AQUATIC ADAPTATION

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Aquatic adaptation occur in those animals which live in water habitat. viz. fresh, brakish or sea water. They are called aquatic animals or hydrocoles.

Based upon the phylogenetic history of the aquatic animals, following two types of aquatic animals have been recognized.

1. Primary aquatic animals
2. Secondary aquatic animals.

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Character of an A. Animal.

An aquatic animal should have the ability to swim to overcome the resistance of the surrounding medium. Therefore it should have a streamlined body with an organs or ability to float. The animal should also have to overcome the problems of osmoregulation.

Primary Aquatic Animals-

P. A.A. are those in which the phylogenetic history is restricted to water as habitat. Therefore all their adaptation are originally designed to meet the necessities of aquatic life. In other words, primary aquatic animals never had a terrestrial ancestry. They exhibit perfect aquatic adaptation. All fishes are primary aquatic animals.

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Secondary A. Animals. Those animals whose ancestors were lung breathing

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Land animal, migrated to the water for some reason and ultimately got adapted to live in aquatic habitat, are called secondary aquatic animals. Some of them live partially while others live totally in the water. All aquatic Reptiles, Ares and mamals are representatives of secondary aquatic animals Amphibians are in transitional forms but primary & 2ndary Aquatic life

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Adaptive feature of P. A. Animals.
or
A. P. A. Adaptaleon :-

I. Body contour :-

The form of body depends upon the habits of life. The majority of fixed and partly sedentary forms have radially symmetrical body forms. eg. Sponges, Hydra, Starfish. The spindle form is the characteristic of fishes & wary, worm like form is found in annelids.

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The piscine body is designed for fast locomotion in water. There occurs a side to side compression of head, body and tail into a beautifully curved streamlined fish form. Head is sub-conical. There is no protu bearence over the body (which would retard the swift passage of the animal through water). Eyes are deeply placed on both side of the head. From

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The skin mucus secretion is protective fn against infection to the skin.

B. Swiming organs :-

Some aquatic animal float passively and don't possess of movement. e.g. protozoa. (dinoflagelats). The medusa & siphonophores move by alternative contraction and expantion of their sub-umbrellar side. Some arthropods, annelids and vertebrates organs are active for swiming. Ex.

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Parapodia of Heteronereis are well adapted for swimming. The preum abdominal appendages are adapted into pleopods or uropods for swimming.

In vertebrates, the primy aquatic animals are the fishes. The fish move (swim) by the help of fins and also by lateral undulation of flexible body. The fin of fish are two types, paired and unpaired. The median

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fin as unpaired fin are caudal, dorsal, and ventral or anal fins. While pectoral and pelvic fins are paired fins. The caudal fins ~~is the~~ plays vital role in forward propulsion during swimming and also act as a rudder for navigation. Dorsal and ventral fins help to keep body vertical & the pectoral and pelvic fin help to steer the body during locomotion.

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paired fins help in propelsion and in making changes in direction.

2. Respiration :-

Some are internal modification of A. animal. Modification of muscles for locomotion. ~~In fis myotone~~ Ex. myotomes, mylomata. They help forward movement of fish.

Some bone also modified for movement.

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3. Respiration :- The P. A-animals are able to respire inside the water, without the need to come up to the surface. The exchange of respiratory gases takes place betⁿ the blood of this animals and the water outside. There are two methods of aquatic breathing 1. Through diffusion through general body surface Ex. protozoans, coelenterates, 2. With the help of spical organ gill

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Ex. prawns, unio, and other mallusca, many vertebratis such as fish, tadepole of frog. Gill of fish are most remarkable aquatic breathing organs utilizeing dissolved oxygen of water.

4. Air bladder:- Advanced bony fishes contain air bladder (swim bladder) which serve as an accessory respiratory argen and hydrostatic organ. Air

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bladder is a hollow outgrowth of the alimentary canal and is filled with gas or air.

