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

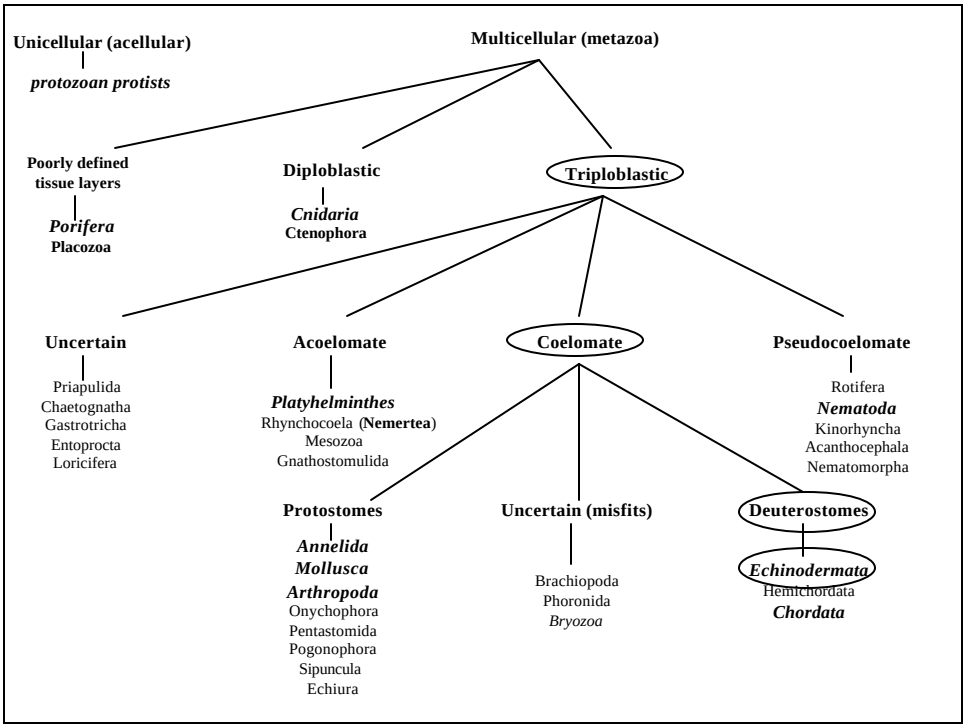
ossicles

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)



Chapter 14: 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/madreporite aboral

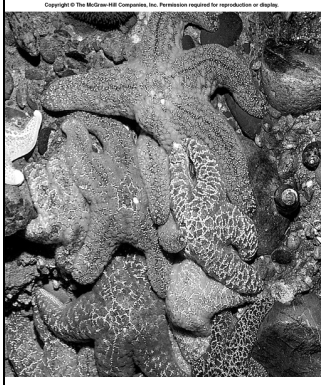
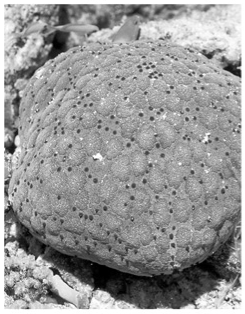


