

Principle of skull development

We divide the skull into 2 parts:

1. **neurocranium** – surrounds the brain and sensory organs;
2. **splanchnocranium** (viscerocranium) – facial part.

Neurocranium

The neurocranium is divided into 2 groups based on the type of ossification they undergo:

1. **desmocranium** – flat bones of the calvaria that develop by intramembranous or desmogenic ossification from connective tissue;
2. **chondrocranium** – bones of the base of the skull ossifying chondrogenically on a cartilaginous base.

Both parts arise from the neural crest and paraxial mesoderm.

Desmocranium

The bones in the desmocranium develop from the mesenchyme of the neural crest, non-segmented paraxial mesoderm and to a small extent from derivatives of the gill arches, which also derive from the neural crest. Mesenchyme surrounds the brain and forms beam-like islets of bone tissue, called *spicules*. The *spicules* are primary ossification centers that grow radially. Further bone growth is ensured by appositional growth on the outer side of the skull bones and resorption carried out by osteoclasts on the inner side.

The bones of the neurocranium that grow from intramembranous ossification are:

- *Parietal bone;*
- *Occipital bone (except basis ossis occipitalis);*
- *Frontal bone;*
- *Lacrimal bone;*
- *Nasal bone;*
- *Vomer;*
- *Squama ossis temporalis.*

Of the listed bones, the parietal bone and the occipital bone are from the mesenchyme of the paraaxial mesoderm, while the rest are formed from the mesenchyme of the neural crest.

Chondrocranium

Before the actual formation of the bones of the skull base, their cartilaginous bases are created, which later merge and ossify. Out of all the cartilaginous joints that ossify in adulthood, two persist as cartilage: synchondrosis petrooccipitalis and sphenopetrosa.

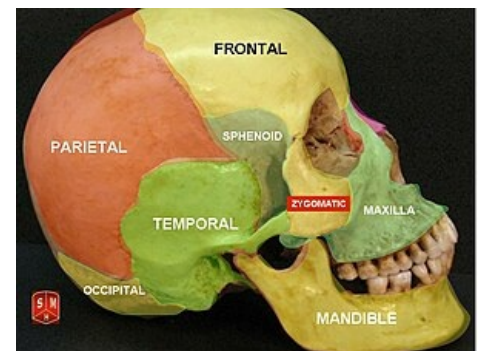
Chondrogenic bones of the neurocranium:

- *Ethmoidal bone;*
- *Body, lesser wing and greater wing of sphenoid bone;*
- *Base of occipital bone;*
- *Pars petrosa ossis temporalis.*

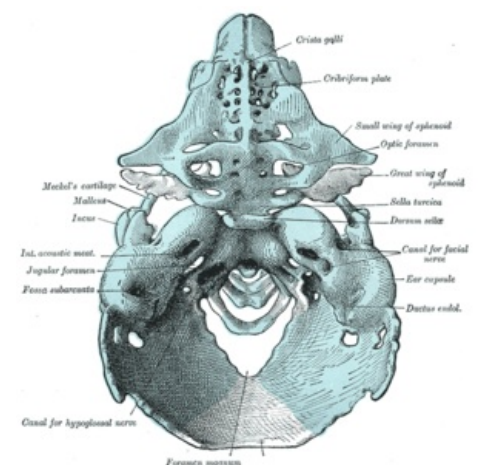
From the above-mentioned bones of the cranial base, the area in front of the rostral end of the notochord (area of the sella turcica) arise from the neural crest – the prechordal chondrocranium and the area of the chordal chondrocranium from the occipital somites of the paraxial mesoderm.

Splanchnocranium

The bones of the splanchnocranium arise on the basis of the first three pairs of gill arches from the ectomesenchyme of the neural crests, which ossify desmogenously, except for the uvula, auditory bones and styloid process of temporal bone, which although belonging to the splanchnocranium, ossify chondrogenically. The first branchial arch is divided into maxillary and mandibular wall. The maxillary ridge gives rise to the premaxilla, maxilla, zygomatic bone, palatine bone and incus. The mandible arise from the mandibular wall, on the base of Meckel's cartilage. The stapes, styloid process, body and lesser horn of the hyoid bone develop from the second gill arch, the basis of which is Reichert's cartilage. The third gill arch eventually gives rise to part of the body and greater horn of the hyoid bone.



Cranium



Chondrocranium of the human embryo

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References