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The Chondrocranium Development Of *Mus Musculus Domesticus* (Rodentia:Muridae) II

STAGE **II**

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ABSTRACT:

This paper aims to study the chondrocranium development of *Mus Musculus Domesticus (Rodentia:Muridae)*. The existence of the skull is an important characteristic of vertebrates,where it arises as a chondrocranium in the fetus, and then transformed during the growth into Osteocranium. The total length of the embryo body in this stage 40 mm, the embryo was obtained and prepared by using some tissue stepsto make serial sections for Head region ,and it has been examined by light microscope then use theKen-a-vision microprojector for graphic reconstruction of the chondrocranium , and describe it in three views: dorsal, ventral, and lateral. We compared the condrocranium with other species of rodentia and other mammils.However in this embryo we foundthe chondrocranium was developed very well.Whereas, the nasal capsule appeared large and complex and contains variety cartilaginous structures like turbinals, paranasal septum, zona annularis, and Jacobson's organs. The optic capsule is medium in size and appears connected to the cranial base and contain interorbital septum, pila preoptica and pila metoptica.The auditory capsule consists of two parts and the semicircular canals was appear very clear.

Keyword: Anatomy**,** Chondrocranium**,** Development**,**Muridae**,**MusMusculusDomesticus , Laboratorymice

INTRODUCTION:

During 55 million years ago of mammalian development, the order *Rodentia* has had an growing success in terrestrial mammalian group. No less than 330 to 400 genera, and 1800 to 2300 species, have been recorded in the recent fauna, and the last number represents half of all species of mammals. All continents and all islands was settled down by these small

animals,sometimes with the aid of human himself. In deserts, mountains, rivers and cities, rodents are joining to human in many of his activities, including utilization of the earth.*Rodents* have had a direct influence on many human activities. This is evident in their negative effect on the growing and storage of crops, pastures, disruption of irrigation systems by burrowing, and in the diffusion of diseases in domestic animals and in wildlife. alot of species of rodents are sources of human diseases. Nevertheless, *rodents* have made important contributions in solving many of the problems of humans and modern societies. They were one of the main laboratory mammals that serve the sciences of medicine and biology and have been used to obtain extensive information and knowledge in anatomy and physiology in vertebrates, And has served and continues to serve a great deal in genetics and molecular biolog ,There are some species of *rodents* live in close association with human which is : *Rattus rattus, Rattus norvegicus, Mus musculus, Bandicotabengalensis, and Mastomysnatalensis*(Hartenberge,1985).

Mus musculus domesticus(House mice)species is spread in asia and europe, and is spread in the kingdom in the western and eastern region, and resembles the black rat, but it is smaller and the color of fur is pale brown and the color of the sides is sandy while the bottom of the abdomen is yellowish pale, and the oldest color is white and has a tail covered withshort hairs and not covered by scales , It living in houses and gardens, also there are white mice (Albino), which is used in experiments and research, where it is active at night and the ability to dig tunnels in the appropriate places, and these mice have high hearing capabilities, especially the ultrafrequencies.Also, ithas an efficient sense of smell that helps to diagnose food, predatory enemies and pheromones.*maic* is characterized by weak vision because the retina possesses a few cones so cannot respond to color vision and it is different from human abilities in colorvision . Laboratory mice that originated from Mus musculus characterized also by aggressive behaviour.

The length of the laboratory *mice* between 12 - 15 centimeter from the top of the snout until the end of the tail and the length of the tail is equal to length of maicbody.The small individuals weigh on the first day of birth between 1-2 grams Where, Its weights increase rapidly during a Breast feeding.

Mus musculus domesticus (House mice) have been selected for anumber reasons: first, they are small, easy to get them, and they have ability to adapt well to various environmental conditions froma the polar regions to tropics regions, as well as their rapid reproduction and shortened life periods.

The chondrocranium is that part of the endoskeleton that protects the brain and sense organs and it is organized into regions that are named for their anatomical contribution to protecting the brain and sense organs: nasal capsule, optic capsule, otic capsule and braincase (Moore, 1981). The braincase consists of the floor, roof, and lateral wall, which protect the brain also supportthe eyes. The nasal capsule protects the olfactory tissues, whereas the otic capsule, consistof the cochlearis partand canalicularis part , contains the hearing and balancing organs protecting the saccule and cochlear duct, and protecting the semicircular canals and utricle (Kawasaki and Richtsmeie, 2017).

Mus musculus domesticus (House mice) embryos were selectedbecauseit is considered the first study on mammals in Saudi Arabiaand for lack research about development of chondrocranium, Also to study the stages of development of the chondrocranium how and when it occurs, knowing the changes that occur in different lengths of embryos, As well as to find out the characteristics of mouse,whereas the most internal anatomical changes occur in the skull, which requires the study of the development of chondrocranium by Study embryos of different lengths and compare them to each other a descriptive anatomical comparison by make serial sections of the head region and drawing it by Ken-a-vision microprojector,whereas The formed cartilage was described accurately in each region and sense capsuls of the skull.However, the development of the chondrocranium was described in detail for various vertebrate species, including humans and various primates, in the late nineteenth and early twentieth centuries by several investigator e.g. (Gaupp, 1906)(Goodrich, 1930)(De beer, 1937) and they did not study the laboratory mouse, which is considered a basic and important model in the laboratory experiments,(McBratney- Owen's ,2008) studied the development of cranial base and tissue origin in mouse .

