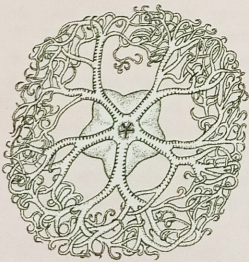
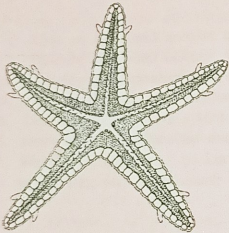


Echinodermata : Characters, Classification and Types



Echinoderms are one of the most beautiful and most familiar sea creatures. Forms such as the sea stars have become a symbol of sea life. Other forms such as brittle stars, sea urchins, sea cucumbers and sea lilies are also quite well known to the visitors on the sea-shore. There are 7,000 sps known in Echinodermata.

HISTORICAL

Echinoderms are known since very ancient times. Name of this phylum was introduced by **Klein** in 1734 for sea urchins. For many years echinoderms and coelenterates were included as a class among Radiata, largely because of the radial symmetry of the adults. **Echinodermata** were first recognized as a group distinct from the Radiata by **Leukart** in 1847.

DERIVATION OF NAME

Echinodermata literally means 'spiny or prickly skinned' (Gr., **echinos**, hedgehog; **derma**, skin) and refers to the conspicuous spines possessed by their test or skin. **Jacob Klein** (1734) first used this name for echinoids. The Greeks applied the name **echinos** to the hedgehog as well as the sea urchin, both having a prickly appearance. Term **echinus** has been used for a certain sea urchin. Possession of spines is not diagnostic of the phylum because only better known members, such as sea urchin, brittle stars and starfishes, have spines.

Echinodermata

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DEFINITION

Echinoderms are exclusively marine and largely bottom dwellers enterocoelous coelomate, triploblastic animals. They have a pentamerous radial symmetry derived from an original bilateral symmetry. They possess an endoskeleton of calcareous plates or spicules embedded in the skin; a peculiar water-vascular system of coelomic origin; numerous podia or tube feet; an ectodermal nervous system; no definite head or brain; no nephridia; gonads open directly to the exterior by special ducts.

GENERAL CHARACTERS

Phylum Echinodermata contains some 5300 known species and constitutes the only major group of deuterostome invertebrates. **Bather** (1900) stated the phylum as "one of the best characterised and most distinct phyla of the animal kingdom". Echinoderms are distinguished from all animals by a number of characteristics.

1. Organ-system grade of body organization.
2. Triploblastic, coelomate and radially symmetrical; often pentamerous.
3. Body unsegmented with globular, star-like, spherical, discoidal or elongated shape.
4. Head absent; body surface is marked by five symmetrically radiating areas (**ambulacra**) and five alternating interradii (**inter-ambulacra**).
5. Endoskeleton of dermal calcareous ossicles with spines, covered by the epidermis.
6. Water-vascular system of coelomic origin, including **podia** or **tube feet** for locomotion and usually with a **madreporite**.
7. Coelom of enterocoelous type constitute the perivisceral cavity and cavity of the water-vascular system; coelomic fluid with coelomocytes.
8. Alimentary canal straight or coiled.
9. Vascular system and haemal system, enclosed in coelomic periahaemal channels.

10. Respiratory organs include dermal branchiae, **tube feet**, **respiratory tree** and **bursae**.
11. Nervous system without a brain and with a circumoral ring and radial nerves.
12. Poorly developed sense organs include tactile organs, chemoreceptors, terminal tentacles, photoreceptors and statocysts.
13. No excretory organs.
14. Usually dioecious, gonads large and single or multiple; fertilization external; development indirect through free-swimming larval forms.
15. Regeneration of lost parts, a peculiarity.
16. Exclusively marine.

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CLASSIFICATION

Subphylum I. Eleutherozoa

(Gr., *eleutheros*, free + *zoios* = *zoon*, animal)

Free-living echinoderms.

CLASS 1. Asteroidea

(Gr., *aster*, star + *eidōs*, form)

1. Starfishes or sea stars.
2. Arms 5 or more and not sharply marked off from the central disc.
3. Tube feet in orally placed ambulacral grooves; with suckers.
4. Anus and madreporite aboral.
5. Pedicellariae present.
6. Free-living, slow-creeping, predaceous and scavengerous.

Subclass 1. Somasteroidea

Fossil Palaeozoic sea stars. *Platasterias latiradiata* is the only living species.

Subclass 2. Euasteroidea

Living sea stars.

