

İskelet Sistemi

1. Dış iskelet – Koruma görevli

Epidermal: Pullar
Tüyler
Kıllar

Dermal: Balık pulları
Kaplumbağa kabukları
Timsah zırhları

2. İç iskelet – Desteklemede görevli

Aksial iskelet
Apendikular iskelet
Heterotopik kemiklert

KEMİKLEŞME

A – Dermal (İntramembranöz kemikleşme)

B – Kondral kemikleşme

1. Perikondral

2. Endokondreal

İç iskelet elemanları

1. Kıkırdak (Embrional)

2. Kondral kemikler

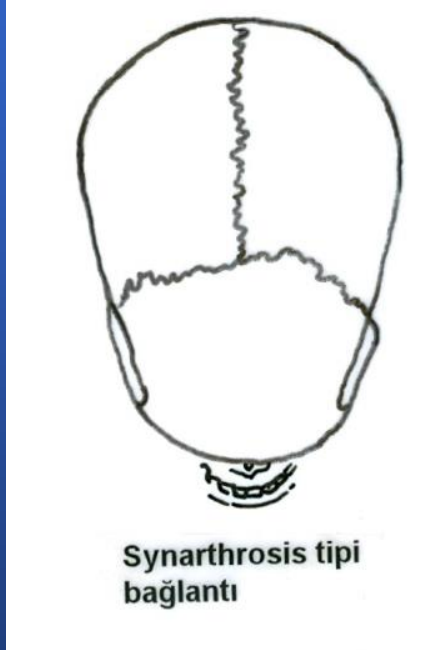
3. Dermal kemikler

a. Balık pulları

b. Kafatası kemikleri

c. Omuz kemer, kemikleri

Synarthrosis : Doğrudan bağlantı



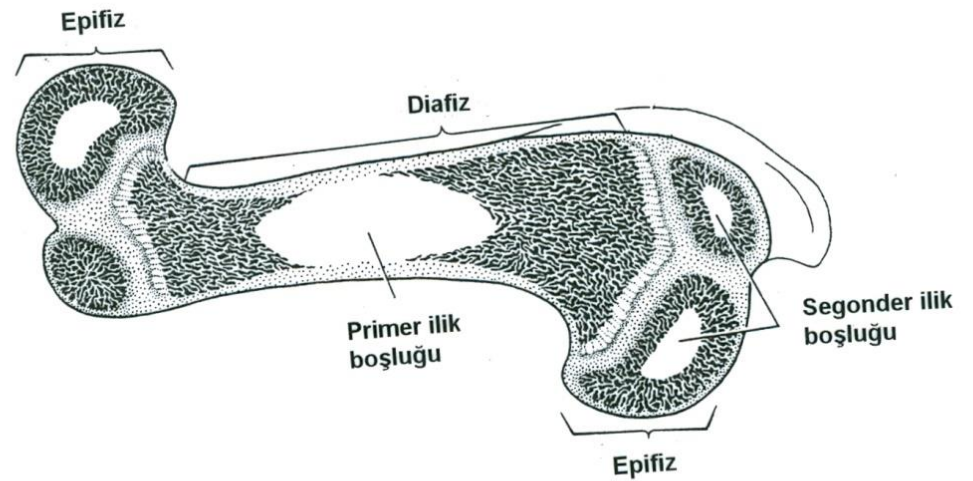
Kafa iskeleti





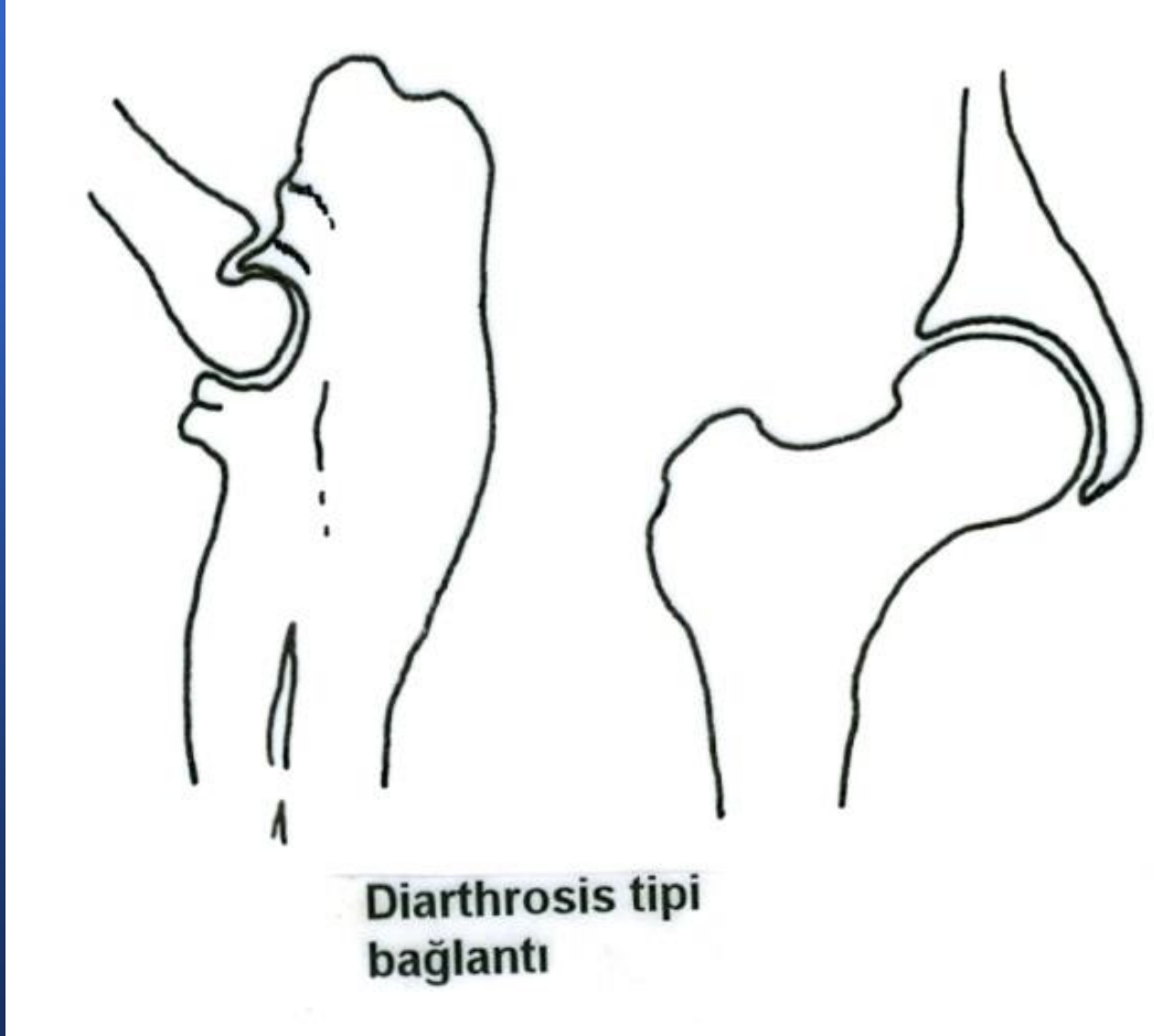
Pelvik kemerde symphysis

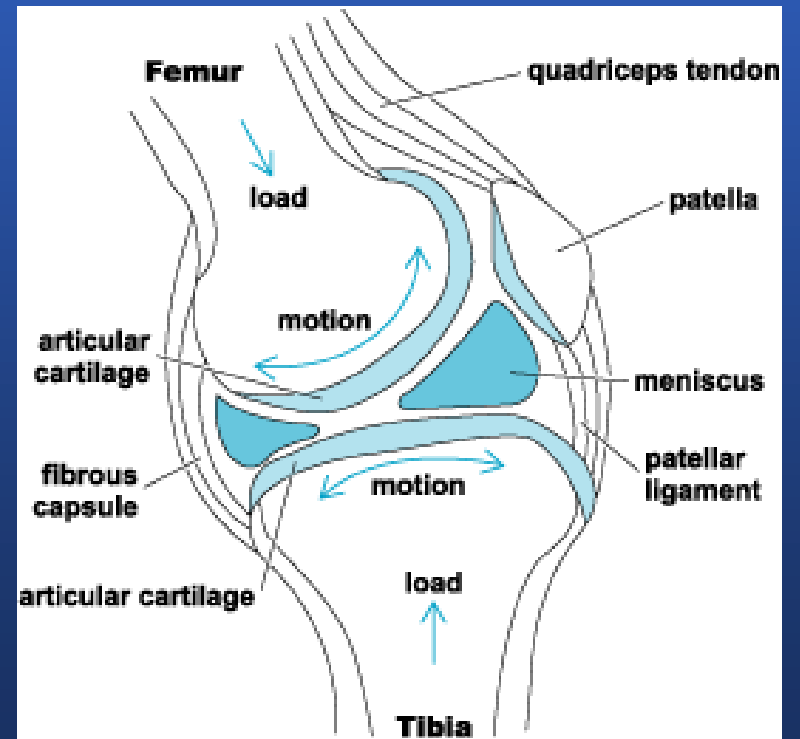
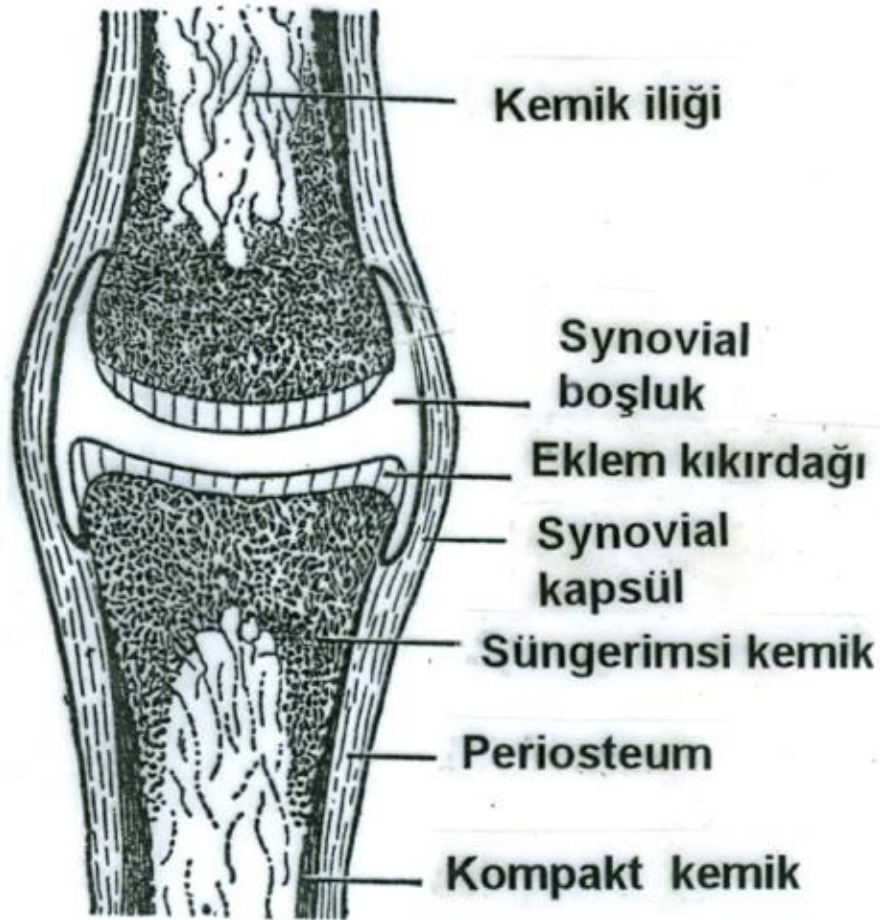
Uzun kemik :
Epifiz – Diafiz eklemleri



Şekil 5 -1. Gelişmekte olan uzun kemikten boyuna kesit (Boyca uzama esas olarak epifizial bölgede gerçekleşir.)

Diarthrosis : hareketli bağlantı – Eklemlili bağlantı





İÇ İSKELETİN SINIFLANDIRILMASI

A – Axial iskelet

1. Kafa ve Solungaç iskeleti
2. Omurga
3. Kaburgalar
4. Göğüs kemiği

B – Apendikular iskelet (Ekstremité iskeleti)

1. Ekstremité taşıyıcıları
 - a. Pektoral kemer
 - b. Pelvik mkemer
2. Ekstremiteler
 - a. Yüzgeç tipi (tek ve çift yüzgeçler)
 - b. Kol ve bacak tipi