MATERIAL AND METHODS:

Embryos were obtained from king fahd medical research center, jeddah, saudiarabia. We fixed the embryos head by putthemin 10% formalin for24 -48 hr,then washed it from the fixative by 70% alcohol and dehydrate them.After that, the samples were stained in toto by borax carmine, and embedded in paraffin wax, then we cut the heads in transversesections(serial sections) at 5µ by using a microtome , then we were stained the samples by Hematoxylin and Eosin. After that, we used the light microscope to examined the sections and used the Ken-a-vision microprojector for graphic reconstruction of the chondrocranium(Taylor and Van Dyke,1985) (Feldman and Wolfe,2014).

Result:

Total body length: 40mm.

Below we describe the chondrocranium of Mus musculus domesticusin many region: cranial base, lateral walls of the chondrocranium, chondrocranium roof and also describe sense capsuls: nasal capsul,optic capsule , and auditory capsule.

1) The Nasal Capsule:

Nasal capsule in the study sample begins with the appearance of a distinctive cartilage structure called the processusalaris superior (PR.AL.SU.), which appears as small projectionatin front of the capsule from the dorsal view, And the processusalaris inferior (PR.AL.I.), which appears on either side of the nariumfenestra (NR.FE.) .there is a cartilaginous pieceascupola front of(NR.FE.)known as thecupula nasi anterior (CU.N.AN.), while behind the (NR.FE.) there is a horizontal cartilaginous piece called lamina transversalis anterior (LA.T.AN.), which is connected to the nasal septum (N.SE.) and form the zona annularis (Z.A.)**(Figure 4A) (Figure 4B)**. (CU.N.AN) is located behind the (PR.AL.SU)from the dorsal view, and It appears as a large cartilage extending to form the nasal capsuleroof,which is known as the nasal tectum (N.TE.). paranasal cartilage (PN.C.) were found on the peripheral side edges of the (N.TE.)which is connected to the posterior edge of the frontal cartilage (F.C.) from the dorsal view. (F.C.) were connected toouter peripheral edges of side walls of nasal capulewhich is appear as cartilaginous rectangular plate known as sphenethmoidcommissure (SPETH.CM.) from the lateral view**(Figure 2) (Figure 3).**

The (N.SE.) appears as cartilaginous stick and carry from the abdomenal said two concave cartilaginous pieces known as paranasal septum (PN.SE.) and it is notable that these cartilage carries a sensory organ known as jacobson'sorgan (J.OR.) or vomeronasal organ ,which is appear narrow from the front part**(Figure 4D).**

The (N.TE.) give on both sides of the nasal septum two long, tortuous cartilaginousgrooves that extending along the nasal capsule from the ventral view , the anterior part of these grooves is known as sulcus anterior lateralis (SL.AN.L.), while the posterior part is known as the sulcus posterior lateralis (SL.PO.L.). The nasal septum separatesthesesulcusfrom each other to right sulcus and left sulcus,andeach sulcus is

separated from the nasal septum by a long fissure extending along the sulcus known as the paraseptal fissure (PSE.FI.) from ventral view**(Figure 2)**. At the end of (SL.PO.L.) the cupula nasi posterior (CU.N.PO.) was formed,and the sulcus of each side are connected to the interorbital septum end (INOR.SE.), which is considered part of (N.SE.), and This contact forms another horizontal piece called lamina transversalis posterior (LA.T.PO.) which is represents the end of the nasal capsule .

From above it can be concluded that the nasal capsule consists of:the mammalian nasal capsule is complex from inside, because itinclude distinctive cartilaginous structures called turbinals that arise from the walls of the sulcus.

The first types of turbinals are formed beginning of the sulcus behind the (NR.FE.) and calledatrioturbinals (ATUR.),which arise from the the nasal capsule floor and they continue with (L.T.AN.). The second type of turbinals arises from the middle region of the nasal capsule and known as maxilloturbinals (MTUR.), which also arise as afree end ofside wall floor of nasal capsule. The third type of turbinals is nasoturbinals (NTUR.), which arise from the nasal capsule roof. From the side walls of the nasal capsule of(sulcus anterior lateralis)arise new cartilaginous projects called crista semicircular (CR.SECI.). The fourth type of turbinals arise beneath the(CR.SECI.) from the side walls of the nasal capsule alsoand called frontoturbinals (FTUR.). as well as at the end of nasal capsule from (SL.PO.L.) arise cartilaginous branched structure called ethmoturbinals (ETUR.), which are three types:

- Primary Ethmoturbinals I (ETUR I.): The largest turbinal and the most branching and arises from side walls of the nasal capsulebeneath the(CR.SECI.).
- Secondary Ethomoturbinals II (ETUR II.): arise as a simple projection beneath the (ETUR I.).
- Tertiary Ethmoturbinals III (ETUR III.): arises from the side walls floor of the nasal capsule.**(Figure 4B)(Figure 4C)(Figure 4D) (Figure 5A).**

2) The Optic Capsule:

The optic capsule begins with formation of two cartilaginous large structures like a large wing in both sides called ala orbital cartilage (AL.OR.C.), and these cartilage are characterized by a narrow fissure known as orbitonasalfissure (ORN.FI.) , These wings are separated from each other by (INOR.SE.). The anterior part of (AL.OR.C.) is connected to the posterior edge of nasal side walls in nasal capsule which called (SPETH.CM.), so the (AL.OR.C.) contributes to the lateral wall of the anterior part of chondrocranium from the

lateral view, and connect from the superior part to the frontal cartilage (FC.), which appear above it from the dorsal view, and the (AL.OR.C.) extends from the inferior edge and flexes inward toward the trabecular communis (TR.CMU.), which is the first area of thecranial base, so the(AL.OR.C.) also contributes to formation a part of cranial base from ventral view, and arises from the middle of (AL.OR.C.) distinctivecartilaginous structures which is similar to U shaped but is horizontal called orbital cartilage (OR.C.) , and these include two cartilages as roots pila preoptica (PI.PREOP.), which located front of the opticum foramen (OP.FO.), and pila preoptica (PI.MOP.), which located behindthe (OP.FO.), and these roots contribute to the connection of (AL.OR.C.) and (TR.CMU.).**(Figure2) (Figure 5B)(Figure3).**

The optic capsule characterized by Small cartilages that integrated with the peripheral edges of the (TR.CMU.) which called hypochiasmaticcartilage (HCH.C.), and these cartilages are also connect to the (PI.MOP.) from the ventral view. The posterior edge of the (AL.OR.C.) connected to the anterior edge of large cartilaginous piece known as orbitoparital commissure (OR.P.CM.) from the lateral view**(Figure 6B).**

3) Cranial Base:

The cranial base of chondrocranium begins with a horizontal broad cartilaginous piece called (TR.CMU.) which is an extension of the (INOR.SE.) and it perforated by two small foramenclose to each other, and its peripheral edges are integrated with the (HCH.C.).

The trabecular (TR.) extends back and becomes smaller, anditposterior edge connect to the hypophysial cartilage (HPH.C.),which is characterized by two consecutive fenestra in the middle and known as the hypophysial fenestra (HPH.FE.)**(Figure 6A).**

The combination of (TR.) and (HPH.C.) called the prechordal plate (PRECH.PL.). From the lateral edges of (HPH.C.) on both sides two top-shaped cartilaginous structures known as the processuspterygoid (PTG.PR.) which extends to form two cartilaginous structures as two open wings called the ala temporal cartilage (AL.TM.C.) which is characterized by presence of a foramen in the middle called alisphenoid foramen (ALSP.FO.).

The (HPH.C.) extends back and has two foramen on each side, known as caroticum foramen (CAR.FO.), and this foramen is limited from anterior by alicochlear commissure (ALCO.CM.) ,While it limited from posterior part by another commissure calledsphenocochlearsommissure (SPCO.CM.) from ventral view.After (HPH.FE.) there is a

large fenestra called basecranial fenestra (BCR.FE.) **(Figure 6B)**which is shows the beginningwide cartilage called acrochordal cartilage (ACH.C.).

The peripheral edges of(ACH.C.) on each side connect to chordo-coclear commissure (CH.CO.CM.) from the ventral view, and the end of (ACH.C.)is integrate with parachordal cartilage (PCH.C.) which are connected to a distinctive cartilaginous structure that limits the foramen magnum(FO.M.) from the top and extends in each side as two wide pieces known as the occipital arch (OC.A.) where extends from its peripheral edges on each side small projection called paracondylarprocessus (PCY.PR.) from ventral view.the (OC.A.) includesmall hypoglossum Foramen (HG.FE.) limits from the top by basicepular fissure basecula (BCAP.FI.).both of (ACH.C.) ,(PCH.C.) and (OC.A.) are integrate together to form a plate known as the Basal Plate(B.PL.)**(Figure1) (Figure2).**

From above we can summarized that the cranial base of the chondrocranium is composed from front to back as follows: (LA.T.AN.), (PN.SE.), (LA.T.PO.), (TR.CMU.), (HPH.C.), (ACH.C.), (PCH.C.) and (OC.A.)**(Figure2).**

4) AuditoryCapsule:

The auditory capsule is consists of two distinctive parts. The first part is known as the coclear part (CO.PT.), the other part is called the canalicular Part (CA.PT.), and the auditory capsule begins with the (CO.PT.) which is connect to (HPH.C.) from the anterior part by (ALCO.CM.),where the anterior part of auditory capsule appears as a hemispherical part from dorsal view , and it extends back and connect to the inner edges of the (ACH.C.) by (SPCO.CM.), and the end of the (CO.PT.) is also connect to the (PCH.C.) by another cartilage known as (CH.CO.CM.) from the ventral view **(Figure2).**

The cochlear part (CO.PT.) extends back and becomes wide to forming (CA.PT.) which its peripheral outer edge connects to the paritalplate (P.PL.) by paritocapsular commissure (P.CAP.CM.) from ventral view, and the (CA.PT) is separated from the (PCH.C.) by the (BCAP.FI.) , and the capsule extends from the posterior part and is connect to the (PCY.PR.) by the exocipitocapsular commissure (EXOCCAP.CM.) from the ventral view**(Figure2) (Figure3).**

The auditory capsule containingthe membranous labyrinth whichincludes in the (CO.PT.) a clear cochlear duct and cartilagineumspiraleseptumthatarise from the capsule floor**(Figure 7A)**, andthe (CA.PT.) which includes three clear semicircular canals:the anterior

semicircular canals (AN.SECI.CN.), the lateral semicircular canals (L.SECI.CN.), and posterior semicircular canals (PO.SECI.CN.)**(Figure 7B).**

5) Lateral Wall Of The Chondrocranium:

