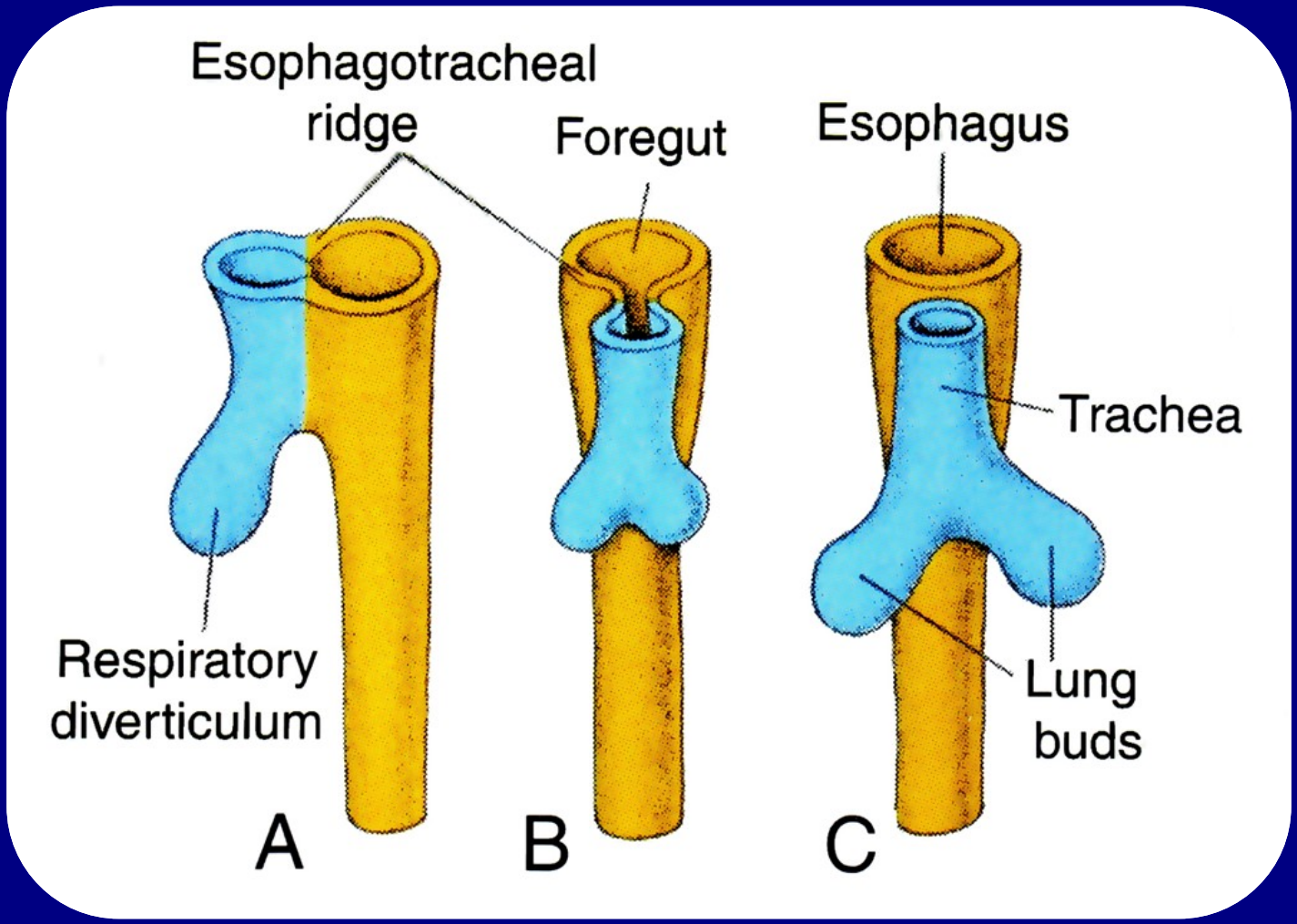
Horizontal section of the embryo, illustrating the floor of the primordial pharynx and the location of the laryngotracheal groove.

