I. Origins of Structures (Tissue Derivatives)

A. From ENDODERM

1. **Epithelial lining of the larynx, trachea, bronchi, and lungs.**
2. **Internal lining of the respiratory diverticulum/lung bud.**
3. **Epithelium of the nasal cavity** (from invaginated nasal placode/surface ectoderm? – Note: The file says "invagination of the surface ectoderm" for nasal pits, but also states "endoderm" for internal linings. The slides on nasal development do not explicitly state the final epithelial origin. The clear endodermal origins listed are for the lower respiratory tract).
4. **Epithelium of the paranasal sinuses** (as outgrowths from the lateral nasal wall).

B. From SPLANCHNIC MESODERM

1. **Cartilaginous, muscular, and connective tissue components of the trachea and lungs.**
2. **Laryngeal cartilages and muscles** (from mesoderm of the **4th and 6th pharyngeal arches**).

C. From SURFACE ECTODERM

1. **Nasal placode (olfactory placode)** – "a localized thickening of the surface ectoderm."
2. **Otic placode** – "a localized thickening of the surface ectoderm."

D. From MESENCHYME (Facial Prominences)

1. **Frontonasal prominence** gives rise to: Forehead, bridge of nose, medial and lateral nasal prominences, and the **superior part of the nasal septum**.
2. **Medial nasal prominences** fuse to form: The tip and crest of the nose, the **inferior (end) part of the nasal septum**, the **intermaxillary segment** (which forms the philtrum, medial 1/3 of upper lip, primary palate, and alveolar part of maxilla with upper four incisors).
3. **Lateral nasal prominences** form: The alae of the nose and the lateral wall of the nasal cavity.
4. **Maxillary prominences** form: Cheeks and the lateral portion of the upper lip.
5. **Mandibular prominence** forms: Lower lip.

E. From the FOREGUT (Endodermal Tube)

1. **The respiratory diverticulum (lung bud)** arises from the **ventral wall of the foregut**.

F. From the PALATINE SHELVES (Outgrowths)

1. **Secondary palate** (from paired palatine shelves).
2. **Soft palate and uvula** (from the posterior, non-ossified extensions of the fused palatine shelves).

II. Weeks Mentioned in the PDFs

A. Embryology-ML1-1.pdf

- **Week 4:** "Respiratory development begins... At Week 4."
- **Week 5:** "Start of fusion of maxillary prominences with medial nasal prominences; appearance of tracheoesophageal ridges."
- **Weeks 5–7:** "Completion of upper lip fusion."
- **Week 6:** "Initiation of secondary palate development (palatine shelves)."
- **Week 7:** "Fusion of palatine shelves → formation of the secondary palate."
- **Week 8:** "Formation of the soft palate."
- **Week 11:** "Formation of the uvula."

B. Embryology-ML2.pdf

- **5–16 weeks:** "Pseudoglandular period" of lung maturation.
- **16–26 weeks:** "Canalicular period" of lung maturation.
- **26 weeks to birth:** "Terminal sac period" of lung maturation.
- **End of the sixth month:** "By the end of the sixth month, approximately 17 generations of subdivisions have formed."
- **Seventh month:** "During the seventh month, sufficient numbers of capillaries are present... the premature infant is able to survive."
- **Last 2 months of prenatal life:** "During the last 2 months of prenatal life and for several years thereafter..." type 2 alv. Cells develop??
- **End of the sixth month:** "another cell type develops at the end of the sixth month. These cells, type II alveolar epithelial cells..."

- **Last 2 weeks before birth:** "The amount of surfactant in the fluid increases, particularly during the last 2 weeks before birth."
- **8 months to childhood:** "Alveolar period" of lung maturation (8 months-10 years).
- **5.5 months of gestation:** "It Also allowed survival of some babies as young as 5.5 months of gestation." (in context of RDS treatment).

