

Echinodermata Gr: spine skin

6500 spp all marine except for few estuarine, none freshwater

1) pentamerous radial symmetry (adults)

*larvae bilateral symmetrical

2) spines

3) endoskeleton

mesodermally-derived

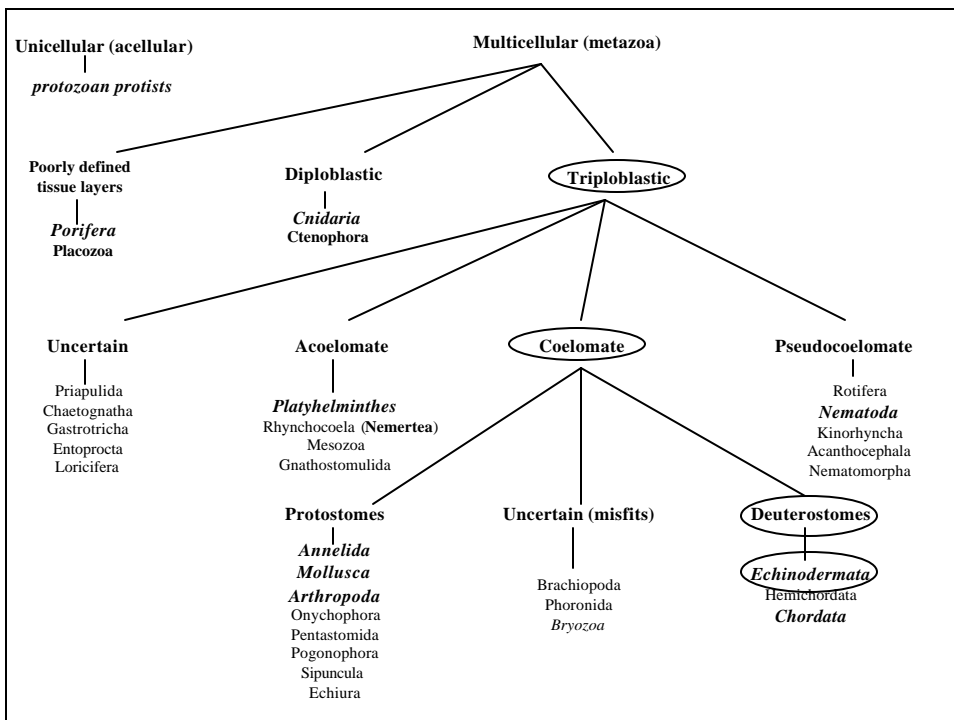
ossicles

calcareous plates

up to 95% CaCO_3 , up to 15% MgCO_3 , salts,
trace metals, small amount of organic materials

4) water vascular system (WVS)

5) tube feet (podia)



Echinodermata

Classes:

- 1) Asteroidea (Gr: characterized by star-like)
1600 spp
- 2) Ophiuroidea (Gr: snake-tail-like)
2100 spp
- 3) Echinoidea (Gr: hedgehog-form)
1000 spp
- 4) Holothuroidea (Gr: sea cucumber-like)
1200 spp
- 5) Crinoidea (Gr: lily-like)
stalked – 100 spp
nonstalked, motile comatulid
(feather stars)- 600 spp

Asteroidea sea stars/starfish

arms not sharply marked off
from central star shaped disc

spines fixed

pedicellariae

ambulacral groove open

tube feet with suckers on oral side

anus/madrepore aboral



Figure 22.01

**Pincushion star, *Culcita navaeguineae*,
preys on coral polyps,
small organisms & detritus**

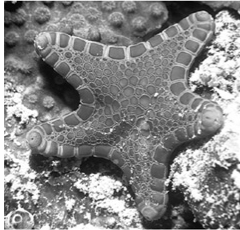
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A



**B *Choriaster granulatus* scavenges
dead animals on shallow Pacific reefs**



C

**On the Great Barrier Reef, *Tosia queenslandensis*
browses encrusting organisms**



**D Crown-of-thorns star, *Acanthaster planci*
forages on corals**

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Figure 22.02a

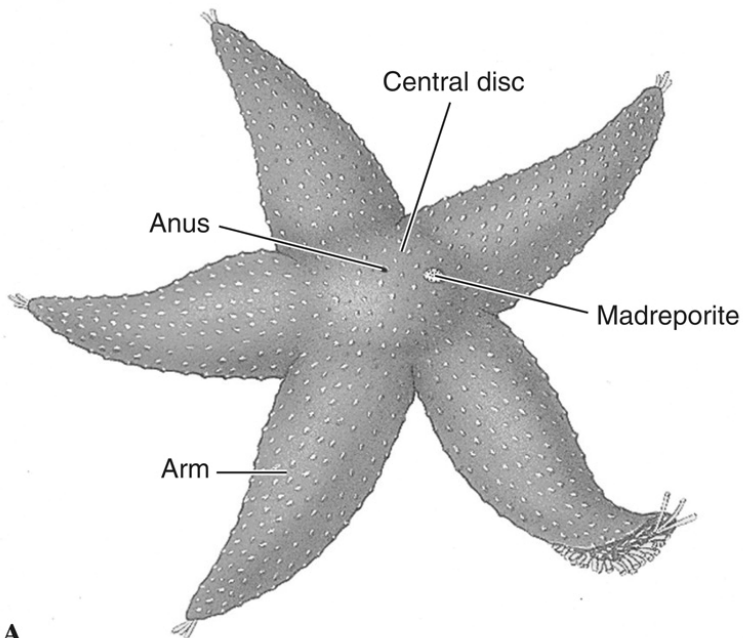


Figure 22.02b

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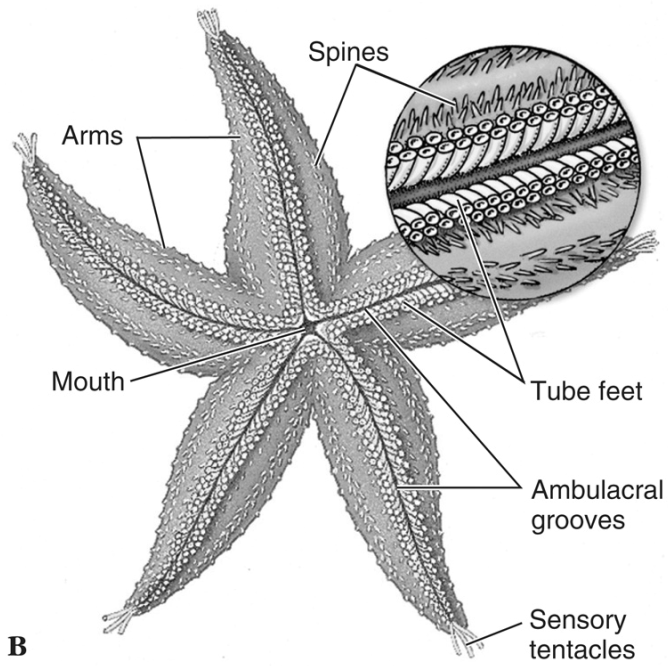