C - Heterotopik kemikler

AXIAL (EKSEN) İSKELET

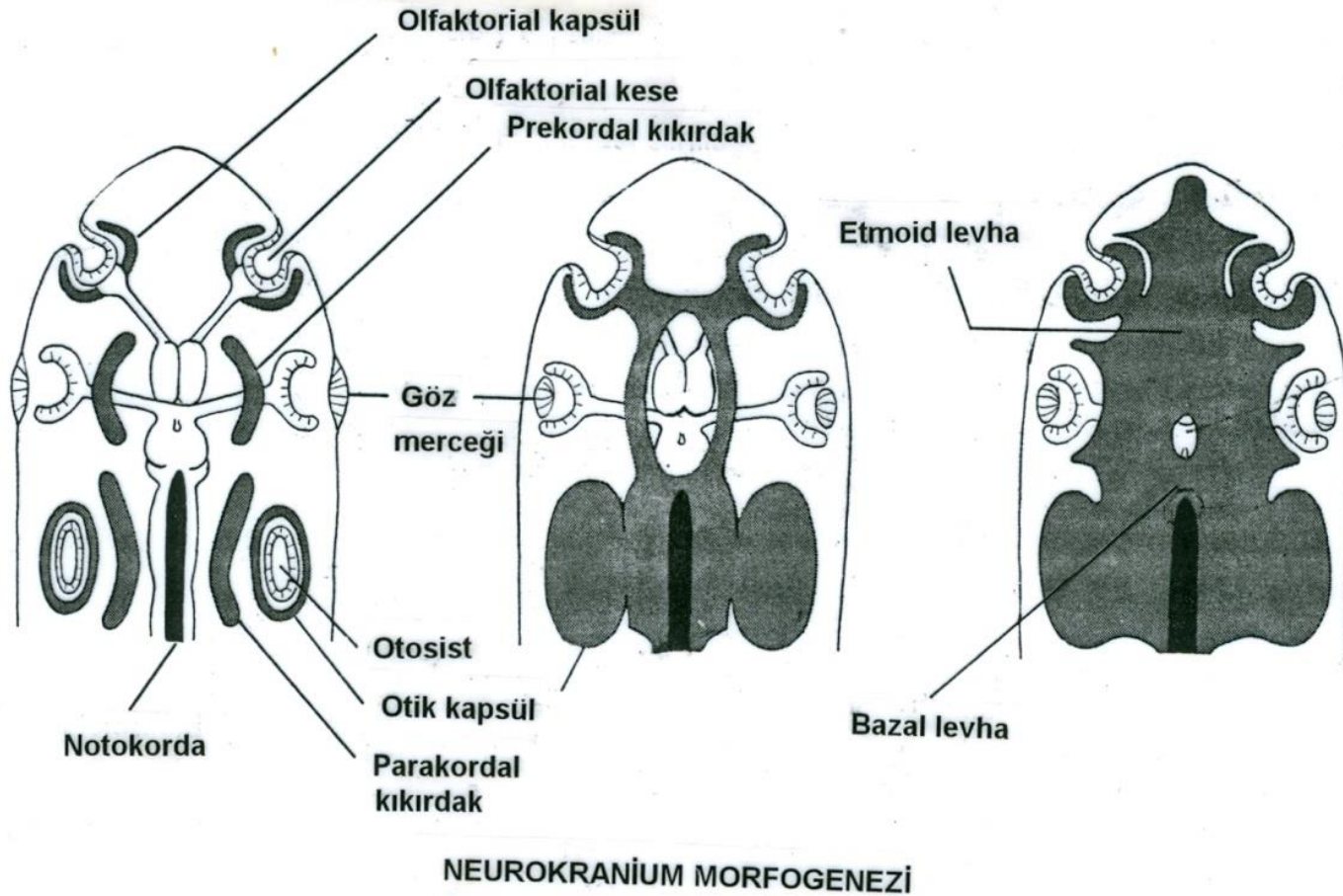
1. Kafa ve solungaç iskeleti

a. Neurocranium – Beyin ve duygu organlarını çevreleyen kıkırdak iskelet

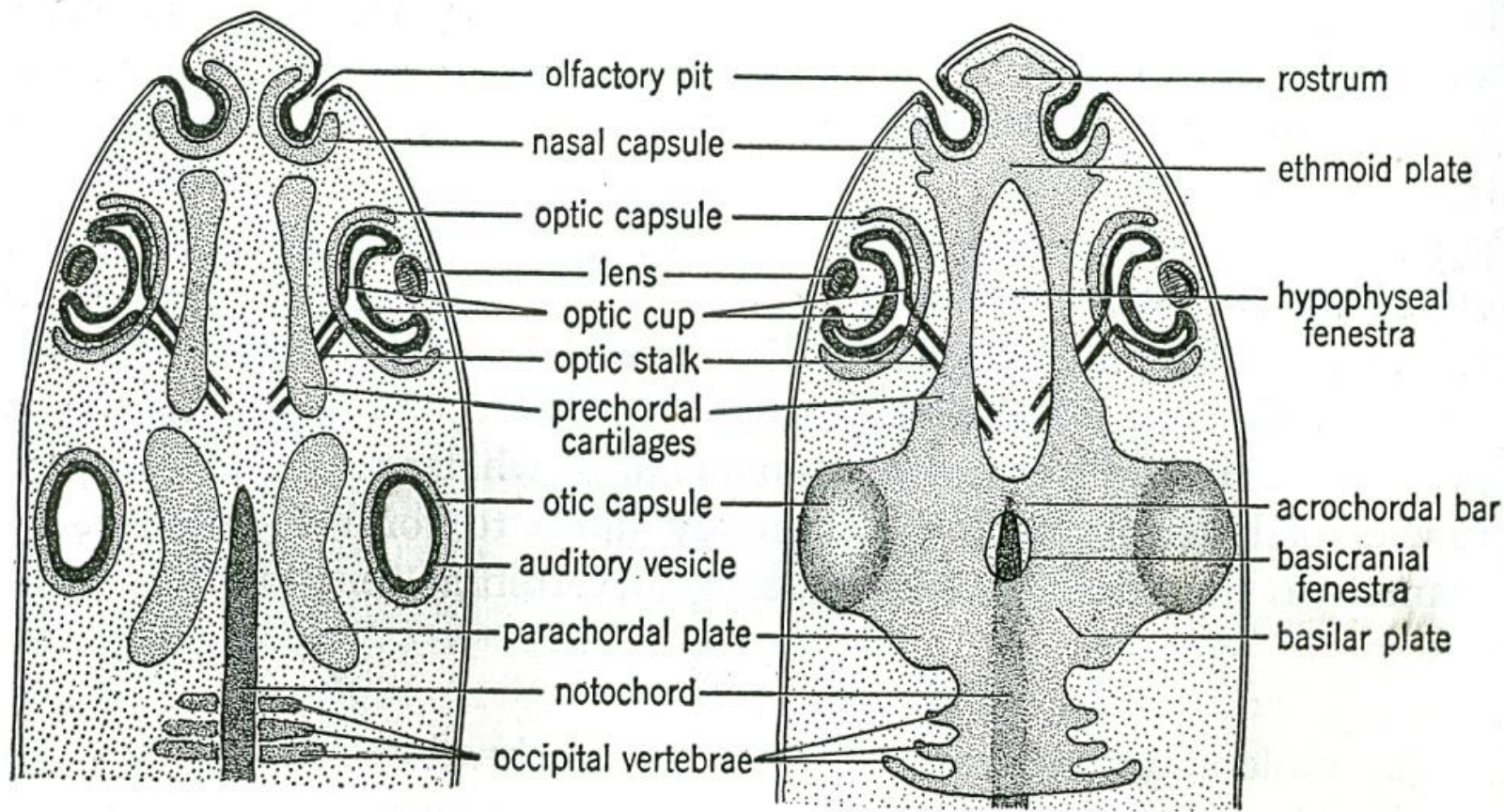
b. Splanchnocranium (Viscerocranium) – Çene ve solungaç iskeleti

c. Dermatocranium – Membran örtü kemikleri

Neurocranium'un Morfogenezi



Şekil 5 - 17. Kıkırdak neurokranium oluşumunun başlangıç safhalarının ventral görünümü - Şematik. (Sağda beyini alttan kuşatan kıkırdak taban tamamlanmış)

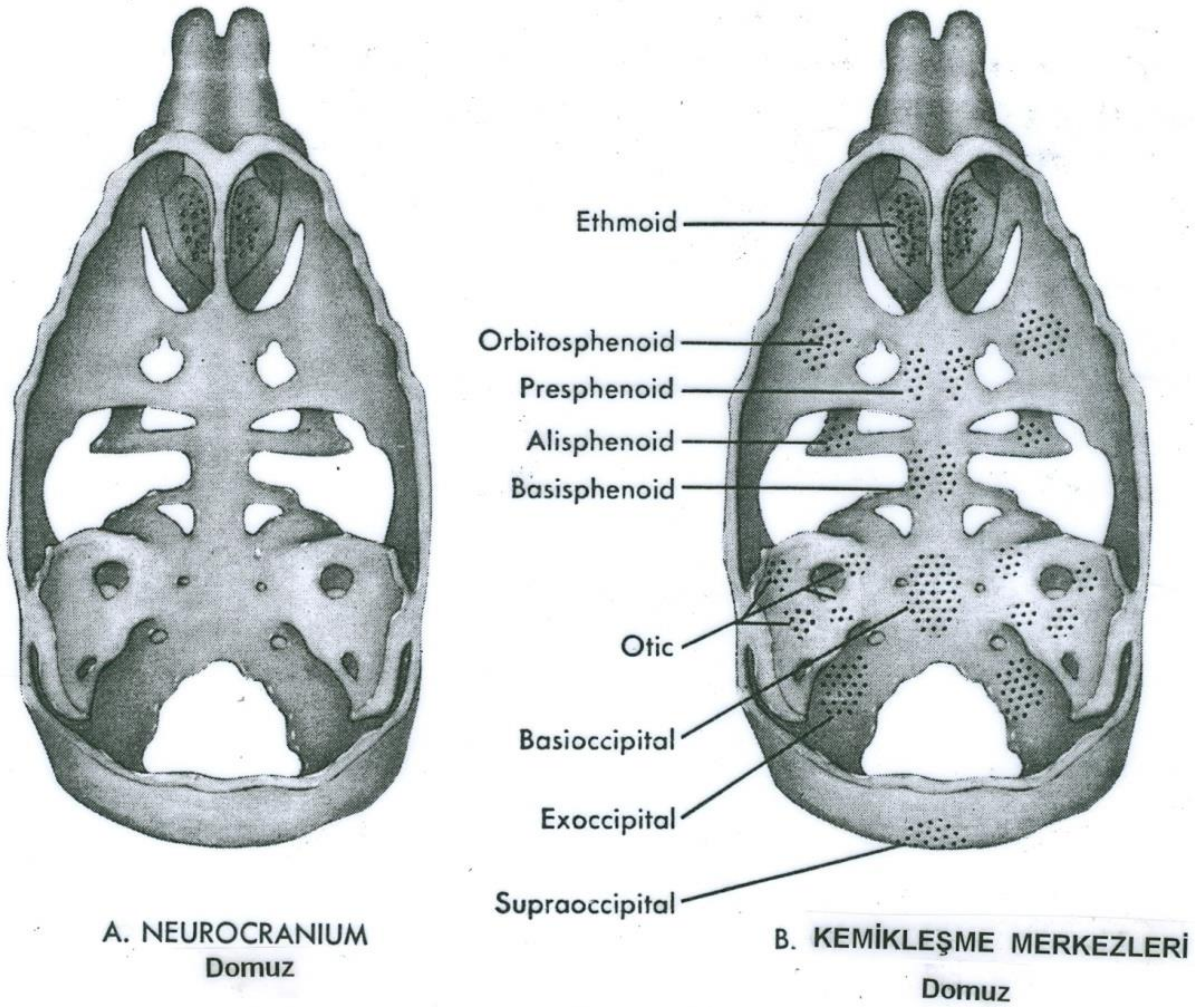


A

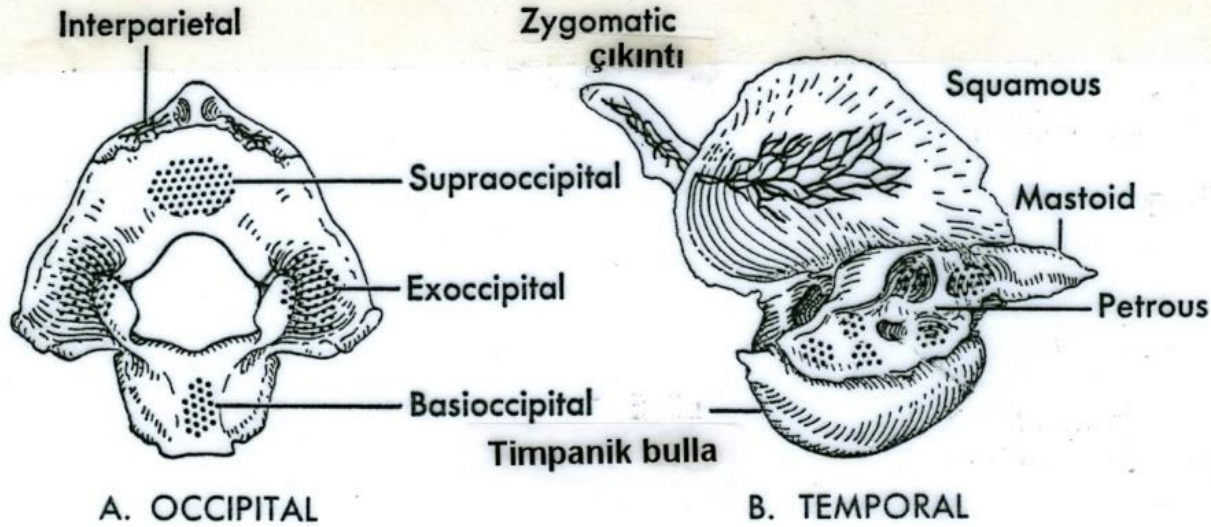
B

FIG. 10.17. Diagrams illustrating development of the chondrocranium. *A*, separate chondrocranial cartilages surrounding the special sense organs and flanking the notochord and brain; *B*, all the cartilages except the optic capsules have fused to form the early chondrocranium.

Neurocranium'un kemikleşme merkezleri



Şekil 5 - 18. A. Domuz fetüs'ü neurokranim'u (beyinin üzerinde tavan kıkırdakları tamamlanmamış). B. Memeli neurokranium'unda kemikleşme merkezleri.



KEMİKLEŞME MERKEZLERİ

Şekil 5 - 19. Oksipital bölgede endokondral kemikleşme merkezleri (noktalı) ve otik kapsül (temporal kemiğin petrosal kısmı). İntramembranöz kemikleşme merkezleri interparietal, squamosum ve jugal (zigomatik) bölgelerde çizgili olarak gösterilmiş. A. Kaudalden görünüm, B. mediandan görünüm. Yeni kıkırdaktan oluşan timpanik bullalar ilk oluşan neurokranium'la birleşmez. Mastoid, petrosal kemiğin dışa doğru çıkıntısı halindedir.

Oksipital bölge ve temporal bölge

Insanda temporal bölge

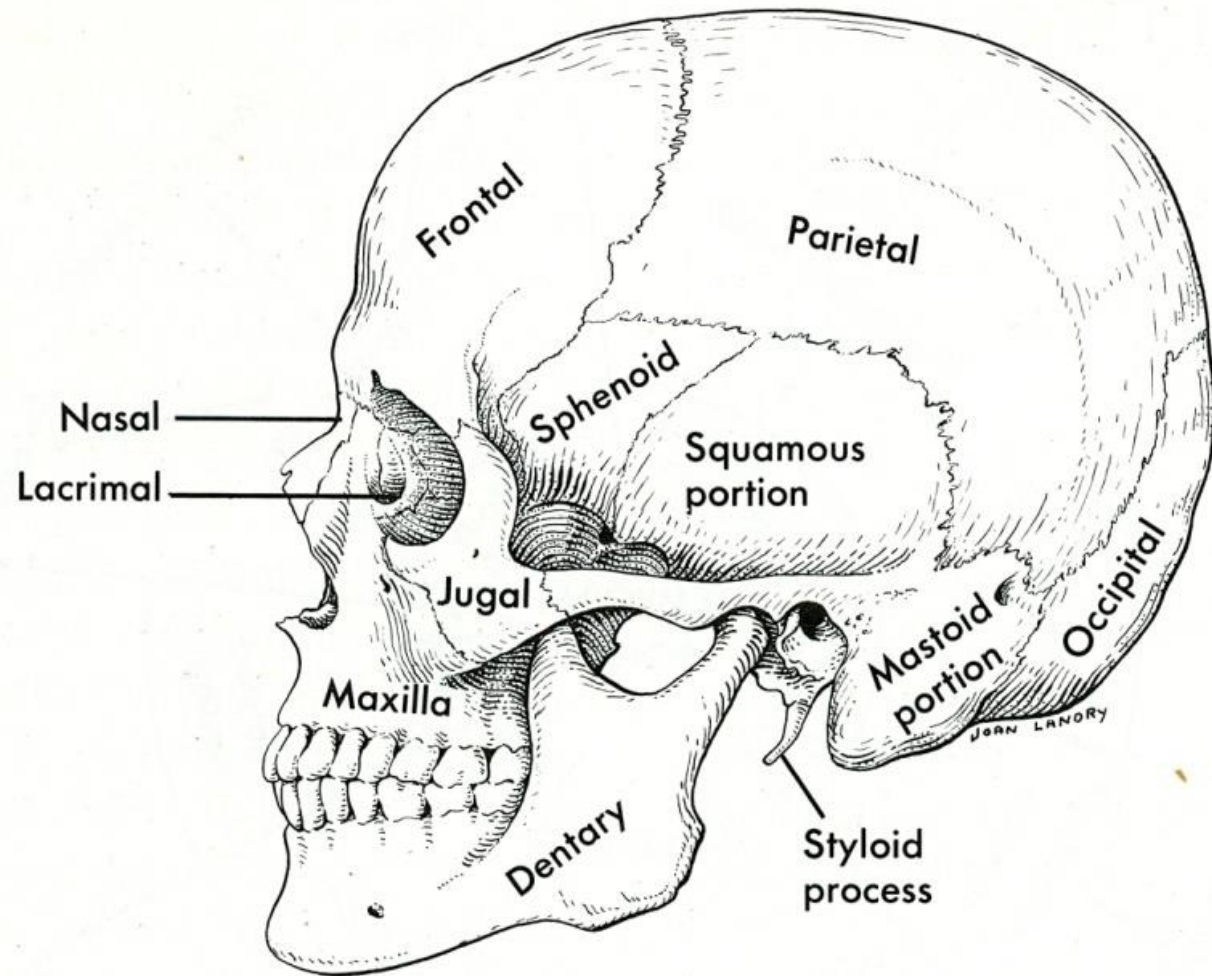


Fig. 8-37. Skull of modern man.

Hamster kafa iskeleti (ventralden)