I. NOSE

- **Nasal Placode (Olfactory Placode):** From **surface ectoderm** ("localized thickening of the surface ectoderm").
- **Nasal Pit & Nostrils (Nares):** From invagination of the nasal placode.
- **Frontonasal Prominence (mesenchymal):** Gives rise to:
    - Forehead
    - Bridge of nose
    - Medial and lateral nasal prominences
    - **Superior part of the nasal septum**
- **Medial Nasal Prominences (mesenchymal):** Fuse to form:
    - The tip and crest of the nose
    - The **inferior (end) part of the nasal septum**
    - The **intermaxillary segment** (which forms the philtrum, medial 1/3 of upper lip, primary palate, and alveolar part of maxilla with upper four incisors)
- **Lateral Nasal Prominences (mesenchymal):** Form:
    - The alae of the nose
    - The lateral wall of the nasal cavity
- **Paranasal Sinuses:** Develop as **outgrowths from the lateral wall of the nasal cavity**.

II. UPPER LIP & PRIMARY PALATE

- **Medial Nasal Prominences (mesenchymal):** Form the **intermaxillary segment**, which gives rise to:
    - Philtrum of the upper lip

    - Medial one-third of the upper lip
    - **Primary palate**
- **Maxillary Prominences (mesenchymal):** Form the lateral two-thirds of the upper lip.

III. SECONDARY PALATE, SOFT PALATE & UVULA

- **Secondary Palate:** From paired **palatine shelves** (outgrowths, likely from palatine bones). They fuse in the midline.
- **Hard Palate:** Anterior part of the secondary palate that ossifies.
- **Soft Palate & Uvula:** From the posterior, non-ossified extensions of the fused **palatine shelves**.

IV. LARYNX

- **Epithelial lining:** From **endoderm**.
- **Laryngeal cartilages and muscles:** From **splanchnic mesoderm** of the **4th and 6th pharyngeal arches**.
- **Laryngeal lumen, ventricles, and folds (true & false vocal cords):** Formed by proliferation and recanalization of the endodermal epithelium.

V. TRACHEA, BRONCHI, & LUNGS

- **Origin:** The entire system begins as the **respiratory diverticulum (lung bud)**, which arises from the **ventral wall of the foregut** (endodermal).
- **Epithelial lining** of the trachea, bronchi, bronchioles, and alveoli: From **endoderm**.
- **Cartilage, smooth muscle, and connective tissue** of the trachea and lungs: From surrounding **splanchnic mesoderm**.
- **Pleura:**
    - **Visceral pleura:** From **splanchnic mesoderm** covering the outside of the lung.
    - **Parietal pleura:** From **somatic mesoderm** lining the body wall.

VI. ESOPHAGUS

- Develops from the **posterior part of the foregut** after separation by the tracheoesophageal septum.
- **Muscular wall:**

- Upper one-third: **Striated (skeletal) muscle**
- Lower two-thirds: **Smooth muscle**

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1. CLEFT LIP

- **Cause:** "Failure of fusion between a maxillary prominence and the medial nasal prominence."
- **Type:** "Could be either unilateral or bilateral."

2. BIFID UVULA

- **Cause:** "Incomplete fusion" of the paired palatine shelves that form the uvula.
- **Appearance:** "Split at the midline."

3. CONGENITAL CYSTS OF THE LUNG

- **Formation:** "Formed by dilation of terminal or larger bronchi."
- **Appearance:** "May be small and multiple, giving the lung a honeycomb appearance on radiograph. Or they may be restricted to one or more larger ones."
- **Problems:** "Usually drain poorly and frequently cause chronic infections, and insufficient gas exchange."
- **Treatment:** "Surgical excision."

4. LUNG HYPOPLASIA

- **Definition:** "Reduced lung size."
- **Causes:**
    1. **Congenital Diaphragmatic Hernia (CDH):** "The lung is unable to develop normally... compressed by the abnormally positioned abdominal viscera." "More common on the left side."
    2. **Oligohydramnios:** "When oligohydroannios (reduced amniotic fluid) is severe lung development is retarded. Severe pulmonary hypoplasia results."
- **Outcome (CDH):** "Most infants with CDH die of pulmonary insufficiency as their lungs are too hypoplastic to support life."

