

8) PHYLUM ECHINODERMATA

INTRODUCTION

Name of the phylum has been derived from two Greek words; echinos means spine and derm means skin. Animals of this phylum have spiny skin.

SYMMETRY

They are triploblastic animals. They are bilaterally symmetrical in the larval stage but are radially symmetrical as adults.

HABITAT

All existing echinoderms are marine. They generally live at sea bottom. They are free living, while a few are sessile and attached to the substratum. (No freshwater or terrestrial representatives)

BODY FORM

It varies considerably. The body is star-shaped, spherical or cylindrical. It is un-segmented. The body lacks head. Usually five arms are present. The arms radiate from a central body.

SPINES AND PEDICELLARIAE

Many echinoderms bear spines

and pincer-like pedicellariae. The spines are protective in function. They make up the spiny skeleton which is made of calcareous plates. (or ossicles)

The pedicellariae keep the body surface clear of debris and minute organisms.

BODY WALL

Body consists of an outer epidermis, a middle dermis and an inner lining of peritoneum. The epidermis is single layered and ciliated.

BODY CAVITY

They have a true body cavity i.e. they are coelomate. They have a large fluid-filled cavity lined with mesoderm.

ALIMENTARY CANAL

Alimentary Canal is usually a coiled tube opening at mouth and anus. Their mouths are almost always on underside of their bodies, and the hole located at top is usually anus.

CIRCULATORY SYSTEM

A typical circulatory system is present also called ^{as} haemal system. The blood is often without a respiratory pigment. There is no heart.

DIGESTIVE TRACT

The Digestive system of echinoderms consists of a short coiled tube, the alimentary canal with ten pairs of pyloric caecae, the digestive glands.

NUTRITION

All echinoderms including starfish are carnivores. Food mainly consists of mollusks such as oysters, clams, mussels etc. Fish, crabs and other small animals are also taken as food.

TUBE FEET

Tube feet help to capture prey. Tube feet are also the principal sense organs. ^{They also help in locomotion.} _{Gas exchange of gase}

EXCRETION

Echinoderms lack specialized excretory organs and so nitrogenous waste, chiefly in the form of ammonia, diffuses out through the respiratory surfaces.

RESPIRATION

Respiration occurs through a variety of structures e.g. papulae in starfishes, peristomal gills in sea urchins, genital bursae in brittle star and cloacal respiratory tract in sea ^{cucumber} ~~urchins~~. Exchange of gases also takes place through the tube feet. i.e. Tube feet also help in respiration.

NERVOUS SYSTEM

Nervous system is primitive consisting of network concentrated into the radial ganglia containing nerve chords. They have no central brain. Sense organs are poorly developed.

REPRODUCTION

Sexes are usually separate with few exceptions. Reproduction is usually sexual. Fertilization is external. A few echinoderms are viviparous as well.

REGENERATION

The power of regeneration is well developed. The starfish & other echinoderms have a remarkable power of regeneration. A single arm with part of central disc regenerates into a new animal.

DEVELOPMENT / BIPINNARIA LARVA

Development is intermediate including characteristic larvae called bipinnaria larva which undergo metamorphosis into the radially symmetrical adults.

AMOEBOCYTES

Amoeboid cells known as amoebocytes roaming about in coelomic fluid absorb waste material and make their way out through the wall of rectal caecae. The amoebocytes are constantly produced in the

body for this purpose.

RADIAL NERVE CORD

Beside many nerve cells which lie among the epidermal cells, the radial nerve cord run along the ambulacral groove and unite with nerve ring encircling the mouth.

APICAL NERVOUS SYSTEM

The apical nervous system consists of a trunk in each arm which meets the other trunk at the centre of the disc. These trunks ^(Supply with nerves) innervate ^(upper side) the dorsal muscle of the arm. The tube feet, which are the principal sense organ, receive nerve fibre from the radial nerve cord at the end of each radial canal. The radial nerve cord ends in a pigmented mass known as eye which is a light perceiving organ.

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UNIQUE FEATURES

1. Presence of spines and pedicellariae.
2. Ambulacral system (water vascular system)
3. Haemal system
4. Mesodermal endoskeleton of calcereous ~~plates~~ plates.
5. Bilateral symmetry in the larva and radial symmetry in the adults.

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WATER VASCULAR SYSTEM

Echinoderms possess a unique water vascular system. This is a network of fluid-filled canals derived from the coelom that function in gas exchange, feeding, sensory reception and locomotion. This system varies between different classes of echinoderms but typically opens to the exterior through a sieve-like madreporite on the upper surface of the animal. The water vascular system assists in the distribution of nutrients throughout the animal's body.

DEGENERATE CHARACTERS

1. Lack of head
2. Simple sense organs
3. Incomplete digestive tract in some forms
4. Reduced circulatory system
5. Absence of excretory system

RESEMBLANCE WITH CHORDATES

Although they are very different from all invertebrate phyla ^(look in book pg 240) still they have a strong affinity to phylum chordate especially to subphylum Hemichordata.

