# Echinodermata: General characteristics and Classification upto classes

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**Phylum Echinodermata: General characters and classification up to classes**

The phylum Echinodermata represents a relatively small group of unique, marine animals. They appear embryologically most closely related to the chordates but they have several features that set them apart. The echinoderms are all marine and have no ability to osmoregulate. They are all benthic organisms that are located in every ocean and at almost all depths. Some are active predators, others are scavengers and still others filter their food from the water.

**Characteristics:**

1. Non-segmented animals with secondary pentaradial symmetry. The animals show no cephalization and no head or brain.

2. They have organ system level of organization.

3. The echinoderms are enterocoelomic, triploblastic deuterostomes.

4. They have a complete digestive system.

5. They have an endoskeleton of dermal calcareous ossicles covered by an epidermis.

6. The echinoderms possess a water vascular system and tube feet.

7. The coelom is extensive, involving the water vascular system and a large perivisceral cavity.

8. The circulatory and excretory systems are reduced or absent.

9. Respiration is by dermal branchiae or tube feet.

10. The nervous system consists of a nerve ring and 5 radial nerve cords.

11. Locomotion is by tube feet, spines or arm movement.

12. Sexes are separate, fertilization external and development involves a free-swimming, bilaterally symmetrical larva.

Echinodermata have a world-wide distribution and the phylum contains some 7,000 known species and a large number of fossil forms. The phylum is divided into two subphyla, viz., Pelmatozoa and Eleutherozoa. Pelmatozoa, has only one living class: Crinoidea whereas Eleutherozoa has four living classes: Holothuroidea, Echinoidea, Asteroidea, Ophiuroidea.

**Classification of Echinodermata:** The classification is adopted from **Hyman, L. H. (1955).** Only living classes have been described.

**Subphylum I. Pelmatozoa: (Gr., pelmatos = stalk + zoon = animal):**

1. Mostly extinct echinoderms.
2. Body is attached by the aboral surface or by an aboral stalk.
3. Mouth and anal aperture present on the oral surface facing upwards.
4. Viscera is enclosed in a calcareous test.
5. Tube feet or podia are primarily food catching and devoid of suckers.
6. Main nervous system is aboral.
7. Pelmatozoa has only one living class i.e., Crinoidea

**Class 1. Crinoidea: (Gr., crinon = lily + eidos = form):**

1. Both extinct and living forms.
2. Oral surface is directed upwards.
3. Mouth usually central, anus present on the oral surface.
4. Arms movable, simple, mostly branched, usually 5 or 10 in number with or without pinnules.
5. Ambulacral grooves are open and extend along arms and pinnules to their tips.
6. Madreporite, spines and pedicellariae are absent.
7. Sexes are separate. Larva **doliolaria.**
8. Commonly called sea lilies or feather stars.

Examples: *Antedon, Metacrinus, Rhizocrinus*

**Subphylum II. Eleutherozoa: (Gr., eleutheros = free + zoon = animal):**

1. Mostly living echinoderms.
2. Stem or stalk absent, usually free living forms.
3. Body structure usually pentamerous.
4. Oral surface bearing the mouth is downward or lying on one side.

5. Anus usually on the aboral surface.

6. Ambulacral grooves usually not for food gathering and the tube feet with suckers are chiefly locomotory organs.

7. Main nervous system is oral.

**Class 1. Holothuroidea: (Gr., holothurion = water polyp + eidos = form):**

1. Body bilaterally symmetrical, usually elongated in the oral-aboral axis having mouth at/near one end and anus at/near the other end.

2. Body surface is coarse.

3. Endoskeleton reduced to microscopic spicules or plates embedded in the body wall.

4. Mouth surrounded by a set of tentacles attached to water vascular system.

5. Podia or tube feet are usually present and locomotory.

6. Alimentary canal is long and coiled and cloaca usually with respiratory trees.

7. Sexes are usually separate and gonad single or paired tufts of tubules.

8. Commonly called sea cucumbers.

**Examples:** *Stichopus, Deima, Cucumaria, Holothuria* etc.

**Class 2. Echinoidea: (Gr., echinos = hedgehog + eidos = form):**

1. Body is spherical, disc-like, oval or heart- shaped.

2. Body is enclosed in an endoskeletal shell of closely fitted calcareous plates covered with movable spines.

3. Outer calcareous plates are distinguished into five alternating ambulacral and five inter-ambulacral areas.

4. Podia or tube feet come out from the pores of ambulacral plates and are locomotory in function.

5. Mouth is centrally placed on the oral surface and surrounded by a membranous peristome. Anus is located at the aboral pole and surrounded by membranous periproct.

6. Ambulacral grooves are absent.

7. Pedicellariae are stalked and 3 jawed.

8. Sexes are separate. Gonads are pentamerous.

9. Development includes a free swimming echinopluteus larva.

10. Commonly called sea urchins and sand dollars.

**Examples:** *Echinus, Cidaris, Formosoma, Arbacia* **etc.**

**Class 3. Asteroidea: (Gr., aster = star + eidos = form):**

1. Body is flattened, pentagonal or star-shaped, generally with 5 arms. Arms radiating symmetrically from a central disc.
2. Tube-feet occur in each ambulacral groove and provided with suckers.
3. Anus and madreporite are on the aboral surface and mouth is on the oral surface.
4. Pedicellariae are the organs of defence and offence.
5. The are free-living. Larval stages are bipinnaria or brachiolaria larva

**Example:** *Asterias, Astropecten, Pentaceros* etc.

**Class 4. Ophiuroidea: (Gr., ophis = serpent + oura = tail + eidos = form):**

1. Body is flattened with a pentamerous or rounded central disc.
2. Oral and aboral surfaces are distinct.
3. Arms usually five rarely six or seven are long, slender, smooth or spiny.
4. Ambulacral grooves are absent.
5. Anus and intestine are absent.
6. Madreporite is on the oral surface.
7. Sexes are separate, gonads pentamerous.
8. Bursae usually 10.
9. Development includes a free swimming pluteus larva.
10. Commonly called brittle stars.

Examples: *Ophioderma, Ophiothrix, Astrophyton* etc.