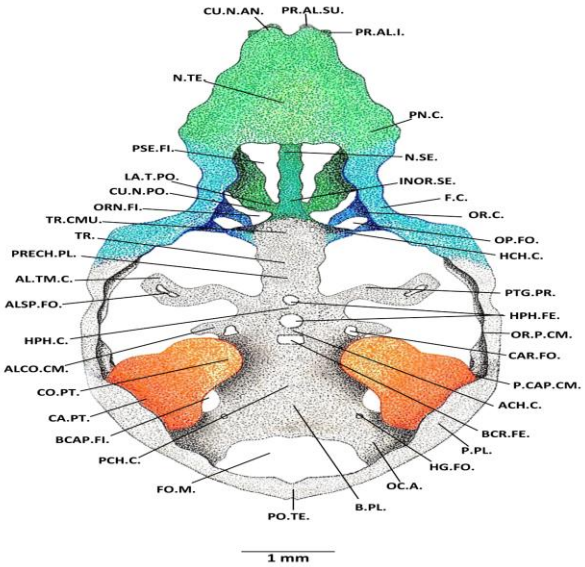
The lateral walls of the chondrocranium are formed from cartilaginous structures that integrate together continuously and are difficult to determine accurately,these walls are represented by (SPETH.CM.) from the nasal capsule, which are connectedfrom the posterior part to (AL.OR.C.)**(Figure3)**.

The (AL.OR.C.) also contributes to the side walls of the optic capsule by two roots (PI.PREOP.) and (PI.MOP.) , and the end of (AL.OR.C.) is connected to the (OR.P.CM.) which are considered side walls that limit the brain region on both sides, and also connected to the parietal plate (P.PL.)**(Figure 7B),** which is forms the side walls of the occipital region.

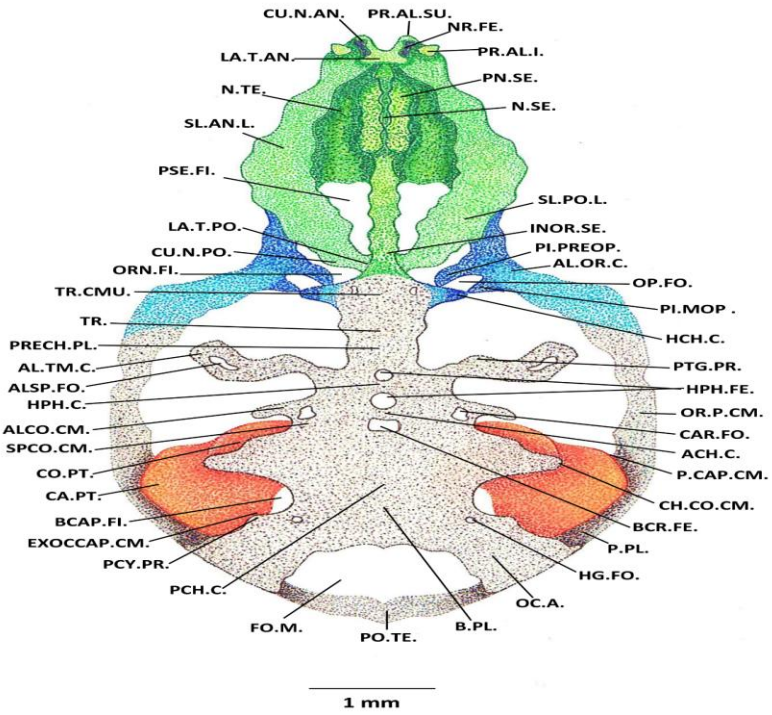
6) Roof Of The Chondrocranium:

The roof of the chondrocranium in this embryo is represented by the appearance of the first roof which is the (N.TE.) , Whilethe second roof is absence Thus, the Fontanell is determined from the front by the (N.TE.) , and the third roof is represented by posterior tectum (PO.TE.) ,Which is integrated with occipital arch (OC.A.), as well as with the (P.PL.) from the dorsal view of canalicular part (CA.PT.) of auditory capsule (**Figure1) (Figure2).**

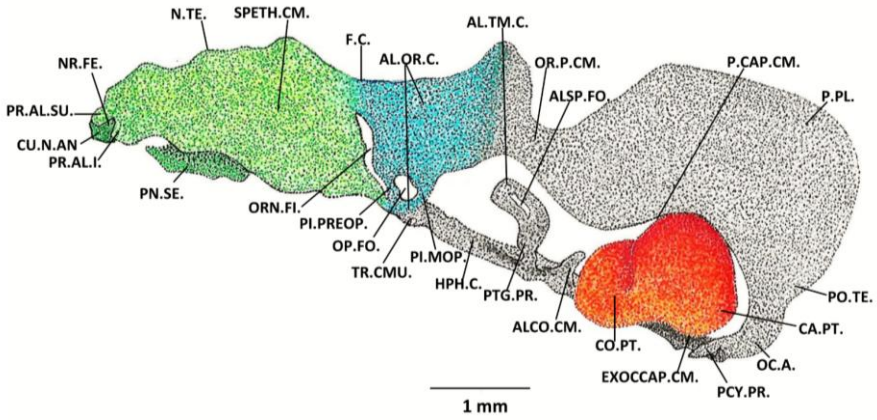
FIGURES:



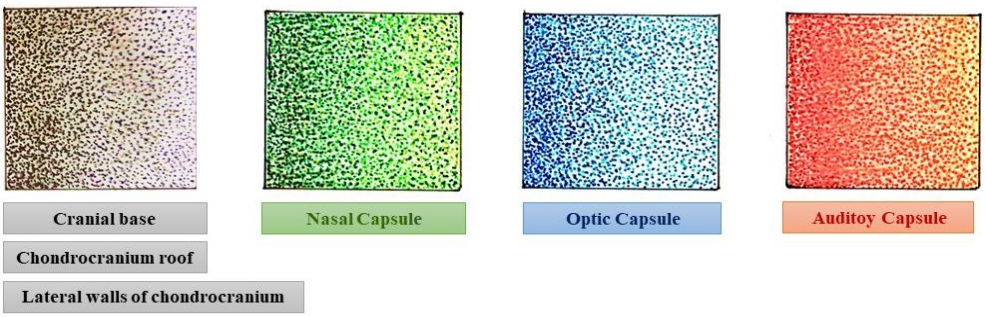
Figuere1: Dorsal view ofGraphic reconstruction ofMus Musculus Domesticus chondrocranium.

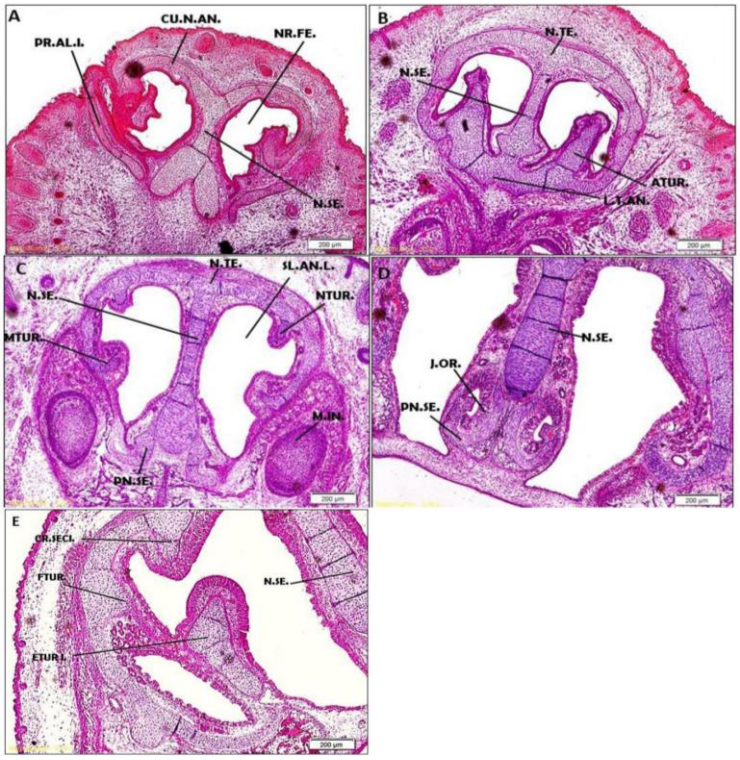


Figuere2: Ventral view ofGraphic reconstruction of Mus Musculus Domesticus chondrocranium.

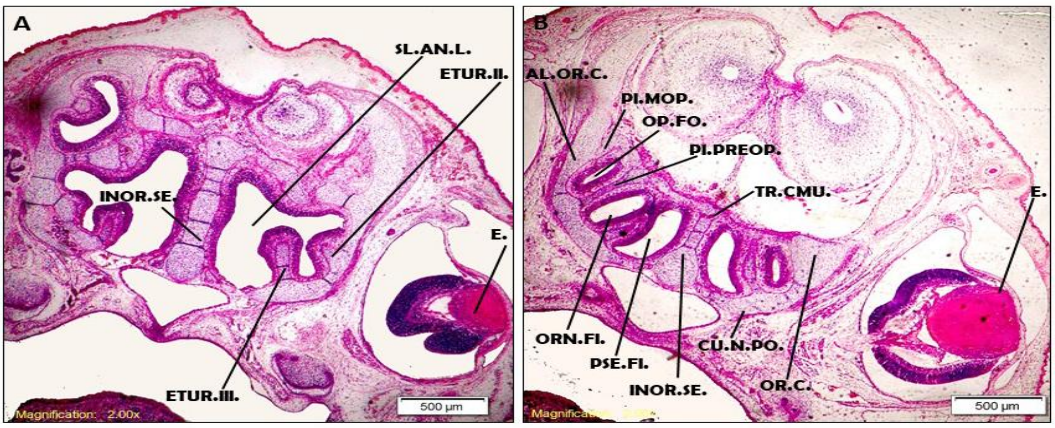


Figuere3: Lateral view ofGraphic reconstruction of Mus Musculus Domesticus chondrocranium.