Figure 22.03a

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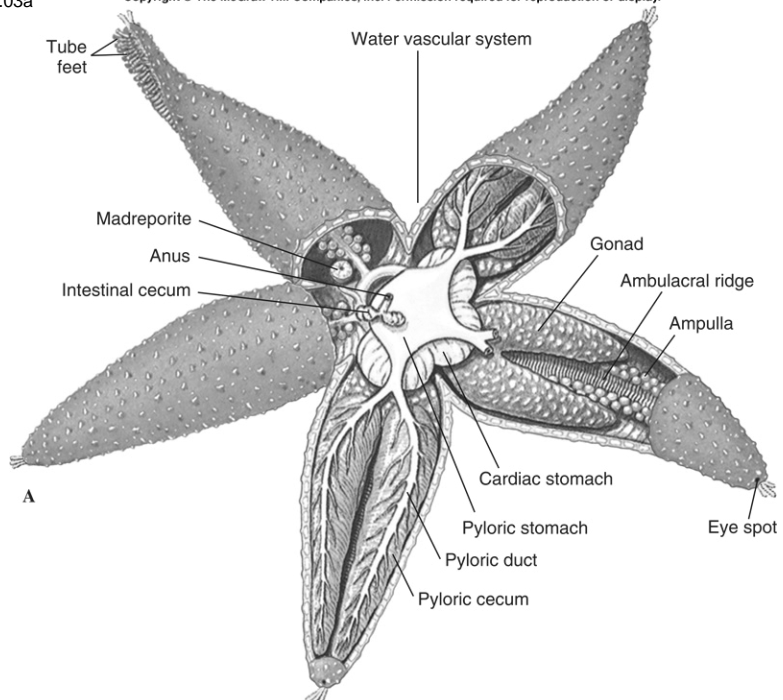


Figure 22.03b

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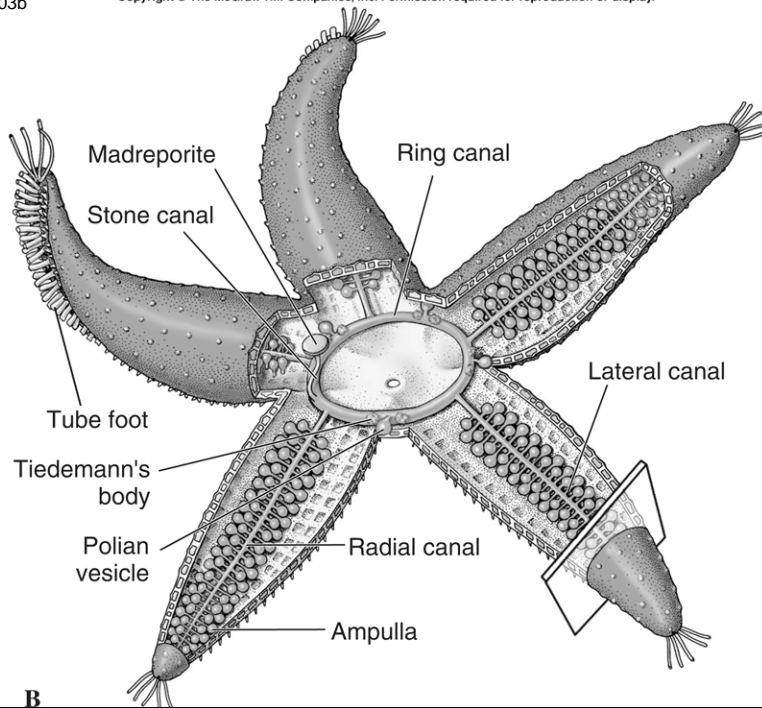


Figure 22.03c

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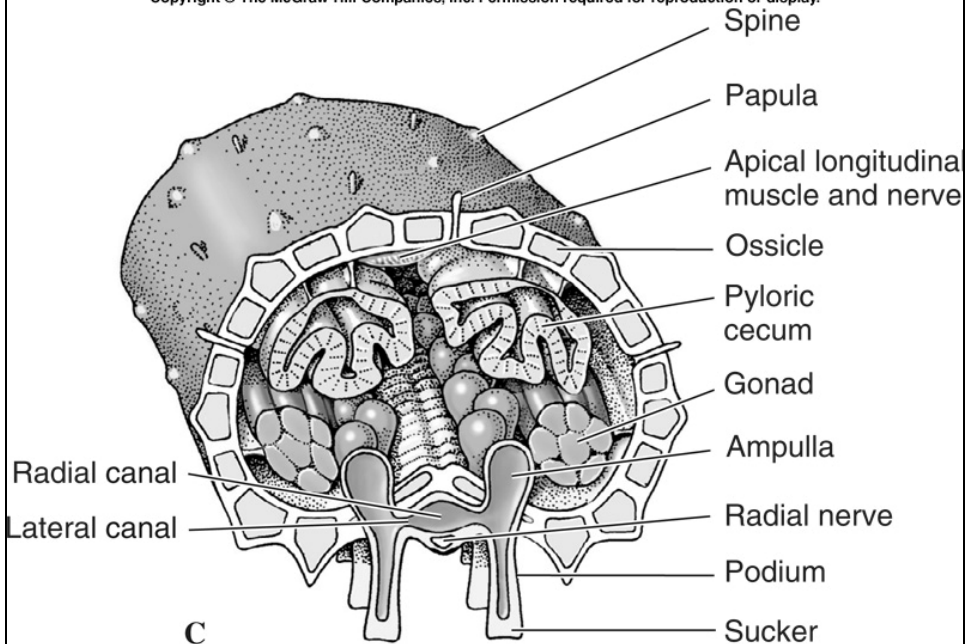


