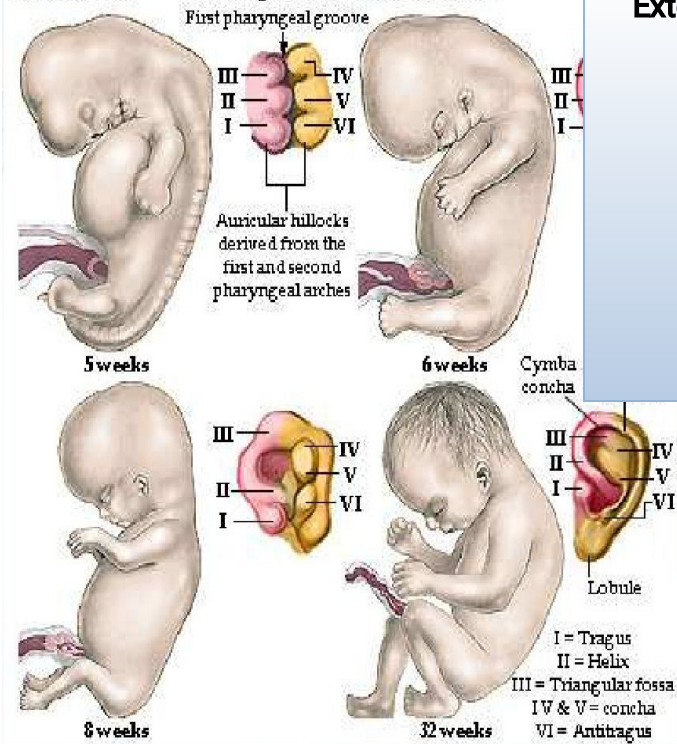




Embryology of the pinna:

6th week of gestation:

Skin, subcutaneous tissue, connective tissue built upon the **cartilaginous** skeleton derived from 6 **auricular hillocks**

Condensation of the **mesoderm** of the 1st and 2nd **pharyngeal/brachial arches** occurs to give rise to 6 **hillocks** of His around the 1st brachial **cleft**

First arch:

- First hillock tragus
- Second hillock helical crus
- Third hillock helix

Second arch:

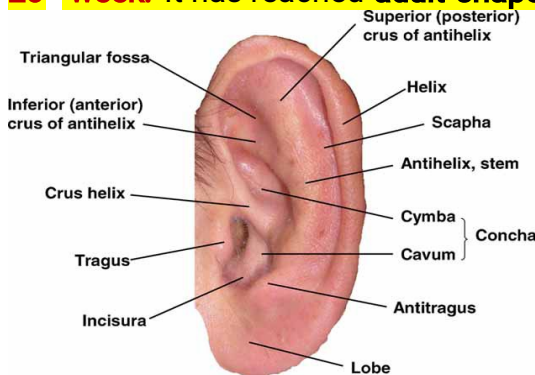
- Fourth hillock antihelix
- Fifth hillock antitragus
- Sixth hillock lobule and **lower** helix

Note: the **last** part to develop of the ear is the **lobule**

7th week: Formation of **cartilage** is in progress.

12th week: The auricle is formed by **fusion** of the hillocks.

20th week: It has reached **adult shape**



9 years: reach adult size (this is the age of performing plastic surgery)

surgery)

The **concha** is formed by 3 separate areas from the **first groove (ectoderm)**

Upper part of the first groove: Concha cymba

Middle part of the first groove: Concha cavum.

Lower part of 1st pharyngeal groove: intertragus incisura

At the 6th months of gestation the epithelial cells of the plug degenerates, causing canalization of the medial bony cartilage

85 % of the ear is derived from the **2nd arch** (mainly 4th + 5th)

Tragus: Is the eminence projecting posteriorly over the external auditory canal. From the Greek word meaning goat, the tragus is so called because hair growth on its medial surface is said to resemble a goat's beard.