Embryo at 3 to 4 weeks. Sagittal section

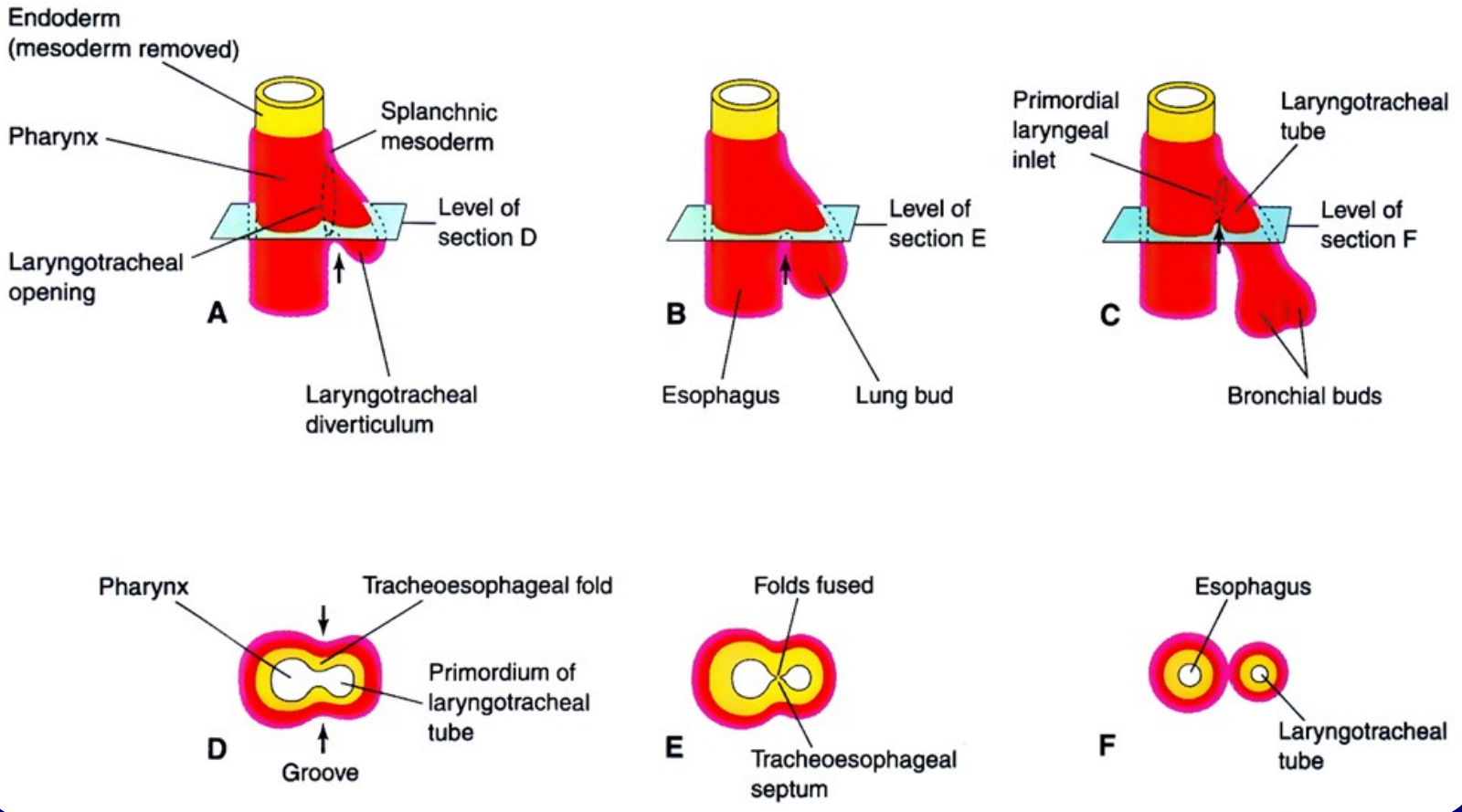


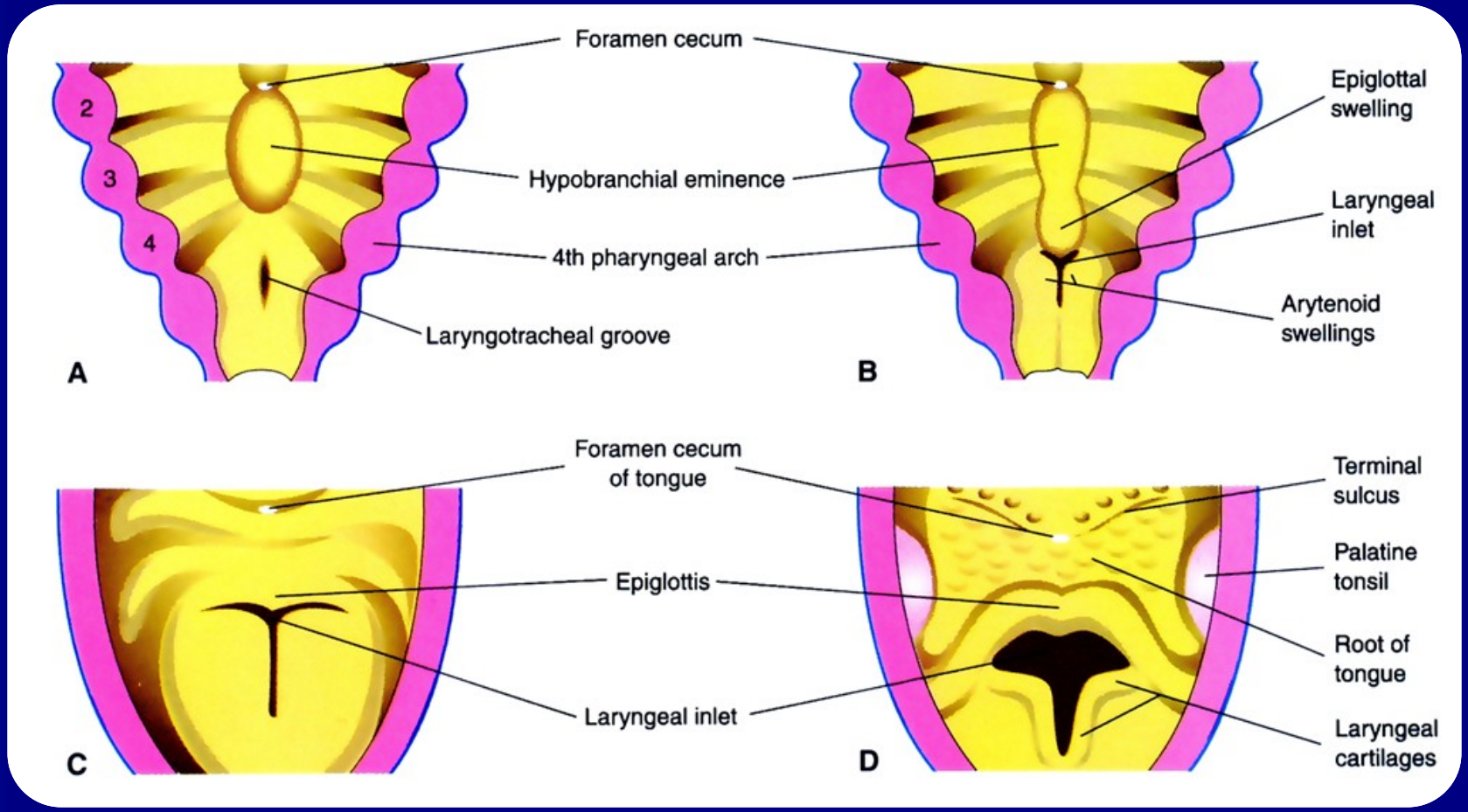
Embryo at 4 to 5 weeks. Sagittal section



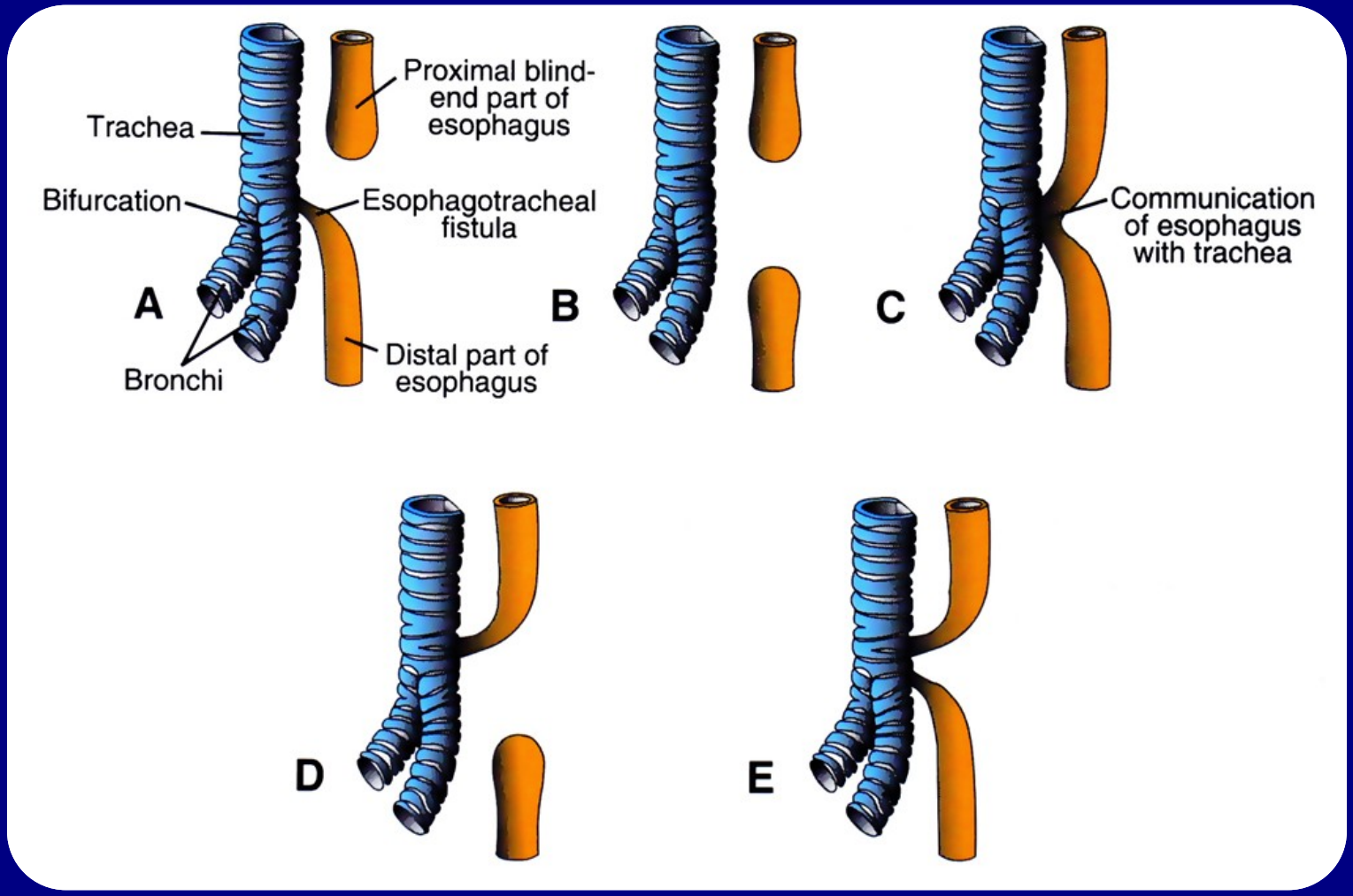


A, B, and C. Successive stages in development of the respiratory diverticulum showing the esophagotracheal ridges and formation of the septum, splitting the foregut into esophagus and trachea with lung buds.