Figure 22.04

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Pedicellaria

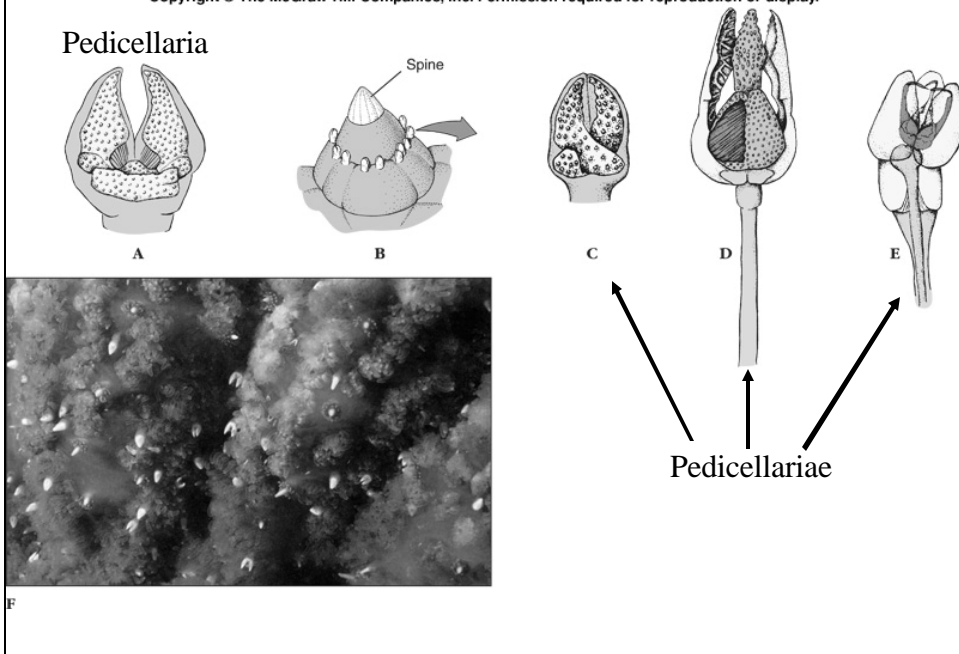


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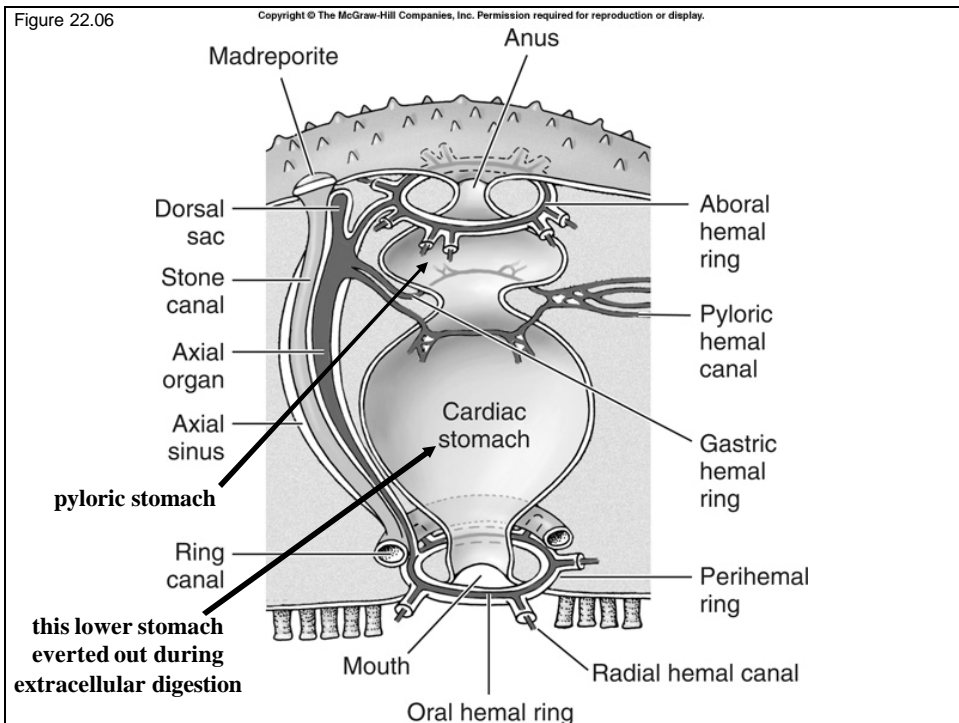


Figure 22.05

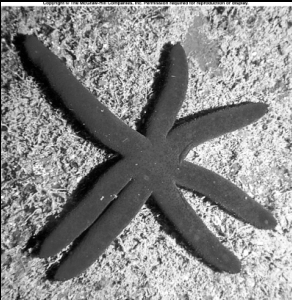
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A *Orthasterias koehleri* eating a clam



B Sun star, *Pycnopodia helianthoides*
(with 20-24 arms) eating sea urchin



Pacific sea star,
Echinaster luzonicus:
regeneration



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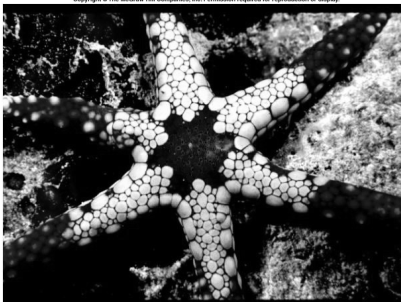


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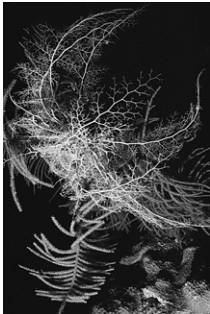


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Ophiuroidea brittle star/basket star



brittle star, *Ophiura lutkeni*



basket star, *Astrophyton muricatum*

arms separate from star shaped central disc

spines on arms

tube feet

without suckers

not used for locomotion

used for feeding

no pedicellariae

no anus

ambulacral groove closed & covered by ossicles

Figure 22.11

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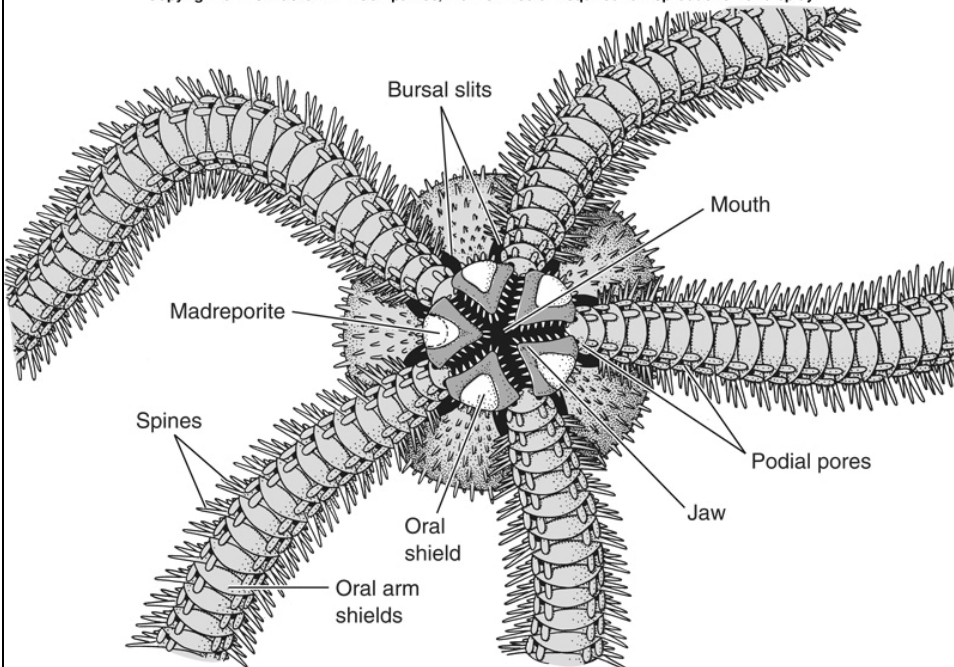


