

Phylum Arthropoda



Phylum Arthropoda

Several million species.
Hard exoskeleton.



Phylum Arthropoda: Arthropods (crustaceans, spiders, insects)

Hard exoskeleton, segmented bodies, jointed appendages

Arthropods are the most successful of all animal phyla based on diversity, distribution, and numbers.

Nearly one million species identified so far, mostly insects.

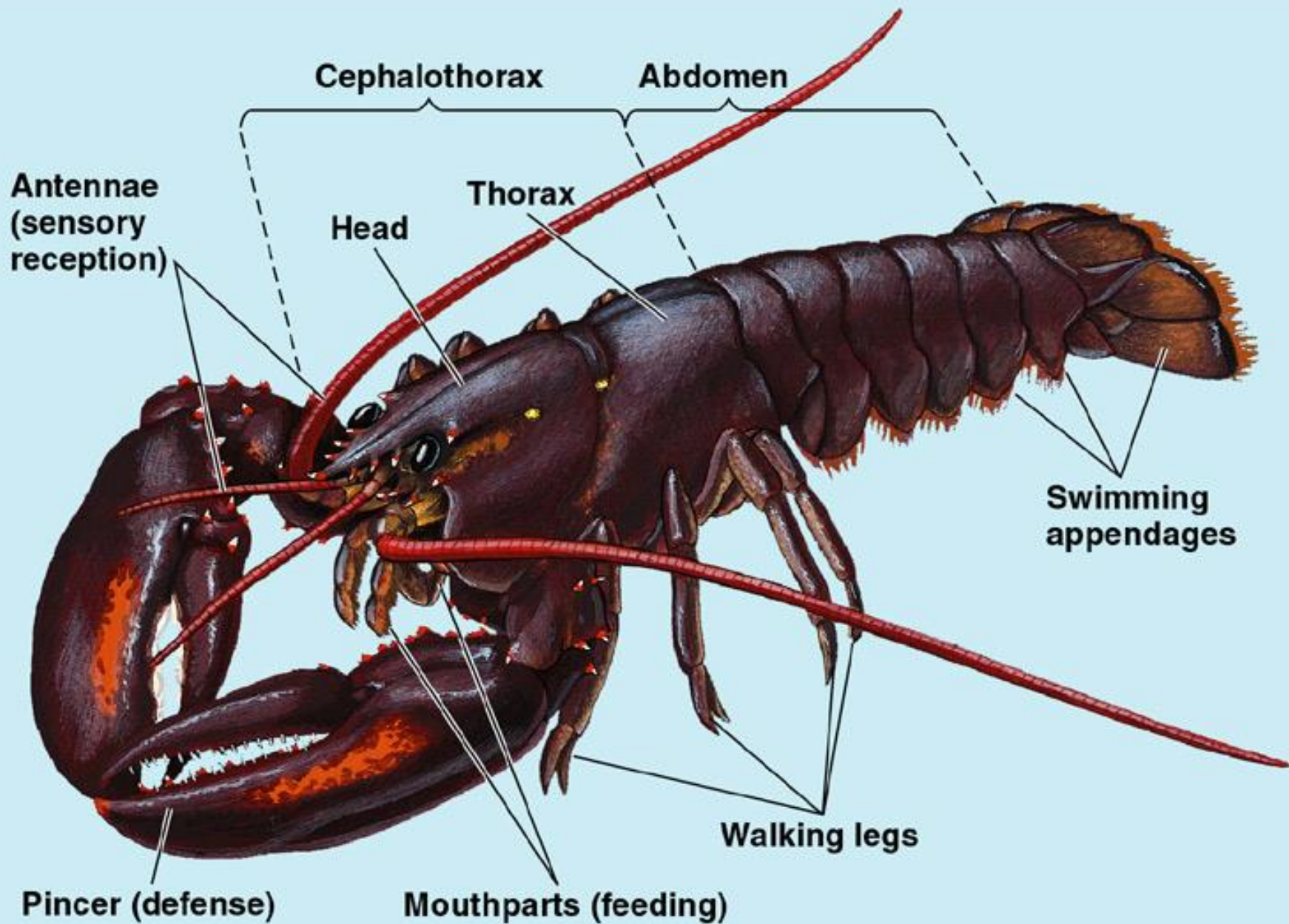
The exoskeleton, or cuticle, is composed of protein and chitin.

Molting of the cuticle is called ecdysis.

Extensive cephalization.

Open circulatory systems in which a heart pumps hemolymph through short arteries and into open spaces (sinuses).

Aquatic members- gills for gas exchange; terrestrial members- tracheal system of branched tubes leading from surface throughout body.