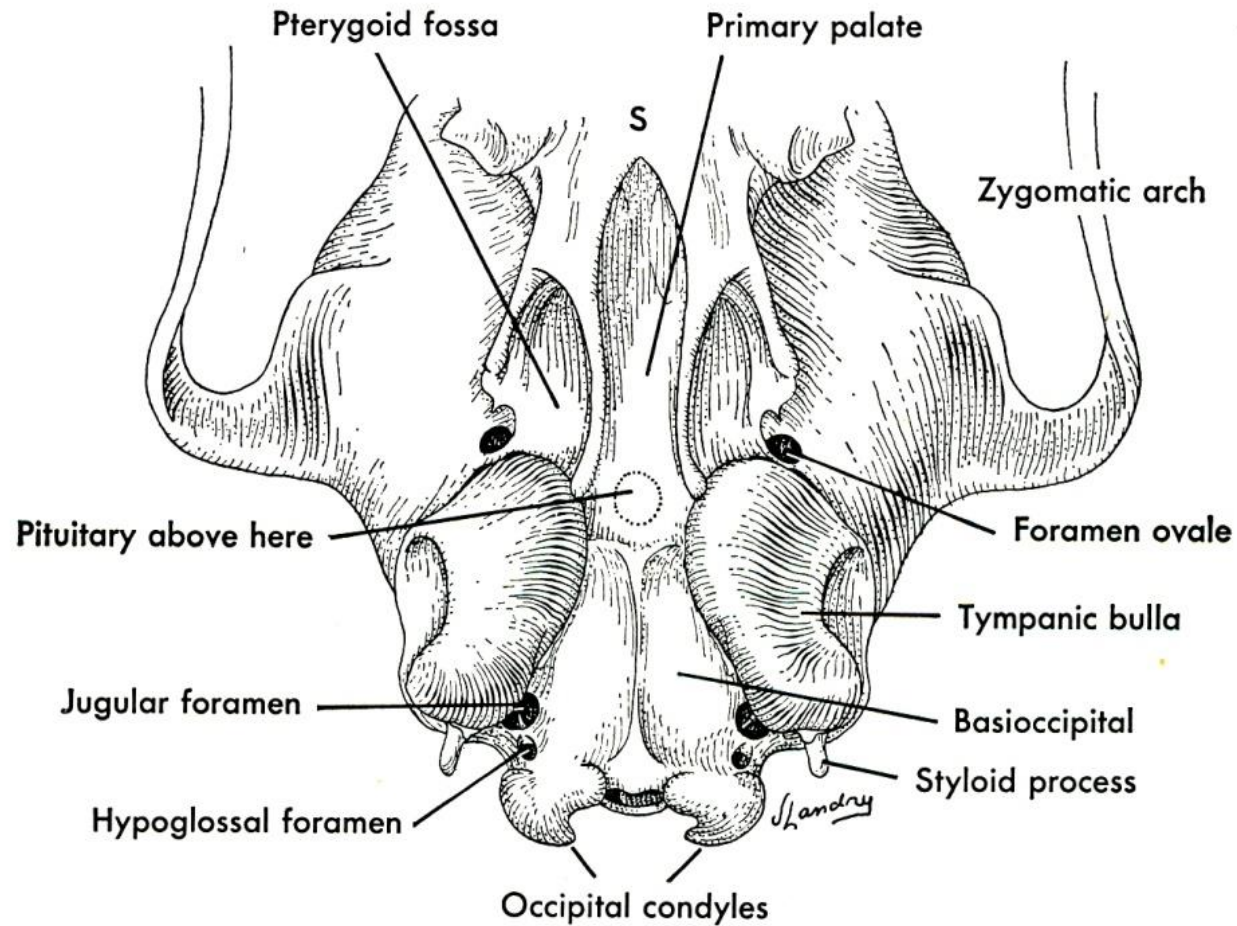
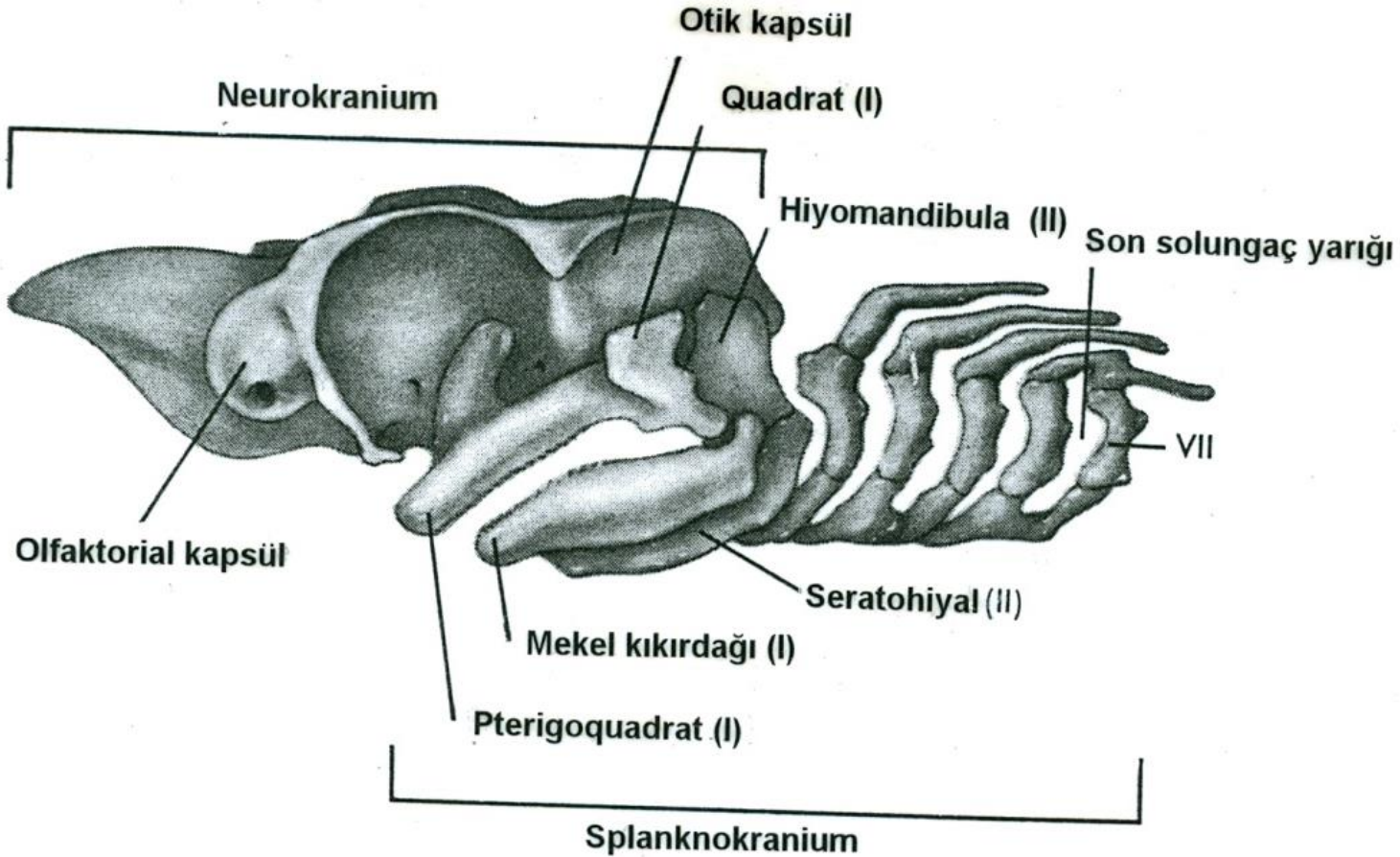


Fig. 8-36. Hamster skull, posterior part, ventral view. **S**, Secondary palate.

Splanchnocranium Morfogenezi



Şekil 5 - 20 . Köpek balığı kafatası. I., II.ve VII.Birinci ikinci ve yedinci yutak yaylarının iskeleti.

Profil'den görünüm

Splanchnocranium Morfogenezi

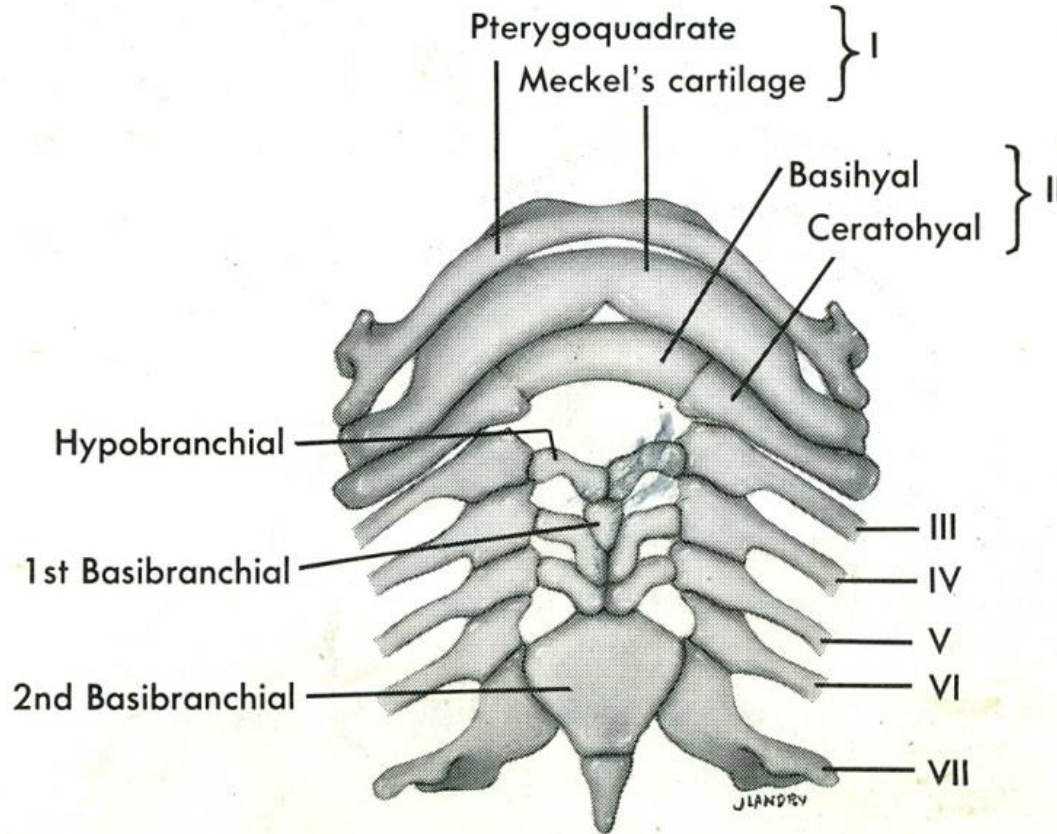


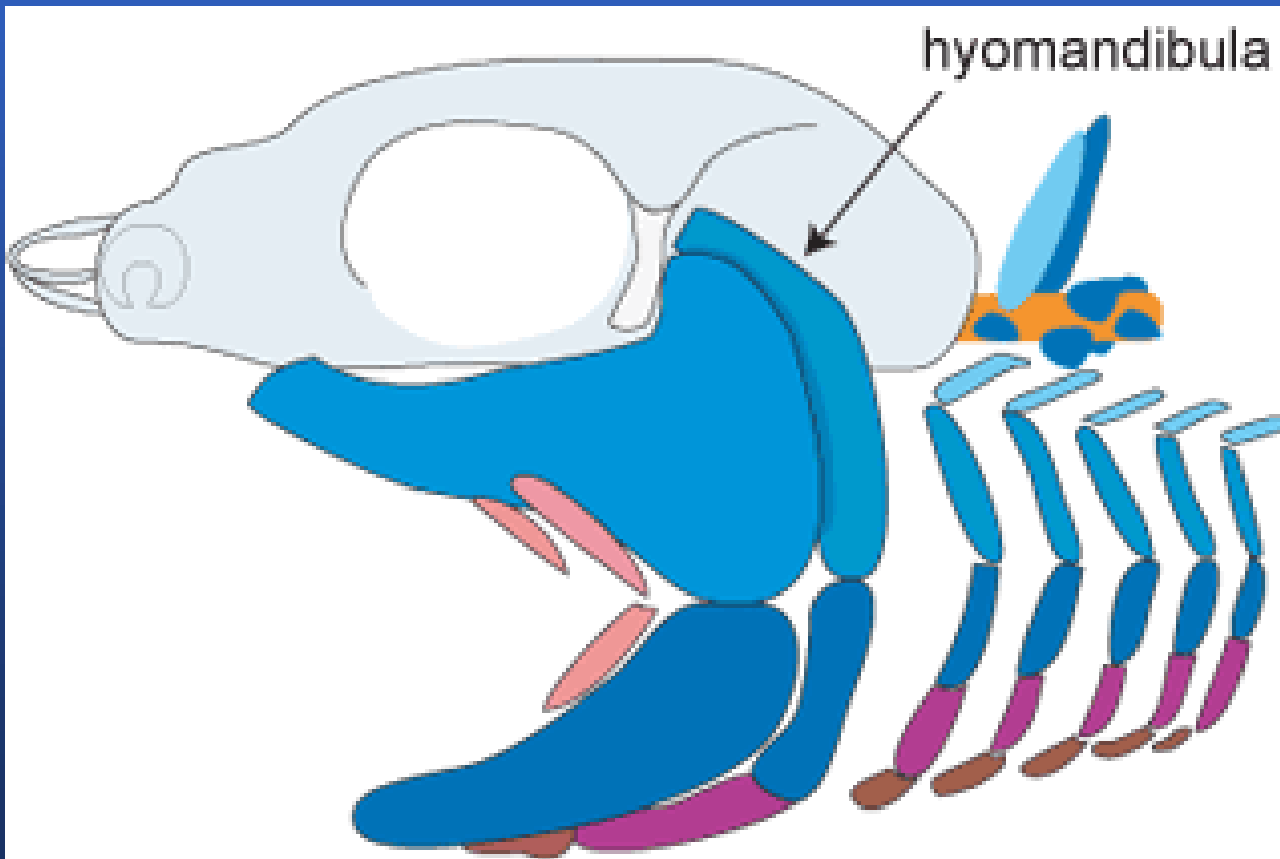
Fig. 8-7. Visceral skeleton of a dogfish shark, ventral view. **III** to **VII**, Ceratobranchial cartilages of the third to seventh pharyngeal arches.

Ventral'den görünüm

Amfistilik çene bağlantısı

I. yay pterygoquadrat'la doğrudan neurokranium'a bağlanır

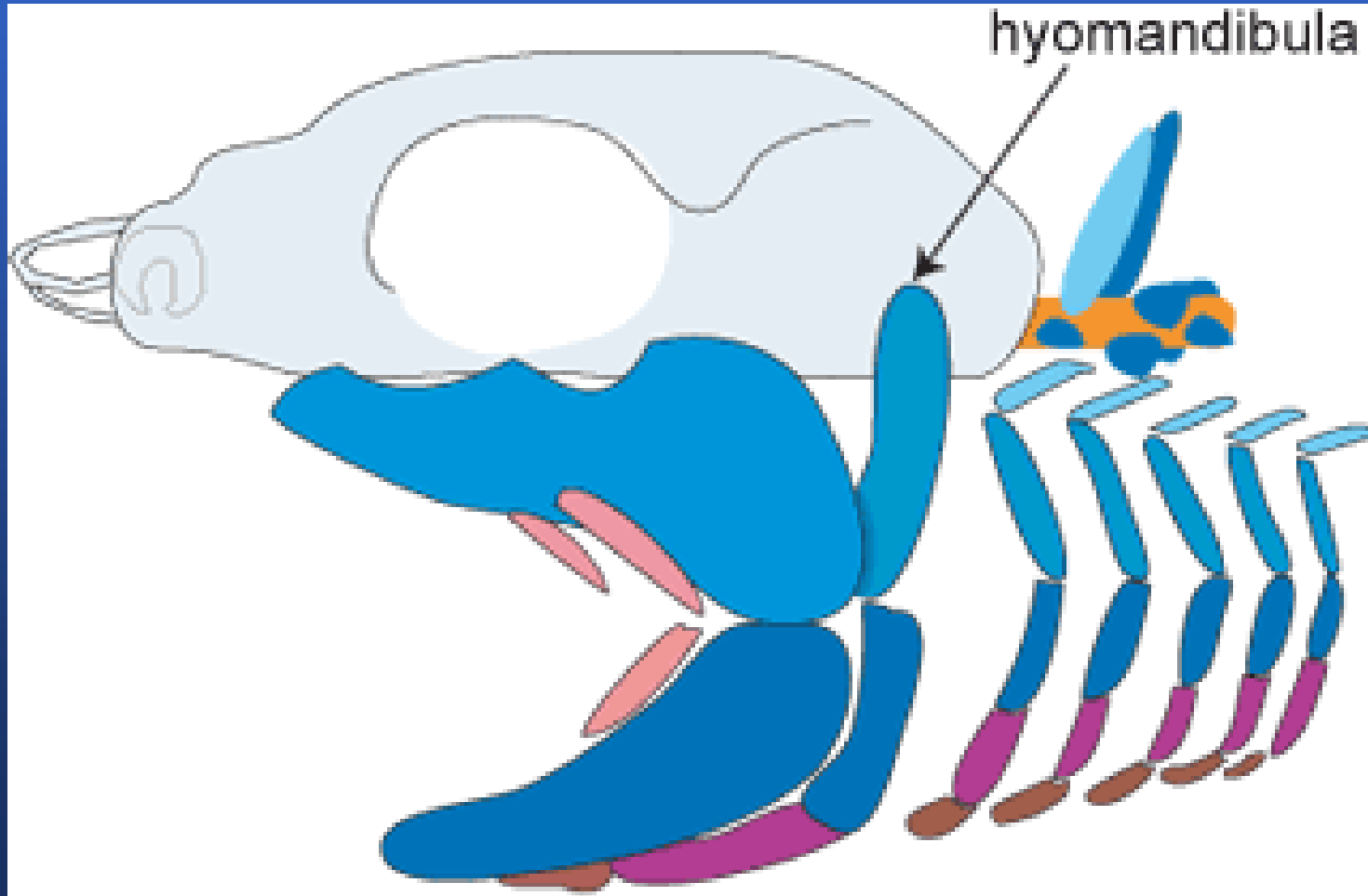
II.yay hyomandibula ile neurokranium'a bağlanır



Elasmobranchia (köpek balığı)