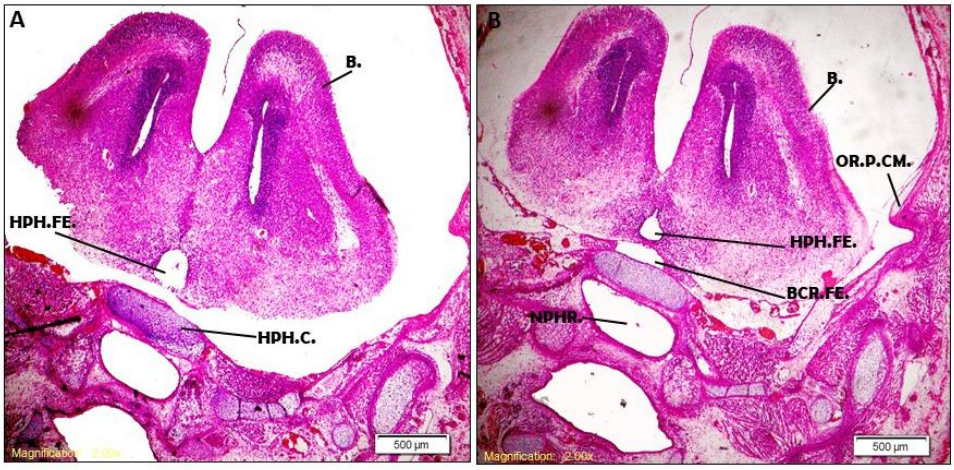




Figuere4:(A): A cross section in nasal capsule shows the nariumfenestra beneath the cupula nasi anterior, and above theprocessus alaris Inferior , and appearing the beginning of the nasal septum. **(B):** A cross section shows thenasal tectum (nasal capsule roof), and appearing oflamina transversalis anteriorwith connected to the nasal septum and atrioturbinals to form the zona annularis. **(C):** A cross section shows the maxilloturbinals which arise as a free end of side walls floor in nasal capsule and the nasoturbinals from the nasal capsule roof. Also the Milk incisor is appear .**(D):** A cross section shows the nasal septum and paranasal septumwith Jacobson's Organ. **(E):**A cross section shows the crista semicircular in nasal capsule roof, the frontoturbinalsand primaryethmoturbinals I that arise beneath the (CR.SECI.)



Figuere5(A):A cross section shows the branched ethmoturbinals, the secondary ethomoturbinals II which is arise as a simple projection from the middle of side wall in nasal capsule and the tertiary ethmoturbinals III which is arises from the side walls floor of the nasal capsule.**:(B):** A cross section shows the optic capsule with large ala orbital cartilage ,and orbitonasal Fissure between opticmforame and paraseptal fissure , and small opticum foramen between pila preoptica and pila preoptica which is arise from ala orbital cartilage and orbital cartilage. the interorbital.septum is clear and contribute to form trabecular communis.



Figuere6.**(A):** A cross section of cranial base shows hypophysialcartilageunder the brain **(B):** A cross section of cranial base shows hypophysial fenestrs and basicranial fenestra the in the middle and orbitoparital commissure which is locatedbetweenala orbital cartilage and parital plate and connect them together.

Figuere7: (A): A cross section of the coclear part with cartilagineumspirale septum and two small cochlearduct. The acrochordal cartilage appear between the auditory capsule**.(B):** A cross section of auditory capsuleshows the Canalicular Part with clear semicircular canals:

the anterior semicircular canals, the lateral semicircular canals and the posterior semicircular canals.

DISCUSSION:

The chondrocranium of mammals has been described in many studies such as: *Insectivores*, *Rodents*, *Lagomorpha*, *Primates* and other, here we compare the chondrocranium of the Mus musculus domesticuswith other mammals, and we focused on the sense capsules, cranial base, chondrocranium roof and laterl walls.

The nasal capsule in the study sample appears big and less than half longitudeof central stemand this is consistent with most mammals such as *SuncusMurinus* (Niida*et al.*, 1994) , *AlbionRat* (Youssef,1966) , *Erethizondorsatus* (Struthers, 1927), as well as in *MicrotusAmphibius*(Fawcett, 1917) while (Voit, 1909)and(De beer and Woodger ,1930) reported that the length of the nasal capsule in *rabbit* is more than half longitude of the central stem.

The posterior part of nasal is connected to ala orbital cartilage by sphenethmoid commissure and this is consistent with both (Youssef,1966) in *Albion Rat* and (Niida*et al.*, 1994) in *SuncusMurinus*, while (De beer and Woodger,1930) reported that the anterior part of ala orbital cartilage in *rabbit*connects to paranasal cartilage by sphenethmoid commissure which forms the frontal boundary of the orbitonasalfissure

The nasal tectum in the study sample extended back to the ala orbital and it considered the roof of the nasal capsule and the primary roof of chondrocranium and this was agreed with (Niida*et al.*, 1994), which stated that the nasal tectum in *SuncusMurinus* with a process extending to ala orbital also.

The mammalian nasal capsule is complex because of many distinctive cartilage structures for example, the nasal septum appears clearly in the study sample and it allows tobreathing air move through the narium fenestra and thus to the lungs , without the septum the air may be lost and interfere in the narium fenestra , the nasal septum is also integrated from the front with lamina transversalis anterior to form distinctive region called zona annularis , it also found in *MicrotusAmphibius* by(Fawcett, 1917), *Erethizondorsatus* by (Struthers, 1927), and in *Albinorat* by (Youssef, 1966) which stated that this zona annularis may exist, absent, complete, or incomplete such as *rabbit*(De beer and Woodger,1930). (Starck,1975) reported in his study about the chondrocranium in the *primates* that the *NorthernTreeshrew* had zona annularis but it narrow , while(Eloff,1951)

found the lamina transversalis anterior does not integrate with nasal septum in *Galagosenegalensis*, thus the zona annularis does not appear in this mammalian species , He pointed also that the zona annularis often does not appear in the *primates*.

