Pharyngeal Apparatus

- Pouches – Endoderm
- Grooves – Ectoderm
- Arch – Neural Crest
- Somitomeres
- Aortic Arch - Vessel

Segmental Organization

Humans:
- Arch 1-4 – prominent
- Arch 5 – absent
- Arch 6 - transient

Face

- Face is formed from 7 primordia surrounding the stomodeum
- 1 frontonasal prominence - cranial boundary of the stomodeum
- Paired nasomedial process
- Paired maxillary process
- Paired of mandibular process

First Arch → Face

- Maxillary Process
  - Caudal - lower jaw
  - Cartilages: Meckel’s cartilage, Incus
  - Bone: Mandible

- Mandibular Process
  - Caudal - lower jaw
  - Cartilages: Meckel’s cartilage, Incus
  - Bone: Mandible

Maxillilary and Mandibular processes are important for Face formation
Frontonasal prominence forms the forehead
Horseshoe-shaped nasal process forms the nasal pit with the nasal placode in the depression.
Nasal prominences fuse medially
Midline fusion of the nasomedial processes forms the intermaxillary segment that later forms:
1) philtrum - groove of upper lip
2) Bridge and septum of the nose
3) Part of the maxilla and gum
4) Primary palate

The nasolacrimal groove separates the nasolateral process from the maxillary process – forms the nasolacrimal duct via ectodermal thickening, internalization and canalization
Maxillary process fuses lateral to the nasal process
Maxillary process forms:
- Lateral parts of the upper lip
- Maxilla
- Secondary palate
Medial fusion of mandibular processes forms the lower jaw
Lateral fusion of maxillary and mandibular processes

Three primordia
Primary palate = median palatine process
Secondary palate = fuses lateral palatine processes
Primary palate - The innermost part of the intermaxillary segment forms a wedge-shaped mesodermal tissue between maxillary processes (median palatine process)
Secondary palate - forms from two projections from the maxillary processes - called lateral palatine processes (palatal shelves)

Projection of lateral palatine processes fuses:
Medially with each other
Medially with nasal septum (from the frontonasal prominence)
Rostrally with the medial palatine process
Palatal raphe = fusion line of lateral palatine processes
Hard palate – Ossification in the lateral palatine processes
Soft palate - posterior to the hard palate and its projection = uvula
#1 - Mandibular Arch

Muscles – from 4th Somitomere
Muscles of mastication (e.g. masseter)
Nerve – Trigeminal (V)
Aortic Arch - Maxillary Artery
1st Pharyngeal Pouch – Auditory tube (eustachian tube) and tympanic cavity (distal end)
1st Pharyngeal Groove – External auditory meatus (exterior ear opening)

#2 – Hyoid Arch

Skeleton
Stapes
Lesser horn of the hyoid bone
Muscles – from 6th Somitomere
Muscles of facial expression
Nerve – Facial (VII)
2nd Aortic Arch - Hyoid artery, Stapedial artery
2nd Pharyngeal Pouch
Supratonsilar fossa – component of the palatine tonsils
**3rd Arch**

**Skeleton**
- Greater horn of the hyoid bone

**Muscles** – from 7th Somitomere
- Stylopharyngeus (raises the pharynx during vocalization and swallowing)

**Nerve** – Glossopharyngeal (IX)

**3rd Aortic Arch** – Internal Carotid artery

**3rd Pharyngeal Pouch**
- Dorsal - Paired inferior parathyroid, fuses with thyroid gland (parathyroid hormone, Calcium regulation)

- Ventral - hollow and elongate - fuses ventro-medially to form the bifobed thymus, secondarily moves posterior to become posterior to the thyroid gland (lymphocyte production, blood-thymic barrier)

**4th Arch**

**Skeleton**
- Laryngeal cartilages

**Muscles** – from occipital somites 2-4 and cervical somite 1
- Pharyngeal and Laryngeal musculature

**Nerve** – Vagus (X)

**4th Aortic Arch** – Right Subclavian artery, Aorta

**4th Pharyngeal Pouch**
- Dorsal - forms paired superior parathyroids

- Ventral - Postbranchial Body (ultimobranchial body, calcitonin)
Anomalies

**Craniofacial:** Mostly defects associated with tissue fusion:
- Estimated 1/3 of all congenital defects
- Facial Clefts - Anomalies associated with defective fusion of Facial prominences
  - Cleft lip - failure of maxillary prominence to fuse with intermaxillary process
  - Cleft palate - failure of the lateral palatine processes to fuse

**Pharyngeal:**
- Branchial cysts, sinus or fistula: opens on the side of the neck. Persistence of the pharyngeal groove and/or pouch
- Piriform sinus fistula: canal is persistent that follows the migration of the postbranchial body from the 4th pouch to the thyroid.