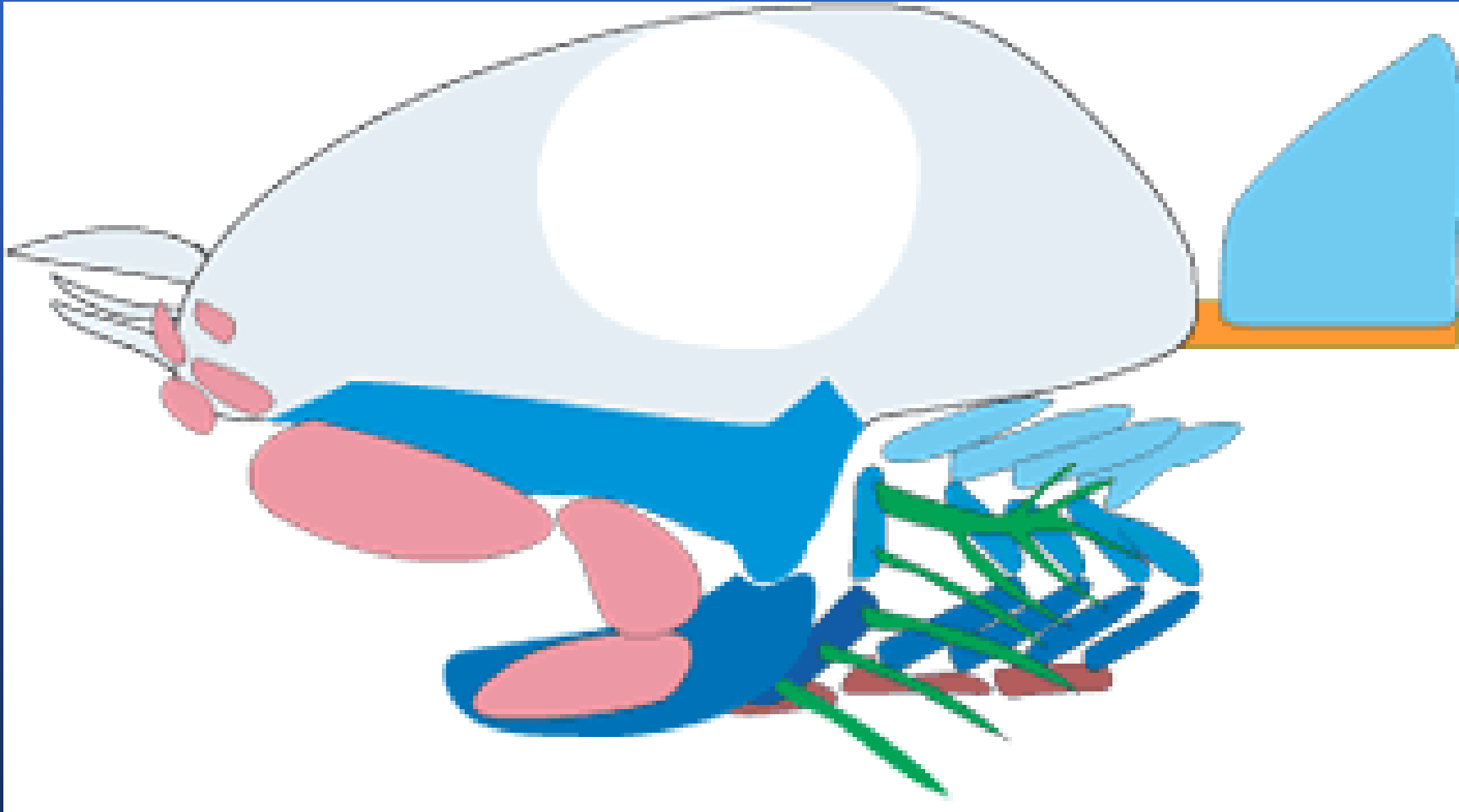
Hyostilik ene baęlantısı

I. Yayın pterygoquadrad'ı, II. Yayın hyomandibulasına baęlanır
Hyomandibula neurkranium'un otik bölgesine baęlanır
(Modern Teleost'lar)



Otostilik çene bağlantısı

Pterygoquadrad kafa iskeletiyle kaynaşmış
Alt çene quadrad'a asılı (Hyomandibula çene bağlantısında
rol oynamaz) – Placodermi, Chimera, Akciğerli balıklar



Çene bağlantıları

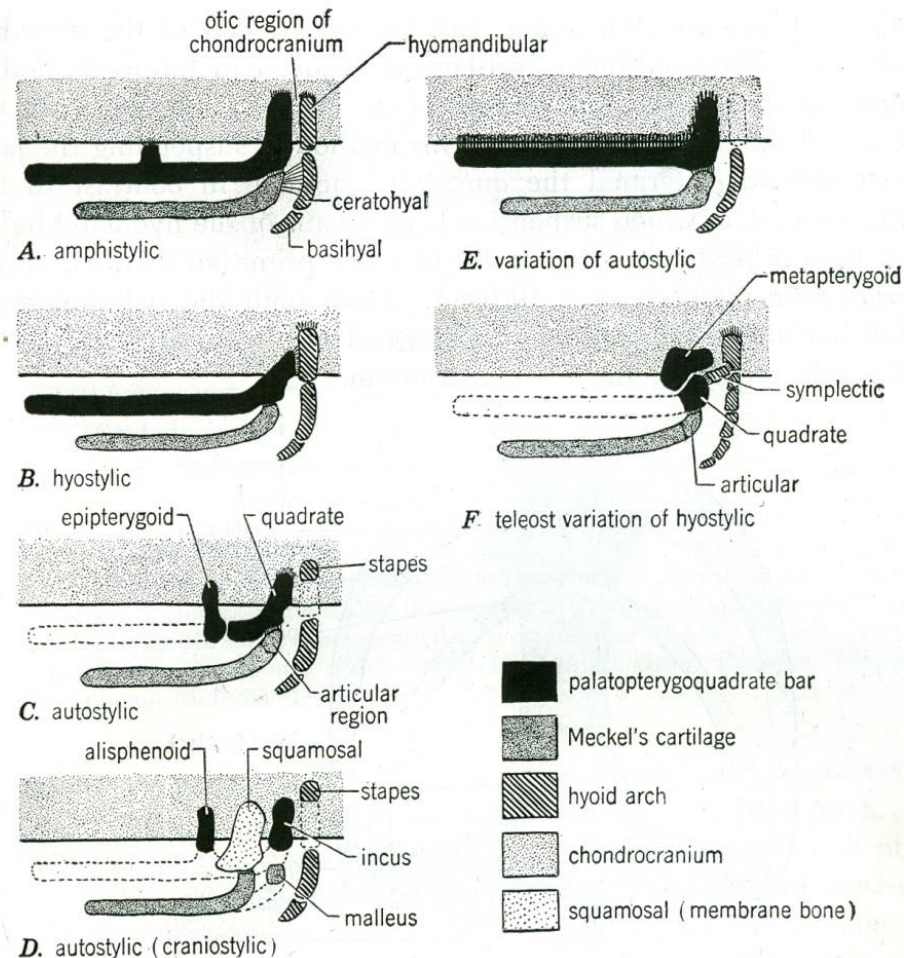


FIG. 10.20. Diagrams indicating various methods of jaw suspension. A, amphistylic, found in a few primitive elasmobranchs; B, hyostylic, found in sharks and sturgeons; C, autostylic, found in tetrapods other than mammals; D, craniostylic, typical of mammals; E, variation of autostylic, found in *Polypterus*, holocephalians, and lung fishes; F, teleost variation of hyostylic, found in *Amia*, *Lepisosteus*, and teleosts. The membrane bones investing Meckel's cartilage are not indicated.

Agnatha – petromyzontia (*Petromyzon marinus*)

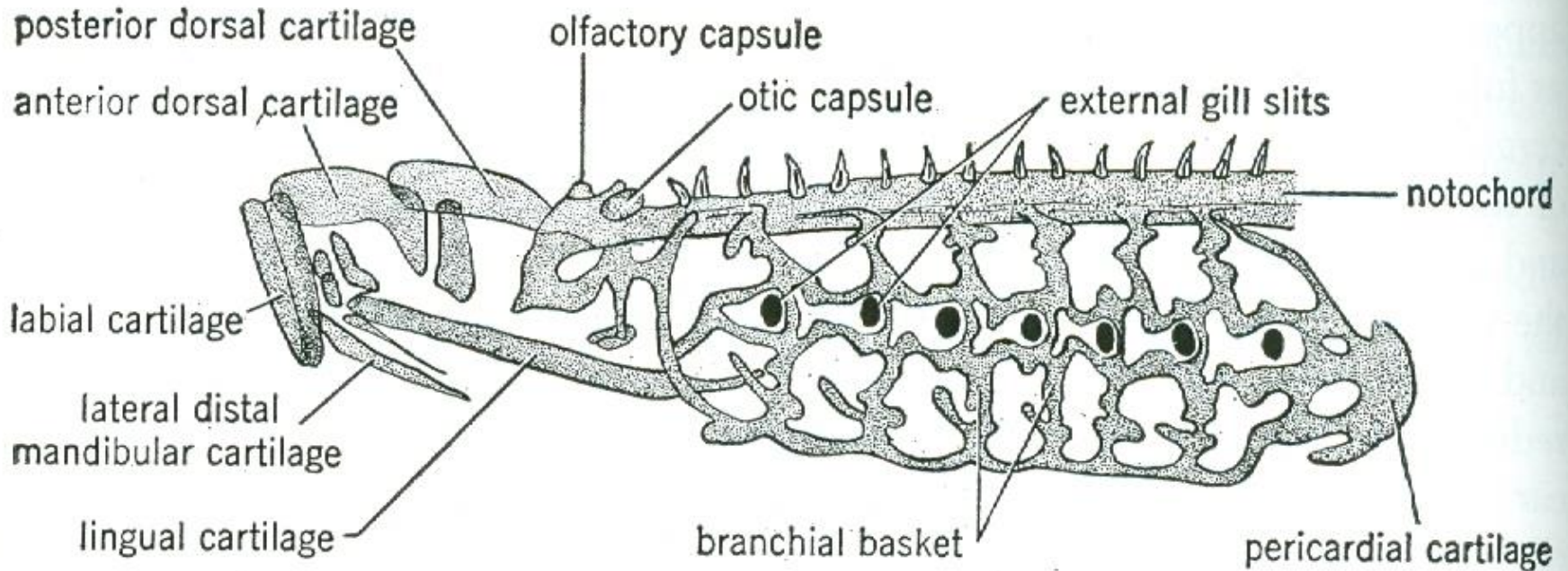


FIG. 10.24. Lateral view of chondrocranium and branchial basket of lamprey, *Petromyzon marinus*. (After Parker, from Schimkewitsch.)

Chondrocranium + Splanchnocranium (lateral'den)

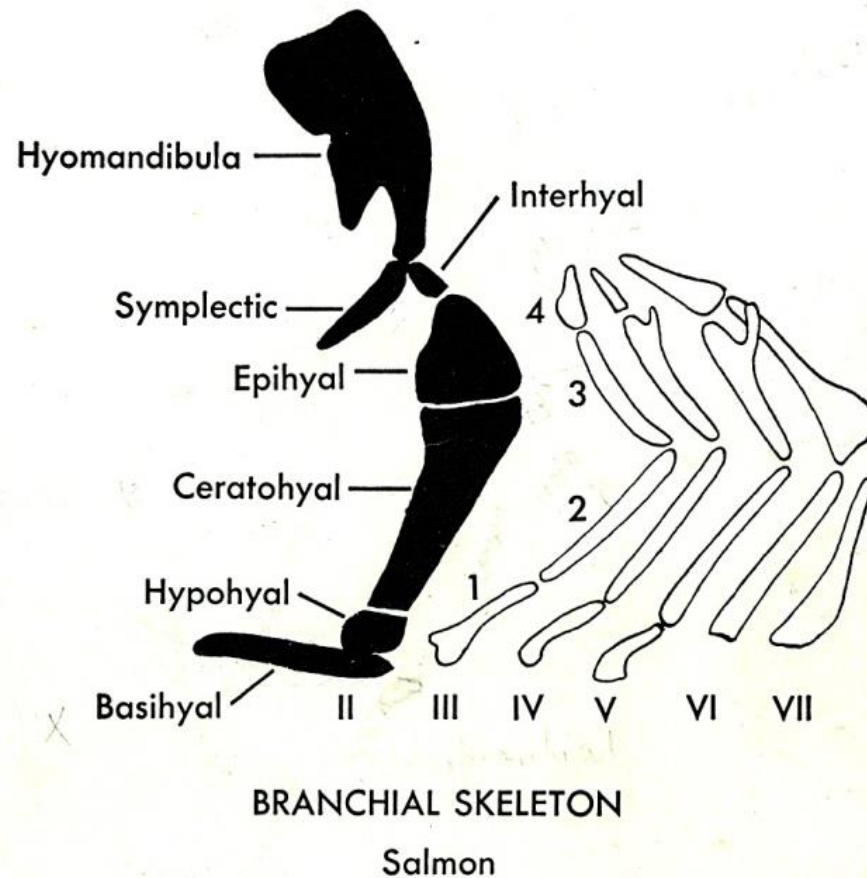
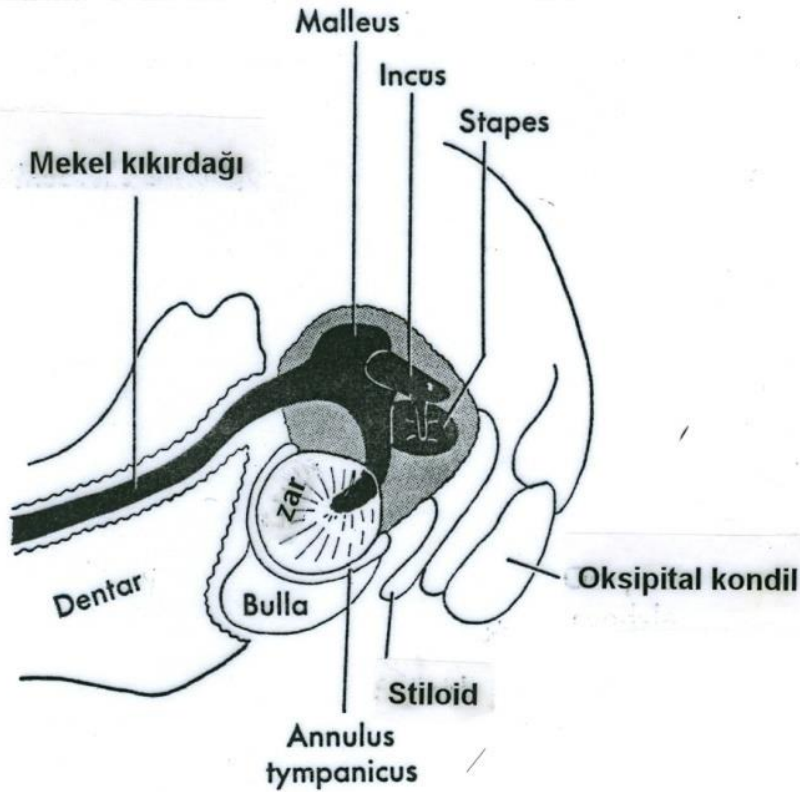


Fig. 8-8. Visceral skeleton of a salmon, upper and lower jaws removed. Hyoid cartilages are shown in black. **1 to 4**, Hypobranchial, ceratobranchial, epibranchial, and pharyngobranchial elements of the third arch, respectively.

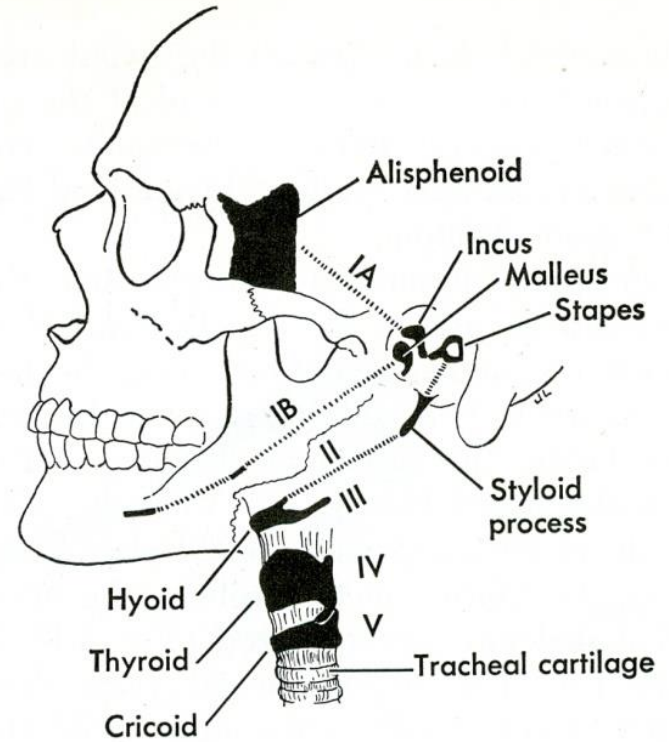
Solungaç iskeleti (Alabalık)

Orta kulak kemikleri



MEMELİ EMBRİYOSU

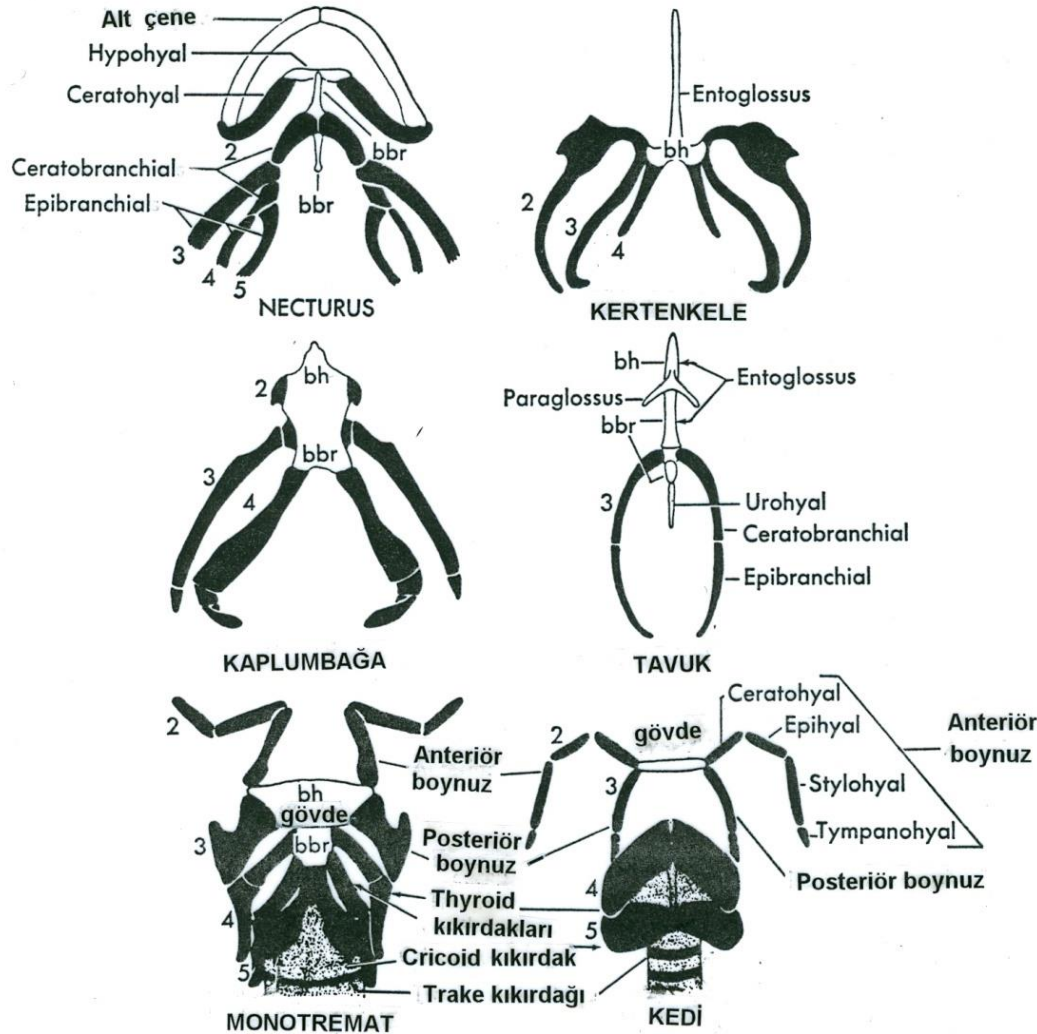
Şekil 5 - 24. Orta kulak kemikleri. Memeli embriosunda malleus, mekel kıkırdağının posteriyör ucu ve gelişmekte olan orta kulak boşluğu tarafından çevrilir.