Theinterorbital septum which is an extension of the nasal septum is connect from posterior part to the lamina transversalis posterior in the study sample but is not integrated with it , while the lamina transversalis posterior separates from the nasal septum in *MicrotusAmphibius*(Fawcett, 1917) , *Erethizondorsatus* (Struthers, 1927) and *Albinorat* (Youssef, 1966) . (Niida*et al.*, 1994) noted in *SuncusMurinus* that the nasal septum connects to the lamina transversalis posterior from the middle not not from the end.

The nasal septum in study sample is carried from the ventral view paranasal septum cartilages which is includesvomeronasal organ or jacobson'sorgan and it is a chemoreception organ helps animal to detect Phermons of the same species for reproduction and social behavior, and it has also been seen in *MicrotusAmphibius* (Fawcett,1917),*Erethizondorsatus* (Struthers,1927) and *Albinorat* (Youssef, 1966) from *Rodents* , and it also found in *Galagosenegalensis* (Eloff,1951) from *Primates.* (De beer and Woodger,1930) reported that the paranasal septum cartilagesappearas a pair of discrete independent cartilages located near from ventral edge of the nasal septum in *rabbit* and this has been found in the study sample also. (Starck ,1975) added that the posterior end of the nasal capsule of the *Northern Treeshrew* is pressed bylarge eyes, also it has incompletecupula nasi posterior and absence of lamina transversalis posterior is absent.

In the study sample, all types of turbinals were present in the nasal capsule the first types appeared behind the narium fenestra and known as atrioturbinals it continues with the lamina transversalis anterior, also the maxilloturbinals which originate from side wall floor was appeared as well as the nsoturbinals and frontoturbinals.Alsowe observed crista semicircular from the nasal capsule roof.

The three types of ethmoturbinalswere also observed in the study sample and it was found *Microtus Amphibius* (Fawcett,1917), *Erethizondorsatus* (Struthers ,1927) and *Albinorat* (Youssef, 1966)where they observed all types of ethmoturbinals except ethmoturbinals II in Most *rodents*, while (Starck ,1975) reported that the nasal capsule in the *Northern Treeshrew* contains the three ethmoturbinals and frontoturbinals.

The nasal capsule floor in the study sample appearing consist of lamina transversalis anterior, paranasal septum and lamina transversalis posterior respectively. this was consistent with (Starck, 1975) in his study of chondrocranium in

primates ,where hereported that the primary nasal floorin mammals is often non-continuous and consisting of anterior and posterior lamina transversalis and paranasal septu,also he added that the paranasal septum arises independently and later integrate with lamina transversalis anterior in *Northern treeshrew,Lemur , Galago and Sifakas.*

The ala orbital cartilage in the study sample is large and characterized by orbitonasal fissure and itconnect to anterior part of nasal capsule by sphenethmoid commissure , the posterior part of ala orbital cartilage also connect to parital plate by orbitoparital commissure , (De beer and Woodger,1930) also found that the posterior edge of ala orbital cartilage in *rabbit* is connect to parital plate byorbitoparital commissure.

The ala orbital cartilage in the study sample contribute to the formation of side walls and cranial base, the ala orbital cartilage,orbital cartilage , pila preoptica , pila metoptica , hypochiasmatic cartilage, appear integrated and connected with each other. While (Niida*et al.*,1994) found that the ala orbital cartilage in *SuncusMurinus*

Is appear independent from pila metoptica , hypochiasmatic cartilages , (De beer and Woodger,1930) observed that the pila preoptica and pila metoptica of the ala orbital cartilage in the *rabbit*appear as a pair on each side and extend to connect to the central stem to form the opticumforamen.

The interorbital septum is exist and clear in the study sample ,which is considered an extension of the nasal septum , and separates the eyes from each other, (Lozanoff*et al .*, 2004) stated that the *Macaca mulatta* has interorbital septum, while the interorbital septum is absent in *Albinorat* (Youssef,1966), *Microtus Amphibius* (Fawcett,1917) and *Erethizondorsatus* (Struthers,1927) .

(Voit ,1909) stated that the *Oryctolagus Cuniculus* has small interorbital septum , (De beer And Woodger ,1930) also observed a small interorbital septum in *rabbit*and they found the mammals that have a well-developed interorbital septum Rodents and Primates, also they classified the interorbital septum based on strength, weakness or lack of development , (Starck, 1975) also observea clear interorbital septum in*Northern Treeshrew.*

The cranial base of chondrocranium in study sample begins with a trabecular communis and its peripheral edges are integrated with the hypochiasmatic cartilage, and the combination of trabecular and hypophysial cartilage called the prechordal plate,while (Niida*et al.*,1994) reported that the hypochiasmatic cartilage arise as three centers in *SuncusMurinus*, (De beer And Woodger ,1930) reported that the hypochiasmatic cartilage of central stem in *rabbits* is narrower than the parachordal cartilage and wider than the trabecular.

The auditory capsule consists of two distinct parts: the cochlear part and canalicular part , where the auditory capsule is begins with the cochlear part which connect to the hypophysial cartilage by alicochlear commissure and connect to the acrochordal cartilage by sphenocochlear commissure, while (Niida*et al.*,1994) found that the cochlear part in *SuncusMurinus*connecte to parachordal cartilage edge by sphenocochlear commissure, while the posterior part of parachordal cartilage remains distant and detached from the cochlear part by basicapsular fissure, (De beer And Woodger ,1930) also reported that the cochlear part in *rabbit* is independent from parachordal cartilage by basicapsular fissure,(Youssef,1966)found that the auditory capsule in *Albino rat* connect from anterior part to ala temporal cartilage by alicochlear commissure, and the auditory capsulae is separate from the central stem bybasicapsular fissure.