5. RESPIRATORY DISTRESS SYNDROME (RDS) / HYALINE MEMBRANE DISEASE

- **Cause:** "Insufficient surfactant." "When surfactant is insufficient, the air-water (blood) surface membrane tension becomes high, bringing great risk that alveoli will collapse during expiration."
- **Pathology:** "Partially collapsed alveoli contain a fluid with a high protein content, many hyaline membranes, and lamellar bodies, probably derived from the surfactant layer."
- **Importance:** "Common cause of death in the premature infant (30% of all neonatal diseases)." "Accounts for approximately 20% of deaths among newborns."
- **Contributing Factor:** "Intrauterine Asphyxia may produce irreversible changes in type II cells."
- **Treatment:**
    - "Artificial surfactant."
    - "Treatment of premature babies with glucocorticoids (betamethasone) to stimulate surfactant production."
    - "Allowed survival of some babies as young as 5.5 months of gestation."

6. ABNORMAL DIVISIONS OF THE BRONCHIAL TREE

- **Description:** "More common; some result in supernumerary lobules."
- **Significance:** "These variations of the bronchial tree have little functional significance, but they may cause unexpected difficulties during bronchoscopies."

7. ECTOPIC LUNG LOBES

- **Description:** "Arising from the trachea or esophagus."
- **Cause:** "Believed that these lobes are formed from additional respiratory buds of the foregut that develop independently of the main respiratory system."
- **Outcome:** "No serious outcomes."

8. GROSS ABNORMALITIES (Rare)

- **Examples:** "Blind-ending trachea with absence of lungs and agenesis of one lung."

9. ESOPHAGEAL ATRESIA & TRACHEOESOPHAGEAL FISTULA (TEF)

- **Frequency:** "Most common congenital anomalies of the esophagus."

- **Embryological Cause:** "Abnormal separation of the foregut into the trachea and esophagus... abnormal development or fusion of the tracheoesophageal ridges, leading to incomplete or incorrect formation of the tracheoesophageal septum."
- **Types:** "Pure esophageal atresia (double atresia), isolated tracheoesophageal fistula (H-type), proximal fistula, distal fistula with esophageal atresia and proximal esophageal atresia with distal tracheoesophageal fistula."
- **Most Common Type:** "Proximal esophageal atresia with distal tracheoesophageal fistula. Occurs in approximately 1 in 3,000 live births."
- **Complications (Fetal):** "Polyhydramnios... In the presence of esophageal atresia, swallowed amniotic fluid cannot reach the stomach... normal absorption of amniotic fluid is impaired."
- **Complications (After Birth):**
    - "Feeding difficulties: The infant regurgitates milk."
    - "Respiratory complications: The distal fistula allows gastric contents and acid to enter the trachea, causing chronic respiratory infections and pneumonia."
    - "Abdominal distension: Air passes from the trachea into the stomach through the fistula."
- **Treatment:** "Surgical correction is immediately indicated after birth."

10. VACTERL ASSOCIATION

- **Description:** "Esophageal atresia is usually part of a constellation of congenital anomalies that tend to occur together."
- **V – Vertebral anomalies**
- **A – Anal atresia**
- **C – Cardiac defects** ("33% association" including VSD, ASD, Tetralogy of Fallot)
- **T – Tracheoesophageal fistula**
- **E – Esophageal atresia**
- **R – Renal anomalies**
- **L – Limb anomalies**

11. TRACHEAL ATRESIA AND STENOSIS

- **Description:** "Rare and uncommon congenital abnormality characterized by the presence of web-like tissue that obstructs airflow through the trachea."
- **Treatment:** "Surgical correction is indicated immediately after birth."

12. LARYNGEAL ATRESIA (Part of CHAOS)

- **Description:** "Very rare congenital anomaly... results in obstruction of the upper fetal airway." Part of **Congenital High Airway Obstruction Syndrome (CHAOS)**.
- **Pathophysiological Changes:**
    1. **Lungs:** "Become enlarged... fetal lungs normally produce fluid... cannot escape... accumulates, causing lung overdistension... appear echogenic on ultrasound."
    2. **Diaphragm:** "Becomes flattened... enlarged lungs push downward."
    3. **Increased intrathoracic pressure:** Leads to "ascites" and "hydrops fetalis."
- **Diagnosis:** "Prenatal diagnosis... using ultrasonography."