VISCERAL SKELETON

Fig. 8-15. Visceral skeleton of man. **IA**, Broken line connects derivatives of pterygoquadrate cartilage; **IB**, broken line connects vestiges and derivatives of Meckel's cartilage; **II**, broken line connects derivatives of second (hyoid) arch commencing dorsally at the stapes and terminating ventrally at the lesser horn of the hyoid; **III** to **V**, derivatives of third, fourth, and fifth pharyngeal arches. **III**, Greater horn of hyoid bone (illustrated also in Fig. 12-17).

Tetrapod'larda visseral iskelet



Şekil 5 - 27. Tetrapodlarda visseral iskelet elemanlarının (2 - 5) akıbeti. Temel model olarak kuşlar esas alınmıştır. *bh*, basihyal; *bbr*, basibrankial.

Dil ve
gırtlak iskeleti

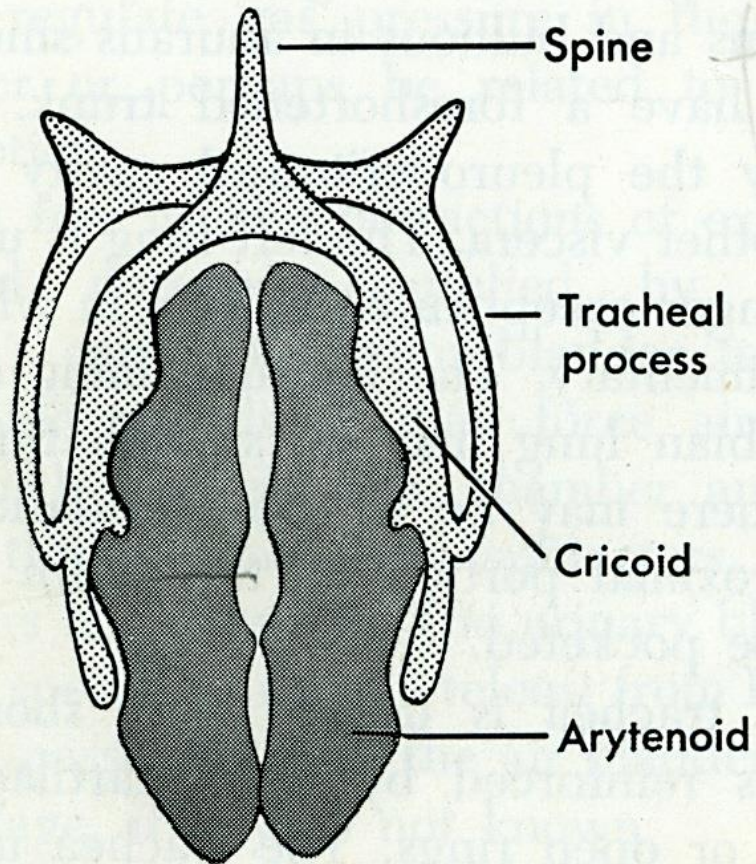


Fig. 12-10. Laryngeal skeleton of a frog. The glottis lies between the two arytenoid cartilages.

Kurbağa gırtlak iskeleti

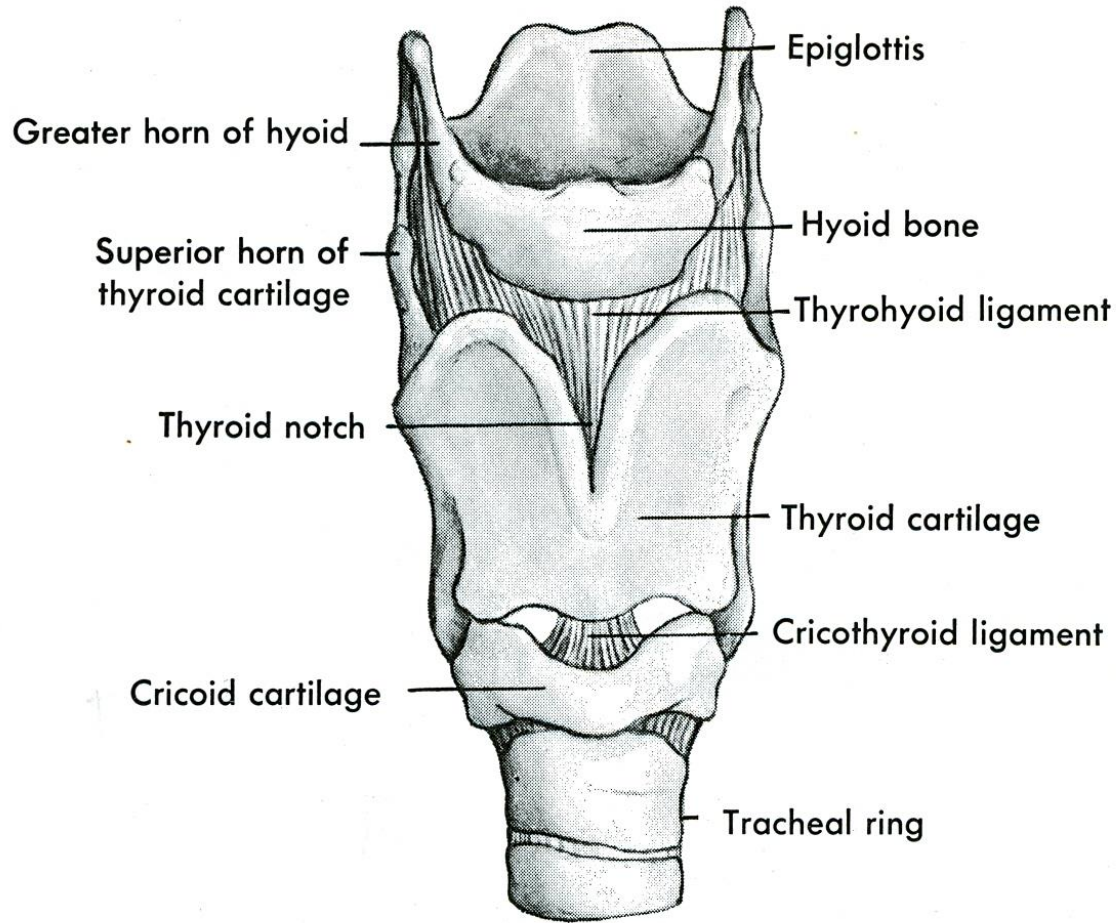
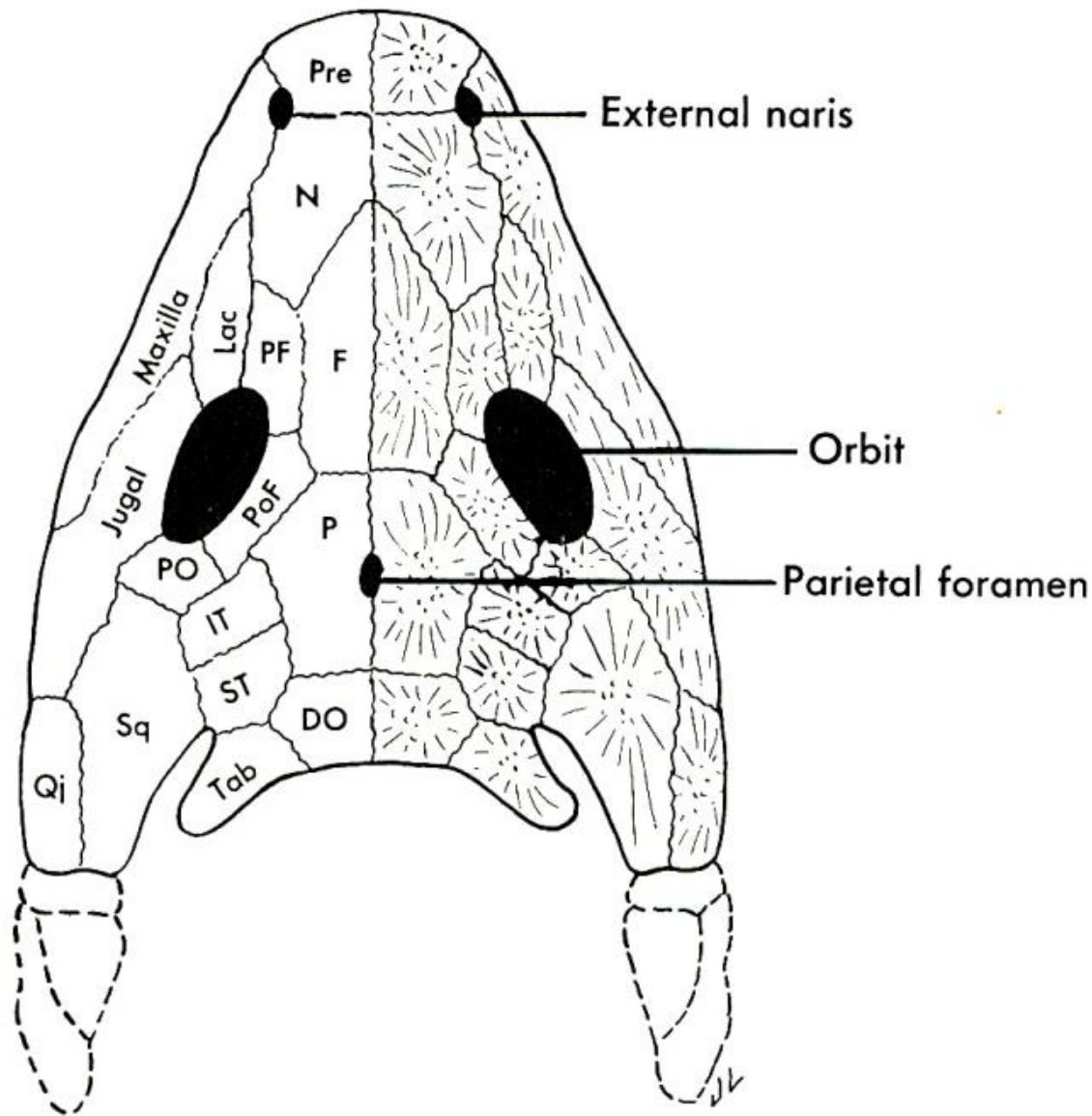


Fig. 12-17. Human larynx, frontal view. (From Francis: Introduction to human anatomy, ed. 5, St. Louis, 1968, The C. V. Mosby Co.)

İnsan gırtlak iskeleti (Frontal'den görünüm)



DERMATOCRANIUM
Primitive pattern

Dermatocranium (Primitif model)

Fig. 8-17. Approximation of the basic pattern from which tetrapod dermatocrania have diverged, based on a labyrinthodont. Broken lines indicate crossopterygian opercular elements lost by early tetrapods. Scale-like appearance of dermal bones shown on right. **DO**, Dermoccipital; **F**, frontal; **IT**, intertemporal; **Lac**, lacrimal; **N**, nasal; **P**, parietal; **PF**, prefrontal; **PO**, postorbital; **PoF**, postfrontal; **Pre**, premaxilla; **Sq**, squamosal; **ST**, supratemporal; **Qj**, quadratojugal; **Tab**, tabular.

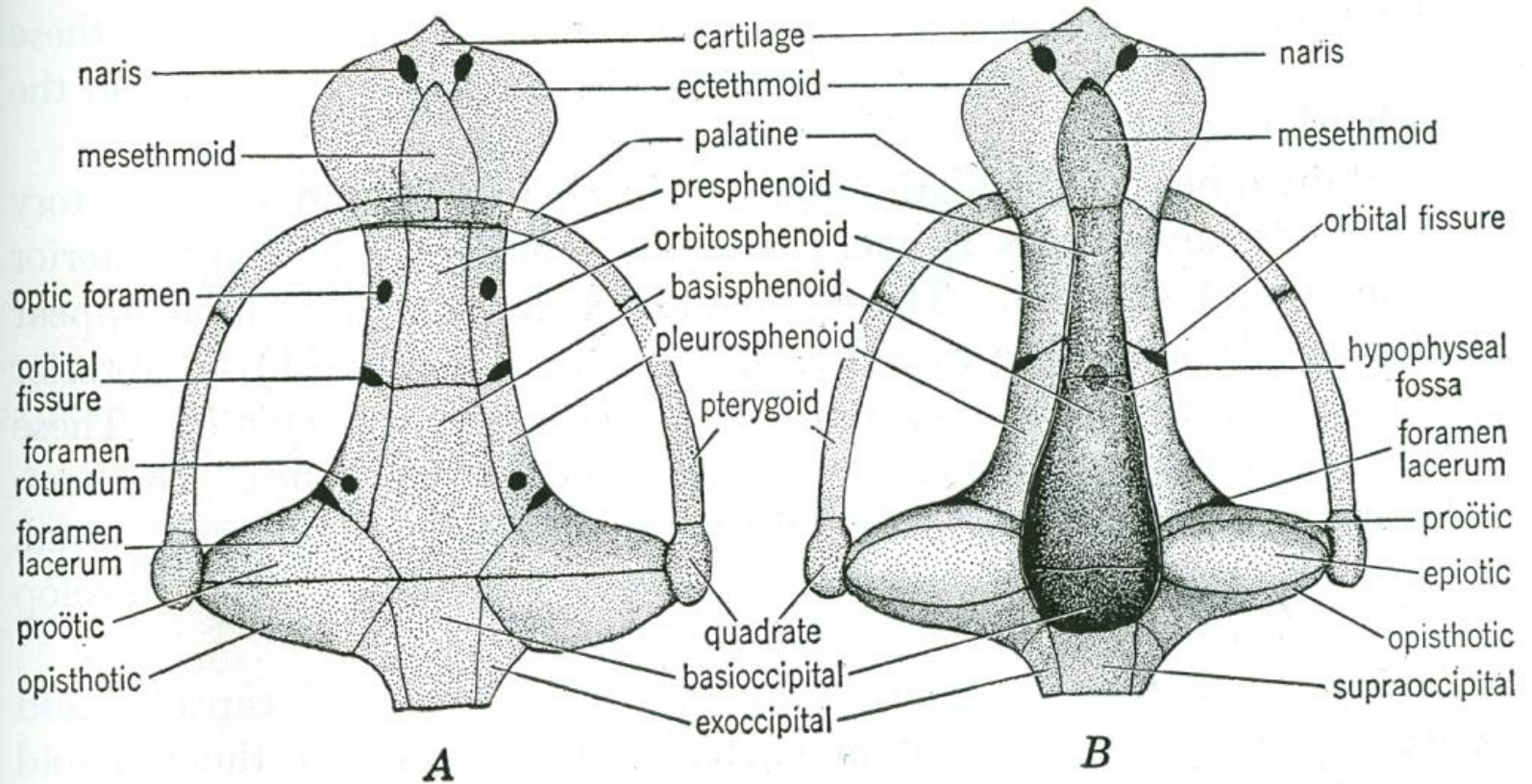
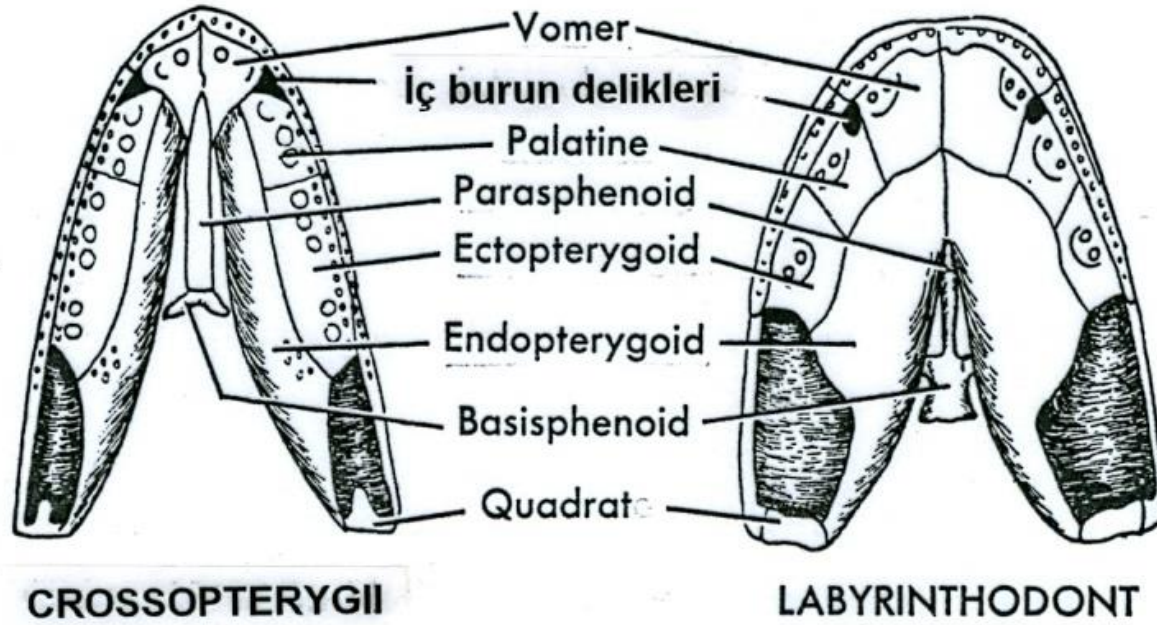


FIG. 10.19. Diagrams of A, ventral, and B, dorsal views of the typical tetrapod chondrocranium, showing the main regions which ossify to form cartilage bones. The palatopterygoquadrate bar is also included. (After Kingsley, "Comparative Anatomy of Vertebrates," The Blakiston Division, McGraw-Hill Book Company, Inc. By permission.)