Cephalothorax

Abdomen

**Antennae
(sensory
reception)**

Head

Thorax

**Swimming
appendages**

Pincer (defense)

Mouthparts (feeding)

Walking legs

Four evolutionary arthropod lineages

- a. Trilobites – extinct
- b. Chelicerates – horseshoe crabs, spiders
- c. Uniramians – centipedes, millipedes, insects
- d. Crustaceans – crabs, lobsters, barnacles

From these lineages arose five major classes of arthropods.

Table 33.5 Some Major Arthropod Classes (based on a traditional taxonomy that places all arthropods in a single phylum, Arthropoda)

Class and Examples	Main Characteristics
Arachnida (spiders, scorpions, ticks, mites)	Body having one or two main parts; six pairs of appendages (chelicerae, pedipalps, and four pairs of walking legs); mostly terrestrial
Diplopoda (millipedes)	Body with distinct head bearing antennae and chewing mouthparts, segmented body with two pairs of walking legs per segment; terrestrial; herbivorous
Chilopoda (centipedes)	Body with distinct head bearing large antennae and three pairs of mouthparts; appendages of first body segment modified as poison claws; trunk segments bear one pair of walking legs each; terrestrial; carnivorous
Insecta (insects)	Body divided into head, thorax, and abdomen; antennae present; mouthparts modified for chewing, sucking, or lapping; usually with two pairs of wings and three pairs of legs; mostly terrestrial
Crustacea (crabs, lobsters, crayfish, shrimp)	Body of two or three parts; antennae present; chewing mouthparts; three or more pairs of legs; mostly marine

Class Crustacea

E.g., crabs, lobsters

Almost all are aquatic.

Ca. 40,000 species.



Includes krill eaten by whales, and daphnia, copepods, & amphipods in Lake Erie, pill bugs, *etc.*





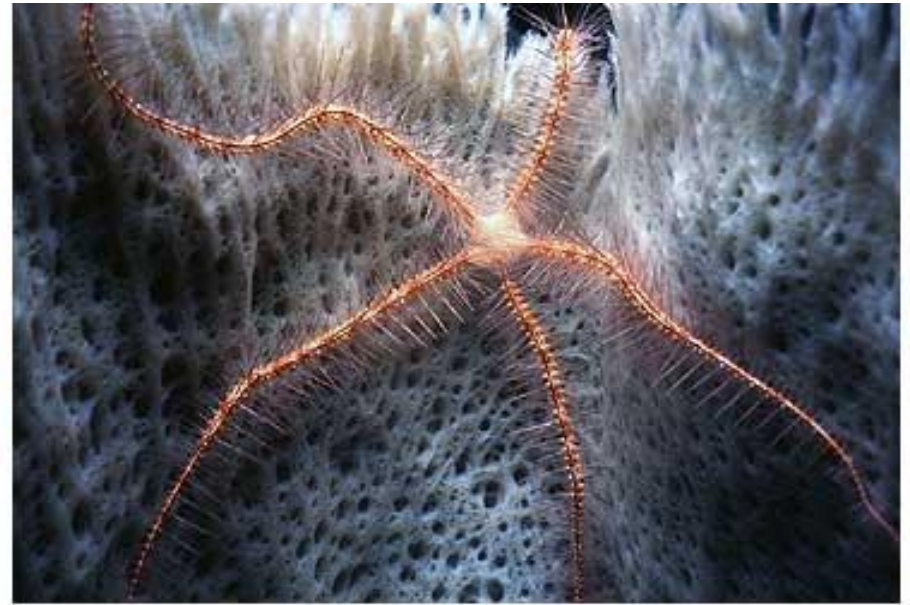
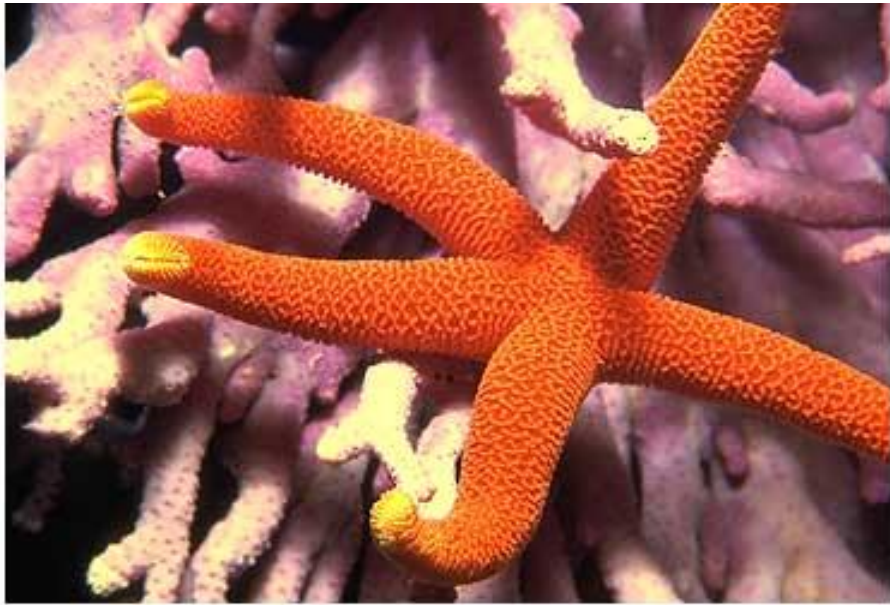