Figure 22.01

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



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**

Figure 22.02a

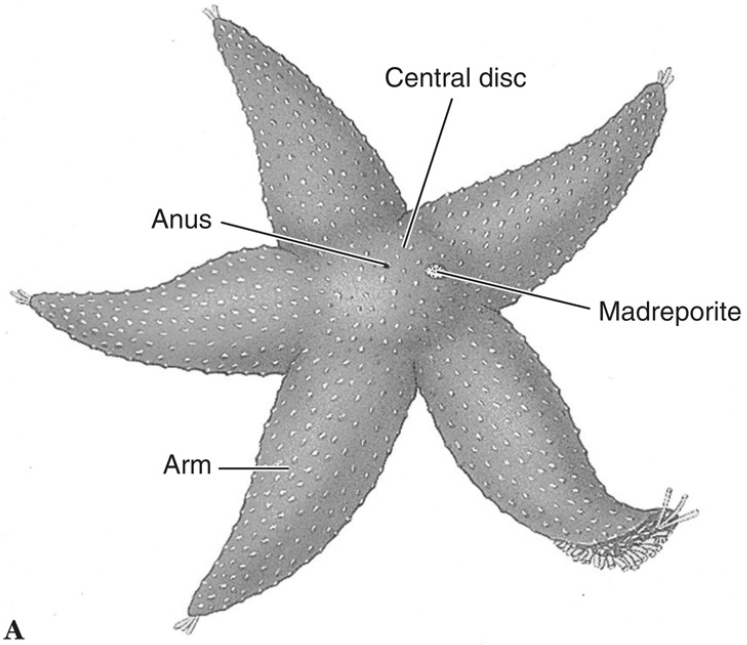


Figure 22.02b

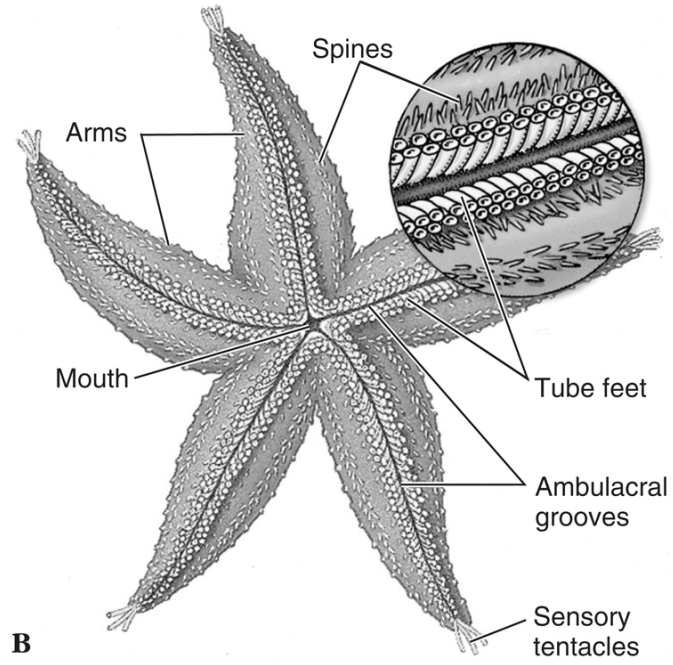


Figure 22.03a

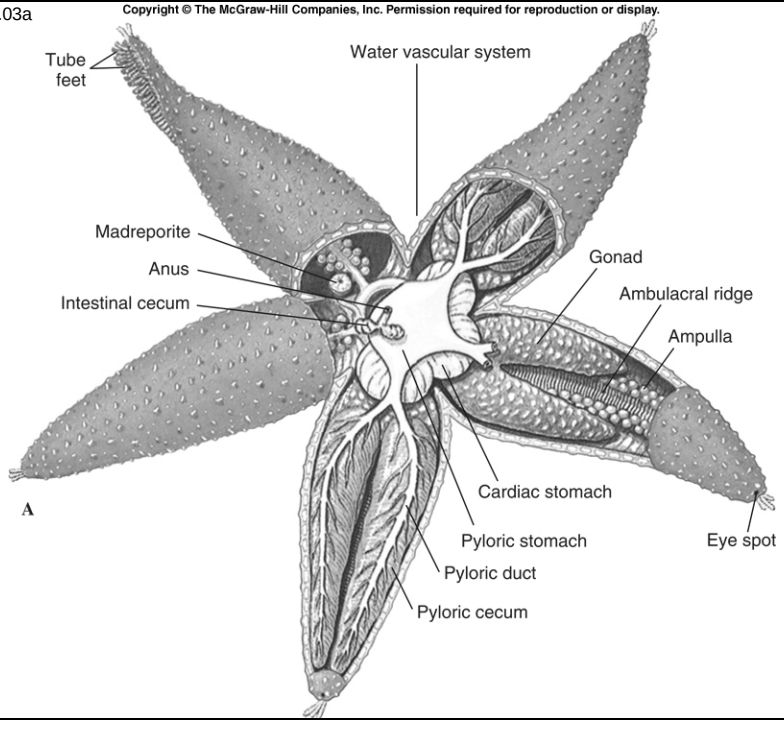