Figure 22.12

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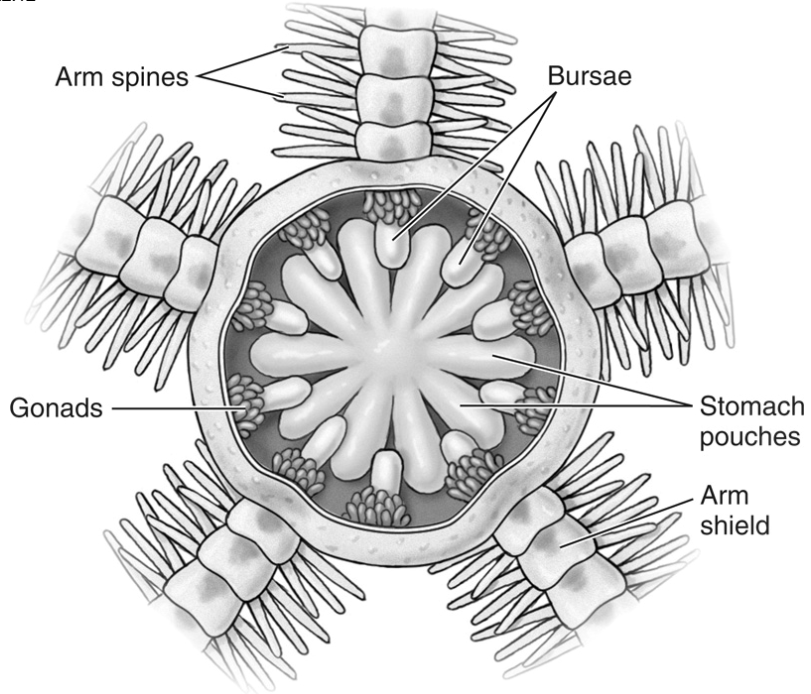
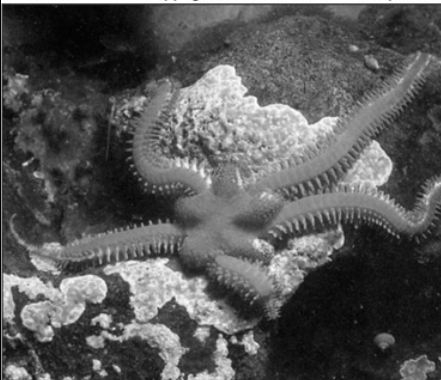
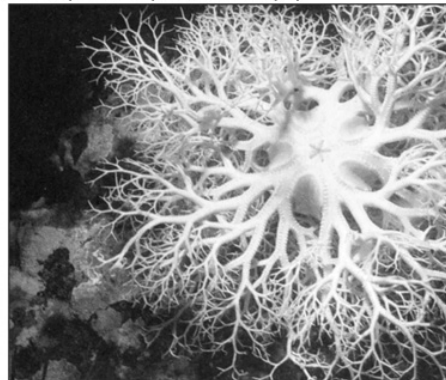


Figure 22.13

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A Brittle star, *Ophiopholis aculeata*
Note swollen bursae & regenerating arms



B Basket star, *Gorgoncephalus eucnemis*
Note pentamerous radial symmetry

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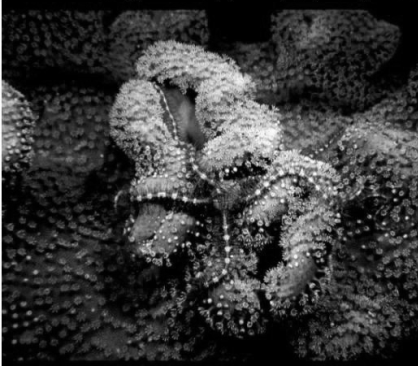


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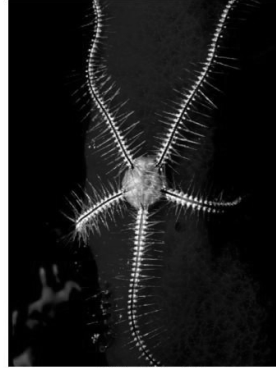


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Echinoidea sea urchins, sea biscuits & sand dollars

globular/disc shape

endoskeletal ossicles fused

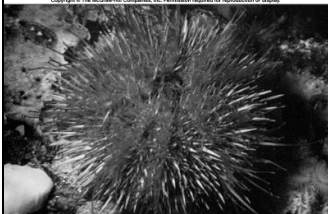
no arms

movable spines (ball & socket)

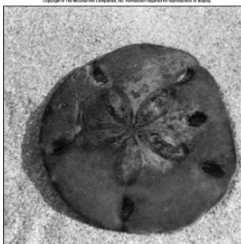
pedicellariae (3 jawed)

tube feet with suckers

ambulacral groove closed & covered by ossicles



Sea urchin, *Strongylocentrotus purpuratus*



B Sand dollar, *Encope micropora*

Figure 22.18

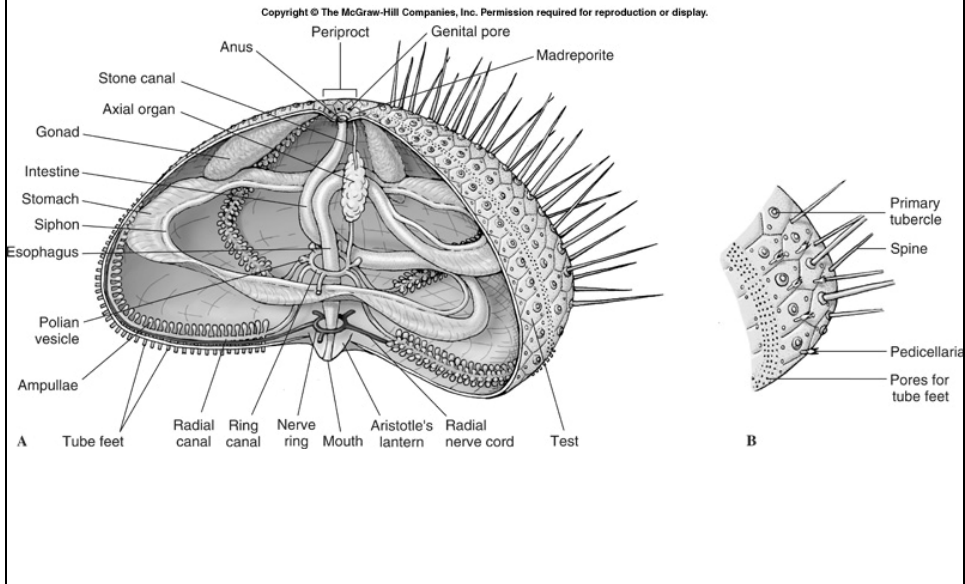
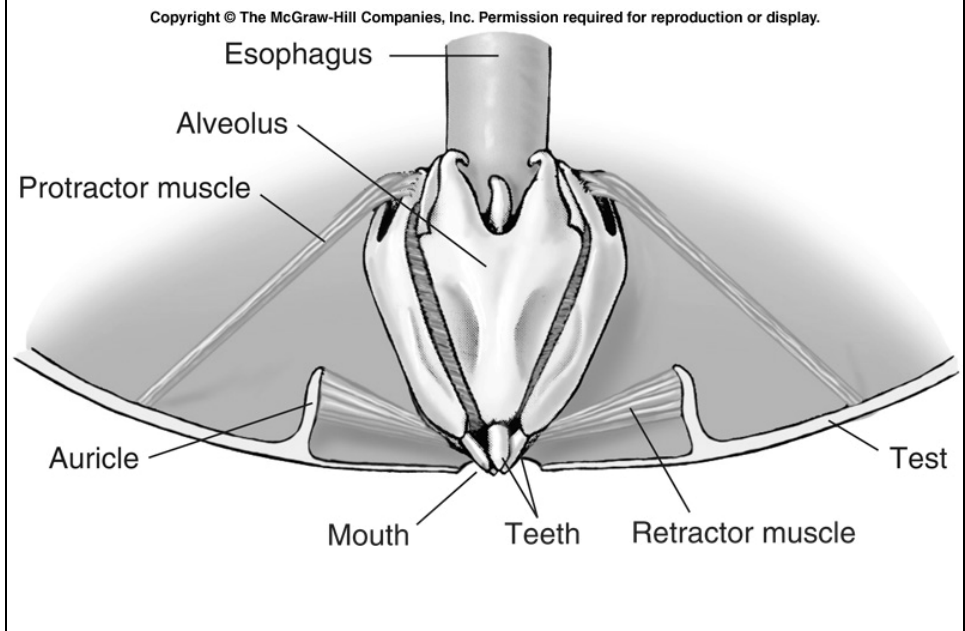