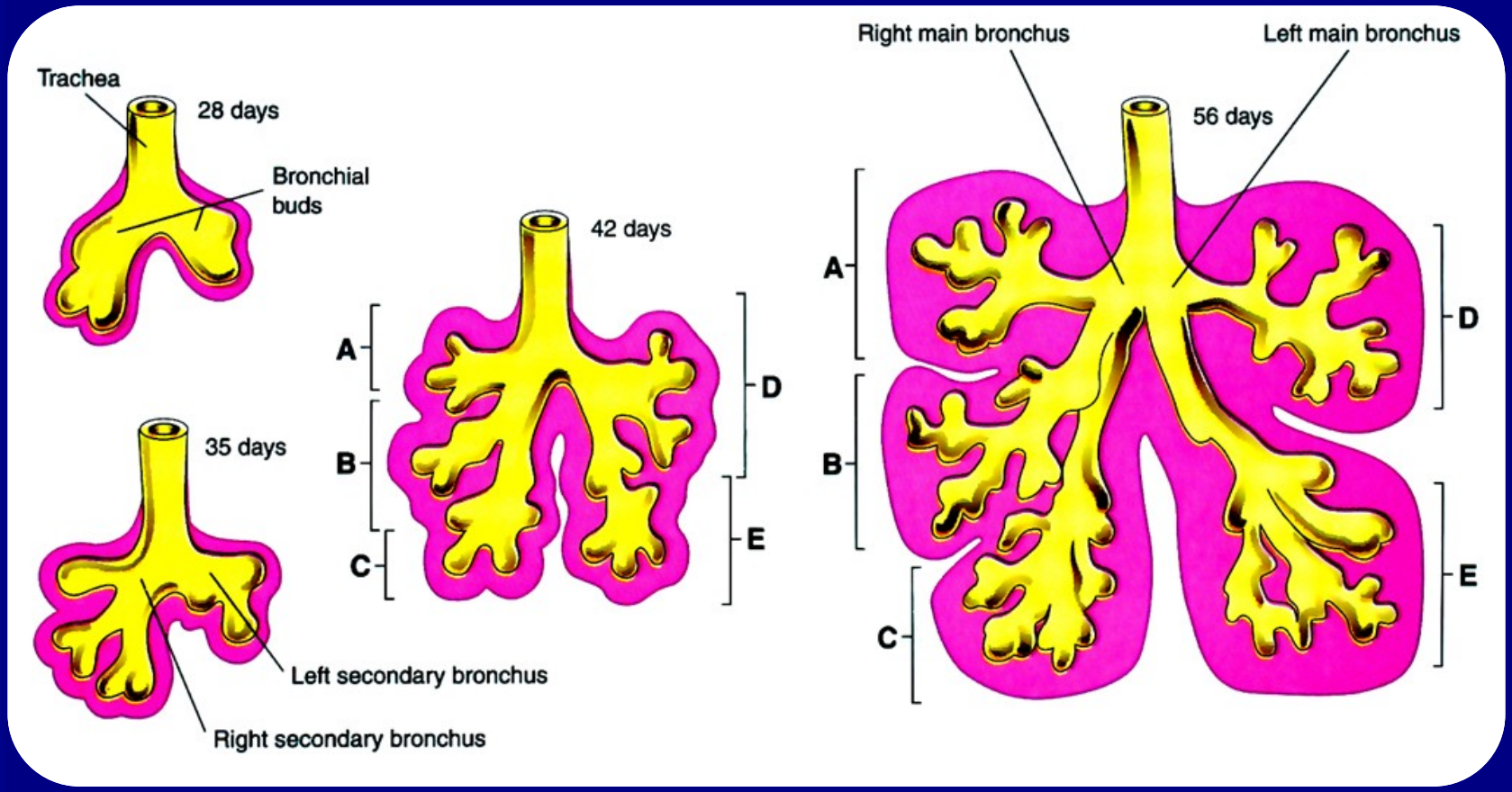

Endoderm
(mesoderm removed)
Pharynx
Splanchnic
mesoderm
Level of
section D
Laryngotracheal
opening
A
Laryngotracheal
diverticulum
Level of
section E
B
Esophagus
Lung bud
Primordial
laryngeal
inlet
Laryngotracheal
tube
Level of
section F
C
Bronchial buds
Pharynx
Tracheoesophageal fold
Primordium of
laryngotracheal
tube
D
Groove
Folds fused
E
Tracheoesophageal
septum
Esophagus
Laryngotracheal
tube
F



A – 4 weeks, B – 5 weeks, C – 6 weeks, D – 10 weeks



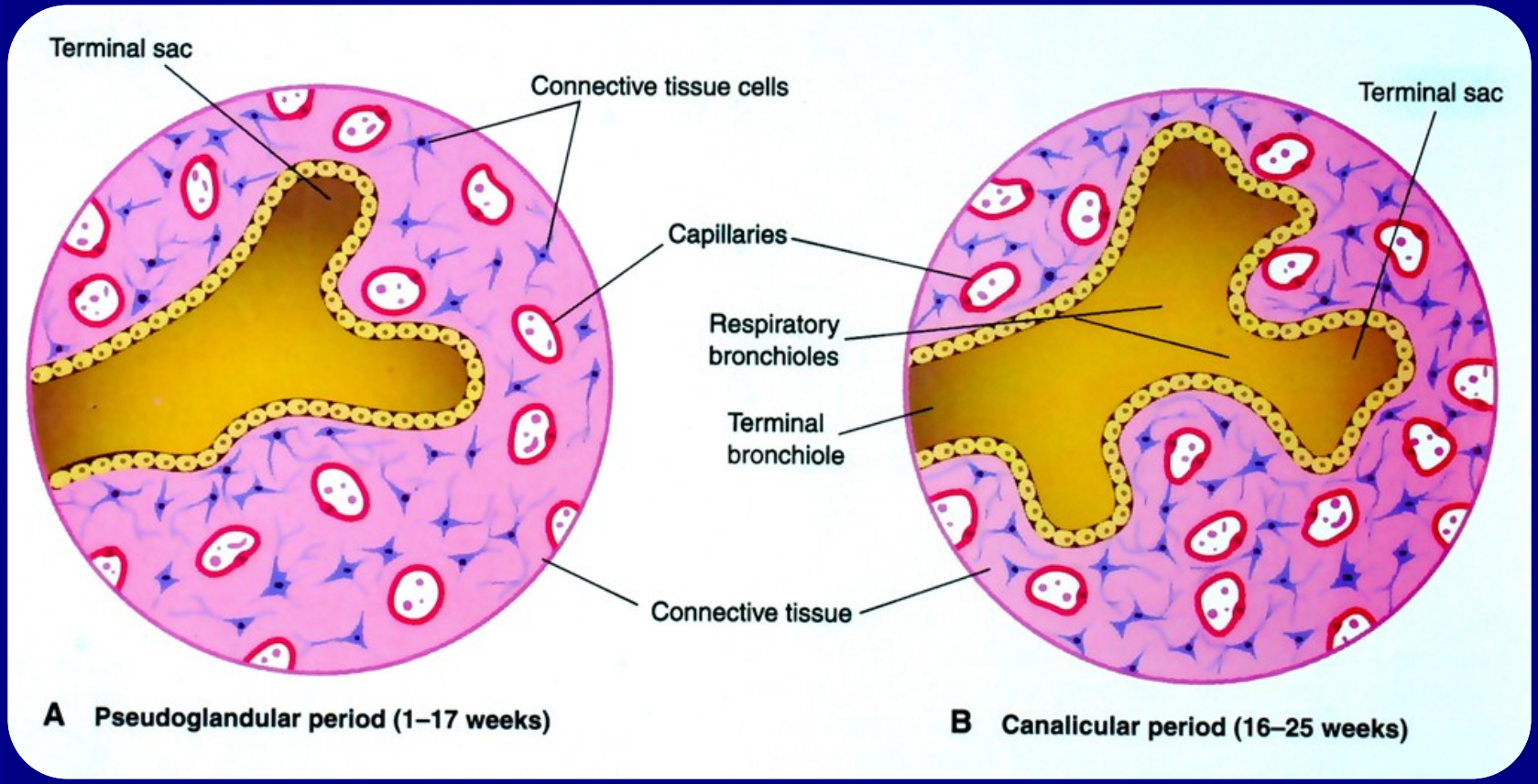
A – The most frequent abnormality (90% cases) occurs with the upper esophagus ending in a blind pouch and the lower segment forming a fistula with the trachea. B – Isolated esophageal atresia (4% of cases). C – H-type tracheoesophageal fistula (4% of cases). D and E – Other variations (each 1% of cases)