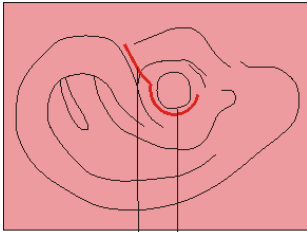
Antitragus is located posteriorly, opposite the tragus, and is separated from it by the intertragic notch.

Lobule: Consists of fibrous and fatty tissues and is devoid of cartilage.

The **preauricular**

sinus results from improper fusion of the 1st & 2nd brachial arches

Darwan's tubercle: small tubercle located postero-superior where the **helix** turns downward



The smaller superior portion is the **cymba conchae** and is the direct lateral relation to the **suprameatal triangle of the temporal bone**.

pear deformity of the external ear, an anthelix is missing, causing protrusion of the lobule side.

Triangular fossa lies between the two crura of the anthelix.

Scaphoid fossa (scoop or shovel) is a narrow, curved depression between the helix and the anthelix.

Concha (shell) is partially divided by the crus of the helix into two portions:

Upper (cymba conchae)

Lower (cavum conchalis)

Lies at an angle of 90 degrees (± 15 degrees) to the cortex of the mastoid bone.

All pinna parts are made of **fibroelastic** cartilage except the **lobule & the ant incisura** (groove between the **tragus & helix**)

The **lobule** is made of fatty and fibrous tissue

Endural incision is made at the groove between the **tragus & the Helix** because there is **no** cartilage avoiding **perichondritis**

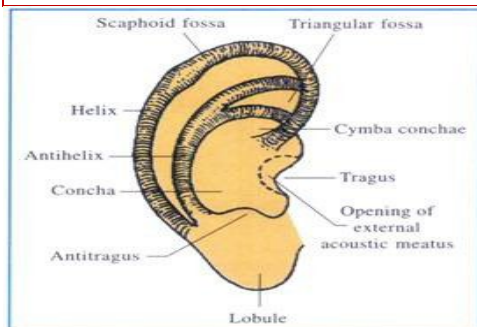


Fig. 14.1. Lateral view of right auricle.

Structure of the auricle

1.

Skin:

Thin: prone to frost bite

Firmly attached to the yellow elastic cartilage: auricular hematoma & chondritis is painful

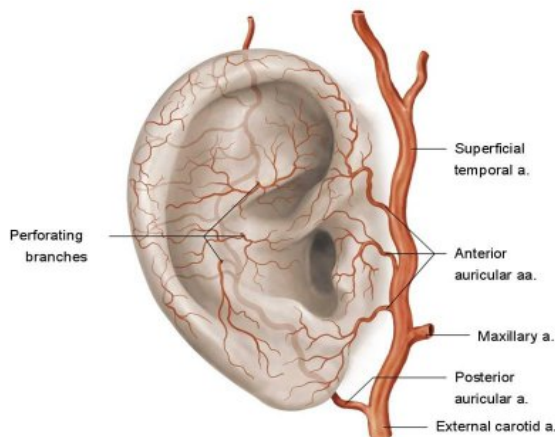
Little subcutaneous fat: auricle hematoma is more in the upper lateral part of the auricle

Note the skin is loosely attached at the area of the mastoid

2. Cartilage of the auricle:



The cartilage of the auricle is covered with **perichondrium** from which it derives its supply of nutrients, as cartilage itself is **avascular**.



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Illustrator: Karl Wesker

Stripping the perichondrium from the cartilage, as occurs following injuries that cause hematoma, can lead to cartilage necrosis with crumpled up 'boxer's ears'.

The auricle is attached to the head by:

- Skin
- An extension of cartilage to the external auditory canal cartilage
- Ligaments:

Extrinsic ligaments (connect the auricle to the **temporal** bone)

- Anterior ligament: zygoma to helix and tragus
- Superior ligament: external auditory canal to the spine of the helix
- Posterior ligament: mastoid to concha

Intrinsic ligaments (connects the various **cartilaginous** parts of the auricle)

- Between the helix & tragus
- Between the anti-helix & postero-inferior portion of the helix)

- Muscles

Both intrinsic & extrinsic muscles are attached to the **pericondrium**

a) extrinsic:



All inserted into the epicranial aponeurosis

1. Anterior auricular muscle
2. Superior auricular muscle
3. Posterior auricular muscle.

Innervated by facial nerve branches:

Posterior auricular nerve: posterior auricular muscle

Temporal branch: Anterior + superior auricular muscle

Functionally unimportant but give rise to the post-auricular myogenic response following appropriate auditory stimulation

a) Intrinsic muscles include:

1. Transverse muscle
2. Oblique muscle
3. Tragus muscle
4. Anti-tragus muscle
5. Major & minor helix

The dimensions of the normal auricle:

The vertical axis of the auricle is thought to be inclined about 20 degrees Posteriorly

Angle of protrusion should be between 20 and 30 degrees.

helical rim protrudes 1 to 2 cm from the skull

The superior aspect of the ear is usually at level of the brow

The vertical height is usually equal to the distance between the lateral orbital rim and the root of the helix at the level of the brow (< 6 cm).

The width should be about 55% of the length.

External auditory canal

Embryology of the external auditory canal:

8th week of gestation: thickening of the ectoderm of the dorsal part (upper part) of the 1st brachial cleft

Starts to grow near the tympanic membrane towards the outside

This solid core of cells continue to grow toward the middle ear

In the same time Concha cavum deepens (invaginates) to form the outer cartilaginous 1/3 of the canal

21st week of gestation: this core starts to resorb & hollow out to form a channel

The **inner** most layer of ectoderm remains to become the superficial layer of the Tympanic membrane

28th week ^(7th month of gestation): the formation of the channel is completed

3 years: complete ossification of the canal

9 years: adult size

The significance of congenitally malformed auricle vs normal auricle with canal atresia

The auricle forms very early making malformation of the middle ear, mastoid & facial nerve very likely



be normal

The canal forms late so previous structures are more likely to

Cerumen:

consists of **desquamated epithelium** mixed with the sebum produced from **sebaceous glands** and the watery secretions of **modified apocrine sweat glands**

acidic: bacteriosatic + fungostatic

contains **lysozymes** which are **bacteriocidal**

Anatomy of the external auditory canal

It is tortuous **S** shaped to protect the Tympanic membrane

Dimensions:

24 mm in length from the concha to the Tympanic membrane

The **superior –posterior (25mm)** dimension is shorter than **Anterior-inferior (31mm)**

The **bony part is narrower** than the **cartilaginous part**

Made of:

A. Bony part:

2/3 of the canal = 16 mm

Made of:

The tympanic ring is not a complete ring, giving a dehiscence superiorly

Notch of Rivinus is the notch on the squamosa, medial to which lies Shrapnell's membrane.

	Tympanic ring	Squamous part
Forms	Anterior +inferior + part of posterior wall	Roof + rest of the posterior wall
Tympanic sulcus	+ve	-ve (Notch of Rivinus)
Tympanic ring of the Tympanic membrane	+ve	-ve
Attached part of the Tympanic membrane	Paras Tensa	Paras flacida

directs **medially & inferiorly**

the skin is very adherent to the periostum, with **no** subcutaneous tissue

the skin is very adherent to the **tympanosquamous** (anteriorly) & **tympanomastoid** (posteriorly) sutures: making elevation of the **tympanomeatal** flap very difficult

A. **Cartilaginous part:**

1/3 of the canal = 8 mm

Made of **yellow elastic fibrocartilage**

deficient in cartilage **superiorly** between the lamina of tragus & crus of the helix

Adults: pull ear upwards and backwards

Infants: pull ear downwards and backwards

apopilo-sebaceous unite:

adnexal appendages of the **cartilaginous** canal compromising hair cells + sebaceous gland +

exocrine gland such as cerumen gland

Human earwax is a Mendelian trait consisting of wet and dry forms. Dry wax, lacking cerumen, is yellowish or grey and brittle, while wet wax is brownish and sticky. The wet phenotype is dominant over the dry type, and is frequently seen in populations of European and African origins

