NAME: EMMANUEL COLLINS DANIEL **MAT NO:** 18/MHS01/121

DEPARTMENT: ANATOMY **COURSE:** SYSTEMIC EMBRYOLOGY **COURSE CODE:** ANA 206

A) DEVELOPMENT OF THE LUNGS

During gestation, the fetal lung undergoes significant morphological changes to provide at birth an organ capable of maintaining respiration and gas exchange.

There are five developmental stages that have been outlined

1. Embryonic stage (3-7 weeks)
2. Pseudoglandular stage (7-16 week)
3. Canalicular stage (16-24 week)
4. Saccular stage (24-36 week)
5. Alveolar (36-40 week through infancy)

The early embryonic and pseudoglandular stages elaborate the conducting airways; the latter canalicular, saccular, and alveolar stages are characterized by reduction of mesenchyme and vascularization to form a thin air-blood barrier. Birth does not signal the end of lung development.

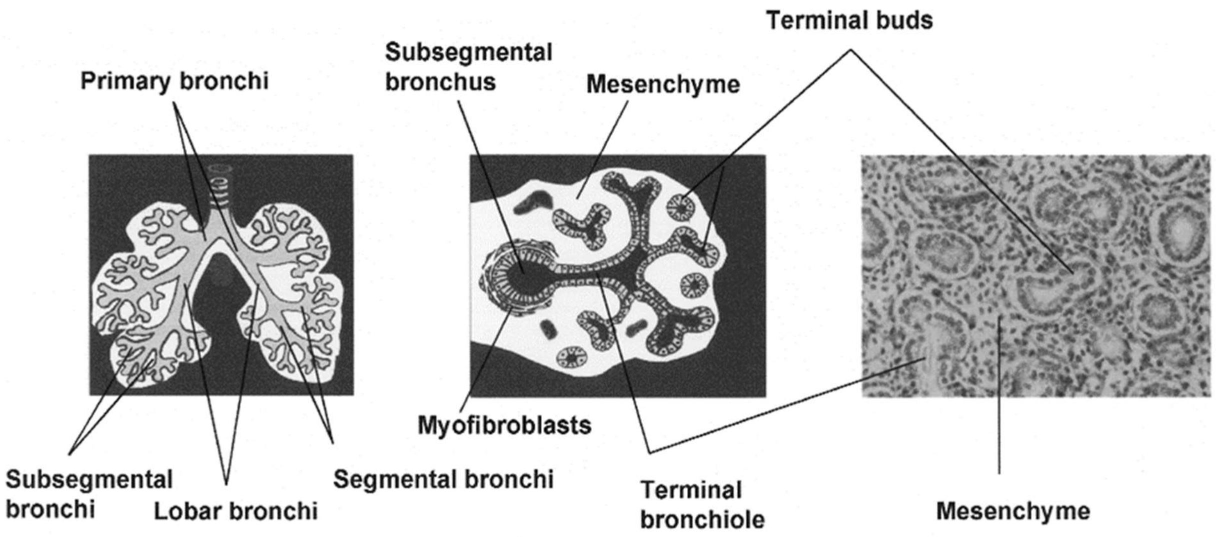
EMBRYONIC STAGE

The embryonic phase takes place between the **third and seventh** week of gestation. The development of the lungs begins during the third week, with the appearance of a respiratory diverticulum (lung bud) as an outgrowth from the ventral wall of the foregut. The lung bud expands in a ventral and caudal direction, invading the mesenchyme surrounding the foregut. Soon after, the lung bud being initially in open communication with the foregut, becomes separated from it eventually forms the esophagus.

Concurrently, the distal end of the lung bud bifurcates into the right and left primary bronchial buds, whereas the proximal end (stem) forms the trachea and larynx. By the fifth week of gestation, the primary bronchial buds form three secondary bronchial buds on the right side and two on the left, foreshadowing the primordial lobes of the lungs. Each secondary bronchial bud gives rise to ten tertiary bronchial buds on both sides, demarcating the end of the embryonic phase.