1. Ciliated larva of certain Hemichordates (e.g. *Tonaria* larva of *Balanoglossus*) and bipinnaria larva of echinoderms are very much similar in shape and structure.

2. Pattern of cleavage of fertilized egg, formation of mesoderm, anus, mouth and coelom in echinoderms and hemichordates is similar.
3. Creatinine phosphate in the muscles of both echinoderms and chordates are similar which produces energy for muscular activity.
4. Both have mesodermal endoskeleton.
5. Both are deuterostomes.

ANCESTRY AND EVOLUTION

On the basis of these similarities the echinoderms and chordates appear to be closely related and evolved from a common ancestor. For this reason these two groups are placed near each other.

EXAMPLES

Examples of this phylum are *Asterias rubens* (star fish), *Ophiothrix fragilis* (brittle star), *Arbacia punctulata* (sea urchin), *Thyone biareus* (sea cucumber) etc.

BRITTLE STAR

Brittle star is called brittle because it can break off its arm if it is injured. This 'autotomy' allows the animal to leave its

arm behind and escape from an enemy to save life. The broken arm regenerates rapidly.

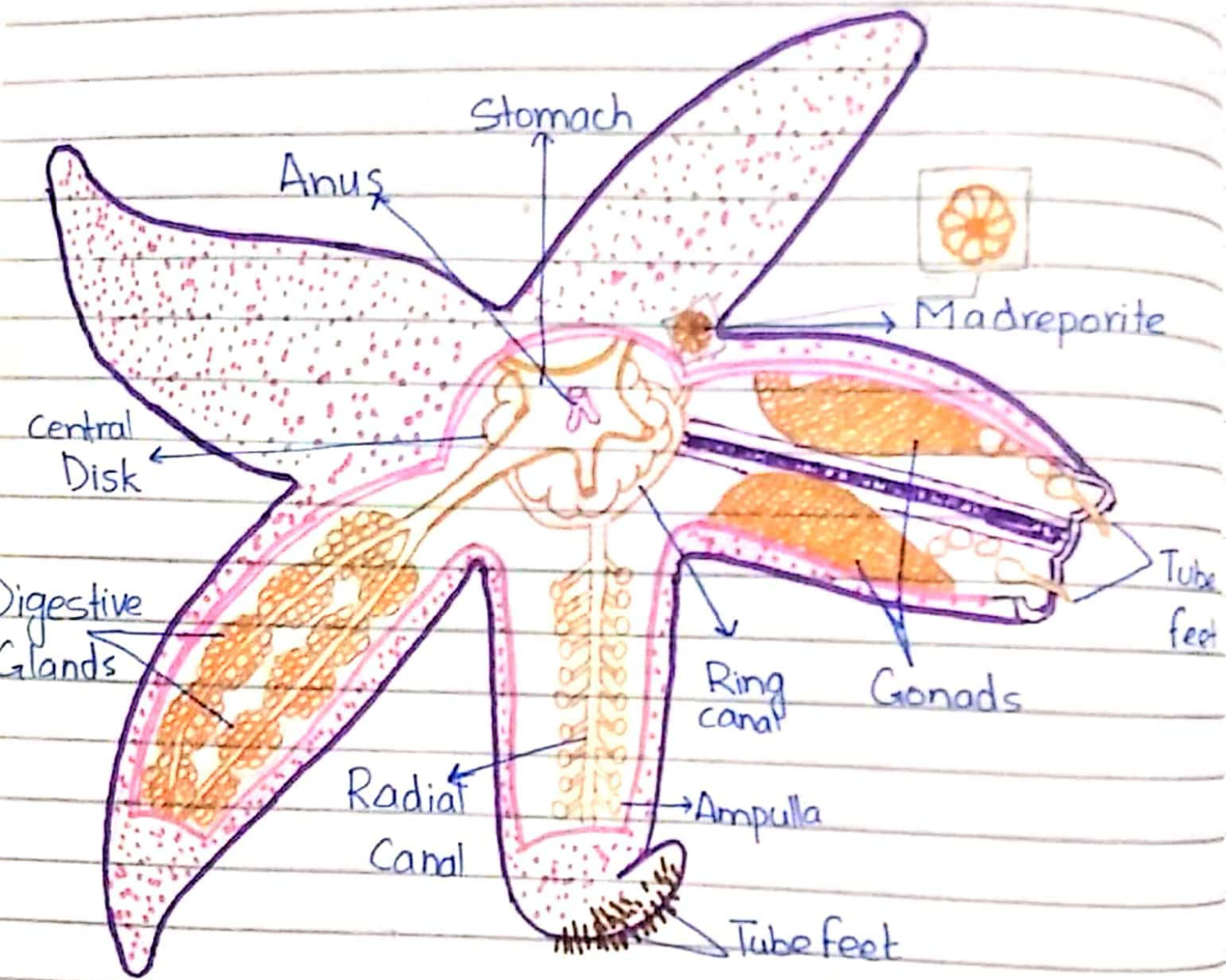


Fig : Star Fish - Echinodermata

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