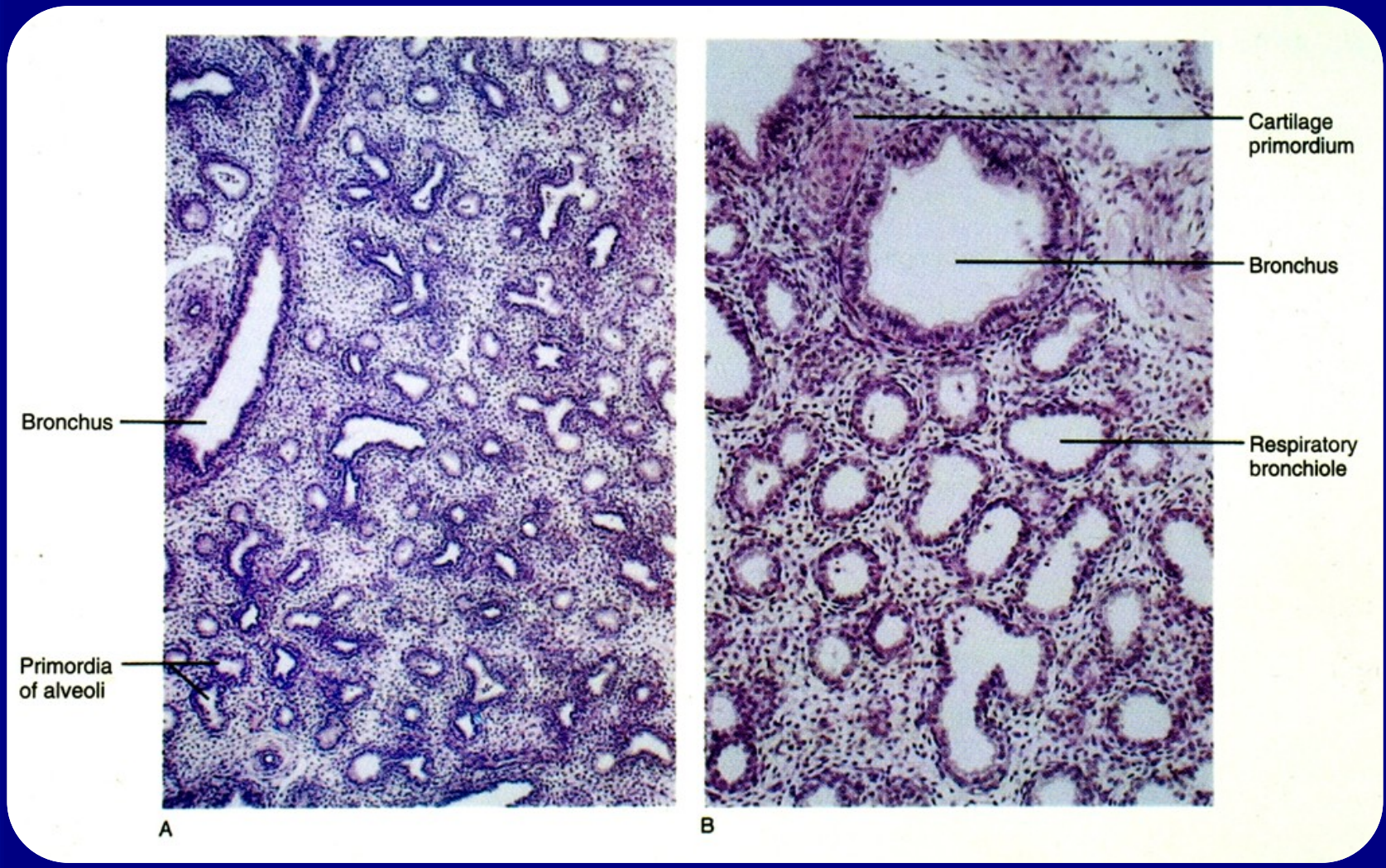


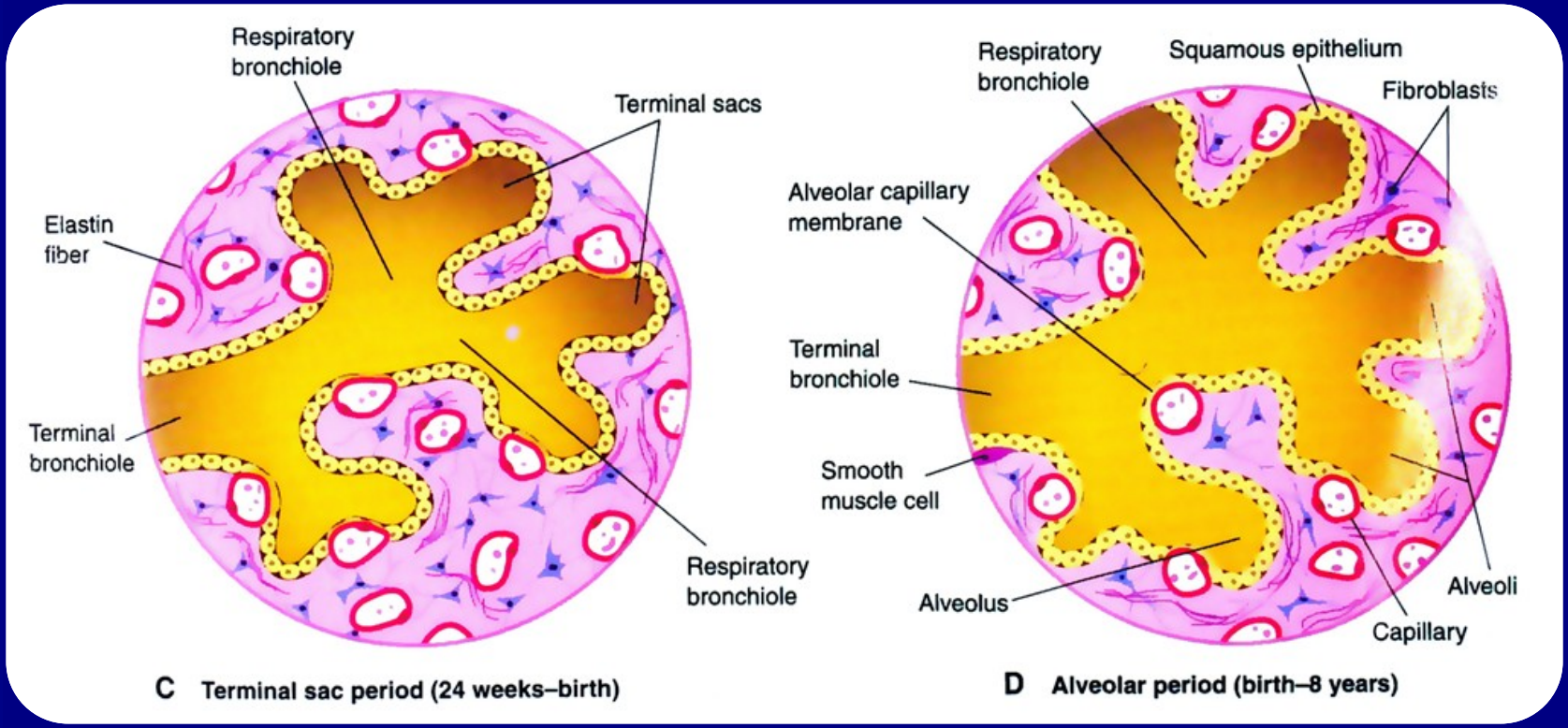
A – Right upper (superior) lobe, B – Right middle lobe, C – Right lower (inferior) lobe, D – Left upper (superior) lobe, E – Left lower (inferior) lobe.

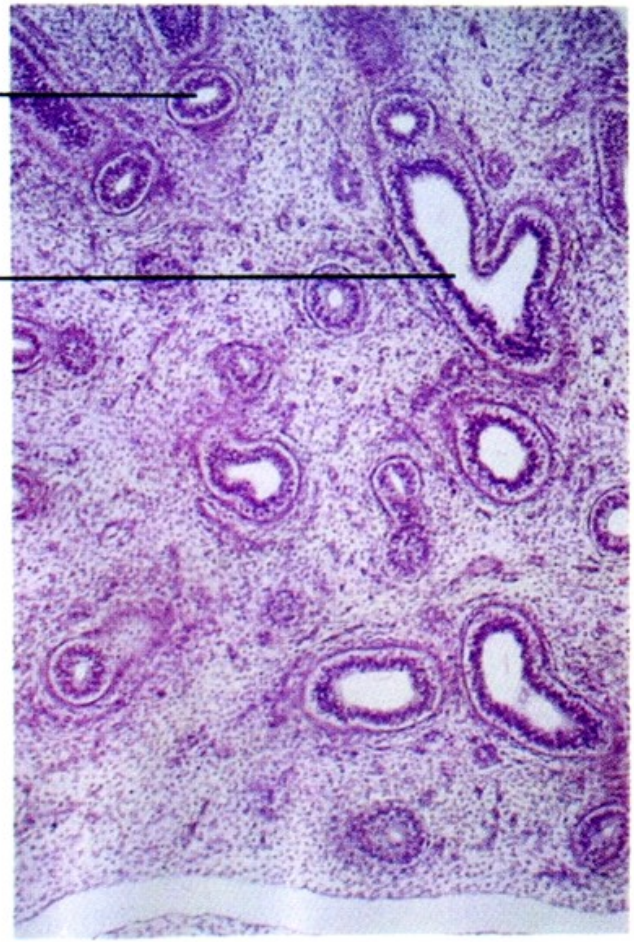
Maturation of the Lungs

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.
Terminal sac period	26 weeks to birth	Terminal sacs (primitive alveoli) form, and capillaries establish close contact.
Alveolar period	8 months to childhood	Mature alveoli have well-developed epithelial endothelial (capillary) contacts.