Figure 22.19



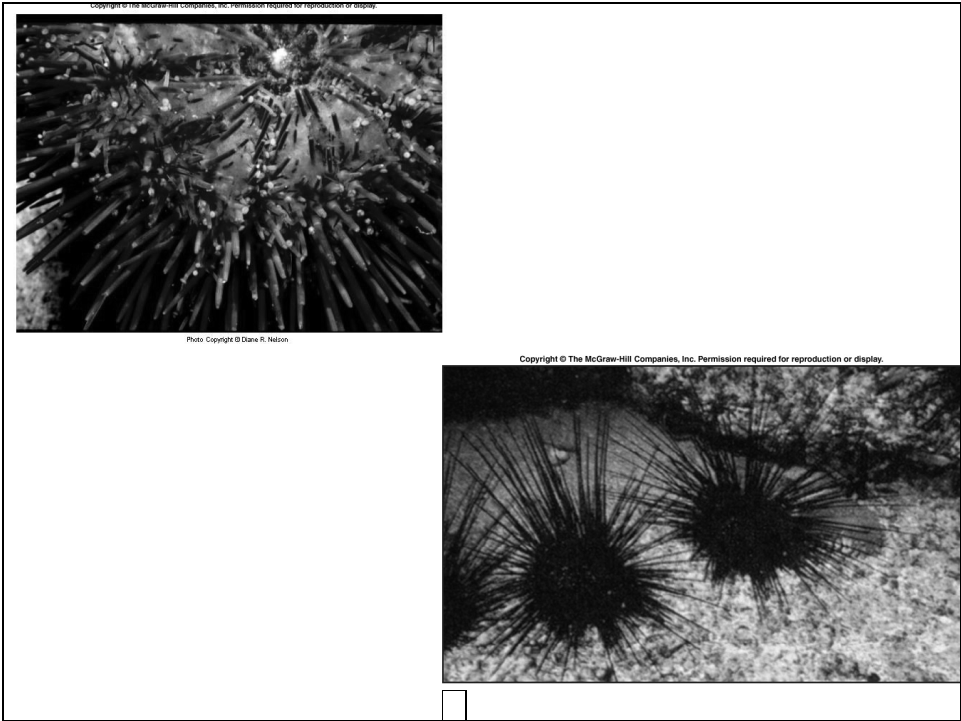
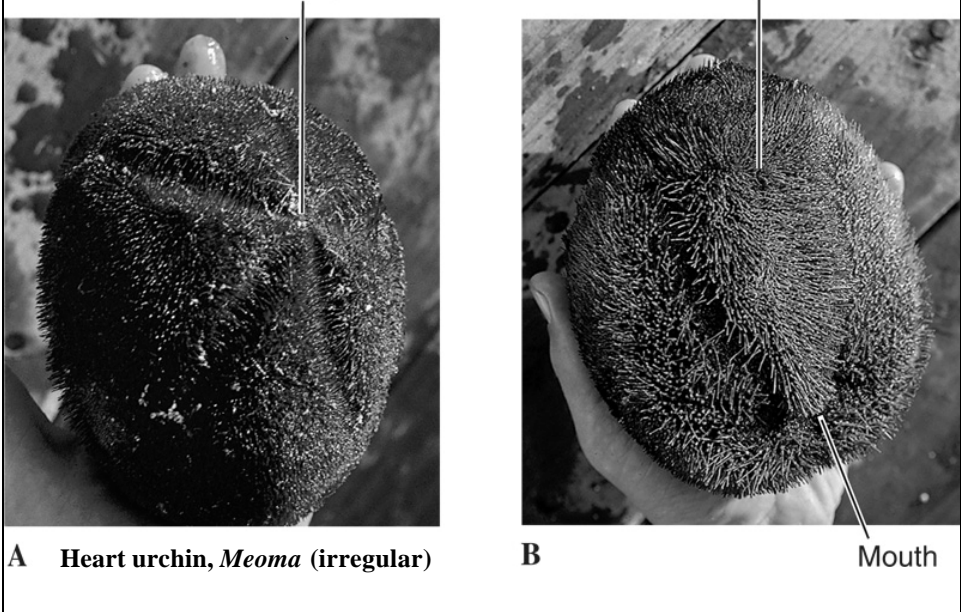


Figure 22.17

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sand dollars
burrowing

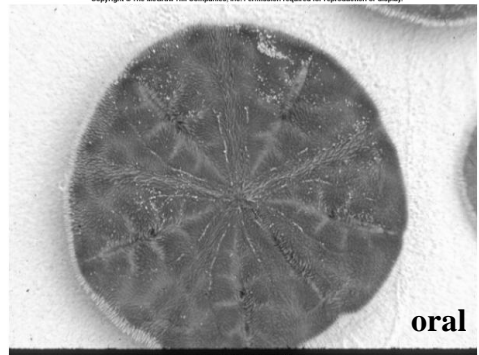
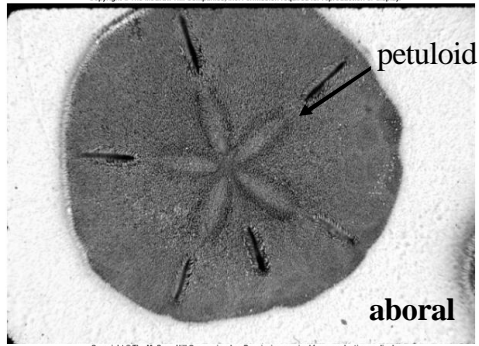
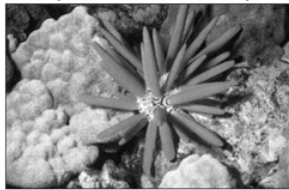


Figure 22.15

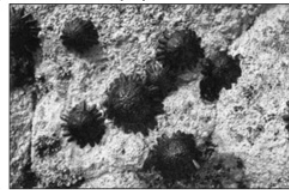
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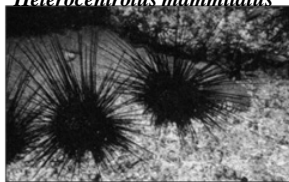
A Ten-lined pencil urchin, *Eucidaris metularia* from the Red Sea (retain ancestral characters from Paleozoic)



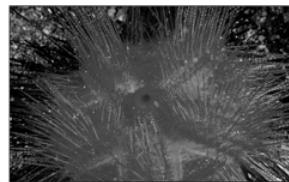
B Slate-pencil urchin, *Heterocentrotus mammillatus*