5, Sense organ- Sense organs are developed in fish body in accordence to life in water. Eye fishes have lateral line system extending all over the body. It contain neuromast organs which act as rheoreceptor (i.e detect pressure chages in sourrounding water.

In all fishes Eye are very

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large. Lens is attached to a retractor lentis in teleostean fishes. Chemical sense organ is thermoreceptor (ampulla of Lorenzini are the most impt sence organ in A. animals.

B. ~~Secondary~~

b. Skin — skin of fishes is rich in mucous gland and/or is protected with scale.

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Secondary Aquatic Adaptation

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1. Stream-lined body:- The body shape is stream-lined like primarily adapted form. Neck constriction disappears and Tail enlarges e.g. whales, dolphin, sirenia, seals. Frog also contain stream lined body.

Enlargement of size —

Aquatic vertebrates tend to be larger in size because in these creatures energy, which in terrestrial form is exhausted in gravitational forces, is turned into gra

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Ex. Balaenoptera musculus.
is several time bigger than
the largest elephant!
giant sharks & sepids.

3. Sub mergence:- All secondary
aquatic animals need to develop
capacity of submergence
since swiming below water
surface demands such an
adaptation. Ex. Whales the
ribs are strongly arched.
Such aquatic insects
too are able to increase

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their period
of sub merginae by storing
air inside the subelytral space
ex. Nepa.

Modefication for locomotion:-
Limbs- Aquatic birds, Pinni-
pedia and platypus, webbed feet
are developed. Limbs are modi-
fied into paddles. In whales
limbs are modefied into fish
fin-like structure, called
flippers. In whales, dolphin
hind limbs are absent.
Fins:- there occur fleshy
and fin like expansion

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of the body wall in whales & ichthyosaurs which help in propulsion. These fin may be dorsal or caudal. Dorsal fin are present in killar whale, while absent in Balaena. In turtles propulsion occurs by fin-like limbs, but in whales tail propulsion take place. In sirenians and cetaceans the forward propulsive thrust comes from the flattened tail or ~~propulsion is in such~~ fluke. This type of propulsion is known as tail propulsion. Pectoral paddels of whales & sirenians exhibit the following adaptation - ① the restriction of movements corresponding to the elbow and wrist joins. 2. the fusion bet^n digits. 3, increase in the number of phalanges called hyperphalangy, ④ increase in the number of digit for increase of expanse of paddling surface called hyperdactyly.

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In Nepa legs are flattened & oar-like.
Disappearance of hair, skin gl., etc. :- In whales and Sirenian ~~are~~ ~~naked~~ skin are without hair. The hair loss is compensated by the formation of fatty layer below the skin (blubber) for the retention of the bodily heat. It also help hydrostatic advantage.
Sweat or oil gl. disappears as they have nothing to do with the aquatic mode of life.

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Muscles and nerve also atropy from the integument due to its thickening and immobility.
Mouth arrangement :- Since jaws are not used for mastication in whales they loss the power of movement. Teeth become simplified.
Skull Modification :- In certain aquatic mamal (Dolphin) in cranium is shortened and front part of the skull become elongated to acquire the shape of a rostrum. In cetacean, zygomatic arch is reduced to a vestige.

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Simplification of vertebrae — In Ichthyosaurs, vertebrae are simple like the fishes, the rib articulation of are modified and are central. Sacrum in cetacean is more or less reduced.

Lightness of bones: bones are light and spongy. In whales, their interstices are filled with oil.

Sensee Organ — External ears have a tendency towards elimination / Eyes are adapted for under water vision and are piscine in nature.

In cetaceans & sirenians the blood volume is almost double to that of their land relatives. High haemoglobin content help in carrying much more oxygen.

Aquatic Adaptation is the one most important adaptation for some animal mammals birds & Aves & Reptiles and fishes. insect also.

Changes of the body organization to exploit water as habitat,

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are known as aquatic adaptation. All classes of vertebrates have their representative leading to partial or total aquatic life.

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