Benjamin
Cummings

Echinodermata

A close-up photograph of two starfish resting on a dark, textured surface. One starfish is bright red and the other is a vibrant pink. To the left, there are several pieces of dried, yellowish-brown seaweed with intricate, wavy patterns. The background is a dark, almost black, surface with a rough, cracked texture.

Riley Galton
Julia Heunis
David Lin



Echinoderm Classes

Asteroidea – Sea Stars:

- Multiple arms radiating from central disk
- Tube feet on bottom



Ophiuroidea – Brittle Stars:

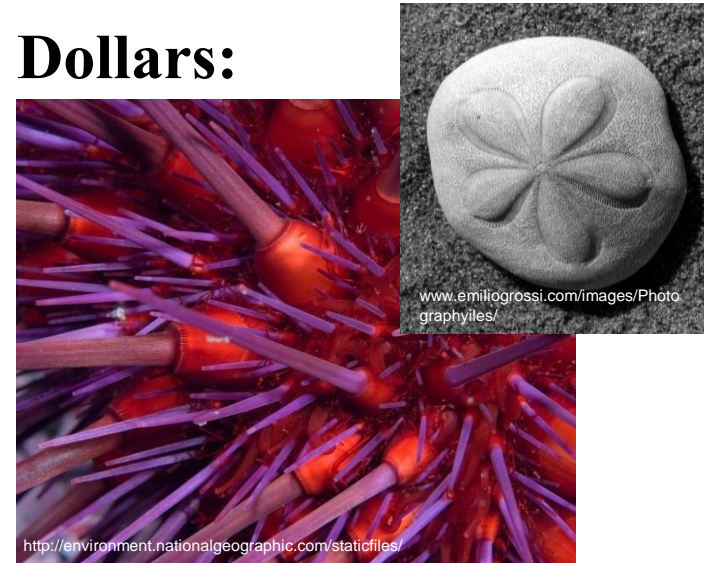
- Distinct central disk with snake like arms
- Tube feet lack suckers



Echinoderm Classes

Echinoidea – Sea Urchins and Sand Dollars:

- No arms, but 5 rows of tube feet
- Have muscles that can move
- spines



Crinoidea – Feather Stars and Sea Lilies

- Flexible arms used in suspension feeding
- Haven't changed in 500 million years



Echinoderm Classes

Holothuroidea – Sea Cucumbers

- Reduced endoskeleton
- Five rows of tube feet



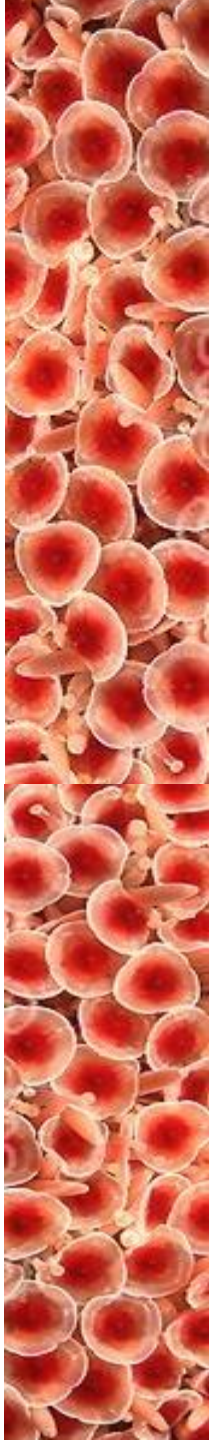
Concentricycloidea – Sea Daisies

- Only two known species
- Disk shaped, less than 1cm in diameter



Echinoderm Sensory Structures

- Eyespots on the ends of ambulacra are sensitive to light
- **Pedicellariae** (jaw like skeletal structures used to keep organisms from settling on skin), tube feet, and spines are sensitive to touch



Body Symmetry

<http://tbn2.google.com/images?q=tbn:KrJSbsj0l4ImqM:http://photos.tobinhosting.com/d/117553-2/sea%2Burchins.jpg>

- evolved from animals with **bilateral symmetry**
- adult echinoderms possess **radial symmetry**
- All echinoderms exhibit **fivefold radial symmetry** in portions of their body at some stage of life (5 parts around central axis), even if they have secondary bilateral symmetry
- For the most part...