Figure 22.03b

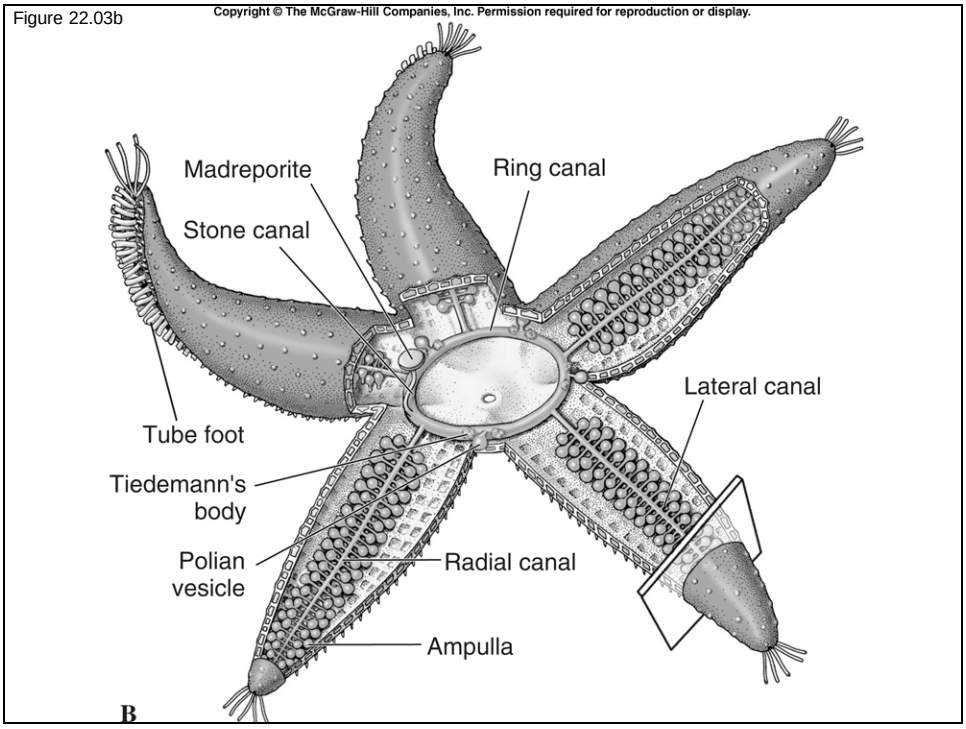


Figure 22.03c

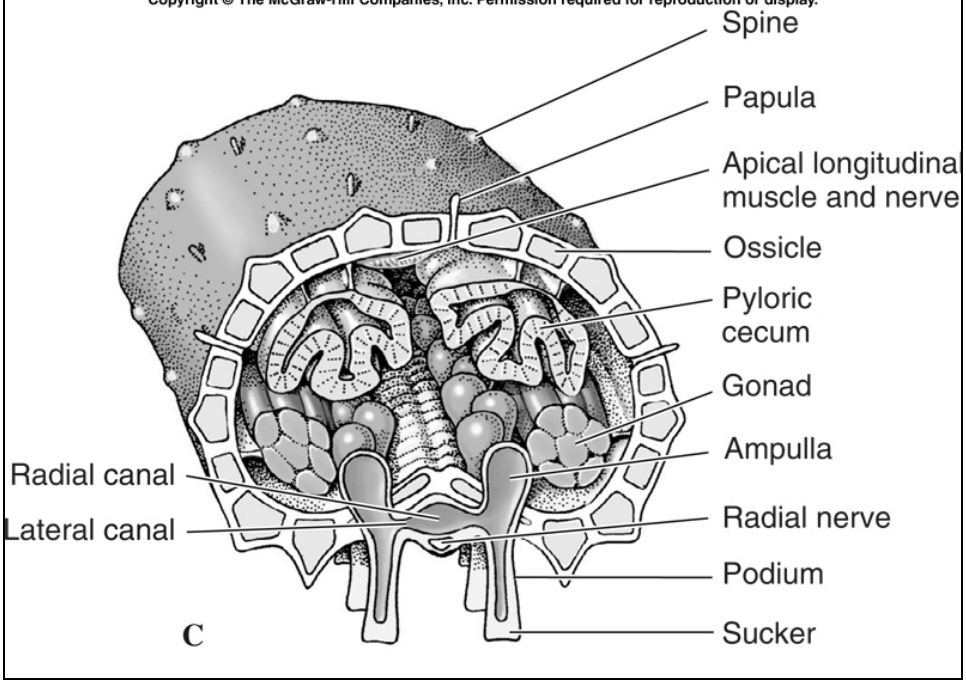


Figure 22.04

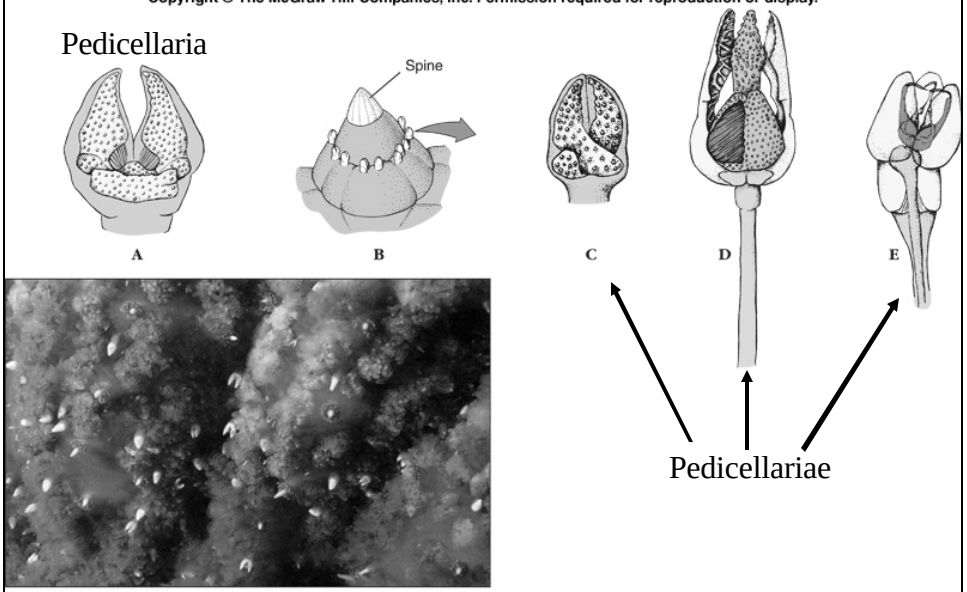


Figure 22.06

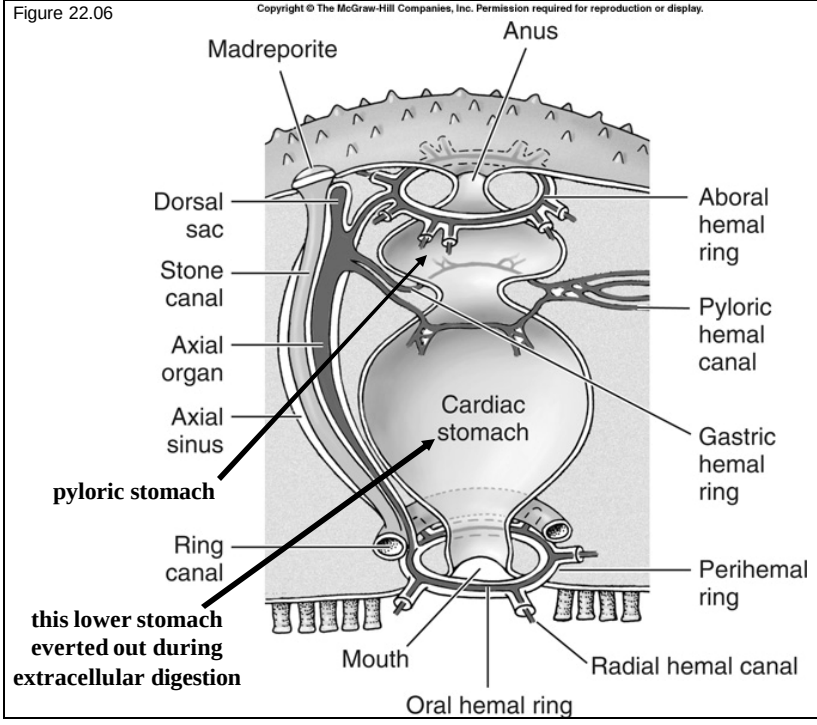
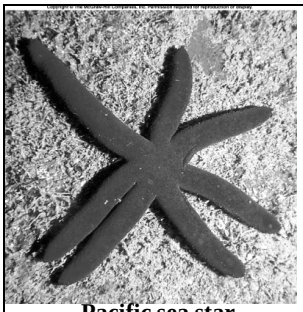