C *Colobocentrotus atraus*



D *Diadema antillarum* from West Indies & Florida



E *Astropyga magnifica*

Holothuroidea

sea cucumbers

cucumber shaped (bilateral symmetrical)

endoskeletal ossicles dispersed

no arms

no spines

no pedicellariae

tube feet with suckers

ambulacral groove closed & covered by ossicles



ossicles

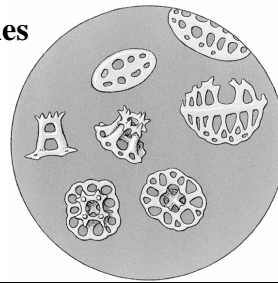
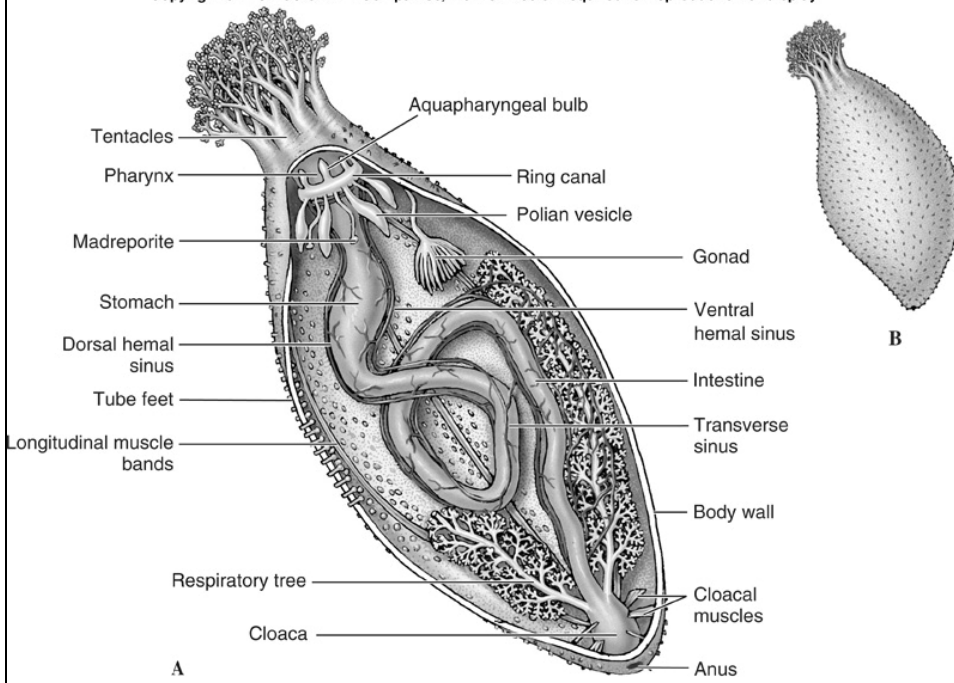
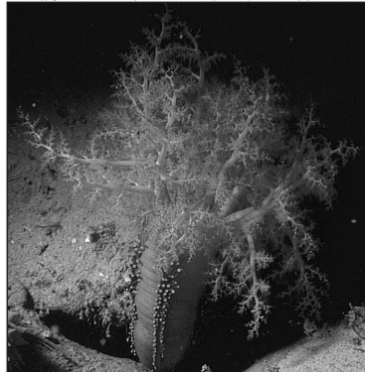
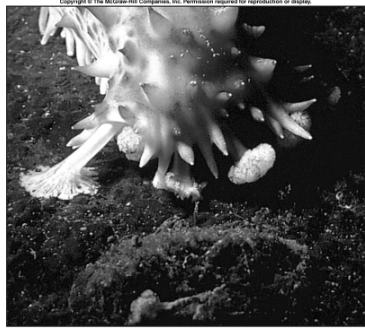
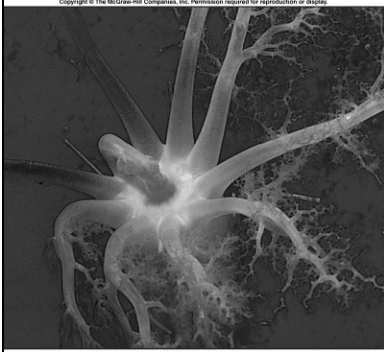


Figure 22.22

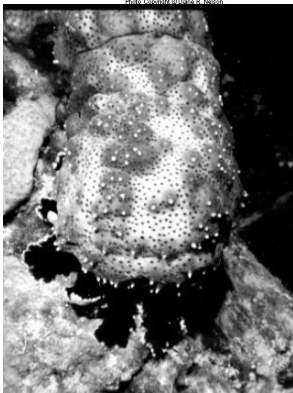
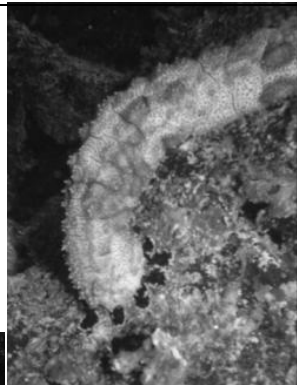
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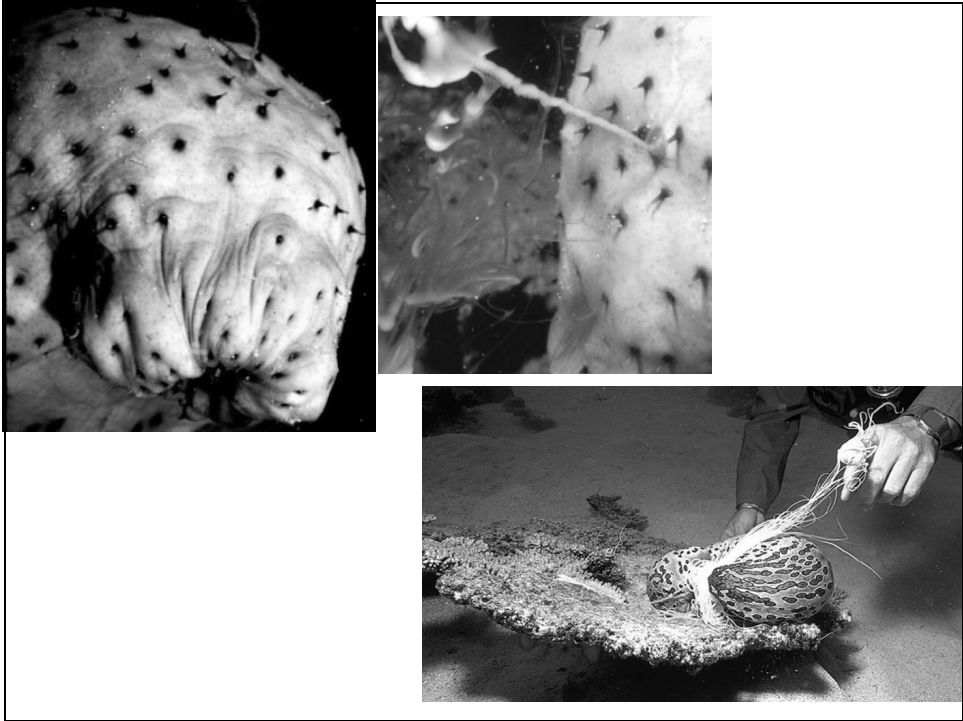