Şekil 5 - 29. *Crossopterygii* ve *Labirintodont*'larda primer damak (Yapısal benzerliklere dikkat ediniz).

Primer damak

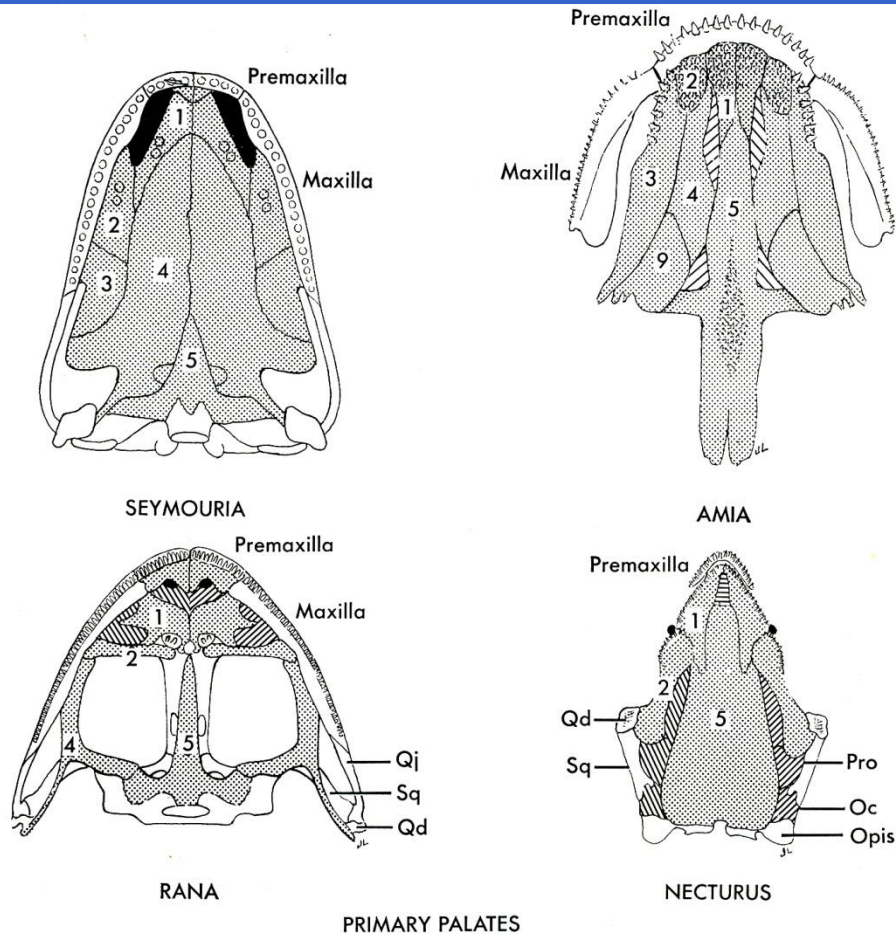


Fig. 8-21. Ventral views of primary palates of a primitive reptile (*Seymouria*), a lower bony fish (*Amia*), a modern amphibian (*Rana*), and a tailed amphibian (*Necturus*). Palatal bones (in gray) are numbered. **1**, Vomer; **2**, palatine (in *Necturus*, palatopterygoid); **3**, ectopterygoid; **4**, pterygoid; **5**, parasphenoid; **9**, epipterygoid. Cartilage is indicated by diagonal lines; internal nares are black. *Amia* lacks internal nares. **Oc**, Cartilaginous portion of otic capsule against which stapes articulates; **Opis**, opisthotic; **Pro**, prootic; **Qd**, quadrate; **Qj**, quadratojugal; **Sq**, squamosal. Note tiny teeth far back on parasphenoid of *Amia* and absence of maxillas in *Necturus*.

Primer damak

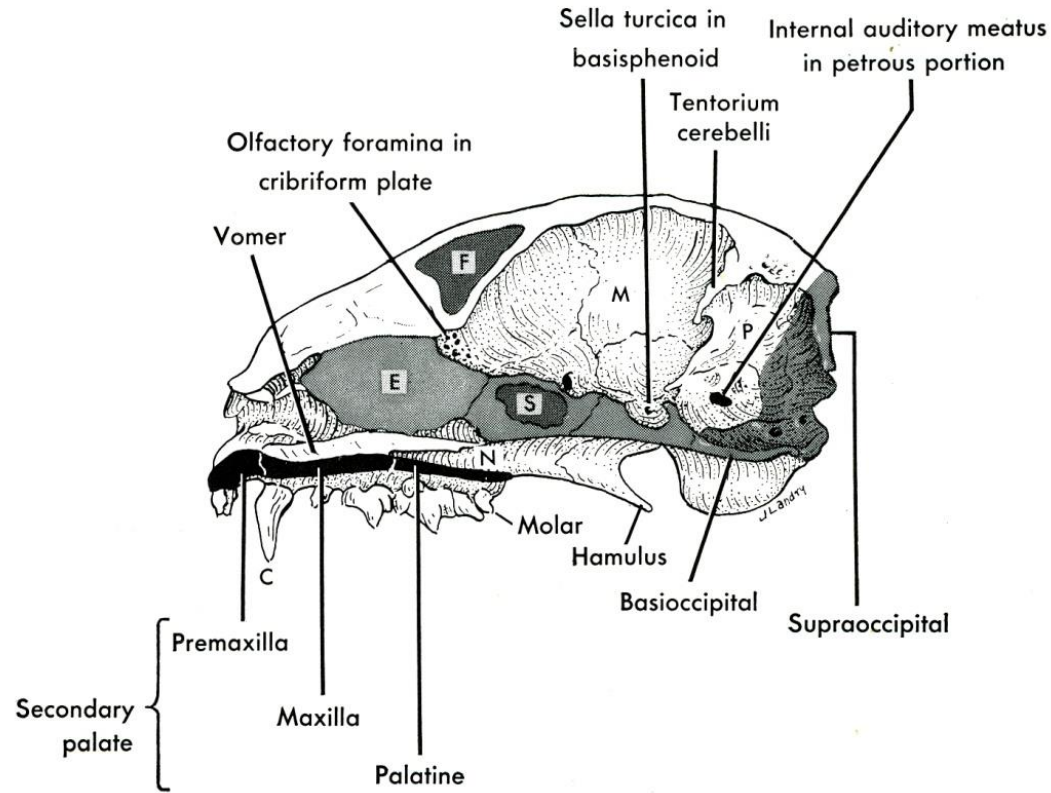
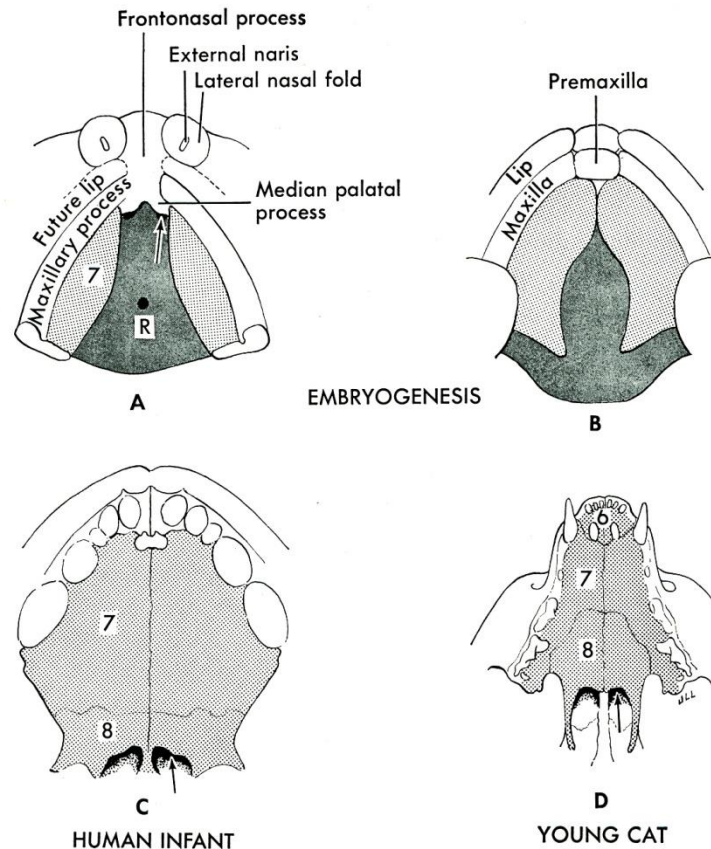


Fig. 8-22. Sagittal section, cat skull, showing bony part of secondary palate in black. **C**, Canine tooth; **E**, mesethmoid (perpendicular plate of ethmoid); **F**, frontal sinus in frontal bone; **M**, middle cranial fossa housing cerebral hemispheres; **N**, nasal passageway; **P**, posterior cranial fossa housing cerebellum; **S**, sphenoidal sinus in presphenoid bone. The teeth to left of the canine are incisors; those to the right are premolars except the last, which is a molar. The olfactory bulb of the brain lies against the cribriform plate.

Segonder damak - Kedi kafa iskeleti



SECONDARY PALATES

Fig. 8-23. A to C, Formation of secondary palate in man. **D,** Secondary palate of a young cat for comparison. In **A** (fetus approximately 18 weeks old) the palatine processes of the maxilla, **7**, are growing toward the midline, forming a secondary roof (stippled) in the oral cavity. Dark gray is the primary roof containing Rathke's pouch, **R**, which gives rise to the adenohypophysis. In **B** the palatine processes of the maxillas have met anteriorly. Failure of closure will result in a cleft palate. In **C** the palatine processes of the maxillas, **7**, have met in the midline and palatine processes of the palatine bones, **8**, have also formed. In **D**, **6** indicates the palatine processes of the premaxillas. Arrows indicate nasal passageway.

Segonder damak gelişimi - İnsan

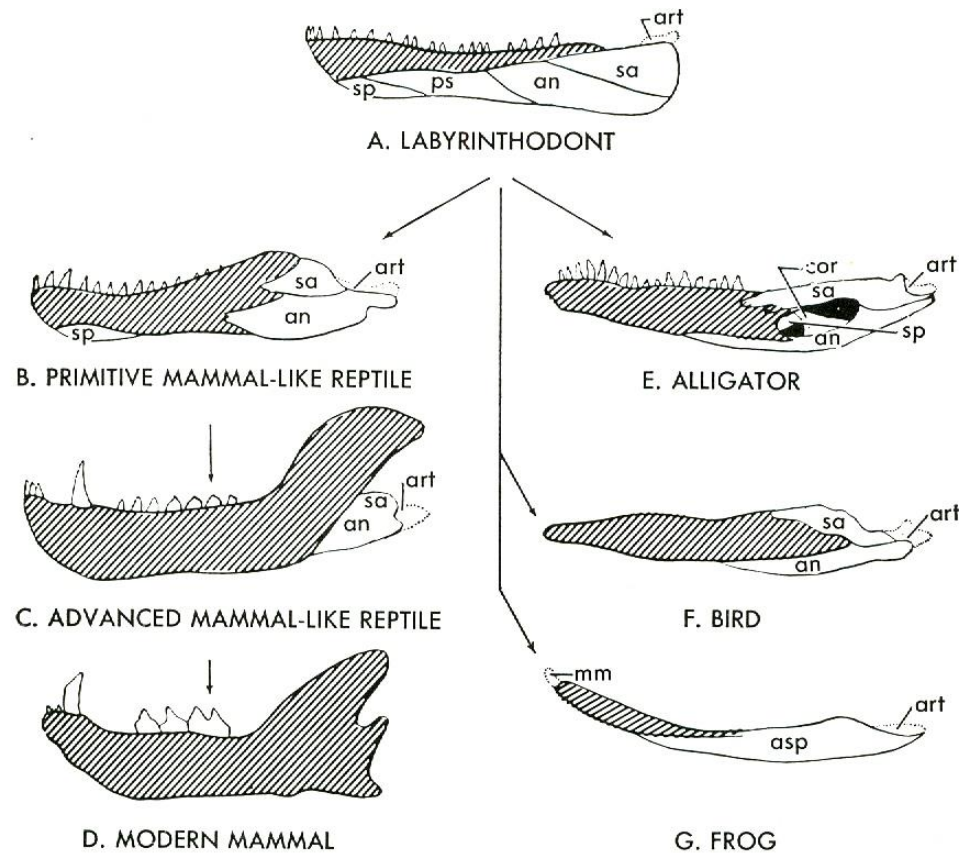
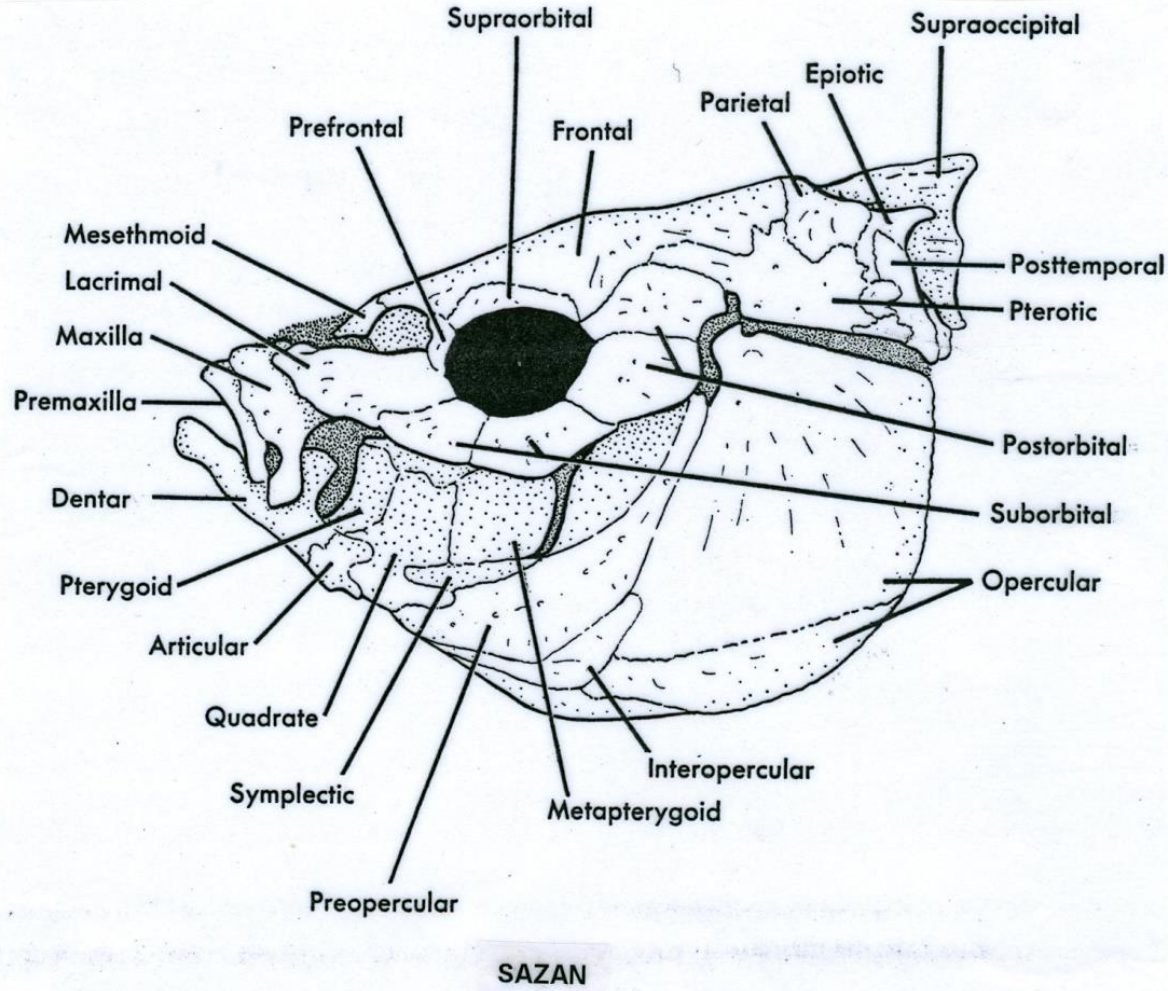


Fig. 8-32. Theoretical evolution of the mandible. **A** to **D**, Probable successive stages of evolution of the lower jaw of mammals. The dentary (oblique lines) became increasingly larger, and other elements were reduced and finally lost. **E** to **G**, Lower jaws of amphibian, reptile, and young bird for comparison with basic pattern. In the modern reptile the pattern has been modified less than in the frog. All elements are dermal bones except those in dotted outline, which are derivatives of Meckel's cartilage. **an**, Angular; **art**, articular; **asp**, angulosplenial; **cor**, coronoid; **mm**, mentomeckelian; **ps**, postsplenial; **sa**, surangular; **sp**, splenial.