Figure 22.05

A ***Orthasterias koehleri*** **eating a clam**

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



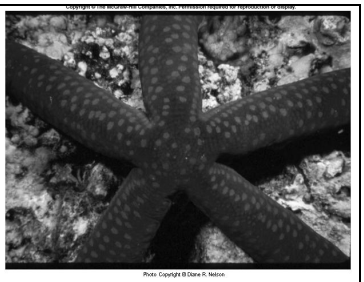


Photo: Copyright © Diane R. Nelson

Pacific sea star,
Echinaster luzonicus**:**
regeneration

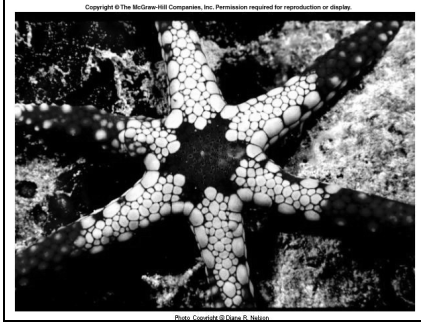


Photo: Copyright © Diane R. Nelson

Photo: Copyright © Diane R. Nelson

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

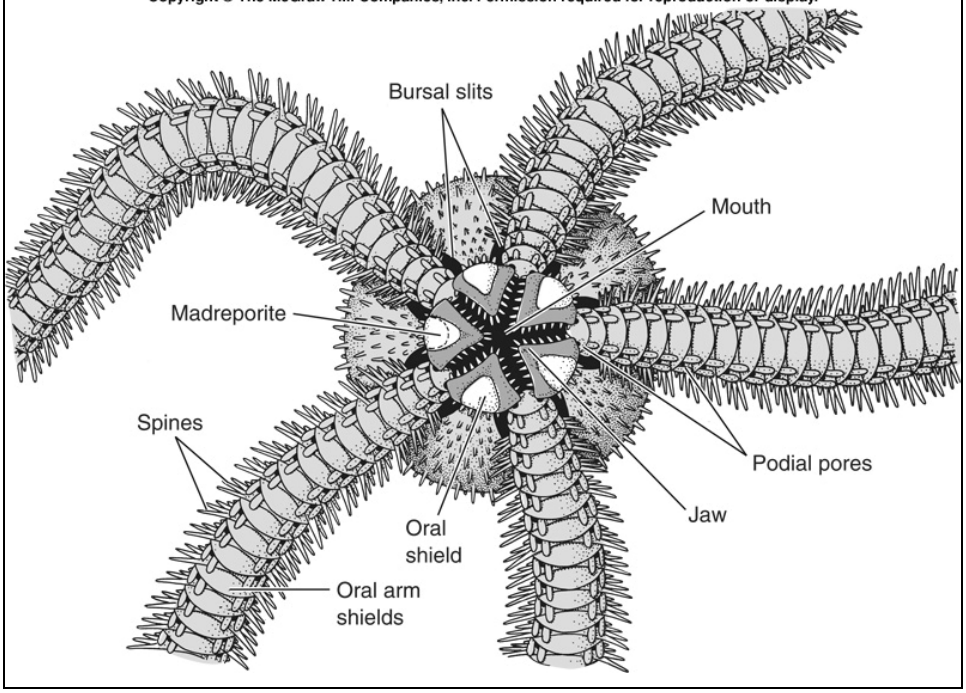


Figure 22.12

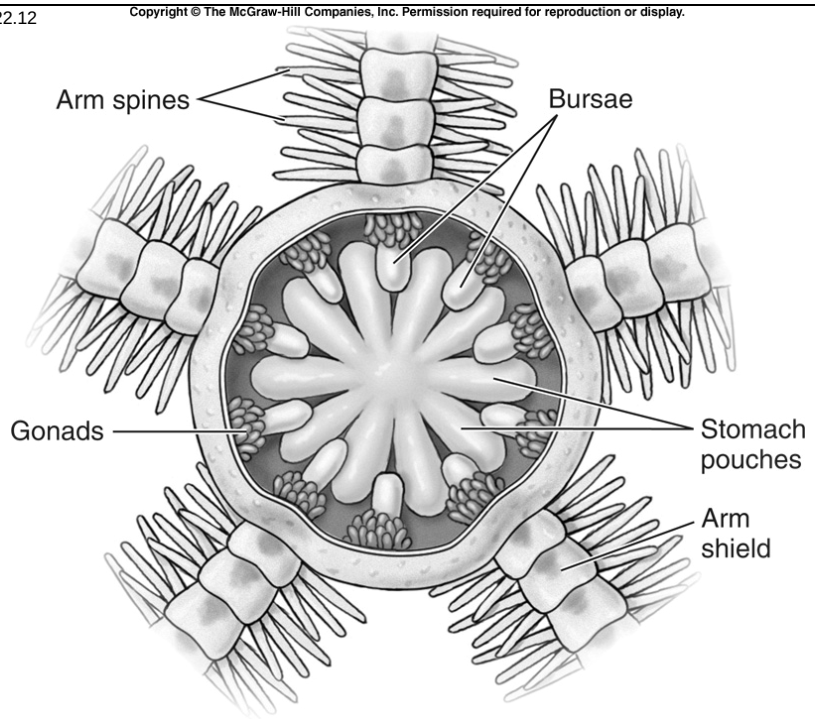
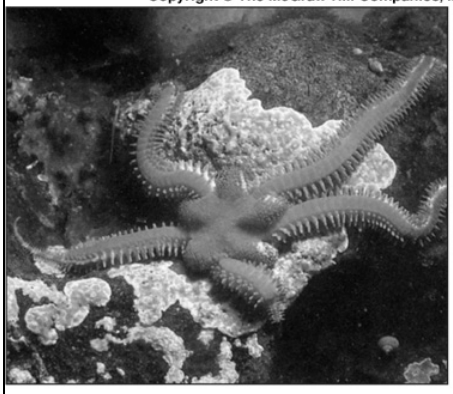
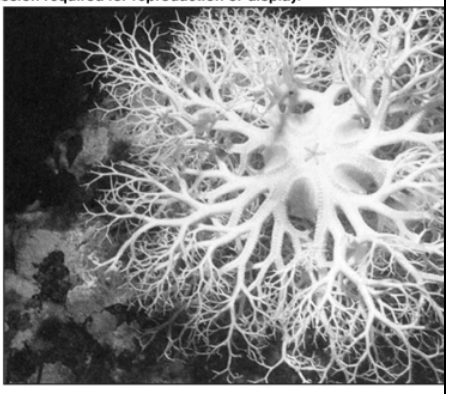


Figure 22.13

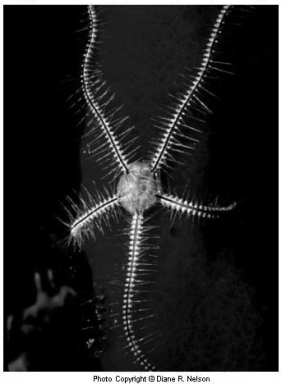


A **Brittle star, *Ophiopholis aculeata***
Note swollen bursae & regenerating arms



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

Photo Copyright © Diane R. Nelson



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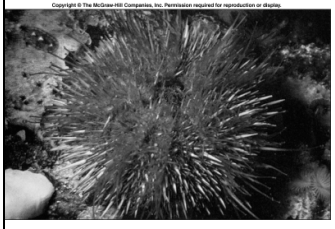
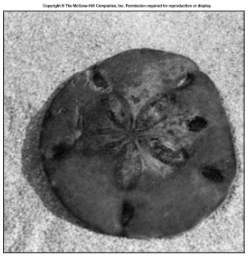
Echinoidea sea urchins, sea biscuits & sand dollars