A single nucleotide polymorphism in the ABCC11 gene is responsible for the determination of earwax type, with the AA genotype corresponding to dry wax and GA and GG to wet wax

Wax is not usually found in the deep ear canal and a lump of 'wax' overlying the upper portion of the tympanic membrane (pars flaccida or attic region) is rarely true wax, but is nearly always associated with an underlying cholesteatoma as it is, in fact, dried-up, oxidized keratin

the primary protective barrier of the EUC is the hair bearing skin & apopilo-sebaceous unit

Skin of pars tensa growth:

directly towards the surface, there is outward, oblique growth of the epidermis of the canal skin and pars flaccida so that the surface layers effectively migrate towards the external opening of the canal, rate of migration is about 0.1 mm/day, but if there is a perforation then it is directed centrally to cover the graft. However, the property of canal skin to migrate can also bring problems with the formation of cholesteatoma if the skin becomes displaced into the middle ear cleft.

Auditory canal constrictions:

at the junction of the cartilaginous and bony portions
the isthmus

The isthmus:

The **narrowest** point of the EAM, 5 mm from the tympanic membrane

Prominence of the anterior canal wall reduces the diameter.

Deep to the isthmus, the antero-inferior portion of the canal dips forward forming a wedge-shaped anterior recess between the tympanic membrane and the canal.

This recess can be a difficult spot for access either in the clinic or at surgery

Narrowed by the canal **angulation**

This narrowing is 5.7 (range 3–7) mm wide in the antero-posterior plane, but 8.2 mm (range 6.5–10) mm wide in the vertical plane

This is mainly an **anteroposterior** narrowing and is oval or inverted pear shaped.

Foreign Body impacted is more likely to occur at the **isthmus** and could be removed by use of **aural hook**, using the potential space at the **superior** portion of the isthmus.

Embryology: **first pharyngeal groove** (cleft)

Foramen of Huschke:

embryological **remnant** that **normally** obliterates: the incomplete tympanic **ring** grows asymmetrically, leaving a defect **anterio-inferiorly** in the **medial bony** external auditory canal (in the **non-ossified** part of the tympanic plate)

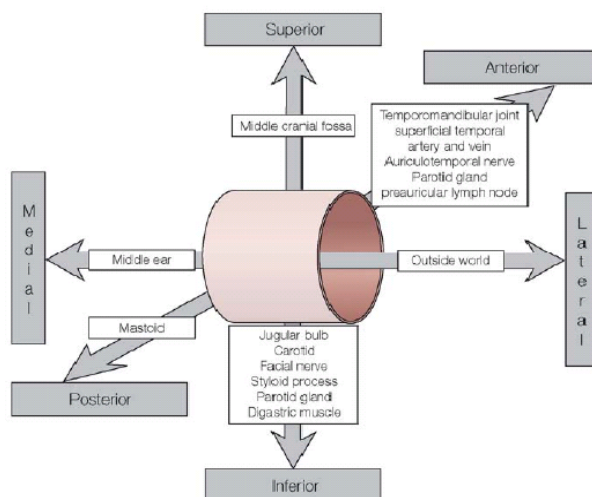
this defect connects the **medial EAC** to the parotid and glenoid fossa region

allows for extension of infection and malignant tumors **outside** the temporal bone or extension of tumor from the parotid gland into the temporal bone

this remnant normally closes at the age of **5** years

lies **near** the fissure of santorini

Fissures of Santorini: (dehiscence in the **floor** of the **cartilaginous** part of the EUC)



lymphatic channels that connect the **lateral**

cartilaginous EAC to the parotid and glenoid fossa region, allows for extension of infection and malignant tumors

Relation of external auditory canal to surrounding structures:

Anterior:

Mandibular foss + TMJ (condylar movement may be conducted into the cartilaginous part of the canal)

Parotid gland

Postero-superior: mastoid antrum

Postero-inferior: mastoid process

Superior:

laterally: middle cranial fossa

medially: epitympanic recess

Note that the **parotid** gland lies **anterior + inferior** to the **EUC**

Note: eddy currents in EAC don't allow water to reach TM while swimming