E-note

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Subclass: Prototheria

characters, distribution & Affinities

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Systematic position & distribution :-

Prototheria is the subclass of class Mammalia and includes egg-laying mammals, distributed only in Australia and the neighbourhood islands of Tasmania and New Guinea. Prototheria includes a single order, Monotremata. These includes the duck bill Platypus and one species of Echidna or Spiny Ant eater, Tachyglossus from Australia and two species of Zoglossus from New Guinea. Both are basically similar to each other, but too different from other mammals. Monotremes desire from an early stock in the principal mammalian line of Descent.

Distinctive characters -

1. **Habit & Habitat :-** The Platypus is highly modified for aquatic life and spiny ant eater are for terrestrial life. Both are burrowing in habit

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and make nests for rearing their youngs. Both are insectivorous, nocturnal, warm-blooded, quadrupedal and oviparous.

2. External Features — Body of Platypus is flattened and covered with a dense soft under-fur protected by harsher outer fur. Body of spiny-anteater is covered above with strong pointed spines, between which are coarse hairs, while the lower surface of the body has only hairs. In Platypus, jaws are produced into a depressed beak covered with soft hairy skin. In spiny anteater, jaws are produced into a long slender pointed rostrum. External ears or pinnae are absent. Tail flat and elongated in Platypus and vestigial in spiny anteaters. Mammary glands devoid of nipples. Mammary pouch on the abdomen of female is present, in which milk is secreted through a large number of specialised sweat glands, but the ducts of these glands are not united to open on external nipples. In Platypus, fore-legs are short and powerful. The five digits are webbed and end in strong claws. Hind limbs are

less specialized. In the male, a hollow tarsal spur is connected with a small crural gland whose secretion is poisonous. This gland is well-developed in duck bill platypus and less developed in Spiny ant-eaters.

Digestive System

In Spiny Ant-eaters, teeth are absent in all stages of Development. In Young platypus flattened, rigid teeth are present and these are replaced by Horny structures formed by an ingrowth of epidermis beneath them and used for breaking the cells of molluscs. Spiny Ant-eaters have a tiny round mouth at the end of long beak. In Spiny Ant-eaters, posterior part of tongue is beset with horny serrations, which grind the food against corresponding ridges on the palate. Sub-maxillary, parotid and sub lingual glands are present whose secretions helps to neutralise formic acid discharged by their preys.

Stomach of Monotremes is almost globular, intestine is differentiated into small and large caecum is present. Rectum opens into cloaca posterior to the ureters. [illegible] differentiation. Liver is [illegible] - large and

there is a gall bladder with bile duct which traverse the pancreas and joins the pancreatic duct.

Respiratory System

Respiration is pulmonary (by lungs). Larynx is also present.

Circulatory System

Heart is four-chambered. Right auriculo-ventricular valve is incomplete and partially muscular. ~~They~~ There are no chordae tendinae. Left auriculo-ventricular aperture is guarded by tricuspid valve, not by bicuspid valve as in other mammals. Single left aortic arch resembles those of other mammals. There are no renal portal veins. In Spiny Anteater, an anterior abdominal vein arising on the bladder and distributed to the liver. Erythrocytes are small, circular and non-nucleated. In Monotremes, heat regulation is imperfect though far advanced over that of living reptiles. In absence of sweat glands, heat reduction by vasodilation occurs. The temp. of spiny anteater rises with that of surrounding above 30°c and dips at 37°C. The Platypus has few sweat glands but it lives mostly in water or in a cool burrow.

According to Phylogenetic Considerations, two hypotheses have been held:—

1. It is said that Monotremes evolved independently from some early mammal-like reptiles and continued to survive in Isolation.

2. It is believed that Monotremes have been derived from very early mammals with peculiar characters and divergent specialisation.

Among Mammals, the position of Monotremes is very controversial. The Monotremes are without doubt mammals but in view of their reptilian features they may be designated as unfinished Mammals, which have failed to their evolution into typical Mammals. They are not to be regarded as ancestors of higher mammals but as the ancestors of side line of mammalian evolution, having probably originated from some different mammal-like reptilian stock than that from which other mammalian groups evolved.