Sea urchin, *Strongylocentrotus purpuratus*



B Sand dollar, *Encope micropora*

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

Figure 22.18

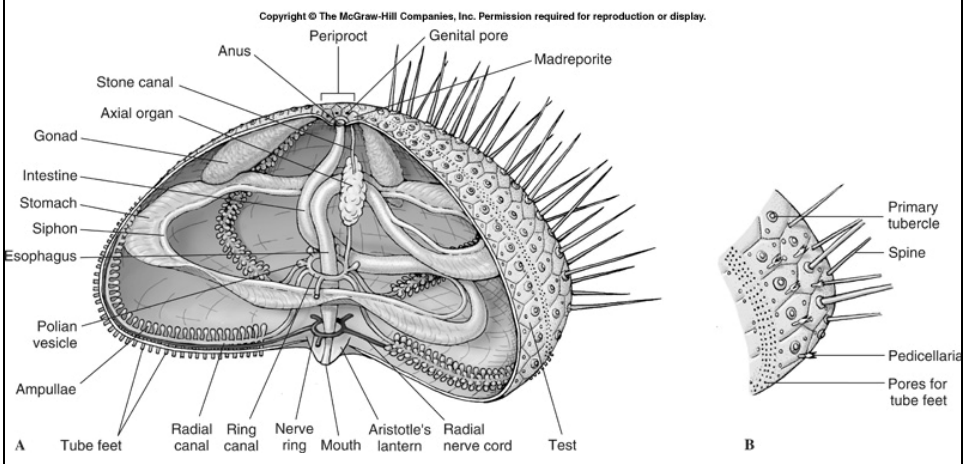
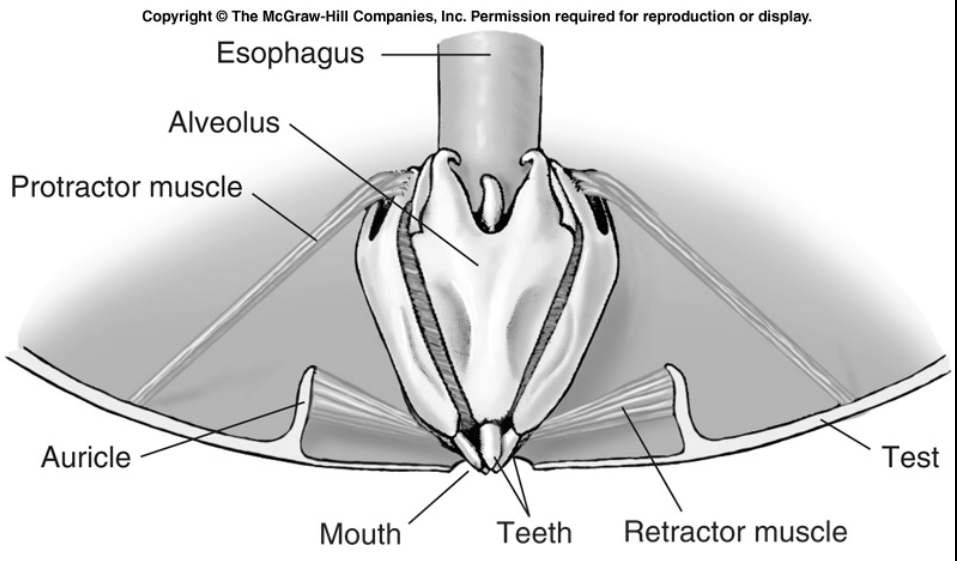


Figure 22.19



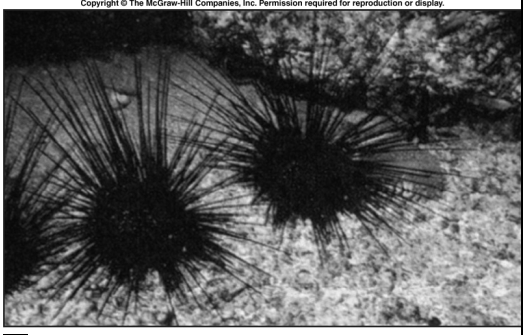
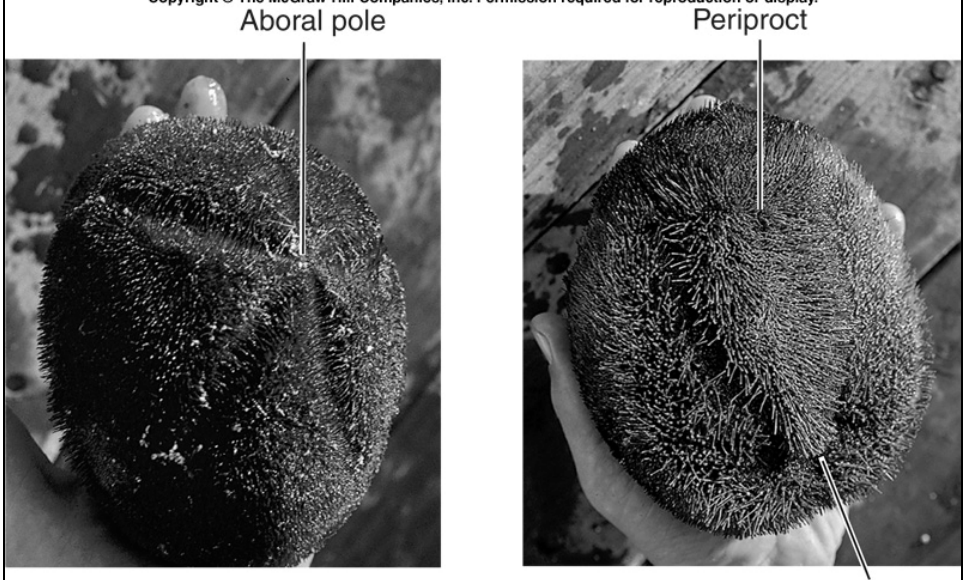


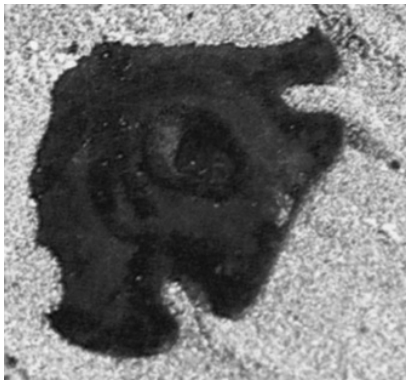
Figure 22.17

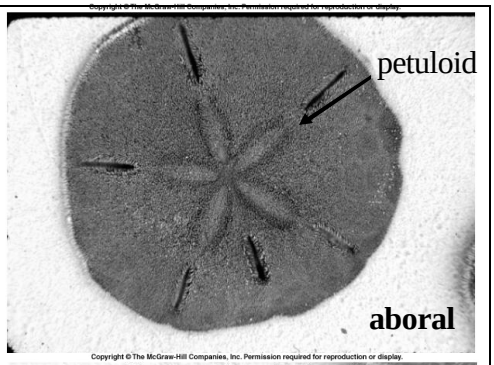


A **Heart urchin, *Meoma* (irregular)** **B**

sand dollars

burrowing





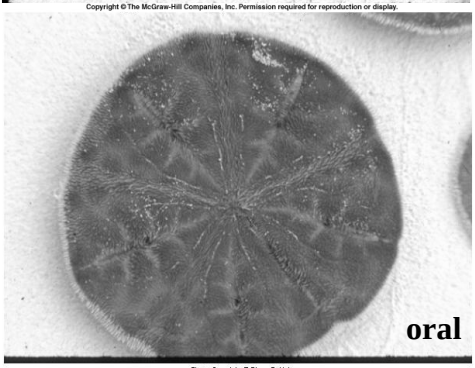
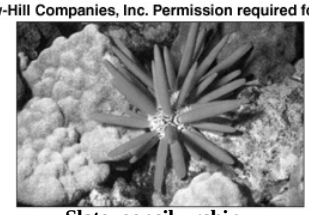
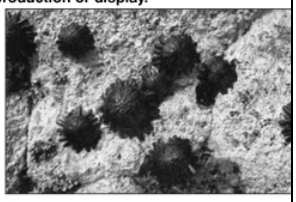