Order 1. Phanerozonia

1. Body with marginal plates and usually with papulae, on aboral surface.
2. Pedicellariae sessile, not crossed.
3. Tube feet without suckers.

58. (Z-1)

- Mostly burrowers in soft bottom.
Examples : *Astropecten*, *Luidia*, *Goniaster*, *Oreaster* (= *Pentaceros*).

Order 2. Spinulosa

- Usually without conspicuous marginal plates and with papulae on both surfaces.
- Pedicellariae rare.
- Tube feet with suckers.
- Aboral surface with low spines.
Examples : *Asterina*, *Solaster*, *Pteraster*, *Echinaster*.

Order 3. Forcipulata

- No conspicuous marginal plates.
- Pedicellariae pedunculate and straight or crossed type.
- Four rows of tube feet.
Examples : *Asterias*, *Heliaster*.

CLASS 2. Ophiuroidea

- (Gr., *ophis*, snake + *oura*, tail + *eidōs*, form)
- Brittle-stars and allies.
 - Body star-like with arms sharply marked off from the central disc.
 - Pedicellariae absent.
 - Stomach sac-like; no anus.
 - Ambulacral grooves absent or covered by ossicles; tube feet without suckers.
 - Madreporite oral.

Order 1. Ophiurae

- Brittle and serpent stars.
- Small and five-armed.
- Arms move transversely.
- Disc and arms usually covered with plates.
Examples : *Ophiura*, *Ophiothrix*, *Ophioderma*, *Ophiopholis*.

Order 2. Euryalae

- Arms simple or branched.
- Arms move vertically.
- Disc and arms covered by soft skin.
Examples : *Gorgonocephalus* (basket star), *Asteronyx*.

CLASS 3. Echinoidea

(Gr., *echinos*, hedgehog + *eidōs*, form)

- Sea urchins and dollars.
 - Body discoid, oval or semi-spherical and without arms.
58. (Z-1)

- Skeleton or test compact bearing movable spines and three-jawed pedicellariae.
- Chewing apparatus or *Aristotle's lantern* with teeth.
- Ambulacral grooves covered by ossicles; tube feet with suckers.
- Gonads usually five or less.

Subclass 1. Bothriocidaroida

- A single row of plates in each inter-ambulacral area.
- Without typical lantern.
- Madreporite radial.
Example : Single extinct Ordovician genus *Bothriocidaris*.

Subclass 2. Regularia

- Body globular, pentamerous, with two rows of inter-ambulacral plates in existing members.
- Mouth central.
- Aristotle's lantern well developed.
- Anus central on aboral surface with well-developed apical plates.
- Madreporite oral.

Order 1. Lepidocentroida

- Test flexible with overlapping plates.
- Ambulacral plates extend up to mouth lip.
- Inter-ambulacral plates in more than two rows in extinct forms.
Example : *Palaeodiscus*.

Order 2. Melonechinoida

- Test spherical and rigid.
- Ambulacral plates continue to mouth lip.
- Inter-ambulacral plates in four or more rows.
- Wholly extinct, carboniferous.
Example : *Melonechinus*.

Order 3. Cidaroida

- Test globular and rigid.
- Two rows of long narrow ambulacral plates and two rows of inter-ambulacral plates.
- No peristomial gills.
- Anus aboral and central.
Examples : *Histocidaris*, *Goniocidaris*.

Order 4. Diadematoidea

- Test globular usually with compound ambulacral plates.

1. Peristomial gills present.
2. Anus aboral and central.

Examples : *Diadema*, *Echinus*, *Arbacia*.

Subclass 3. Irregularia

1. Body oval or circular, flattened oral-aborally.
2. Mouth central or displaced anteriorly on oral surface.
3. Anus marginal, outside the apical system of plates.
4. Tube feet generally not locomotor.

Order 1. Holoctypoida

1. Test regular with simple ambulacral and centrally located peristome and apical system.
2. Lantern present.
3. Mostly extinct.

Examples : *Holoctypus*, *Echinoneus*.

Order 2. Cassiduloida

1. Aboral ambulacral areas petaloid, forming a five-armed figure like petals of a flower.
2. Lantern absent.
3. Mostly extinct.

Example : *Cassidulus*.

Order 3. Clypeastroida

1. Test flattened with oval or rounded shape.
2. Mouth central, anus excentric.
3. Aboral ambulacral areas petaloid.
4. Aristotle's lantern present.
5. Gills absent.
6. Bottom dwellers.