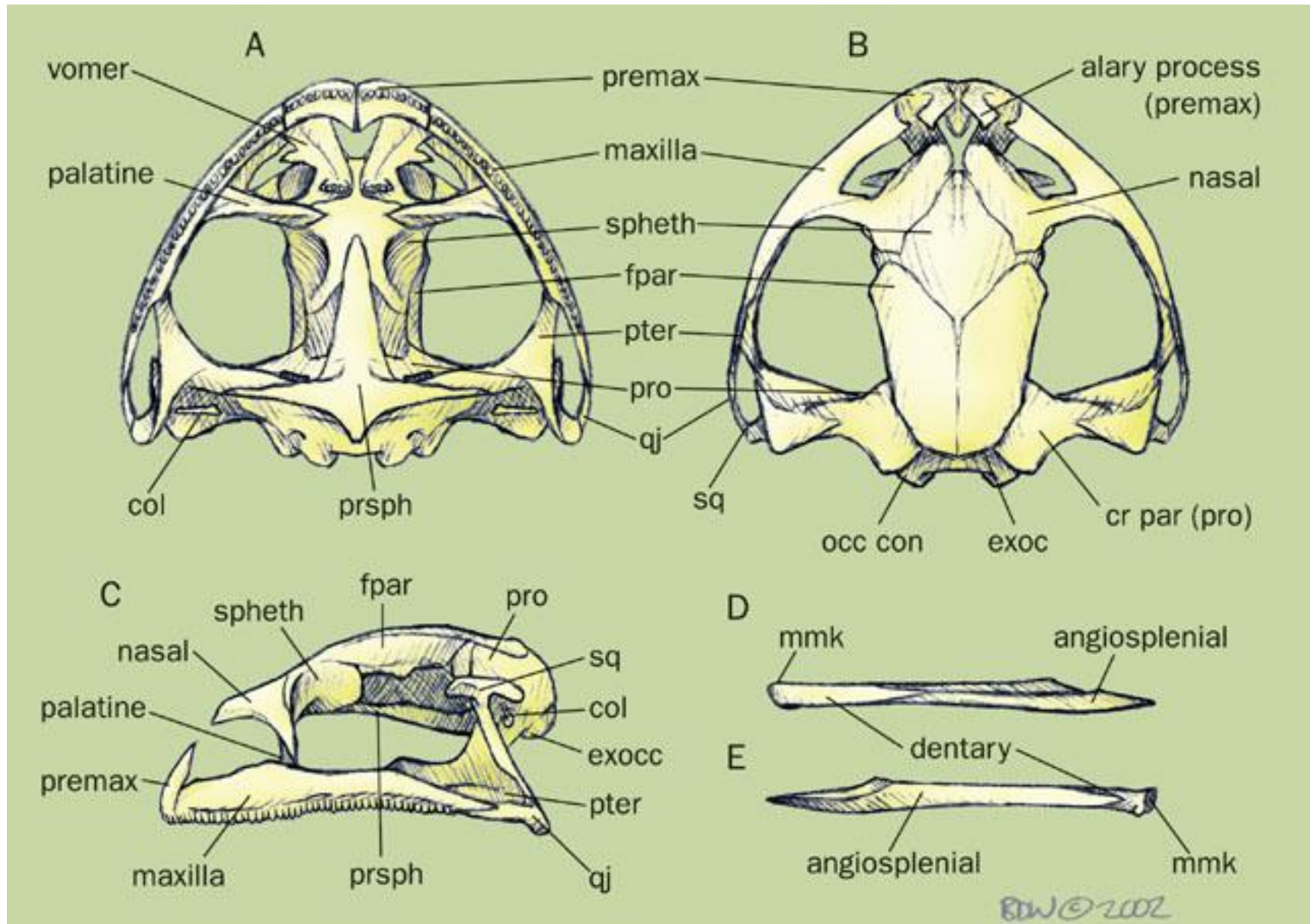
Alt çenenin evrimi – Teorik olarak

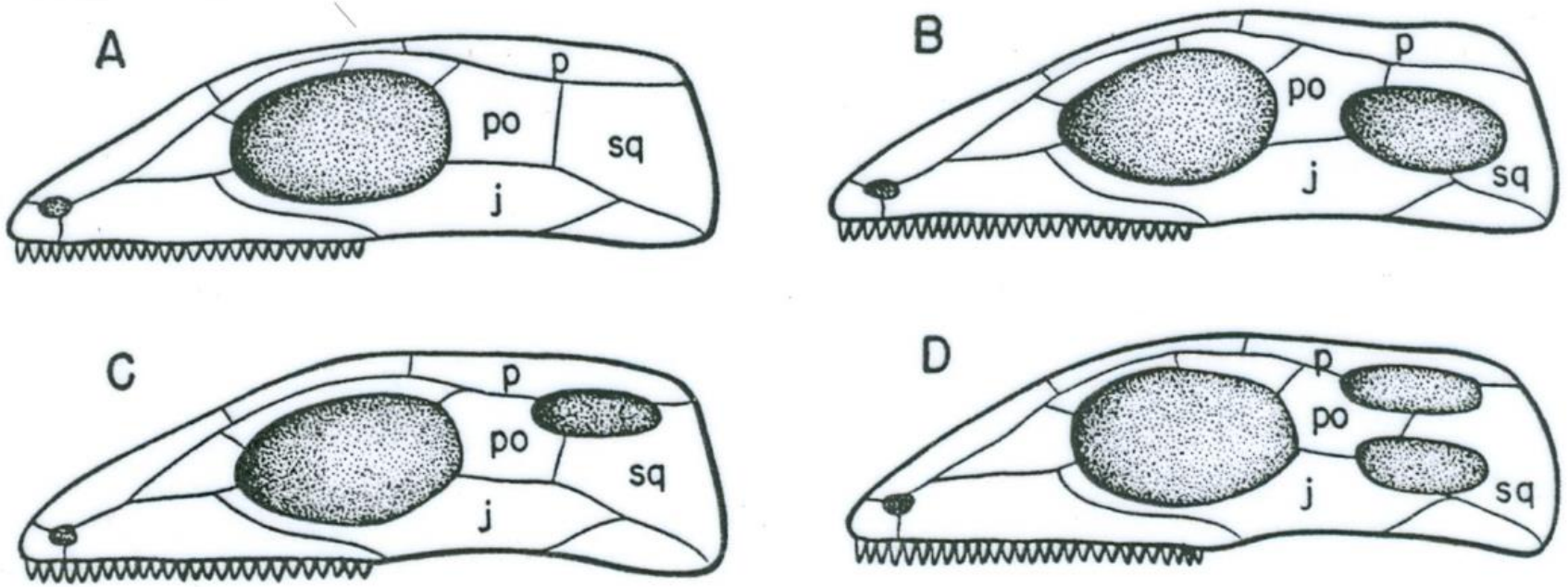


Şekil 5- 32. Sazan'da kafa iskeleti. Koyu noktalı yerler kemikleşmemiş kıkırdığı göstermektedir.

Kafa iskeleti – operkular seri - Kemikli balık (Sazan)

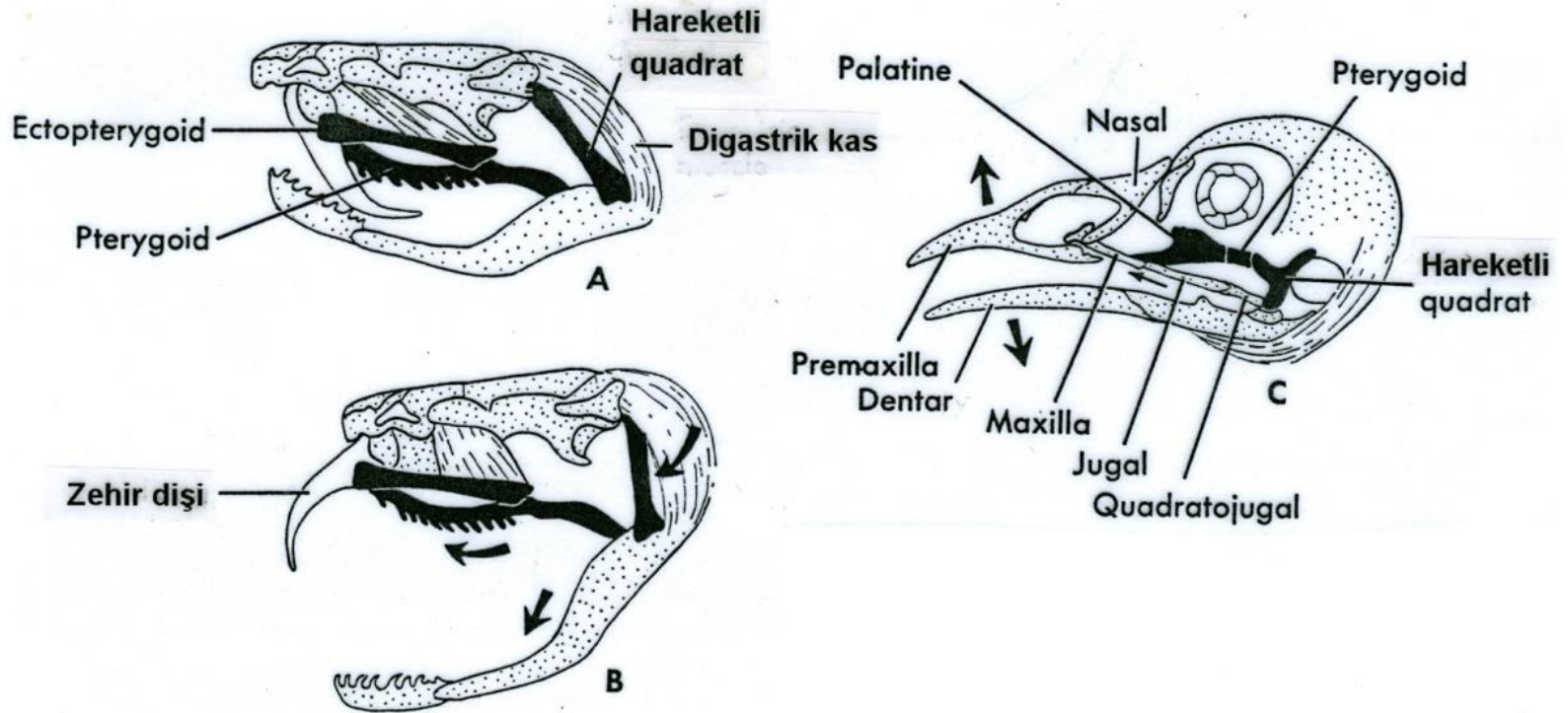
A – Platybasik tip kafa (Amphibia), - B - Trochobasik tip kafa (Reptilia)





Şekil 5 - 33. Reptillerde temporal açıklık tipleri. A, anapsid tip (Ata reptiller, kaplumbağalar); B, synapsid tip (Memeli benzeri reptiller); C, parapsid tip (tükenmiş plesiosaurs ve denizel reptiller); D, diapsid tip (Rhynchocephalia, kertenkele ve yılanlar - bir ya da iki temporal yay kaybolmuş). j, jugal; p, parital; po, postorbital; sq, squamosal.

Reptil kafa iskeletindeki özelleşmeler



Şekil 5 - 34. Kinetik damak ve quadrad kemikler. A - B, yılan'da; C, kuş'ta. A, ağız hemen hemen kapalı. B ve C, ağız açık. (Oklar hareket yönünü göstermektedir).

Kinetik damaklar

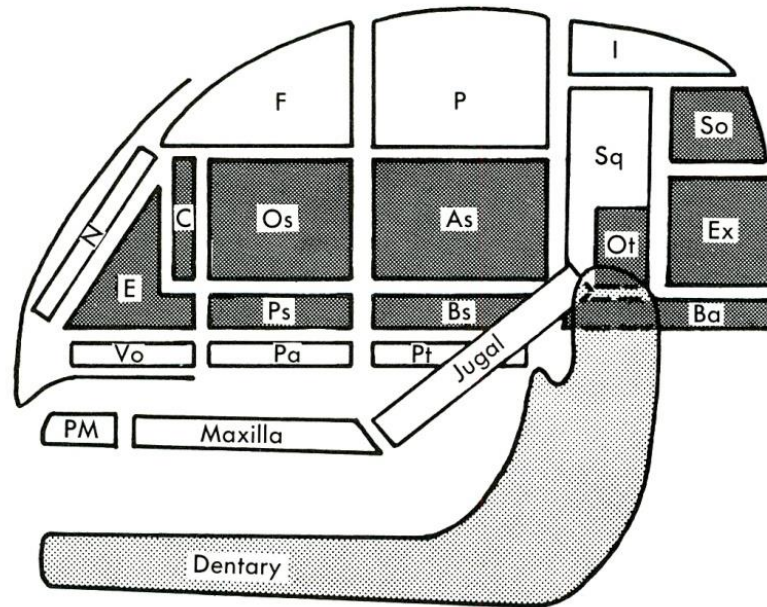


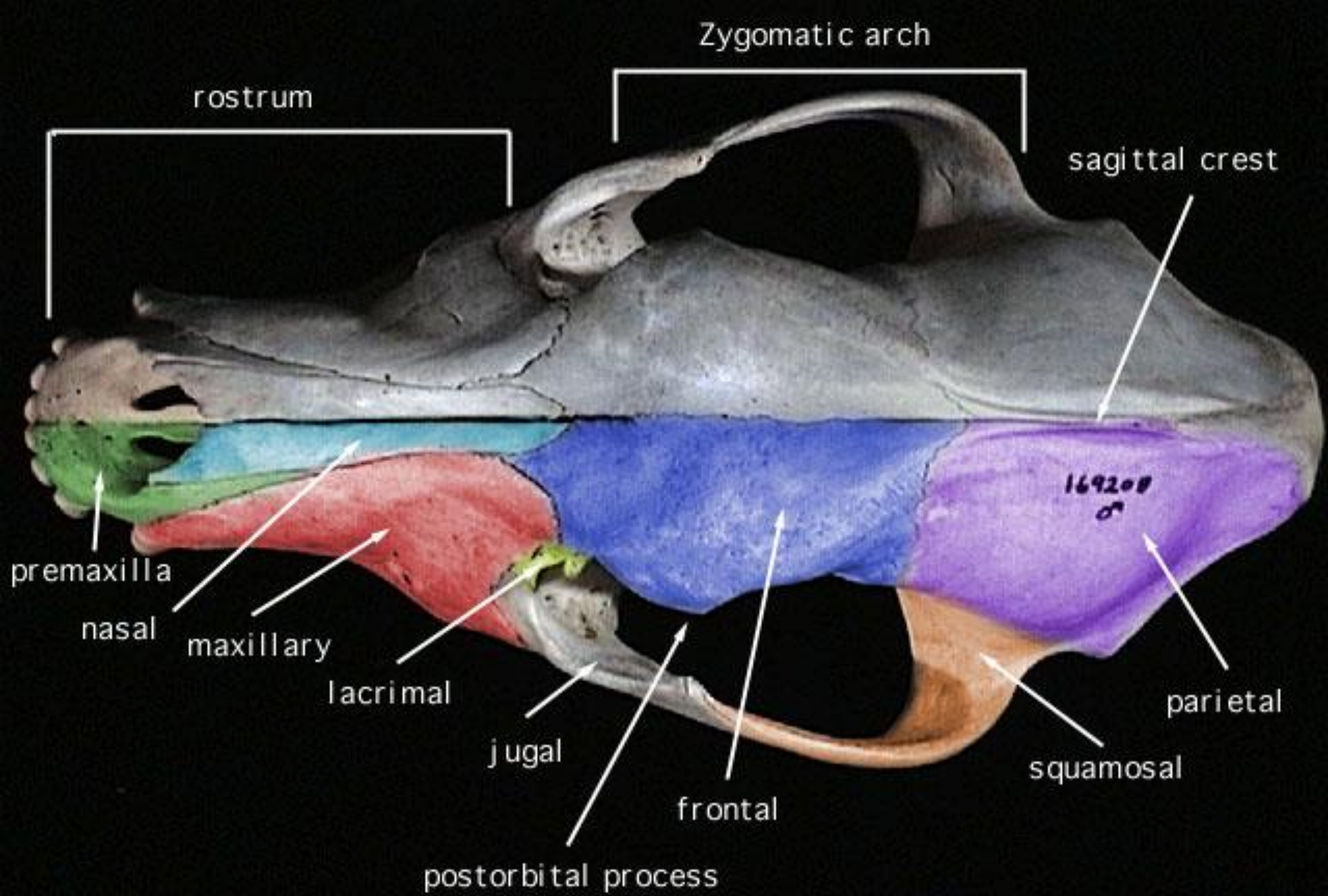
Fig. 8-34. Chief components of the neurocranium (dark) and dermatocranium (white) in a mammalian skull. The vomer, palatine, and pterygoid are components of the primary palate. The premaxilla and maxilla contribute to the secondary palate. The dentary is an element of the visceral skeleton.