Figure 22.15

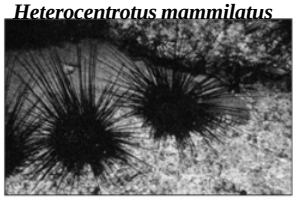
A **Ten-lined pencil urchin, *Eucidaris metularia* from the Red Sea (retain ancestral characters from Paleozoic**



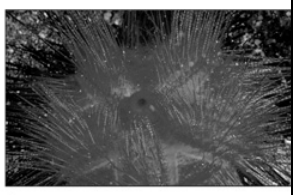
B **Slate-pencil urchin, *Heterocentrotus mammilatus***



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

Parastichopus californicus

ossicles

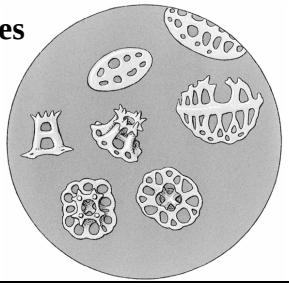
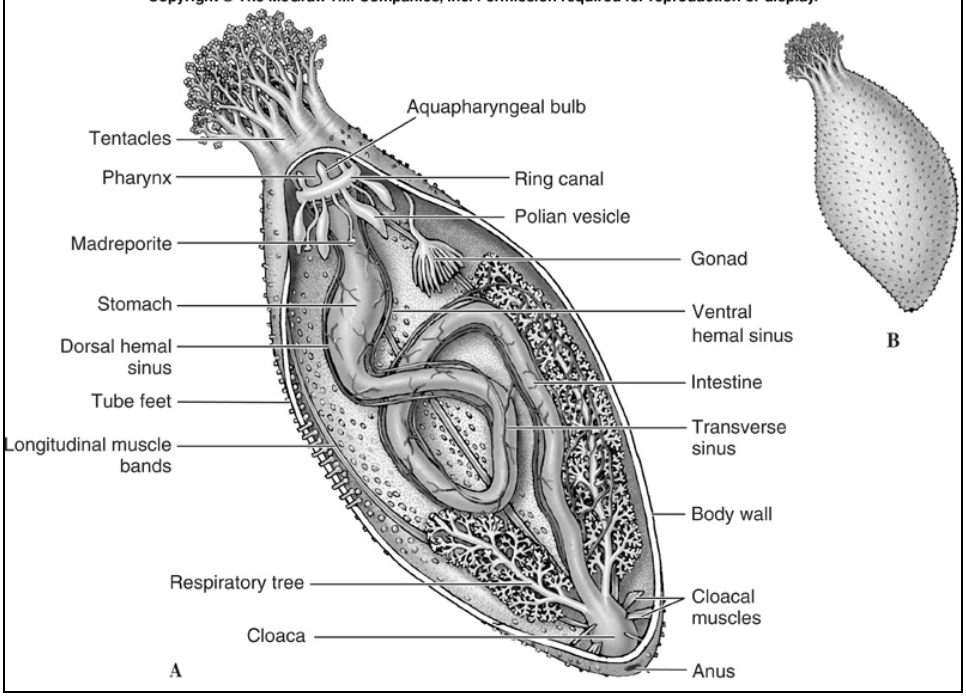
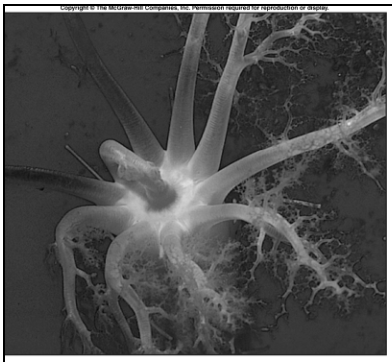


Figure 22.22





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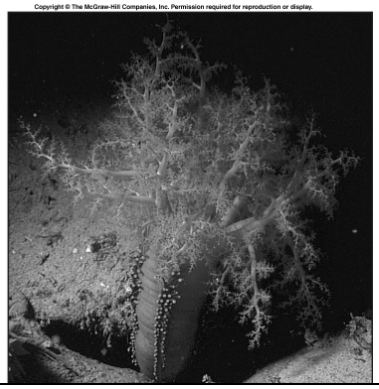