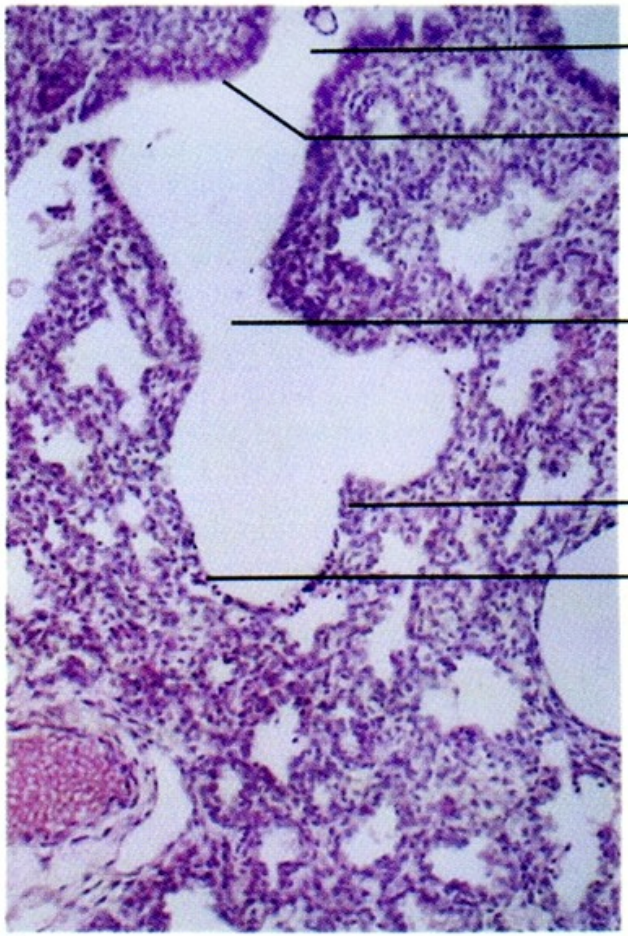

Terminal sac
Connective tissue cells
Capillaries
Respiratory bronchioles
Terminal bronchiole
Connective tissue
Terminal sac
A Pseudoglandular period (1–17 weeks)
B Canalicular period (16–25 weeks)


Bronchus
Primordia of alveoli
A
Cartilage primordium
Bronchus
Respiratory bronchiole
B

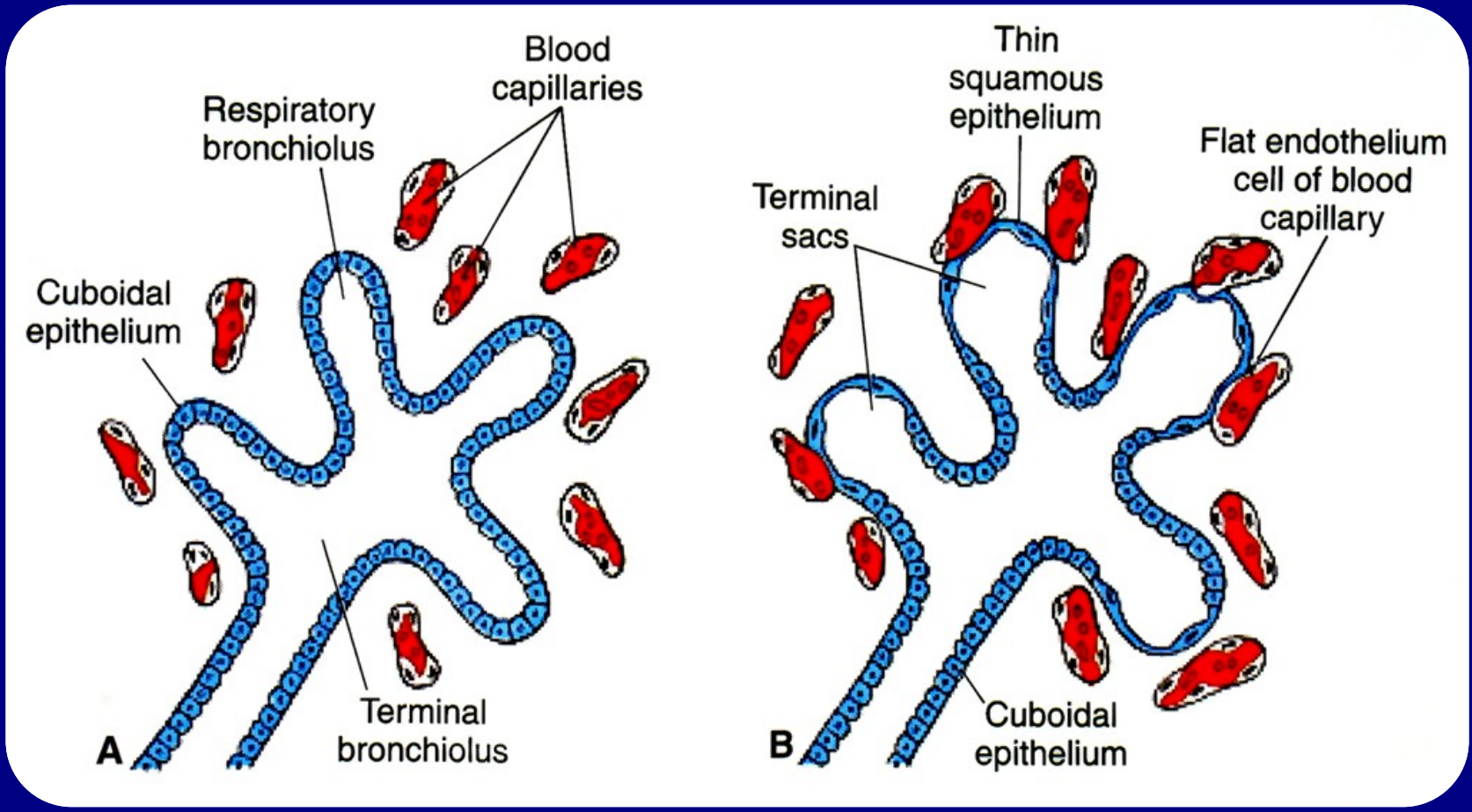

Respiratory bronchiole
Terminal sacs
Elastin fiber
Terminal bronchiole
Respiratory bronchiole
C Terminal sac period (24 weeks–birth)
Respiratory bronchiole
Squamous epithelium
Fibroblasts
Alveolar capillary membrane
Terminal bronchiole
Smooth muscle cell
Alveolus
Alveoli
Capillary
D Alveolar period (birth–8 years)