Examples : Sand dollars : *Clypeaster*, *Echinarachinus*, *Echinocyamus*.

Order 4. Spatangoida

1. Test oval or heart-shaped with excentric mouth and anus.
2. Four aboral ambulacral areas petaloid.
3. Lantern absent.
4. Gills absent.
5. Burrowing.

Examples : Heart urchins; *Spatangus*, *Echinocardium lovenia*, *Hemipneustes*.

CLASS 4. Holothuroidea

(Gr., *holothurion*, sea cucumber + *eidos*, form)

1. Sea cucumbers.
2. No arms, no spines.

3. Body elongate on oral-aboral axis; body wall leathery.
4. Mouth anterior, surrounded by tentacles.
5. Ambulacral grooves concealed; tube feet with suckers.
6. Usually with respiratory tree for respiration.

Order 1. Dendrochirota

1. Tentacles irregularly branched.
2. Tube feet numerous, on the sole or all ambulacral or entire surface.
3. Respiratory tree present.

Examples : *Cucumaria*, *Thyone*.

Order 2. Aspidochirota

1. Tentacles peltate or leaf-like.
2. Tube feet numerous, sometimes forming a well-developed sole.
3. Respiratory tree present.

Examples : *Holothuria*, *Actinopyga*.

Order 3. Elaspoda

1. Tentacles leaf-like.
2. No respiratory tree.
3. Tube feet webbed together to form fins.
4. Deep-sea dwellers.

Example : *Pelagothuria*.

Order 4. Molpadonia

1. 15 digitate tentacles.
2. No tube feet.
3. Posterior end tail-like.
4. Respiratory tree present.

Examples : *Molpadia*, *Caudina*.

Order 5. Apoda

1. Worm-like sea cucumbers.
2. No tube feet and respiratory tree.
3. Burrowing.

Examples : *Leptosynapta*, *Synapta*.

Subphylum II. Pelmatozoa

(Gr., *pelmatos*, stalk + *zooios*, animal)

Stalked, sedentary echinoderms.

CLASS 5. Crinoidea

(Gr., *crinon*, lily + *eidos*, form)

1. Sea lillies.
2. Body attached during part or whole of life by an aboral stalk.

59. (Z-1)



3. Mouth and anus on oral surface.
4. Arms with pinnules.
5. Tube feet without suckers; no madreporite, spines and pedicellariae.
6. Ciliated ambulacral grooves on oral surface.

Order : Articulata

1. Living sea lillies and feather stars.
2. Feather stars non-sessile and free swimming.
Examples : *Antedon* (sea lily), *Neometra* (feather star).

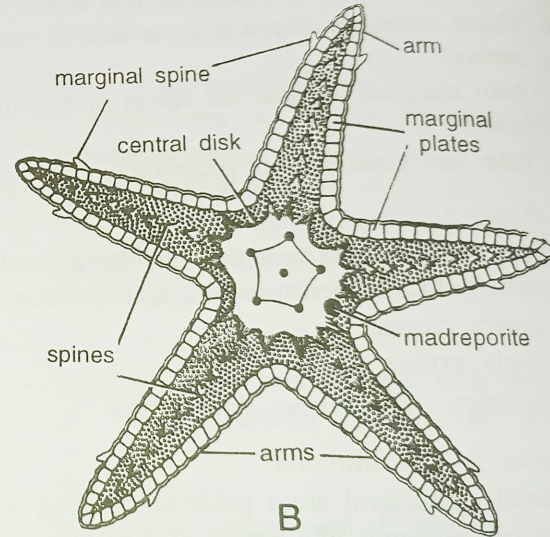
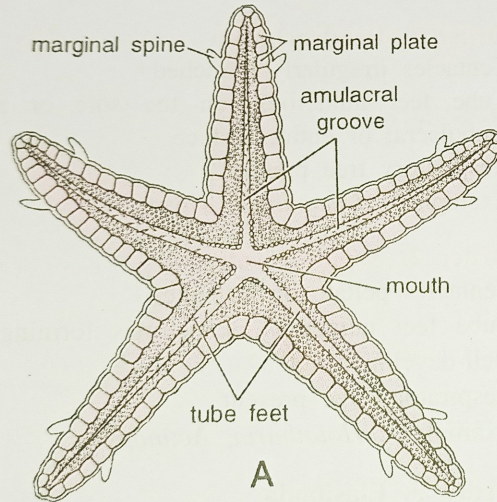


Fig. 1. *Pentaceros*. A. Oral view. B. Aboral view.