The auditory capsule contains membranous labyrinth which includes in cochlear part clear cochlear duct and cartilagineumspirale septum which is arise from the capsule floor, while the canalicular part includes three clear semicircular canal, (Youssef,1966) found in the *Albino rat* that the cochlear part is representing the anterior part of auditory capsule and canalicular part is representing the posterior part and the last include the semicircular canals, (De beer And Woodger,1930) added that the auditory capsule in *rabbit*consists of two parts and the canalicular part more larger than the cochlear part and it form a large part of the chondrocranium walls.

The side walls of the study sample are represented in a group of cartilages that integrate together which is: sphenethmoidcommissure,ala orbital cartilage, the two optic roots pila preoptica , pila metoptica , orbitoparital commissure from the middle of the skull and paritalplate end of the skull. This corresponds with (Niida*et al.*, 1994), which noted that the ala orbital cartilage in *Suncusmurinus* is the first cranial wall that develops in the anterior part of the cranial base, also (Youssef,1966) said that the ala orbital cartilagein*Albino rat* connect to parital plate by orbitoparital commissure, while (Struthers,1927)reported that the orbitoparital commissure is absent in *Erethizon dorsatus*, (De beer And Woodger,1930) added that the parietal plate arise independent and integrate with the supraoccipital cartilage in *rabbit*, and also said that the ala orbital cartilage connect to the nasal capsule by sphenethmoid commissure.

There are two chondrocranium roofs appear in the study sample, The first roof is the nasal capsule roof which represented by nasal tectum and the third roof which represented by posterior tectum which connect to occipital arch , parital plate and auditory capsule , (Terry

,1917) stated that the parietal plate forms the posterior tectum in *Felis*and it connect to occipital arch , while this contrasts with (Noordenbos,1905), who stated that the posterior tectum in *Talpa*arise separate from the parietal plate and occipital arch , also said that the parietal plate arise separate from auditory capsule.

List Of Abbreviations:

AL.OR.C.	Ala orbitalis cartilage.
AL.TM.C.	Ala temporalis cartilage.
AN. SECI.CN.	Anterior semicircular canal.
ACH.C.	Acrochordal cartilage.
ALCO.CM.	Alicochlear commissure.
ALSP.FO.	Alisphenoid foramen.
B.	Brain.
B.PL.	Basal Plate.
BCAP.FI.	Basicapsular fissure.
BCR.FE.	Basicranial fenestra.
C.SPI.SE.	Cartilagneumspirale septum
CA.PT.	Canalicular part
CAR.FO.	Caroticum foramen.
CH.CO.CM.	Chordo - cochlear commissure.

CO.D.	Cochlear duct.
CO.PT.	Cochlear part.
CR.SECI.	Crista semicircular
CU.N.AN.	Cupula nasi anterior.
CU.N.PO.	Cupula nasi posterior.
E.	Eye
ETUR.	Ethmoturbinals.
ETUR I.	Ethmoturbinals I.
ETUR II.	Ethmoturbinals II.
ETUR III.	Ethmoturbinals III.
F.C.	Frontal cartilage.
FO.M.	Foramen magnum.
FTUR.	Frontoturbinals.
HCH.C.	Hypochiasmatic cartilage.
HG.FO.	Hypoglossum foramen
HPH.C.	Hypophysial cartilage
HPH.FE.	Hypophysial fenestra.
INOR.SE.	Interorbital septum.

J.OR.	Jacobson's organ.
L.SECI.CN.	Lateral semicircular canal.
LA.T.AN.	Lamina transversalis anterior.
LA.T.PO.	Lamina transversalis posterior.
MTUR.	Maxilloturbinals.
M.IN.	Milk incisor.
N.SE.	Nasal septum.
N.TE.	Nasal tectum.
NPHR.	Nasopharyngeus.
NR.FE.	Narium fenestra.
NTUR.	Nasoturbinals.
OC.A.	Occipital arch.
OP.FO.	Opticum foramen.
OR.C.	Orbital cartilage.
OR.P.CM.	Orbitoparital commissure.
ORN.FI.	Orbitonasal fissure.
P.CAP.CM.	Paritocapsular commissure.
P.PL	Parital plate.
PCH.C.	Parachordal cartilage.
PCY.PR.	Paracondylarprocessus.
PTG.PR.	Pterygoid processus of ala temporalis.

PI.MOP.	Pila metoptica.
PI.PREOP.	Pila preoptica.
PN.C.	Paranasal cartilage.
PN.SE.	Paranasal septum.
PSE.FI.	Paraseptal fissure.
PO.SECI.CN.	Posterior semicircular canal.
PO.TE.	Posterior tectum.
PR.AL.I.	Processus alaris inferior.
PR.AL.SU.	Processus alaris superior.
PRECH.PL.	Prechordal plate.
SL.AN.L.	Sulcus anterior latiralis.
SL.PO.L.	Sulcus posterior latiralis.
SPCO.CM.	Sphenocochlear commissure.
SPETH.CM.	Sphenethmoid commissure.
TR.	Trabecular.
TR.CMU.	Trabecular communis.
Z.A.	Zona annularis.

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