* 4th week:
1] proliferation starts from the mesenchyme or mesodermal cells.
2] placode ⟶ precursor of organs.
3] stomodume ⟶ Anterior of oral cavity separated posteriorly by oropharynx membrane.

* 5th week:-
1] formation of nasal pits (nostrils) then it dilates deeper making the vestibule (lined by stratified squamous epithelium) ⟹ Nasal pits coming from nasal placodes invagination.
2] medial prominence / lateral prominence / frontal prominence / Maxillary prominence / Mandibular prominence
frontal ⟶ frontal bone (forehead) / nasal bridge / fuse with the medial making nasal septum (medial nasal wall)
Maxillary ⟶ cheeks / Maxilla / lateral part of upper lip. ⟹ Grow medialy compressing the medial wall prominence and fuse with it making cleft that disappears later making philtrum.
Mandibular ⟶ Mandible / upper lip.
Medialy ⟶ fuses with ⟶ frontal ⟶ nasal septum (medial wall of the nose)
⟶ Maxillary ⟶ philtrum ⟶ vertical depression above the upper lip. ⟹ fusion problem makes unilateral or bilateral hernal lip or labial cleft.
⟶ tip and crest of the nasal cavity
laterally ⟶ Ala of the nose + lateral nasal wall

from ectoderm (skin).

* 6th week: nasal cavity formation
1] Nasal pits grows deeper by the development of the mesynchyme and form the conchae / recess / meatuses
2] oronasal membrane separates nasal pits and primitive oral cavity ⟶ by premitive choana. } oral membrane making nasal cavity floor.
oronasal membrane rupture the forming again perminant oral membrane by secondary and primary palates
3] Secondary palate separates oral and nasal cavities and forms the meatuses, recesses and conchae.
* definitive choana lies btw nasal cavity and pharynx (nasopharynx).
* paranasal sinuses: develop as diverticula of lateral nasal wall (drainage side) as ducts into frontal, ethmoidal, sphenoidal, maxillary, end as sinuses reach their maximum age at puberty.

* primary palate: maxillary develops medialy ⟶ fusion of medial prominences not just on the surface, but also deeply
Deep fusion of medial + maxillary prominences ⟶ Intermaxillary segament
⟶ labial part ⟶ philtrum
⟶ upper jaw component ⟶ 4 Incisor teeth
⟶ primary palate ⟶ Triangular in shape.

* Secondary palate:
6th week ⟹ outgrowth of palatine shelves from lateral side of maxilla ⟹ making the main part of definitive palate.
⟶ They descends obliquely downward on each side of the tounge.
7th week ⟹ 2 shelves ascend to attain horizontally above the tounge ⟶ fuse forming secondary palate
then secondary palate + primary palate (△) fuse with the frontonasal
Anteriorly shelves fuse with primary palate (△) ⟹ Incisive foramen midline between primary and secondary palates (landmark)
at the same time ⟶ frontonasal septum grows down + joins with the cephalic aspect of the newly formed palate (primary + secondary)
2 folds grows posterior to hard palate from edge of the palatine process forming soft palate and the uvula

8th week ⟹ fusion of 2 soft palates 11th week ⟹ fusion of 2 parts of uvula in midline ⟹ x fuse well fine cleft separating the uvula.

---

* Respiratory system: develops of
1] pharyngeal gut (pharynx) ⟹ from buccopharygeal membrane (separates between oral + pharynx) ⟶ tracheobronchial diverticulum = lung bud (posterior of oral cavity + pharynx).
2] fore gut ⟹ located caudal to the pharyngeal tube then extends as far caudally as the liver bud. (2nd part of duodenum upper half).
3] mid gut ⟹ caudal liver bud ⟶ right junction of proximal 2/3 + (left) distal 1/3 of transverse colon.
4] Hind gut ⟹ left distal 3rd of transverse colon descending colon., sigmoid colon, rectum and upper 1/2 of anal canal ⟶ cloacal membrane.

4th week: diverticulum (lung bud) outgrowth from ventral wall of foregut
* location of the gut and bud determined by ⟶ signal (Fibroblast growth factor (FGF)) from the surrounding mesenchyme ⟹ Problems lead to anomalies
* epithelium lining larynx, trachea + bronchi ⟶ from endodermal origin.
* cartalages + muscles (i.e Trachialis) + C.T ⟶ splanchic mesoderm which surrounds the foregut
* lung bud open communication with the foregut.
* Esophagus ⟶ begins short then extends after the formation of the heart pericardium.

* Diverticulum extends caudally → 2 ridges tracheoesophageal ridges separate between them
at the same time of tracheoesophageal septum formation → The foregut separates into → ventral → trachea + lung bud
→ dorsal → esophagus.

*larynx inlet (slit like) → connects respiratory + GI tracts.

*Anomalies = Tracheoesophagus ⇒

*Tracheoesophageal fistula (TEF) ⇒ Tracheal fistula + esophageal atresia (blind end of the esophagus).↘

Abnormality in partitioning of esophagus and trachea by tracheoesophageal septum leading to esophageal atresia with or without tracheoesophageal fistula.

- proximal blind end of esophagus (atresia) making a pouch + lower segment forming a fistula with the trachea ⇒ 90% or 1/3000 ⇒ proximal atresia + distal fistula.
- Double atresia
- H- shape TEF
- proximal fistula + distal atresia
- Double fistula.

