Pharyngeal arches and pouches

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Pharyngeal arches

- a.k.a. visceral or branchial arches
- Develop (and disappear as distinctively visible structures) in a rostro-caudal sequence
- Require neural crest cells for their development
- Even after they are no longer visible externally, they have a lasting impact on the anatomy of the head and neck and of the great vessels

Basic body plan of all chordates (incl. vertebrates)

- Dorsal hollow neural tube
- Segmented lateral mesoderm
- Central notochord
- Ventral digestive tube (Pharyngeal gill slits)

Pharyngeal arches: a definition

A segmental series of five paired swellings that surround the foregut between days 20 to 35 of embryonic development. These segments, which are unique to vertebrates and their immediate precursors, are "wedged" between the developing forebrain and heart.
5 Pharyngeal arches
5 Aortic arches
Arches numbered 1-6

Pharyngeal groove
Pharyngeal pouch
Pharyngeal arch
Pharyngeal membrane
Foregut

Arches, grooves, pouches, and membranes

Mesenchyme in cephalic region
is derived from:
- Mesoderm
- Neural crest

Chai Y, Ito Y, Han J (2003)

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Chai Y, Ito Y, Han J (2003)
**Extent of cephalic (cranial) neural crest**

**Neural crest involvement in the development of the heart**
Segmental components of arches

Connective tissues - nc
Muscle – mesoderm
Branchiomeric nerve – nc, ectoderm, neuruectoderm
Skeletal bar- nc - (cartilage) last to form
Artery – mesoderm- first to appear

Aortic arch development

5 Aortic arches
Arches numbered 1-6

Aortic arch development cont’d
Muscles

Arch 1: Muscles of mastication (V)
Arch 2: Muscles of facial expression (VII)
Arch 3: Stylopharyngeus muscle (IX)
Arch 4-6: Laryngeal muscles (X-XI)

The cartilage elements of the pharyngeal arches (cartilaginous viscerocranium, purple) at 7 weeks.

Skeletal derivatives

External ear receives contributions from arches 1 and 2

Moss-Salentijn L et al (1972)
Larsen WJ (2001)
Netter F, Ciba collection
External ear development by merging of 6 auricular hillocks

Endodermal swellings on arches 1-4 contribute to the tongue

1. Paired lingual swellings and single median tuberculum impar
2. Single median copula
3-4. Combined median hypobranchial eminence

Netter F, Ciba collection

Endoderm plays key role in morphogenesis of pharyngeal region

Derivatives of dorsal and ventral parts of pharyngeal pouches


Tuchmann-Duplessis H, Haegel P (1975)

Thyroid gland development

Thyroglossal duct

Larsen WJ (2001)

Superior and inferior parathyroid glands

Watt, Marie A, and Sanders, Colin
University of Glasgow