B

C





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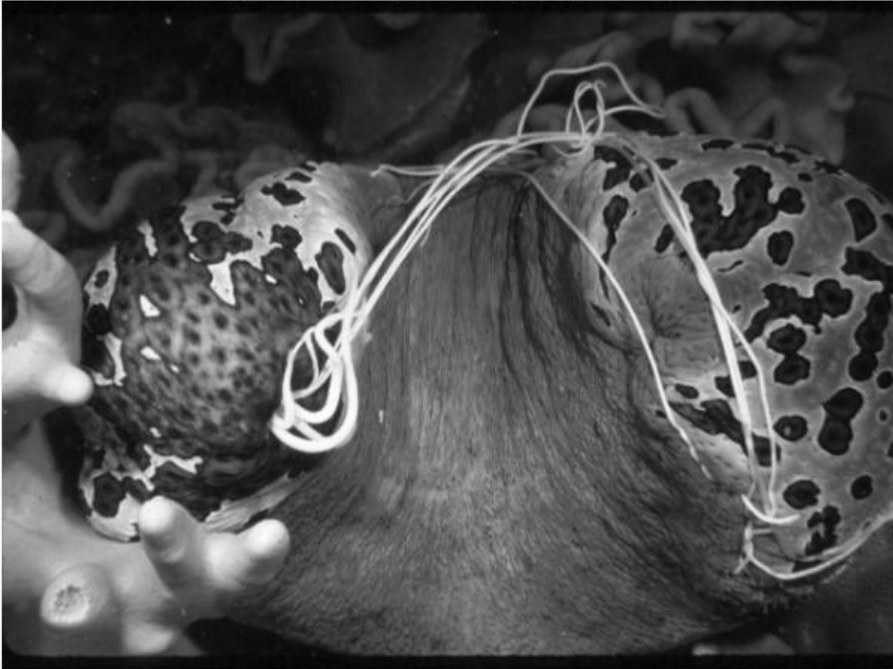
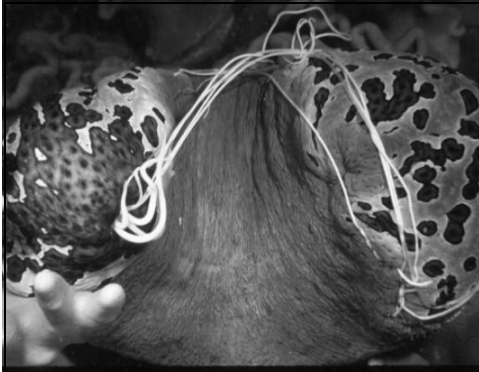


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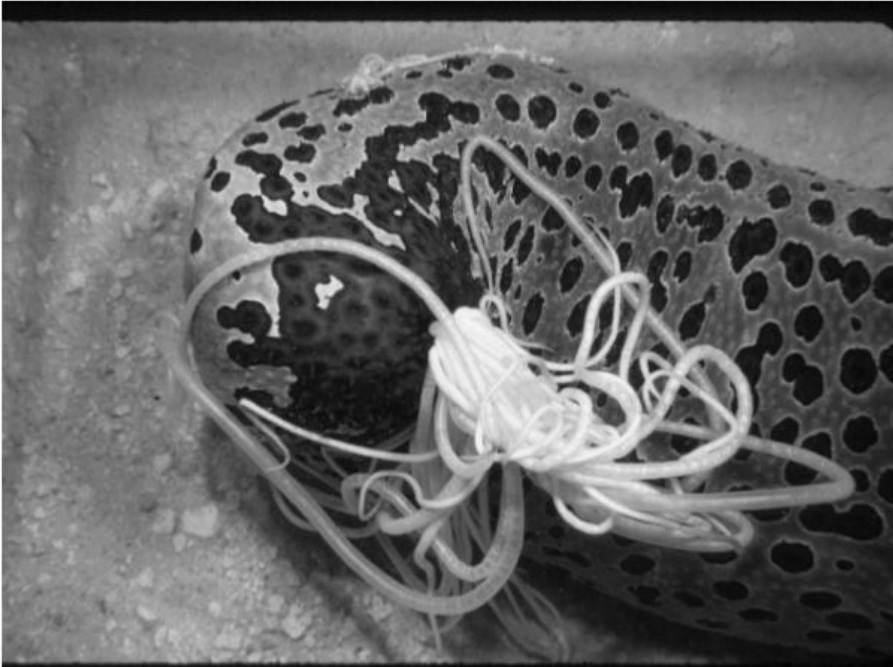


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Crinoidea sea lilies/feather stars

aboral attachment stalk of dermal ossicles

no spines

five branching arms with side branches (pinnules)

no pedicellariae

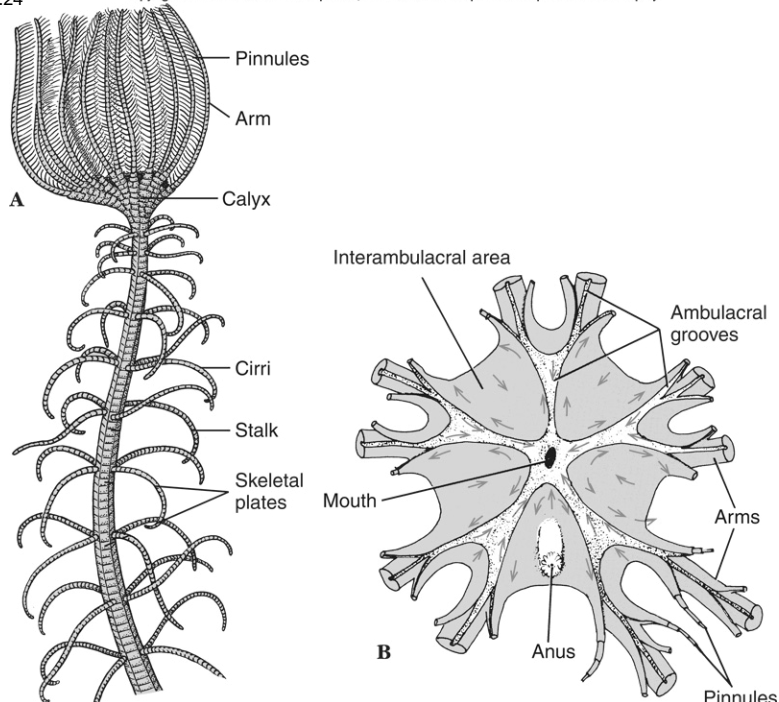
ciliated ambulacral groove on oral surface