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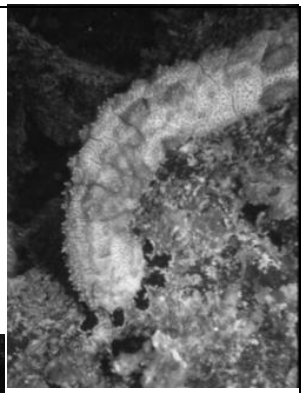
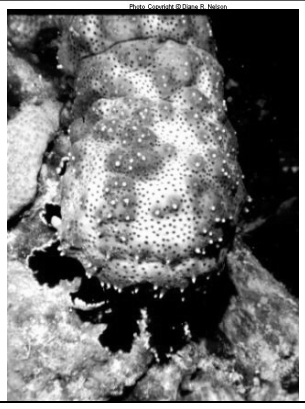
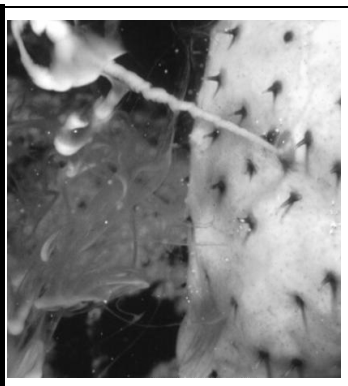
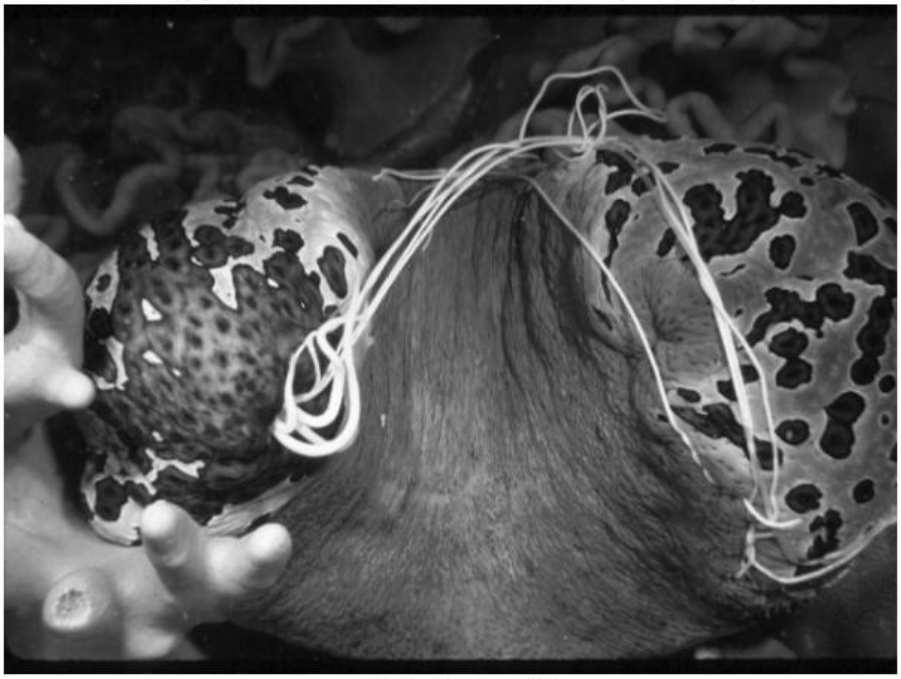
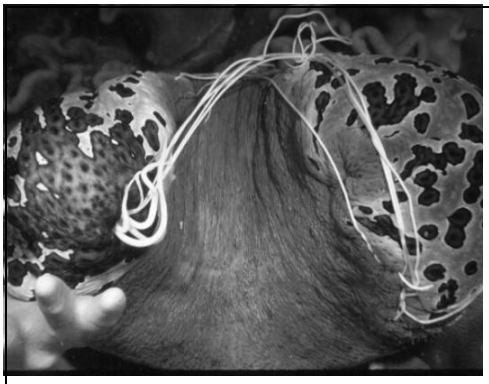
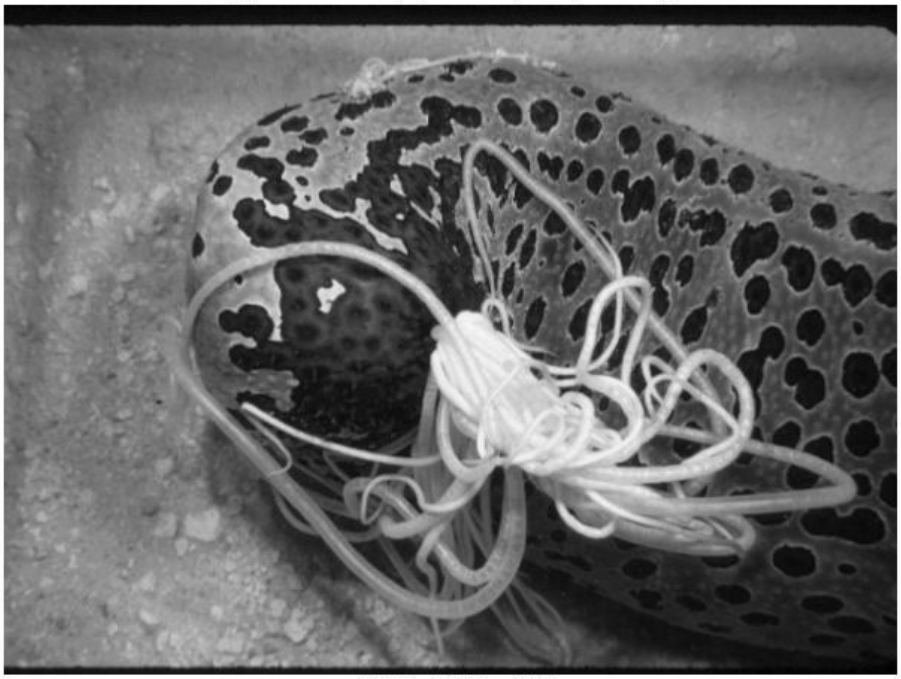












Crinoidea **sea lilies/feather stars**

aboral attachment stalk of dermal ossicles

no spines

five branching arms with side branches (pinnules)

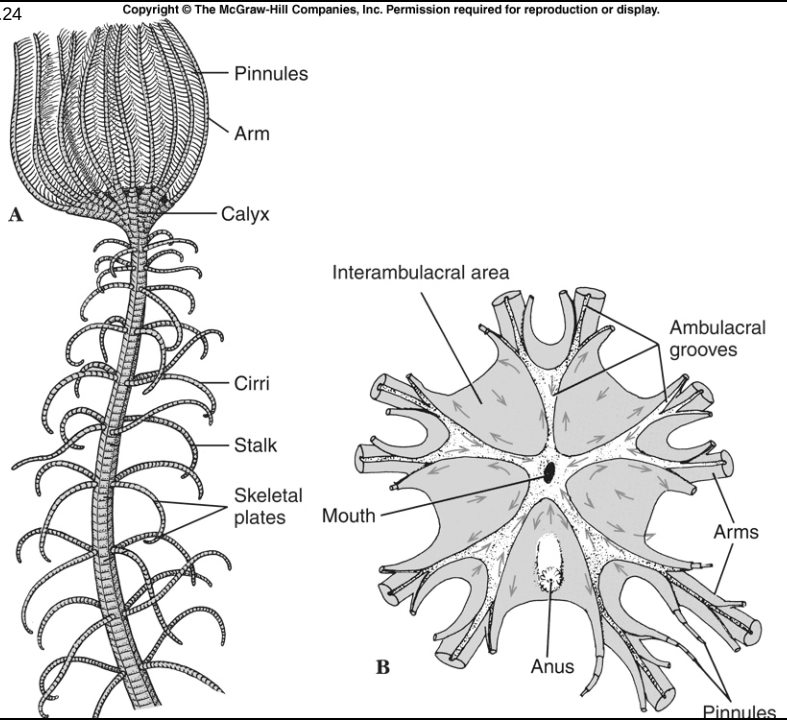
no pedicellariae

ciliated ambulacral groove on oral surface

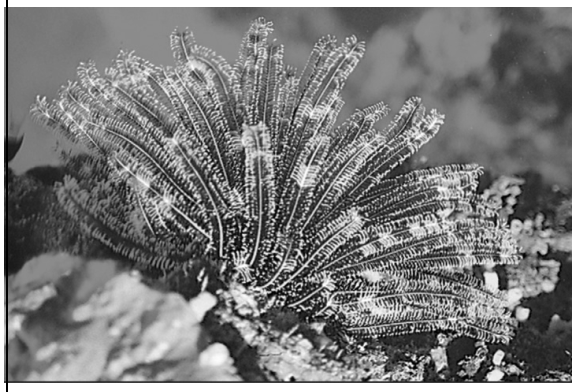
tube feet tentacle-like on oral surface for food collecting