Bud for bronchiole
Stem bronchus

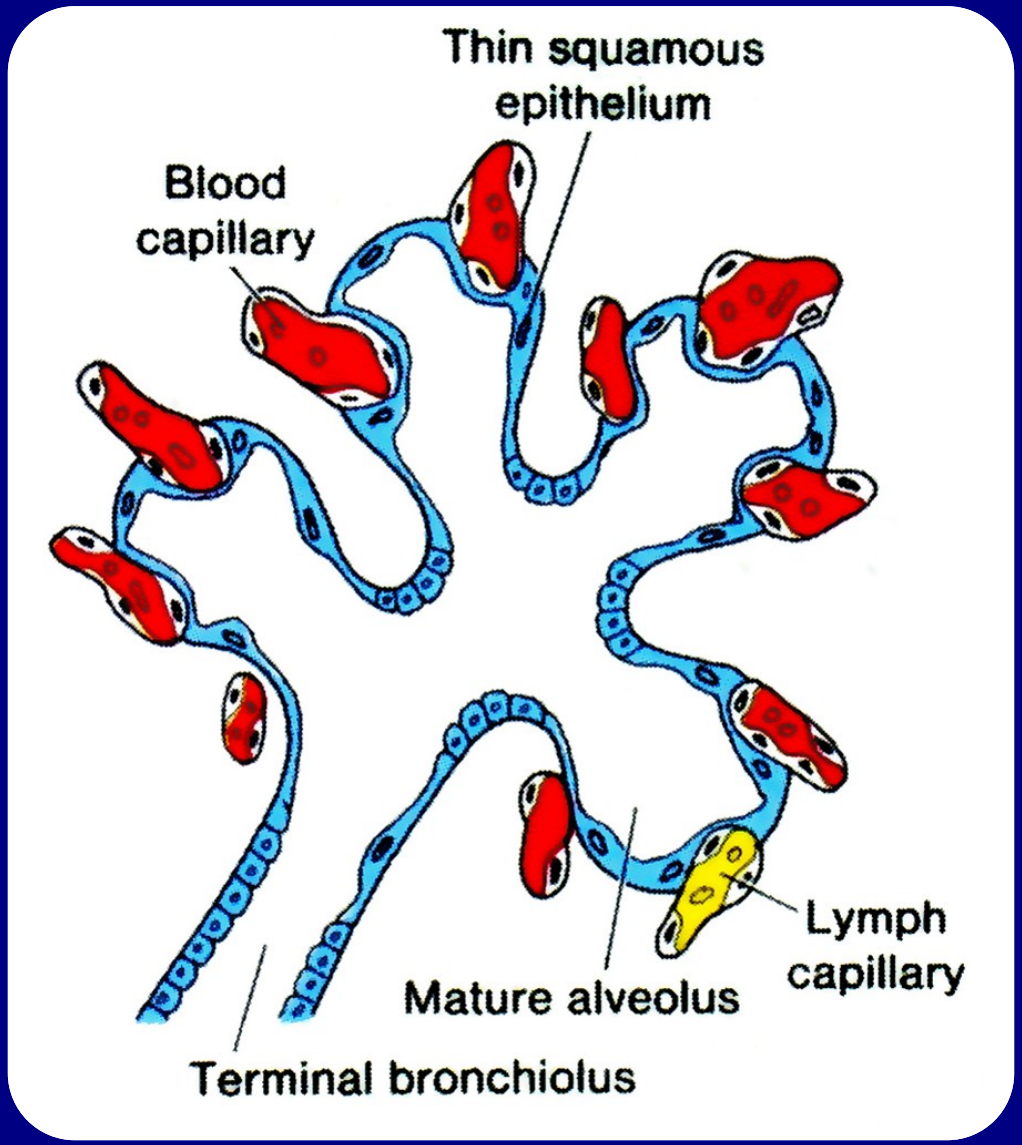
C


Respiratory bronchiole
Cuboidal epithelium
Alveolar duct
Capillary
Flattened epithelium of alveolus

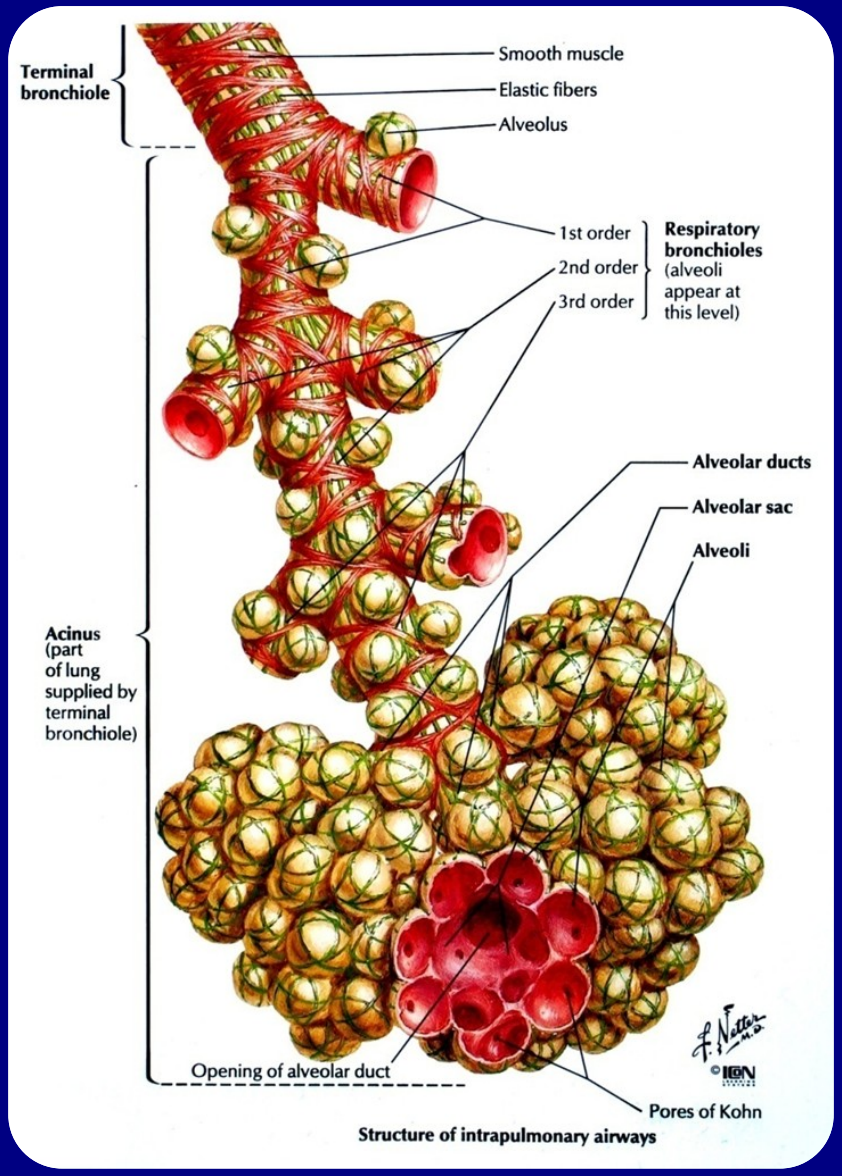
D



A – The canalicular period, B – The terminal sac period.