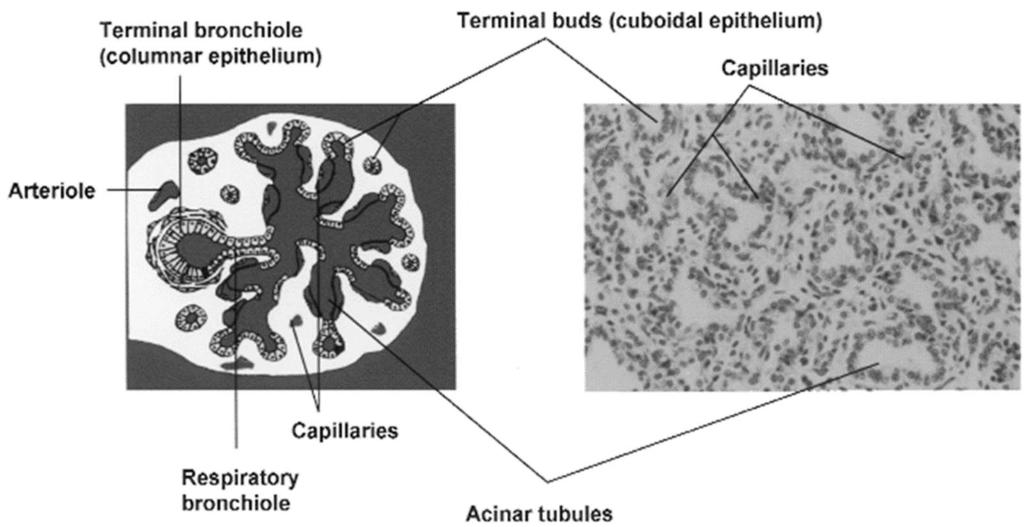
Pseudoglandular

The pseudoglandular phase takes place during between the **seventh and sixteenth week** of gestation. The respiratory tree undergoes twelve to fourteen more generations of branching, resulting in the formation of terminal bronchioles. This passageway will be lined with a specific type of respiratory epithelium, simple columnar epithelium (ciliated) transitioning to simple cuboidal epithelium (some cilia).



Canalicular

The canalicular phase takes place during the **sixteenth and twenty-fourth week** of gestation. Each terminal bronchioles further divide into respiratory bronchioles, which become surrounded with an increase in vascularization. Subsequently, the lumens of the respiratory bronchioles become enlarged as a result of the thinning of their epithelial walls. This process sets up the differentiation of specialized cell types associated with the lungs.

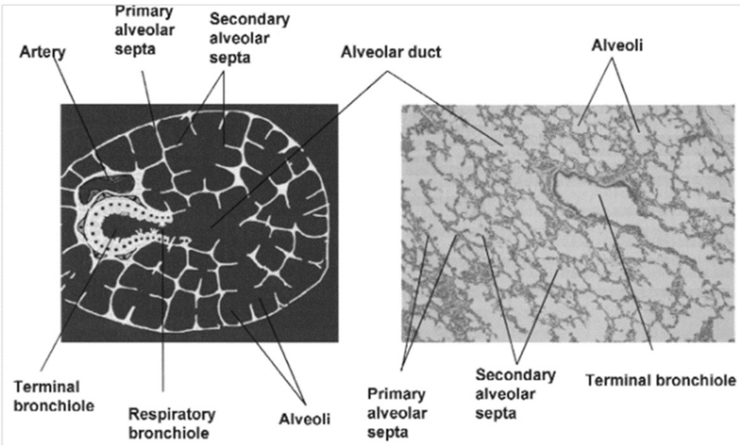


Saccular

The saccular phase takes place between the **twenty-fourth and thirty-sixth week** of gestation. The respiratory bronchioles give rise to a final generation of terminal branches. These branches become invested in a dense network of capillaries, forming the terminal sacs (primitive alveoli) that are lined with type I and type II alveolar cells.

Type I alveolar cells (type I pneumocyte) are branched cells which are the gas exchange surface in the alveolus. Type II alveolar cells act as the 'caretaker' by responding to damage of the type I cells. Type II alveolar cells do this by dividing and acting as a progenitor cell for both type I and type II cells. In addition, they synthesise, store and release pulmonary surfactant into the alveolar hypophase, where it acts to optimise conditions for gas exchange. Although gas exchange is possible at this point, it is very limited as the alveoli are still immature and few in numbers. In fact, the formation of the terminal sacs continues during fetal and postnatal life. Prior to birth, there are approximately twenty million to seventy million terminal sacs, whereas the total number in a mature lung is approximately three-hundred to four-hundred million.

Alveolar The alveolar phase is characterized by the maturation of the alveoli, a process that takes place during the end of fetal life and many years after birth.