tube feet tentacle-like on oral surface for food collecting

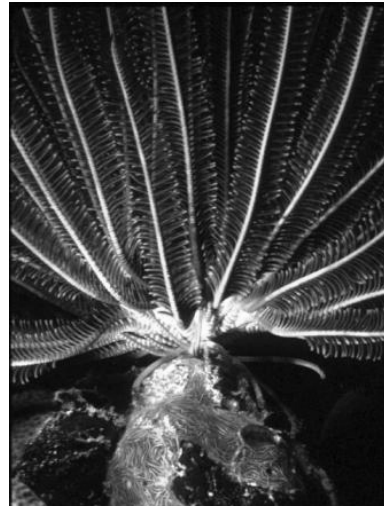
anus on oral surface

Figure 22.24

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feather stars



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Class: Concentricycloidea

sea daisies: only 2 spp
1 cm diameter 1000 m deep New Zealand

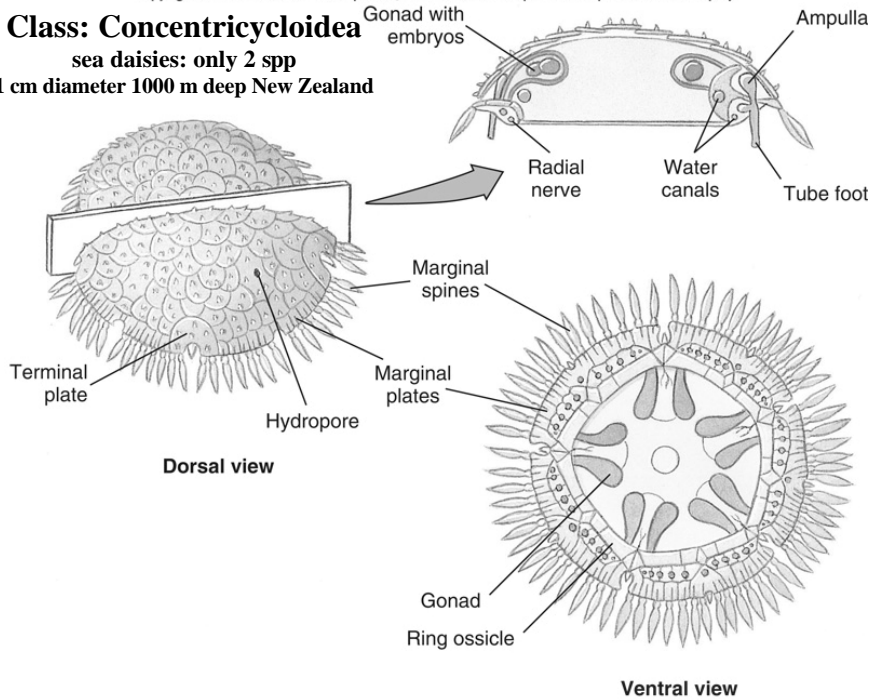
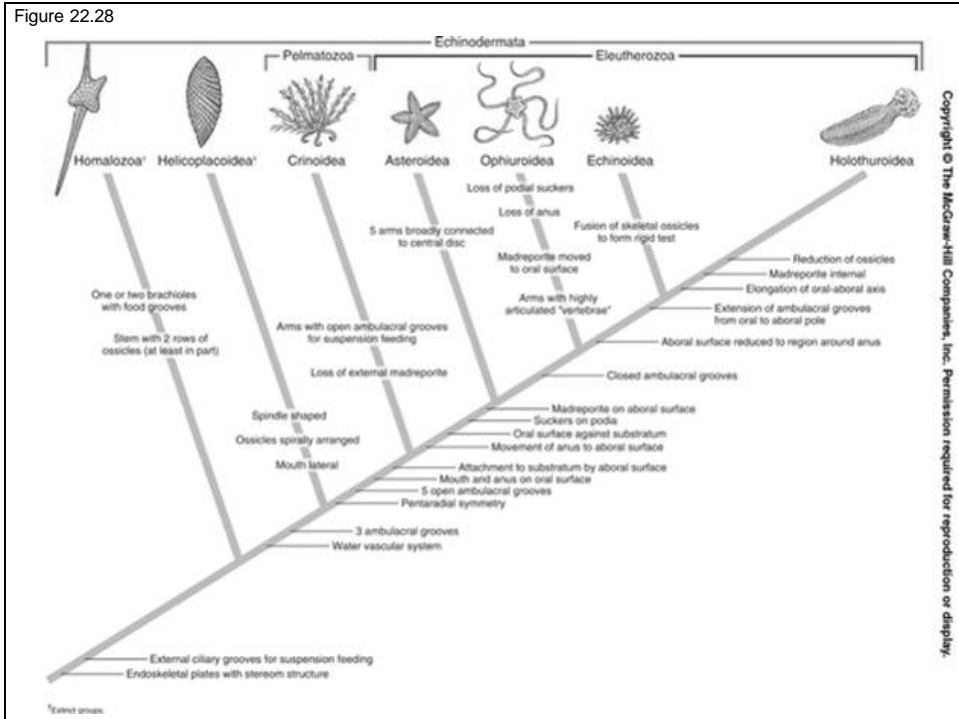


Figure 22.28



Echinoderm Larvae

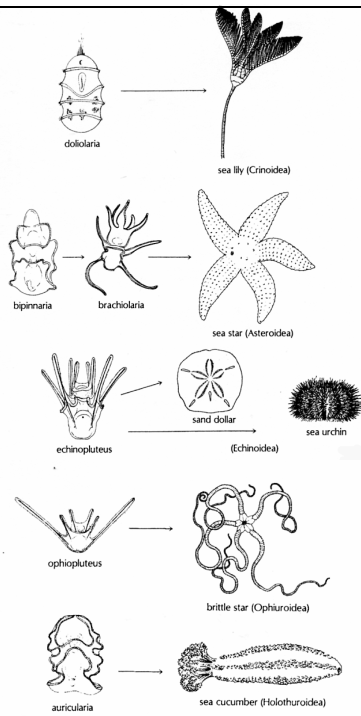
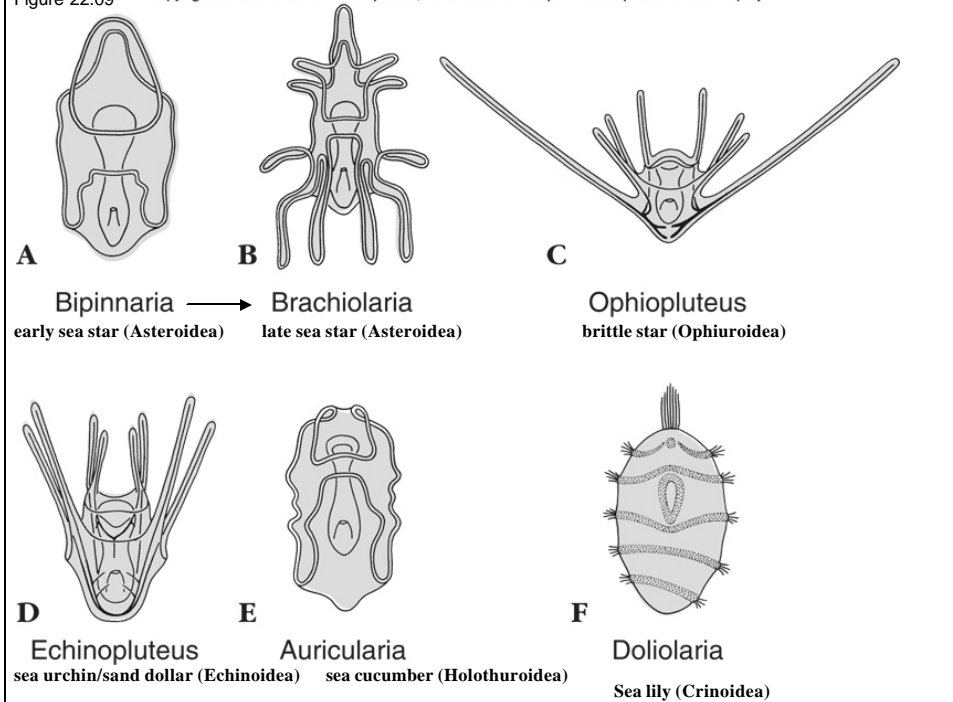


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Importance of Echinoderms

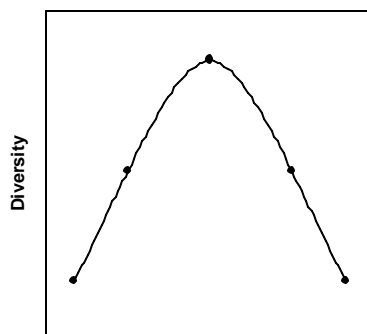
I. Developmental biology

sea urchin egg/sperm → elucidate the jelly membrane surrounding a recently fertilized egg

II. Ecology keystone species

Kelp Forest/Mussel bed Communities

Intermediate Disturbance Hypothesis



Disturbance ← sea stars/sea urchins

Figure 22.34

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