Affinities

Prototherians are fully mammalian in some characters but they also possesses a no. of reptilian characters. Thus, this group is a connecting link between the reptilian ancestors from which the mammals evolved and the modern mammals. The prototherians are also sometimes referred to as living fossils as they represent a very primitive level of mammalian evolution.

Affinities with Reptiles :- Although there is no definite connecting link known between Prototheria and Reptiles, there is enough evidence to show that mammals have a reptilian ancestry. This is supported by following resemblances between monotremes and the living reptiles.

Resemblances - (i) Skull with epi-pterygoids, palatines

pterygoids, prevomers and annular tympanic bones.

2. Vertebrae without epiphyses, except in tail region of Platypus. Cervical Vertebrae bear free ribs. Caudal vertebrae with inferior spines.

3. Ribs are single headed.

4. Pectoral girdle, Scapula with developed acromian process and without spine. Coracoids and Pre-coracoids and in front of coracoids are epicoracoids. In Pelvic girdle, epipubic or marsupial bones are articulated with anterior border of pubis.

5. Cloaca is present.

6. Anterior abdominal veins is present.

7. In Nervous System, Corpus Callosum is present; connecting two cerebral hemispheres.

8. Cochlea of Internal Ear is with lagena.

9. Ureters opens into the urinogenital sinus and does not open into the bladder.

10. Testes are abdominal. Penis is erectile and only used for carrying sperms.

11. Oviducts separately open into the urinogenital sinus. Vagina absent.

12. Fertilization Oviparous and external.

3. Eggs are large macrolecithal and discoidal, cleavage is meroblastic.

4. Young hatches out of the egg by breaking the egg shell with the help of caruncle over the head and egg tooth.

Affinities with Aves :- The relationship of prototherians with Aves (birds) does not have solid facts. The Similar Characters present is these are chiefly due to the fact that both possess common reptilian ancestory. Important Resemblances are —

(i) Shape of beak of Platypus resembles with birds.
(ii) Teeth is both are absent.
(iii) Feet of both are webbed.
(iv) Presence of obliterated cutaneous skull.
(v) Tarsal region bears Spur.
(vi) Oil gland is present.

Affinities with Mammals :- The prototherians are essentially mammals as they possess the following mammalian characters —

(i) Body covered with hairs. Pinnae (External ear) is present.

(ii) Skin is richly glandular and has sweat and Sebaceous glands.
(iii) Mammary glands are present which open with marsupial pouch through minute ducts and pores. Nipples are absent.
(iv) A typical mammalian diaphragm is present.
(v) Skull is dicondylic. Chondrocranium is typically mammalian.
(vi) Lower jaw is formed of a single bone, dentary.
(vii) Middle Ear has three Ear Ossicles. Malleus large, Incus small and stapes elongated, cochlea slightly coiled.
(viii) Salivary glands present is buccal Cavity
(ix) Liver typically mammalian.
(x) Heart four-chambered.
(xi) Only left aortic arch present.
(xii) Erythrocytes Circular and non-nucleated
(xiii) Optic lobes are four. (Corpora quadrigemine).
(xiv) Ejaculatory organ is glans penis whose Corel is surrounded by corpus spongiosum.

Specialized characters of Prototheria

1. Hollow tarsal spur is present over the tarsus bone of male, which is connected to crural gland whose secretion is poisonous. 2. Milk glands derived

from Sweat glands, not from sebaceous glands as in other mammals and without teats.

3. Development of temporary abdominal pouch (in mammary glands) in female in breeding season for the development of young.

4. Jaws elongated forming a beak or rostrum, bearing external nares.

5. Teeth present in young platypus are replaced by horny plates in adults.

6. Presence of epipubic or marsupial bone for the support of marsupium.

7. Imperfectly warm blooded, body temp. varies from 25°c to 28°c.

8. Right Ovary is smaller and usually not functional.

Conclusion :- Peculiar affinities of Prototheria with reptiles suggest an intermediate stage between two groups. Presence of primitive, degenerate and highly specialized characters suggest their early separate line from main mammalian stock. Monotremes show that reptiles, birds and Mammals together constitute a natural group more homogenous than the group Ichthyopsida or even the superclass Pisces.