

PROTOTHERIA

The Sub-class Prototheria of class Mammalia include 3 genera, Monotremes, echidna and platypus - of egg laying mammals commonly called Monotremata. They represent a very primitive level of mammalian evolution and constitute a connecting link between mammals and their reptilian ancestors. They are therefore mammalian in some respect, but in other respect as fully reptilian.

Distribution: found in Australia and neighbouring islands of Tasmania and Guinea. Due to the sub-barrier all around, they have been forced to a restricted distribution without further evolution.

Habit and Habitat - Nocturnal, burrowing, aquatic/terrestrial oviparous mammals; Insectivorous.

External features

- 1) Body is covered with hair; hairs on back are coarse or spine like
- 2) Ear is without pinna
- 3) Poison spur is present in male
- 4) Tail may be present or absent
- 5) Digit ends in sharp claws and are webbed
- 6) Many glands are without teeth
- 7) Jaws are either beak-like or produced into a rostrum.

Body cavity - A muscular diaphragm is present between the thoracic cavity and abdominal cavity.

Skeleton

- 1) Skull dicondylic and the sutures between the bones are not distinct.
- 2) Skull cavity large, cranial walls thin and smooth.
- 3) The tympanic bulla is absent and the malleus and incus are comparatively larger.
- 4) Mandible is slender with slightly marked coronoid process and made of dentary only.
- 5) Scapular spine is placed at the anterior border.
- 6) Vertebrae are without epiphysis.
- 7) Ribs are with capitulum only.
- 8) Coracoid and epicoracoid bones are well developed.
- 9) A-T shaped interclavicle is present.
- 10) Acetabulum is perforated.
- 11) Ischio-pubic symphysis is present.
- 12) An epipubic bone is present.

Digestive System

- i) Tongue long and sticky
- ii) thick saliva for capturing insects
- iii) alimentary canal ends in a cloaca

Circulatory system

- i) Heart four chambered
- ii) Right auriculo-ventricular valve is incomplete & fleshy
- iii) Chordae tendinae absent
- iv) Only left aortic arch present
- v) RBCs are non nucleated
- vi) An anterior abdominal vein is present in Echinids.
- vii) Imperfectly warm blooded.

Respiratory system - Respiration is pulmonary (= lungs)

Nervous system

- i) Brain simple (poorly developed)
- ii) Corpus Callosum absent
- iii) A large anterior commissure present
- iv) Cochlea is less coiled and possess a lagena.
- v) Cerebrum smoother in Ornithorhynchus, but convoluted in Echinids

Urogenital System

- i) Kidneys - metanephric
- ii) ~~Cochlea less coiled and possess a lagena.~~
Uterus open into a urogenital sinus.
- iii) Testes are abdominal
- iv) In male an erectile penis (made of corpus spongiosum and corpus fibrosum) is present.
- v) The penis bears a groove for conveying spermatozoa
- vi) Right ovary is reduced
- vii) The oviducts open into the urogenital sinus in front of the Ureter.
- viii) Uterus and vagina are absent
- ix) Females are oviparous.

Development - (i) Fertilization internal

- (i) Eggs have much yolk
- (ii) Egg shell is tough
- (iii) Cleavage - meroblastic
- (iv) Modified sweat glands produce milk on which young ones are fed.

Affinities of Prototheria

Prototheria are primitive mammals and possess a rather mixture of reptilian and mammalian characters. They represent an intermediate stage between two classes of vertebrates, and provide the living basis for therefore, their affinities can be considered under the following two heads

1) Reptilian ~~ancestral~~ affinities

The prototherians possess a number of characters that are shared by reptiles and are as follows.

- a) External pinnae absent
- b) Tympanic bone does not form a bulla.
- c) Suture between skull bones obliterated
- d) Epiphyses absent
- e) Ribs single headed
- f) T-shaped interclavicle present
- g) Separate pterygoid
- h) Clavicles coincide at precoracoid coxly developed
- i) Ischia and pubis form a ventral symphysis
- j) Acetabulum perforated
- k) Presence of cloaca
- l) the right auriculo-ventricular valve incomplete and fleshy
- m) Cloaca present
- n) Corpus callosum absent
- o) Testes abdominal
- p) Distinct vagina and uterus absent
- q) Female oviparous.
- r) Egg yolk
- s) Cleavage meroblastic
- t) Imperfectly hemithymous
- u) Development of foetal membrane of reptilian type.

2) Affinities with Marsupials

The prototherians share the following characters with marsupials:

- a) Similar skull structure
- b) Marsupial bone present in both
- c) General contour of brain similar
- d) Mandibular inflexion similar
- e) Foetus of monotremes resembles that of Marsupial
- f) Lactation is similar

On the basis of these similarities, Gregory (1947) included both the groups in a sub class - Marsupionata. However, it is clear that prototherians originated from the main line of mammalian evolution and not from a pre-marsupial stock.

Though monotremes share a no. of reptilian characters, yet they possess many distinctly mammalian characters.

- 1) Presence of hair on body
- 2) Presence of diaphragm
- 3) Presence of Mammary glands
- 4) Dicoelous skull
- 5) Mandible is formed of dentary alone.
- 6) Presence of three ear ossicles
- 7) Cervical vertebra seven.
- 8) Like lobes typically mammalian
- 9) Presence of a moderate caudal caecum
- 10) Heart four chambered with persistent left aortic arch only.
- 11) RBC's are non nucleated
- 12) Brain with four optic lobes
- 13) Cerebellum well developed
- 14) Cochlea slightly coiled
- 15) Fertilization external.

Conclusion: The mammalian features clearly indicate that monotremes are mammals and hence they should be treated as a separate subclass due to the presence of reptilian characters in them. It also indicates that monotremes evolved independently from the early mammal like reptiles, but failed to complete the evolutionary transformation of higher ~~mammals~~ mammals.

So it is clear that they represent the end product of a slender evolutionary line of mammal like forms (= reptilian stock) and not from the main stock of mammalian evolution. Hence they can not be regarded as ancestor to higher mammals though they are connecting link between reptiles and mammals.