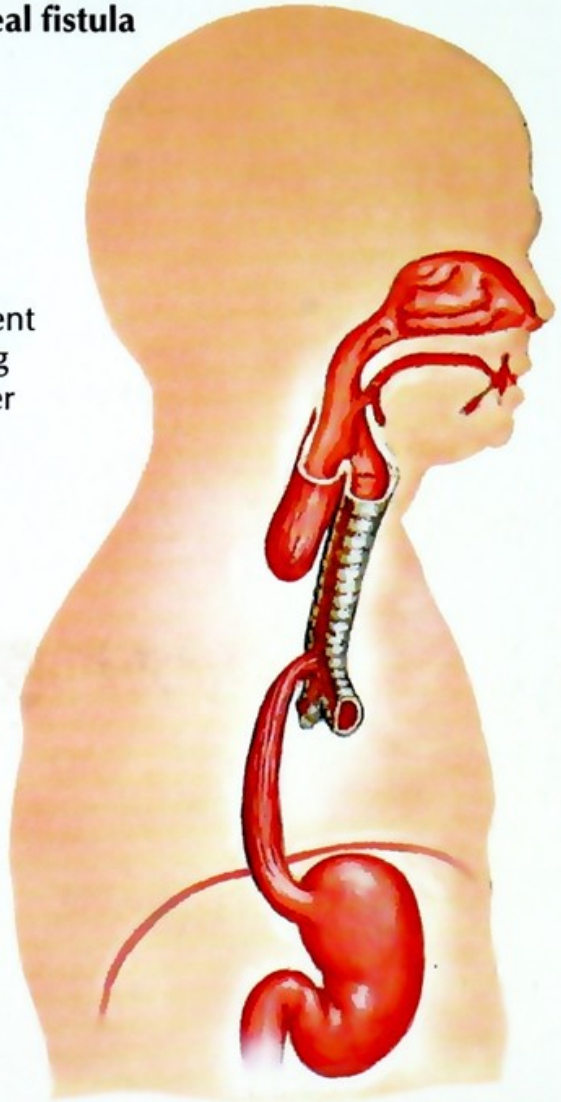
Lung tissue in a newborn



Development of bronchioles and alveoli

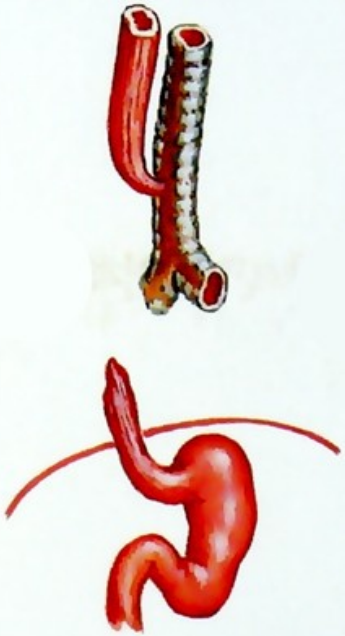
A. Tracheoesophageal fistula

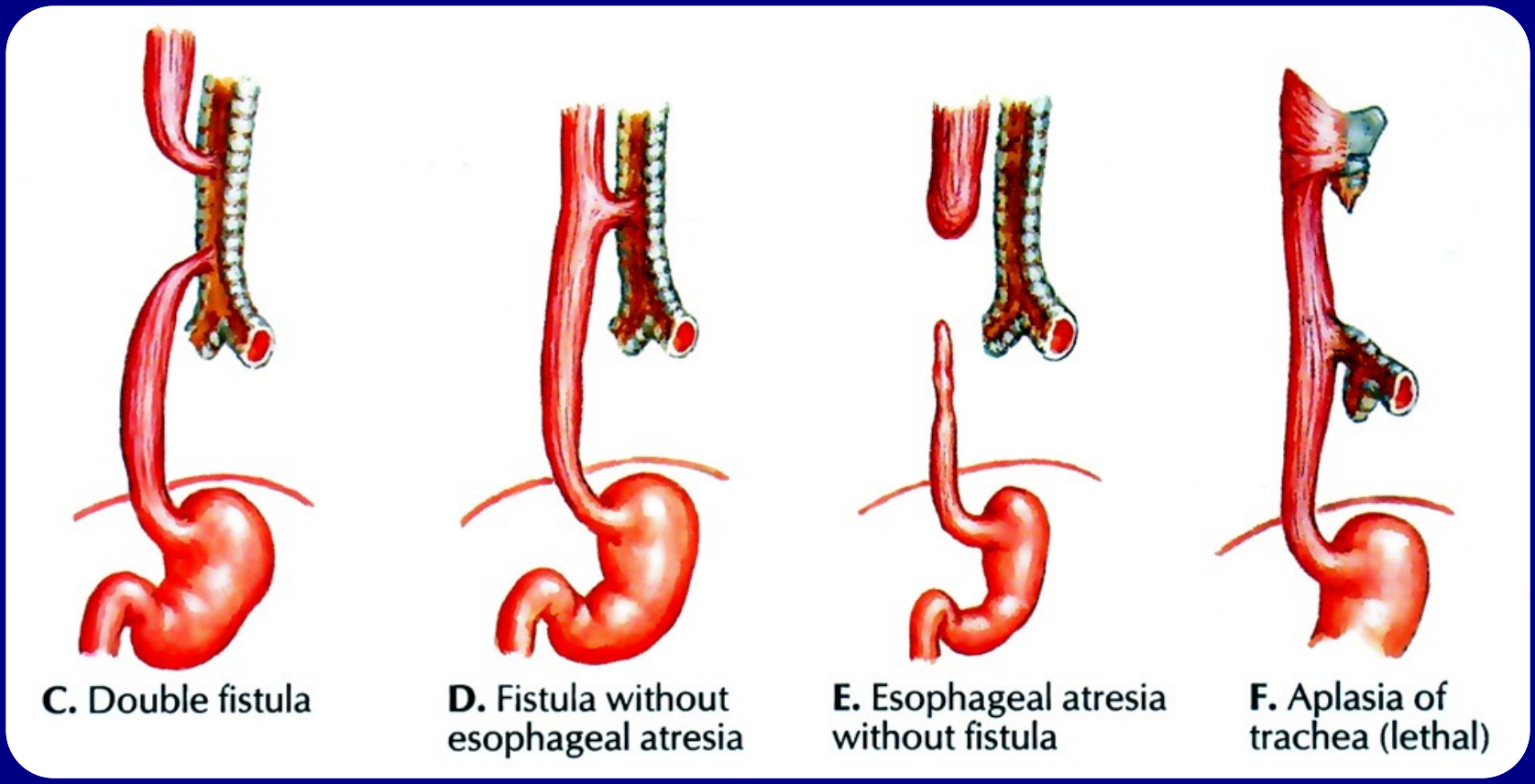
Most common form (90% to 95%) of tracheoesophageal fistula. Upper segment of esophagus ending in blind pouch; lower segment originating from trachea just above bifurcation. The two segments may be connected by a solid cord