*leading to problems → 1) milk drinking swallowing → fill esophagus → regurgitation.
→ 2) polyhydramnios → excessive amniotic fluid within amniotic sac since it doesn't pass to stomach + intestine
→ 3) gastric content + amniotic fills the trachea through a fistula ⇒ pneumonia or pneumonitis
→ air from respiratory tract → digestive tract ⇒ abdomen distend during respiration.

*Anomalies associated with cardiac defects

VACTERL
- V: Vertibral anomalies
- A: Anal atresia
- C: cardiac defect
- T: TEF + Esophageal atresia
- E: Renal anomalies
- R: limb defect.
- L

* Tracheal atresia and stenosis ⇒ (associated) Uncommon (with TEF varities) ⇒ Web tissue obstruct tracheal air flow → partial / incomplete tracheal atresia.

---

*Larynx :-

The lining epithelium from endoderm.

Muscles + cartilages ⇒ 4th (Cricothyroid m.) + 6th (The rest muscles) pharyngeal arches.

*As the mesynchyme prolifrate rapidly → The laryngeal orifice changes it's shape from sagittal slit into T shape.
laryngeal orifice reaches the thyroid, cricoid and artynoid cartilages → it's charichtaresties can be recognized.

*At the time of cartilages formation → epithelium prolifrate ⇒ occlusion of the lumen → vacculization → recanalization forming laryngeal ventricles + saccules binding by fold → false + true vocal cords.

*larynx supplied by vagus n. (10th n.)
- superior laryngeal → Internal laryngeal
  → External laryngeal → 4th arch (cricothyroid).
- recurrent laryngeal → 6th arch arising muscles.

*laryngeal anomalies & laryngeal Atrasia = conginetal high air way obstruction syndrom (Chaos)
- uncommon → obstruction of the upper air way
- diagnosed by prenatal Ultra-sonography
- results: Enlargment of the lung or distal atrasia → As lungs are trying to compensate.
  flattened or inverted diaphragm
  Fetal ascitis → abdominal cavity filled with fluid.
  Hydrops → Accumulation of serous fluid.

* Trachea, bronchi, lungs:

- lung bud separates from foregut → making 1] Trachea, 2] bronchial buds (lateral outpocketing)
  - → beginning of 5th week
    - → right main bronchi → then 3 secondary / lobar bronchi
    - → left main bronchi → 2 secondary / lobar bronchi

pericardial peritoneal canal (they're narrow) → pleuropericardial + pleuroperitoneal forming lung's spaces.

* The lungs grow within the pleuropericardial space

pericardial peritoneal canal separated from the peritoneal and pericardial cavities through pleuropericardial + pleuroperitoneal folds → remnant spaces → primitive pleural cavities

* outer lining mesoderm of the lung → visceral pleura.
* Inner " somatic mesoderm → prietal pleure
) space in between pleural cavity.

More divisions:

lobes → dichostomos forming
- → right 10 segments
- → left 8 segaments (Apicoposterior + Anteriomedial)

↓

17 subdivision prenatal + 6 postnatal (befor terminal tree complesion) = 23 dividings.

alveoli + alveolar sac + duct → form primivalary after birth.

Growth by FGF.

Table at page 45 of the slides

* lung's Maturation:

* 7th prenatal month:

1] Deviding of terminal bronchiol into smaller canals → canaticular phase 16-26 weeks

2] steadily increasing in vascular supply → There's no respiratory membrane (capillaries not in contact) + cells are still cuboidal.

* Terminal sac period (26 weeks) → Respiration is possible as the cuboidal cells get flattened
  - → primitive alveoli → cells are associated with numerous blood, lymph capillaries. (They get contacted)
  - → cells become squamous
  - → 7th month → Respiratory membran ✓ + Sufficient no. of capillaries → To guarante adequate gas exchange so premature infants are able to survive (7 months / 26 weeks after)

No mature Alveoli before birth. 1/6 at birth
The remaining alveoli grow the 10 year postnatal

Type 1 cells ⇒ surrounding the primitive alveoli → Then cells becomes thinner then invagination of capillarier into alveolar sac.

* 6th month ⇒ growing of pneumocyte type II → releasing of surfactants → ↓surface tension ⇒ If → ↓Surfactants causes IRDS = hyaline membrane disease (causing lung collapse = Atelectasis)
  - At the same time with lymphatics.
  - [mainly increase 2 weeks before birth]

* Breathing movement
  - → Aspiration of amniontic fluid.
  - → Reabsorption of fluids (suctioning can be done for further air way cleaning)

then surfactant → phospholipid thin coat lining the alveoli preventing the air-water (blood) high tension interfering with the first breath.

* Anomalies:

1] ↓ Surfactants → ↑ air-water (blood) tension → Alveolar collapse/rupture = Atelectasis ⇒ Respiratory distress syndrom. causes 20% neonates death.

2] Abnormal bronchial tree devision → more common

3] Ectopic = outside the normal site → lobes arising from trachea or esophagus

4] congenital cyst of the lung → The most important
- → Multiple small cysts → Honeycomb in radiography
- → restricted to one or more larger ones.

} result in lung's Chronic infection. because of poor drainage

5] lung hypoplasia → Associated with conginetal diaphramatic hernia (CDH) → Abnormal compression of abdominal viscera on the lung (more on left side) ⇒ result in
- → ↓ lung volume
- → pulmonary insufficiency because of hypoplastic lung → infants death.

6] Oligohydroaminose → ↓ amniotic fluid → retrading in lung's development (As Amniotic fluid is important for lung development and muscles conditioning) ⇒ result in pulmonary hypoplasia.

* fresh healthy lung contain some air → floating in water

* Still born dead babies lungs are firm → sinking in water (as they contain fluid not air)