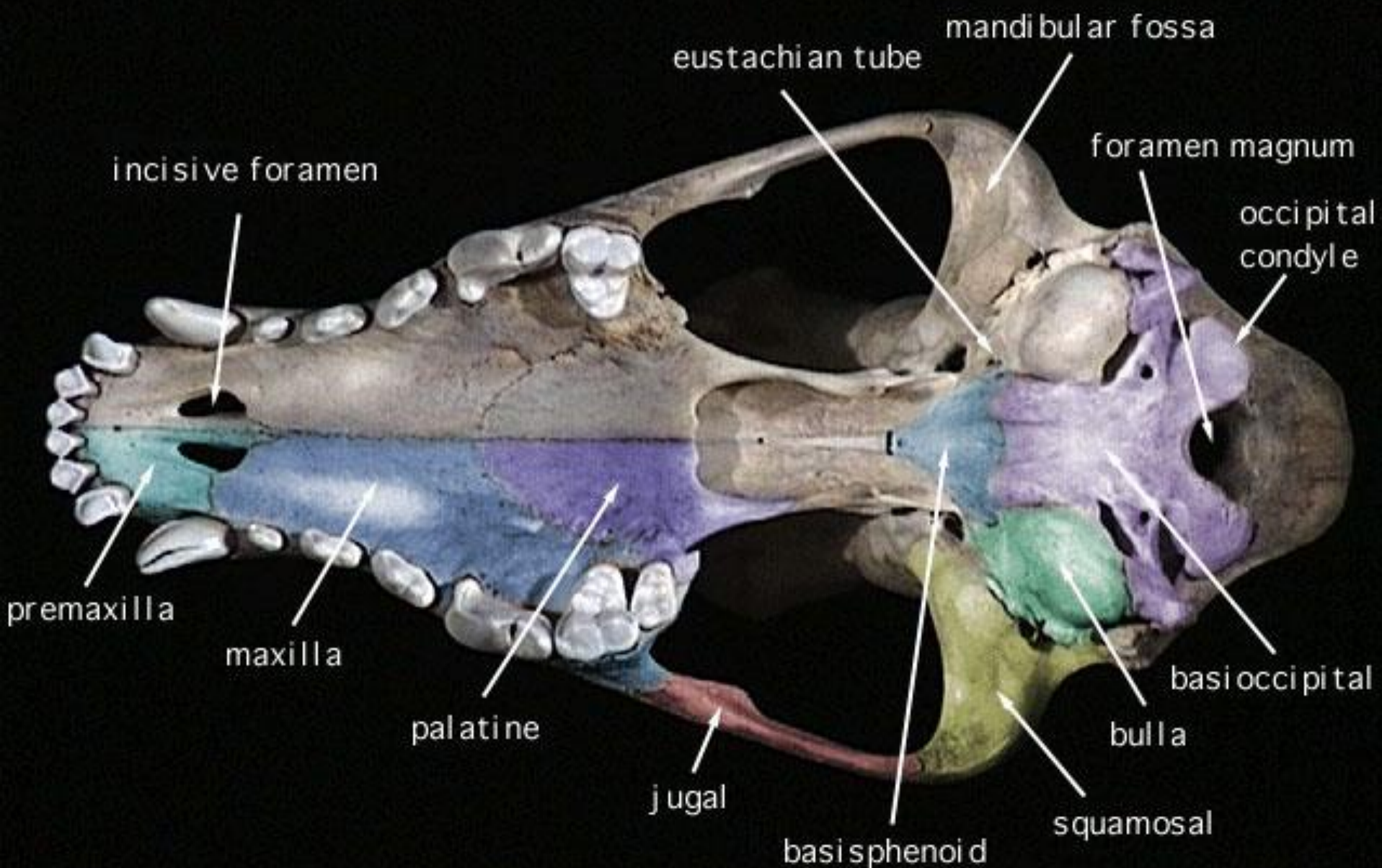
As, Pleurosphenoid (alisphenoid)
Ba, Basioccipital
Bs, Basisphenoid
C, Cribriform plate of ethmoid
E, Ethmoid, perpendicular plate
Ex, Exoccipital
F, Frontal

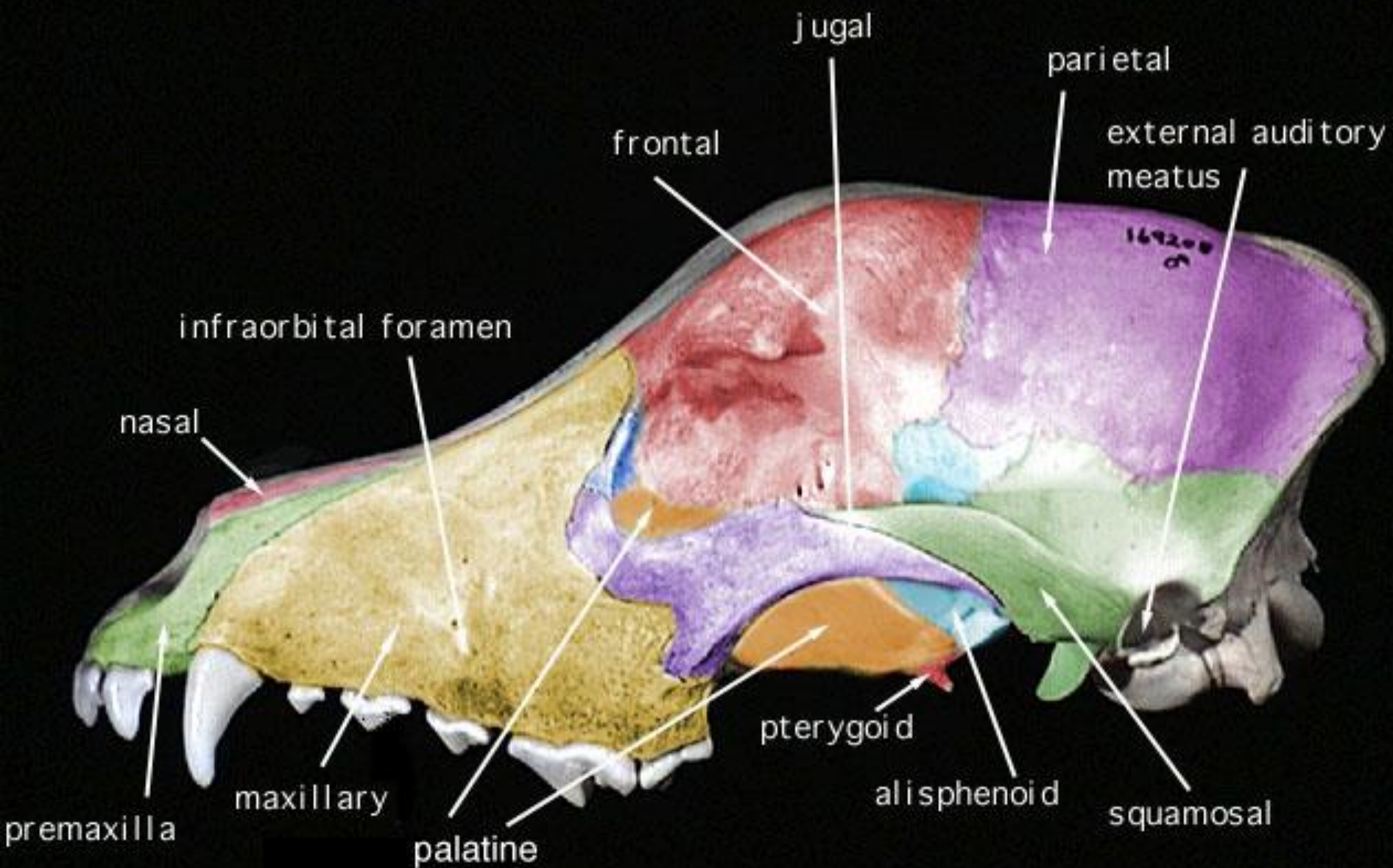
I, Interparietal
N, Nasal
Os, Orbitosphenoid
Ot, Otic (petrous)
P, Parietal
Pa, Palatine

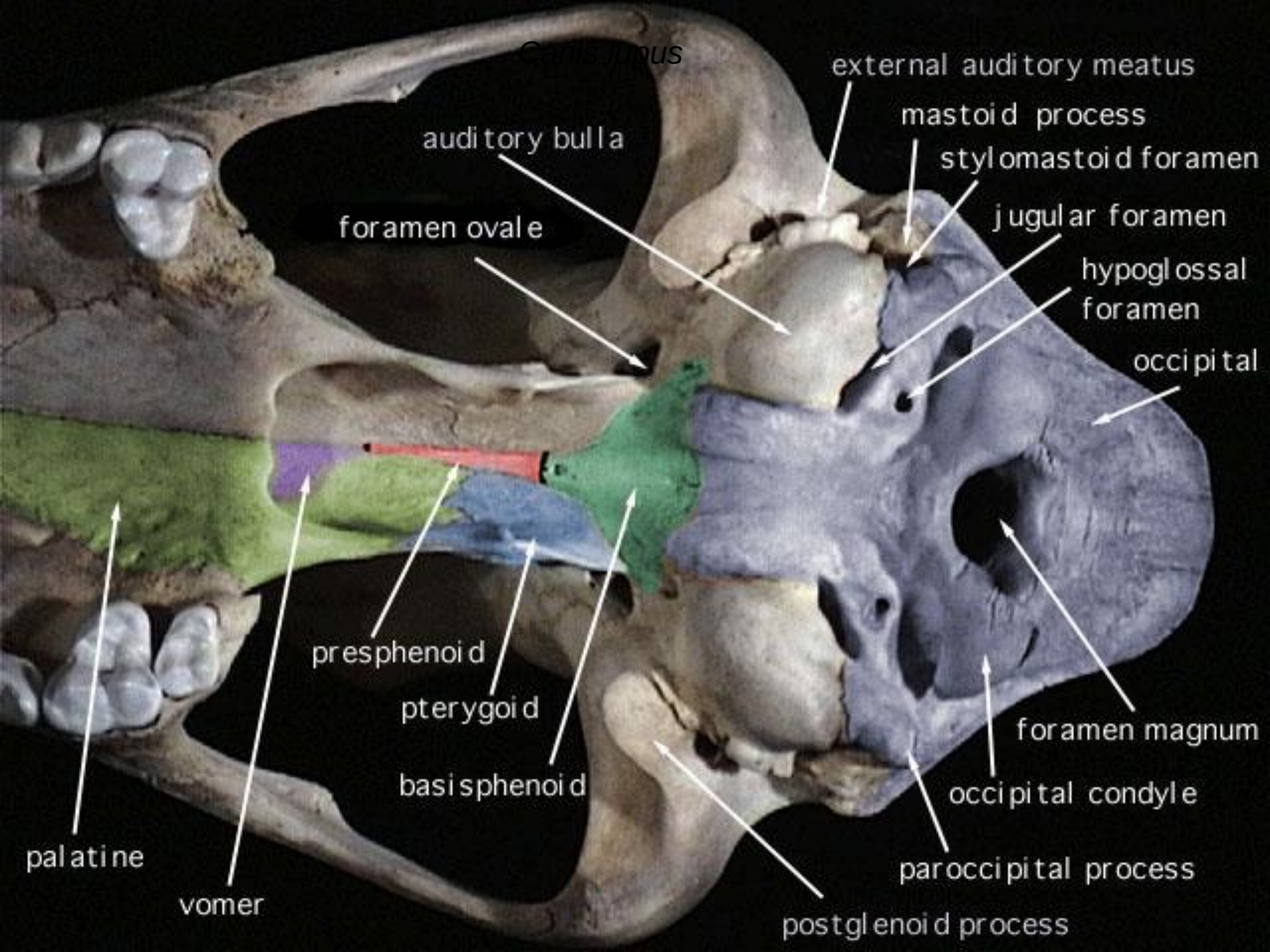
PM, Premaxilla
Ps, Presphenoid
Pt, Pterygoid
So, Supraoccipital
Sq, Squamosal
Vo, Vomer

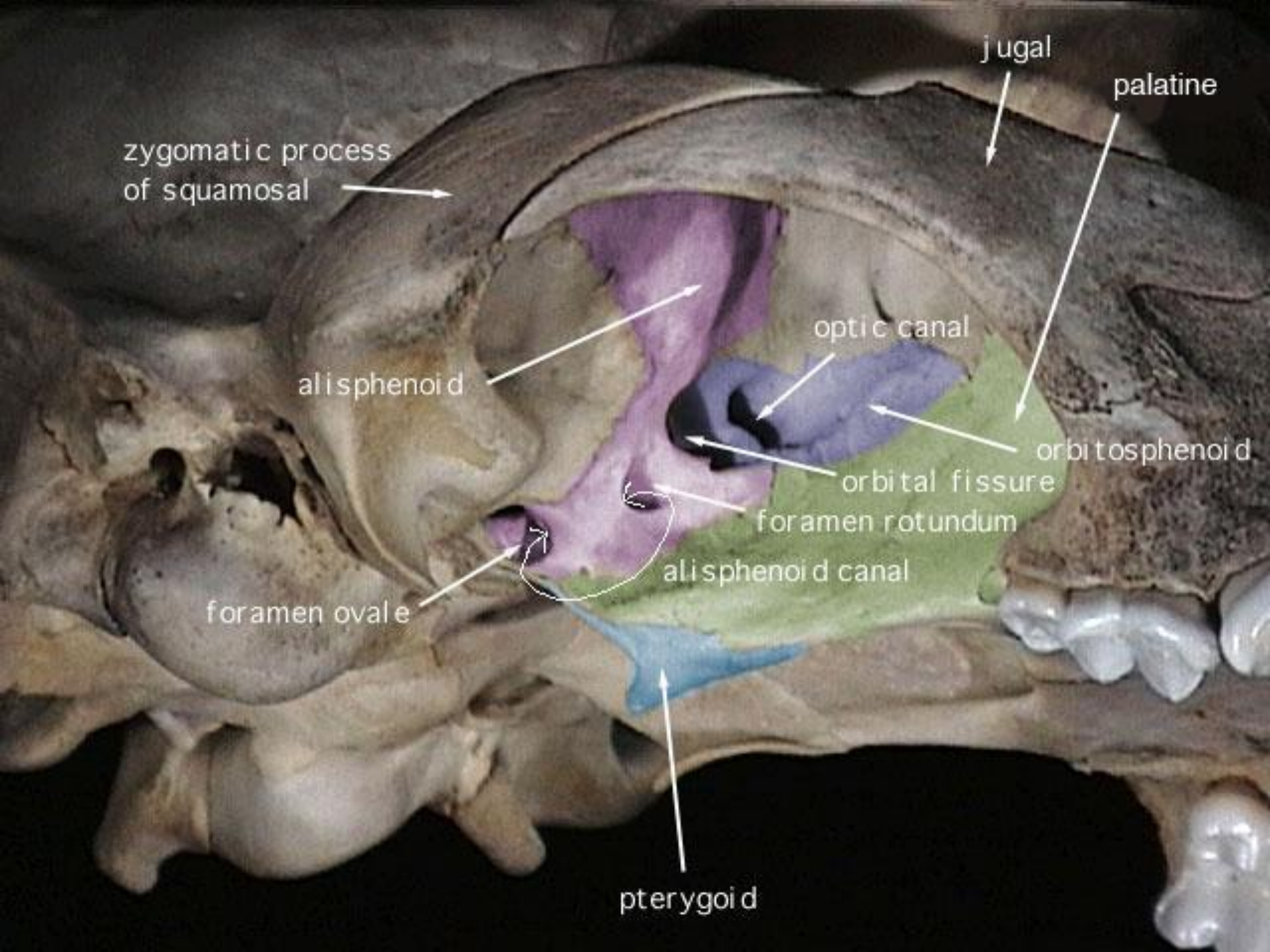
Memeli kafa iskeleti (Şematik)











zygomatic process
of squamosal

jugal

palatine

alisphenoid

optic canal

orbitosphenoid

orbital fissure

foramen rotundum

alisphenoid canal

foramen ovale

pterygoid