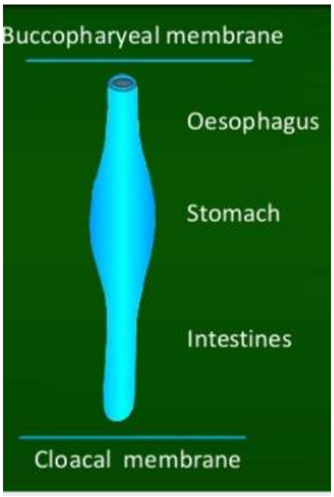


Postnatal lung growth

During the postnatal phase, lung growth is geometric, and there is no increase in airway number. There is proportionately less growth in the conducting airways in comparison with alveolar-capillary tissue. Estimates of the number of alveoli at birth vary widely, but an average of 50 million is generally accepted. These alveoli provide a gas-exchanging surface of approximately 3 to 4 m2. Alveoli greatly increase in number after birth, to reach the adult range of 300 million by 2 years of age and the surface area of 75 to 100 m2 by adulthood. There is substantial remodeling of the parenchyma after birth, with morphologic changes in the septa. Alveolarization occurs through the formation of numerous short, blunt tissue crests or ridges, and their protrusion into alveolar sacs increases the internal surface of the lung. The development of the alveolar crest is closely linked with elastin deposition and the local proliferation of interstitial and epithelial cells. Post-mortem examination of lungs of children who died as a result of trauma or after short illnesses revealed that males had larger lungs than females of the same stature which resulted in greater alveolar number and greater alveolar surface area than girls for a given age and stature.

B) ROTATION OF THE STOMACH AND FORMATION OF THE OMENTAL BURSA

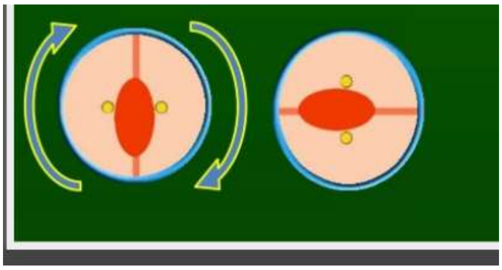
The primordium of the primitive stomach is visible about the end of the fourth week. It is initially oriented in the median plane and suspended from the dorsal wall of the abdominal cavity. Descent-due to rapid elongation of the esophagus, the cardiac end of the stomach descends from C2 at 4 weeks to T11 at 12 weeks , as the stomach enlarges it slowly rotates through 90 degrees

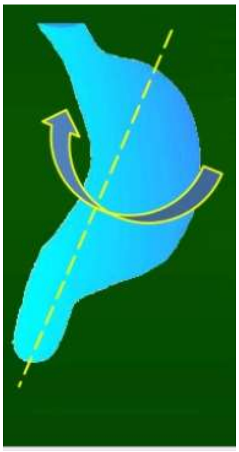


The stomach undergoes two rotations along a longitudinal and anteroposterior axis

1st Rotation

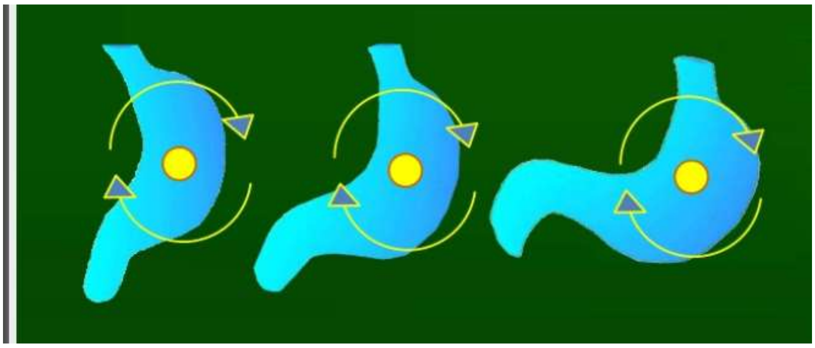
The Longitudinal rotation of the stomach involves a 90 degrees clockwise rotation resulting in the right isde of the stomach becoming posteriorly oriented and the left side facing anteriorly, placing the left vagus nerve along its anterior side and the right vagus nerve along its posterior side.





2nd Rotation

The stomach subsequently rocks on its longitudinal axis, causing the pylorus to shift to right and the cardiac orifice to shift to the left.



Positioning of Stomach

Initially the two ends of the stomach lie in the midline. During rotation the cranial end moves to the left and slightly downward while the caudal end moves to the right and upward

After rotation, stomach assumes its final position with its long axis running from above left below right. During this rotation one side grows faster than the other forming the greater and lesser curvatures

Mesenteries

Ventral border of stomach is connected with anterior body wall by ventral mesogastrium

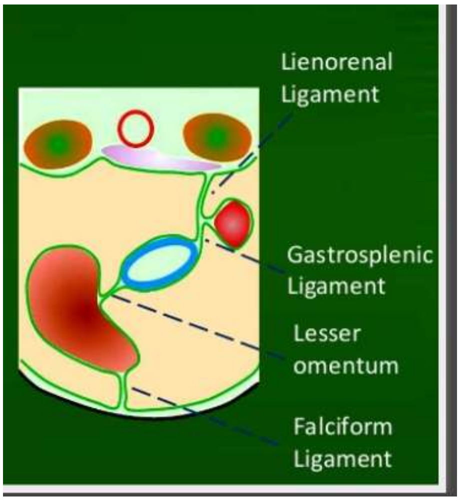
Dorsal border of stomach is connected with posterior abdominal wall by dorsal mesogastrium