B. Variations of tracheoesophageal fistula and rare anomalies of trachea

Upper segment of esophagus ending in trachea; lower segment of variable length



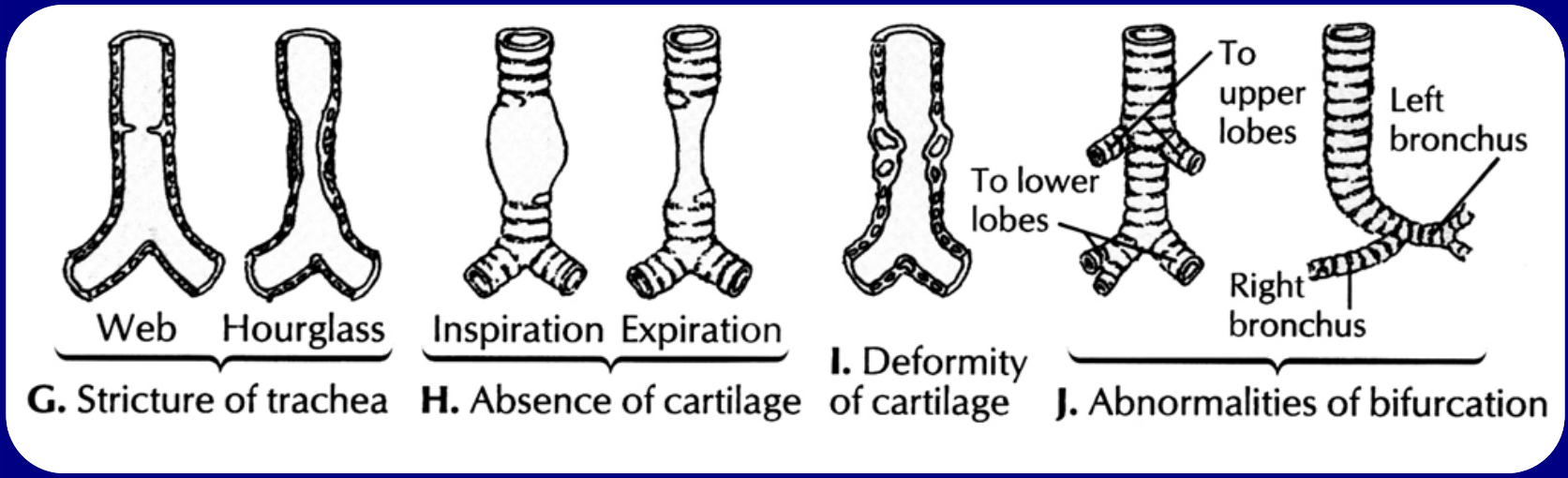


C. Double fistula

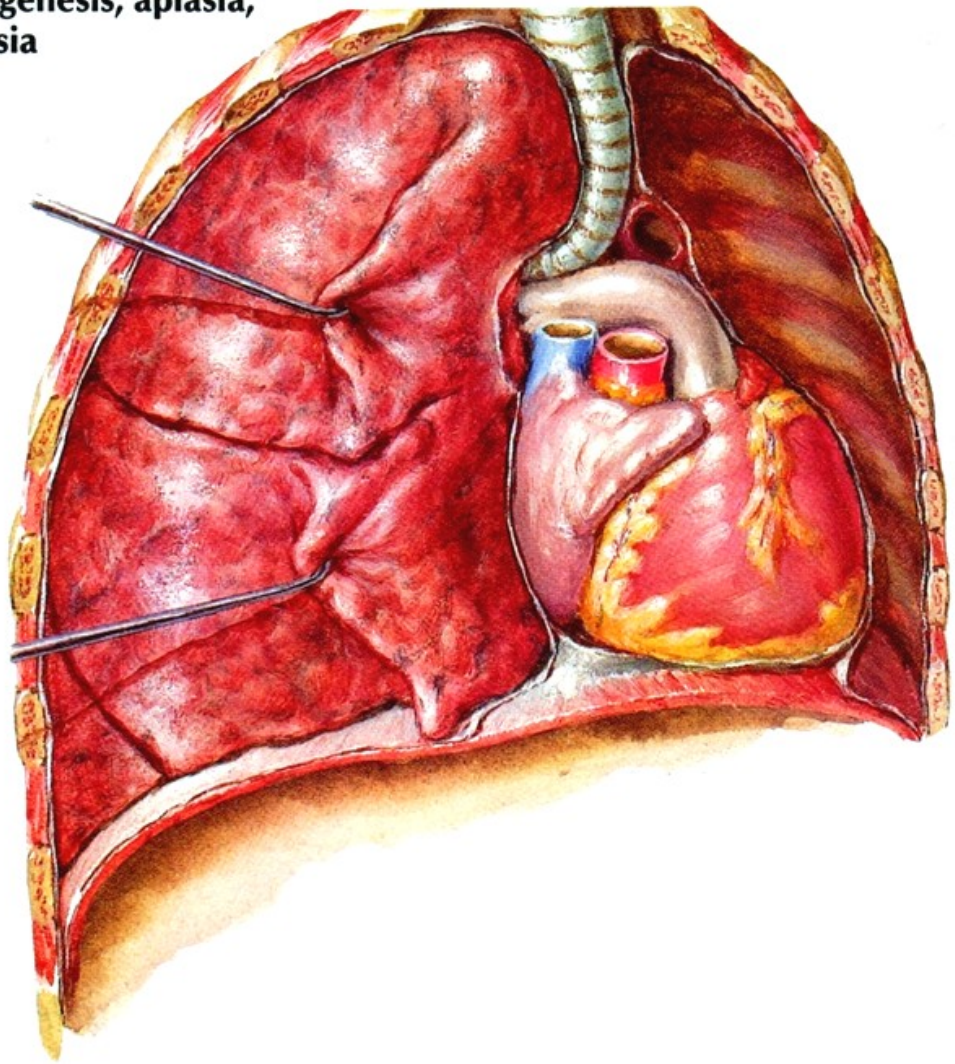
D. Fistula without esophageal atresia

E. Esophageal atresia without fistula

F. Aplasia of trachea (lethal)

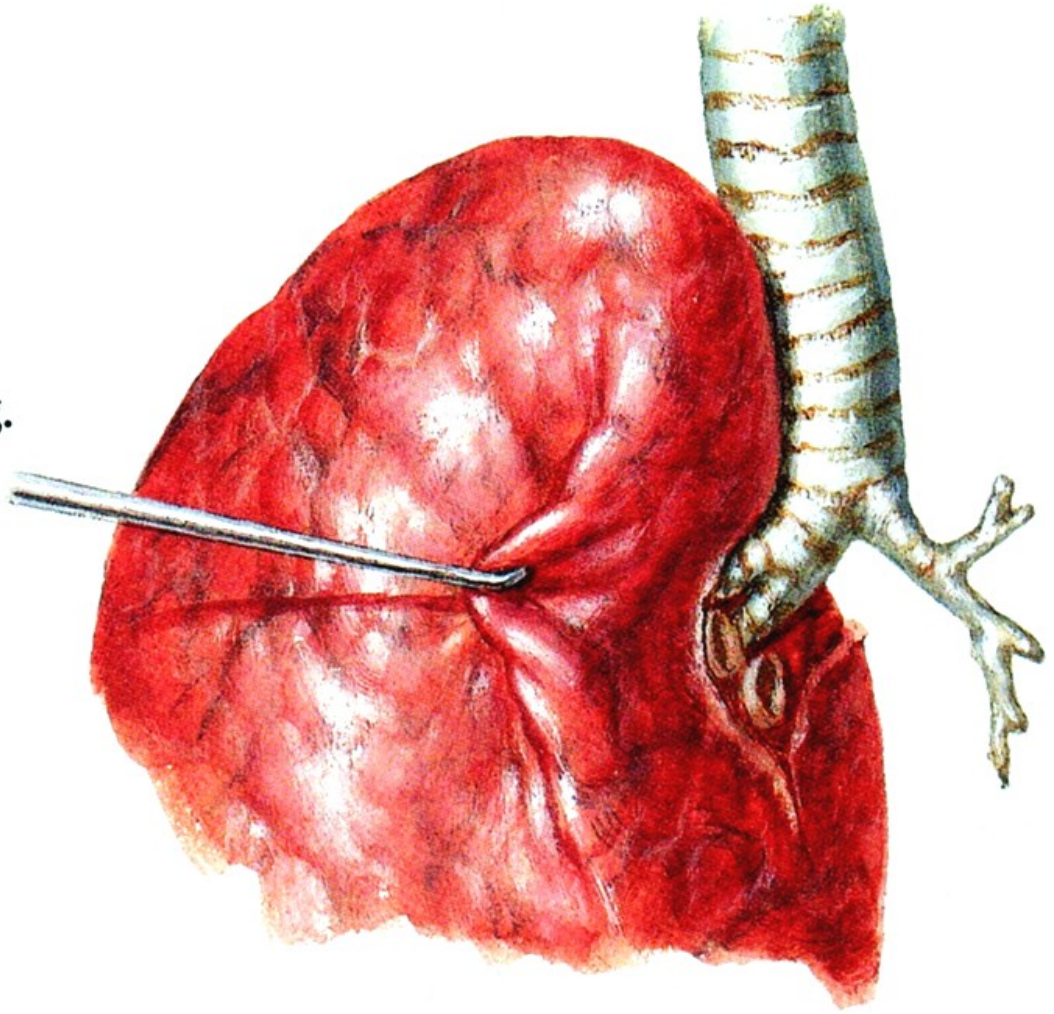

Web
Hourglass
Inspiration
Expiration
To upper lobes
To lower lobes
Left bronchus
Right bronchus
G. Stricture of trachea
H. Absence of cartilage
I. Deformity of cartilage
J. Abnormalities of bifurcation

Pulmonary agenesis, aplasia, and hypoplasia

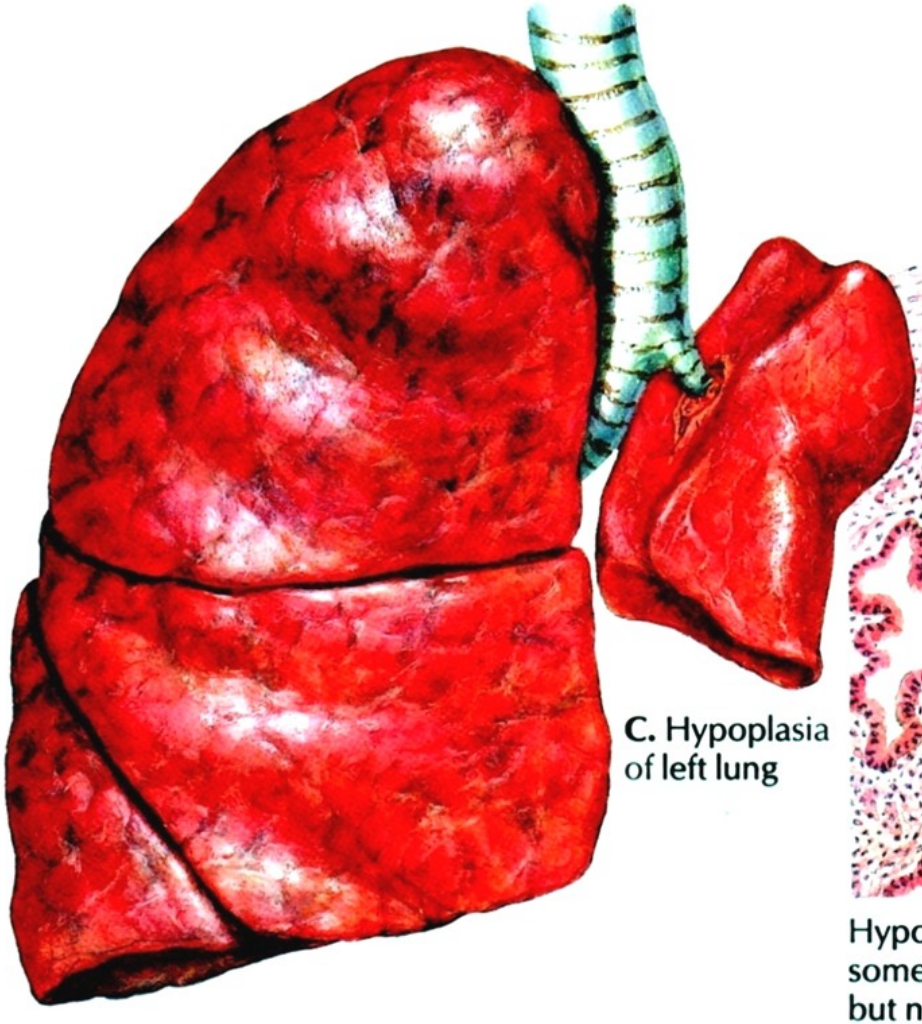


A. Complete unilateral agenesis. Left lung and bronchial tree are absent. Right lung is greatly enlarged with resultant shift of mediastinum to left, elevation of left diaphragm, and approximation of ribs on that side

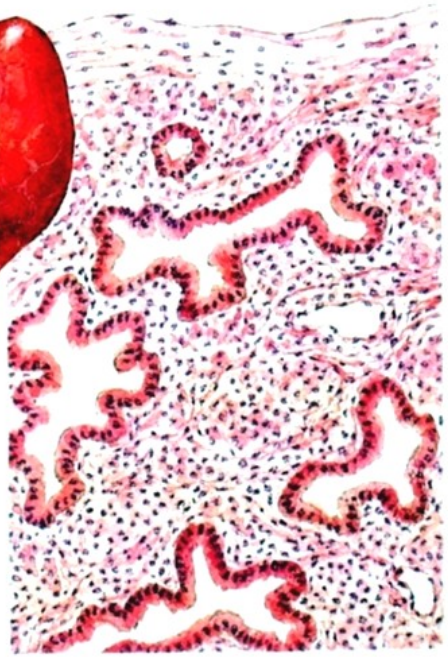
B. Aplasia of left lung. Only rudimentary bronchi on left side, which end blindly



Airway branching anomalies



C. Hypoplasia of left lung



Hypoplastic lung contains some poorly developed bronchi but no alveolar tissue

Airway branching anomalies