LARVAE ~ bilateral

ADULTS ~ radial



<http://en.wikipedia.org/wiki/Echinoderm>

Skeletal Type

Echinodermata: “Spiny Skinned”

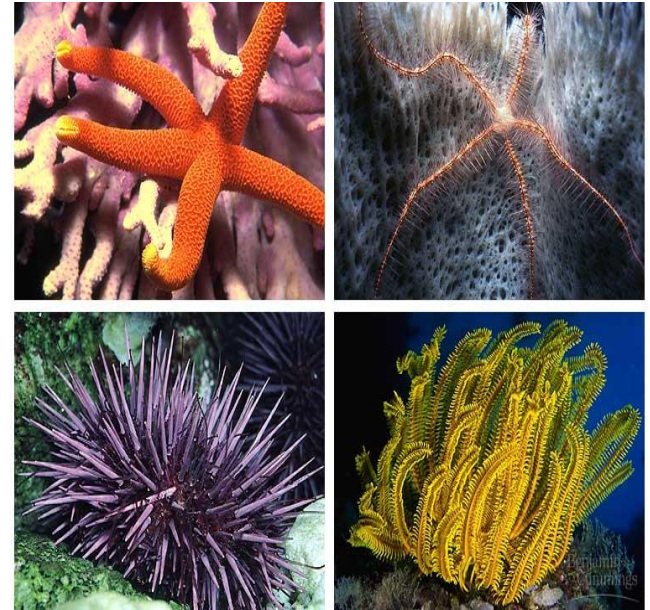
- DO NOT possess an exoskeleton
- a thin outermost skin covers a mesodermal endoskeleton made of tiny calcified plates and spines - forms rigid support contained within tissues of the organism
- Skeleton composed of skeletal plates called *ossicles*
- *Ossicles* = small bones
- In some species, such as the sea urchin, plates of the skeleton are locked together to form a rigid structure.
- most sea stars and brittle stars can flex their ‘arms’ = skeleton has gaps, flexible plate junctures



<http://ebiomed.com/prod/BOechinoderms.html>
<http://en.wikipedia.org/wiki/File:Sanc0521.jpg>

Other Unique Features

- Echinoderms can REGENERATE
ex: sea cucumbers can eject a portion of gut in response to predators and regenerate when safe
- Water vascular system (described earlier) is unique to echinoderms; varies water pressure to control tube feet
- Crinoids and some brittle stars = passive filter-feeders, absorbing suspended particles from passing water
sea urchins = grazers
sea cucumbers = deposit feeders
starfish = active hunters



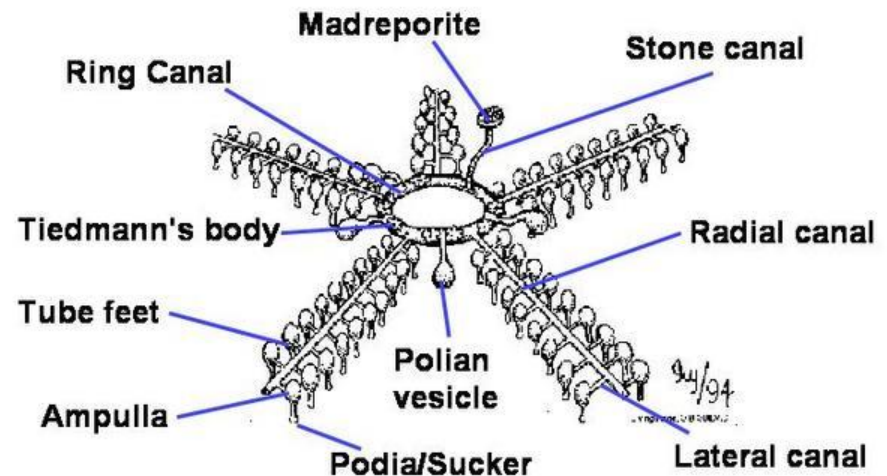
More Unique Features

- Autonomy = The spontaneous self amputation of an appendage when the organism is injured or under attack. The autotomized part is usually regenerated.
- “arms” → multiples of 5; some have more because of regeneration
- mutable collagenous tissue ~ connect ossicles; can maintain different positions without much effort



Locomotion/Musculature

- Utilize water vascular system and tube feet
- Water in from madreporite, pumped into ampulla by radial canal
- Ampulla contracts, water to podia
- Podia contracts, water to ampulla
 - Podia bend, shorten allows movement (vacuum and suction)



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