The hepatic bud then divides ventral mesogastrium into two

- Lesser Omentum
- Falciform and Coronary Ligament

Developing spleen divides the dorsal mesogastrium into

- Gastro-splenic ligament
- Lieno-renal ligament

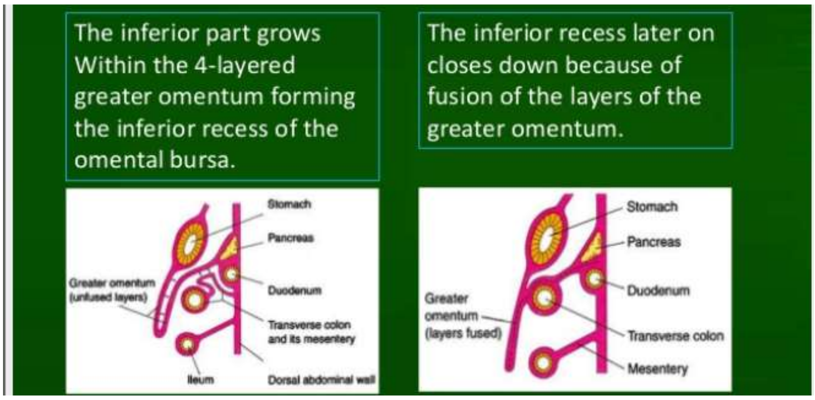


Omental Bursa- Lesser Peritoneal Sac – a space behinf\d the stomach

It begins as small isolated clefts in the dorsal mesogastrium that soon join to form a single cavity

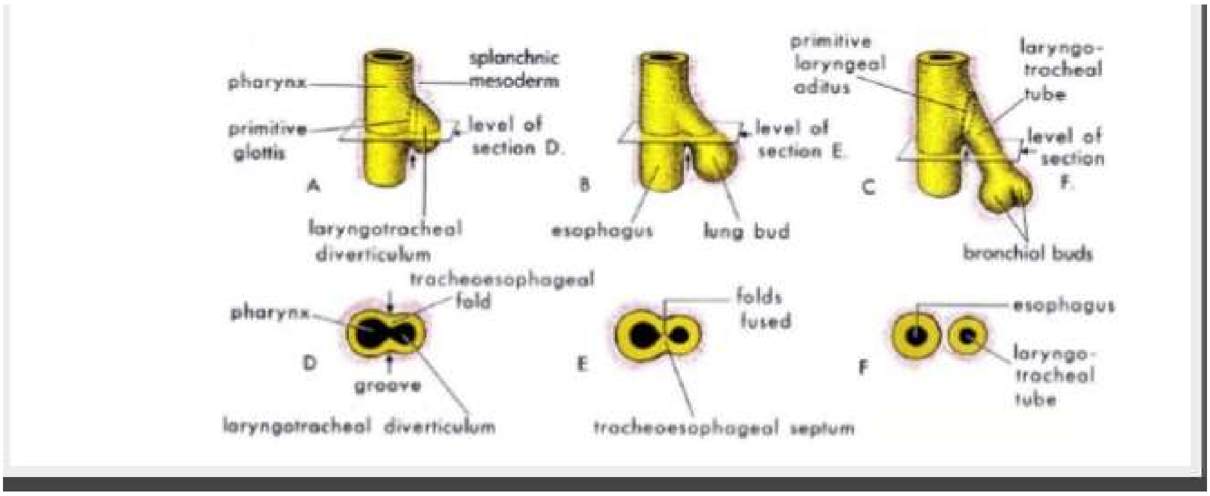
Rotation of the stomach pulls the dorsal mesogastrium to the left thus enlarging the cavity

The bursa expands transversely and cranially and lies between the stomach and the posterior abdominal wall. The superior part of the bursa is cut off as the diaphragm develops . inferiorly it persists as the superior recess of the omental bursa



C) DEVELOPMENT OF THE ESOPHAGUS

During the third week of gestation, a respiratory diverticulum (lung bud) forms as an outgrowth from the ventral wall of the proximal foregut. While the lung bud continues to expand, it becomes separated from the foregut, which forms the esophagus. Initially, the esophagus is short, but becomes rapidly elongated as a result of the growth and relocation of the heart and lungs. By the 7th week it reaches its final position, its lumen is completely or partially obliterated due to proliferation of its epithelial lining. Recanalization occurs by the end of the embryonic period. Its muscle develops from the surrounding mesoderm.



Muscle is striated in upper 1/3

Mixed in the middle 1/3

Smooth in the lower 1/3(vagus)