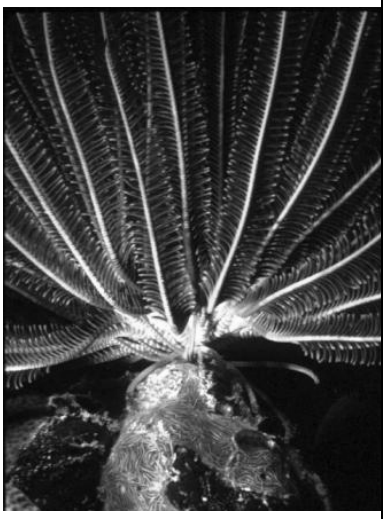
anus on oral surface

Figure 22.24



feather stars





Class: Concentricycloidea

sea daisies: only 2 spp

1 cm diameter 1000 m deep New Zealand

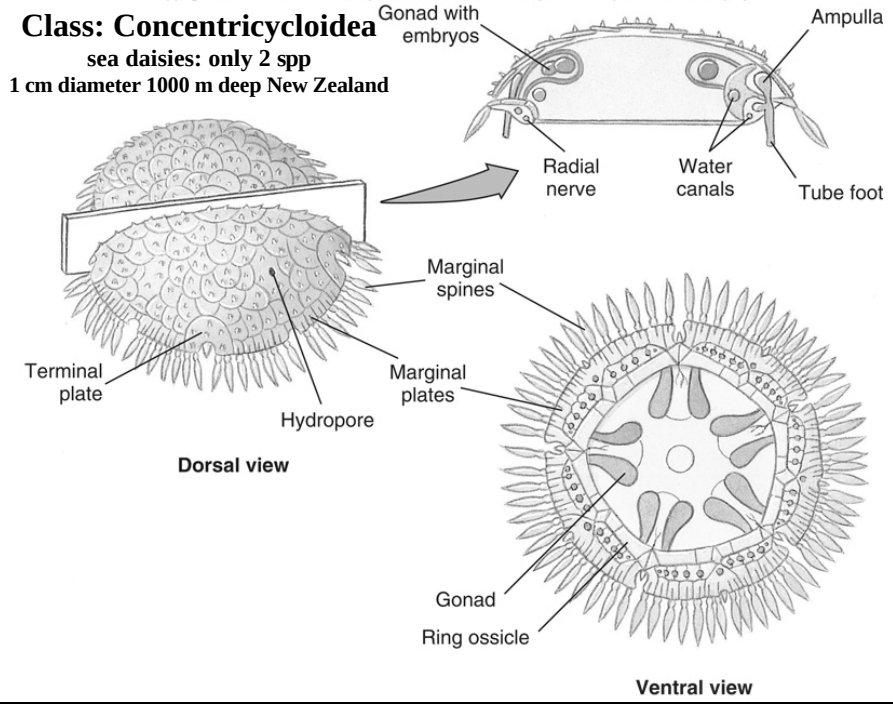
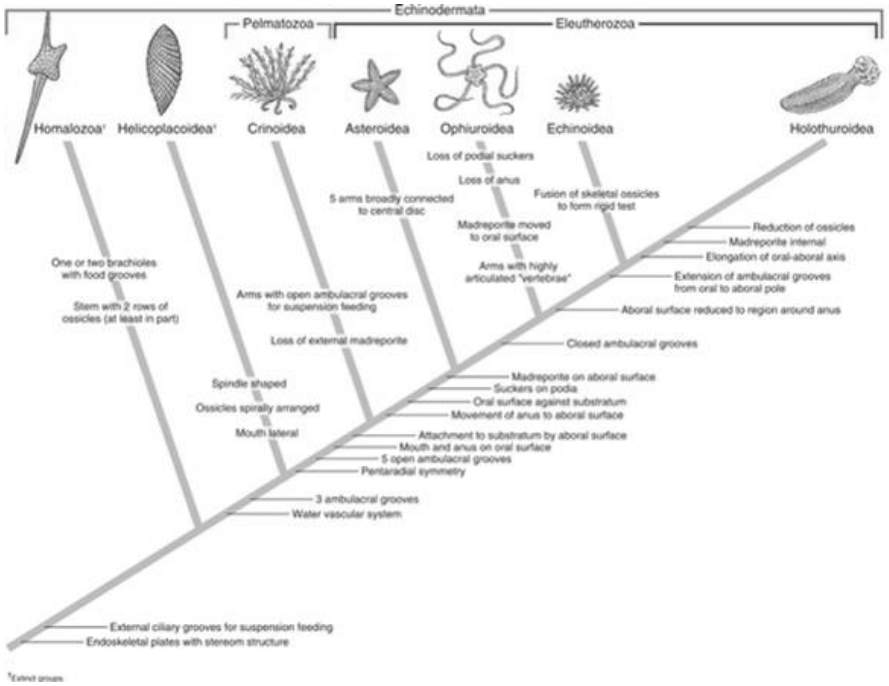


Figure 22.28



Echinoderm Larvae

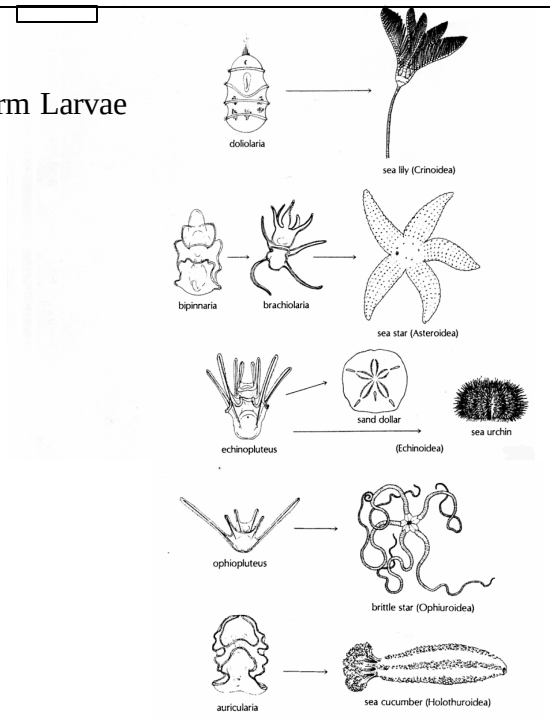
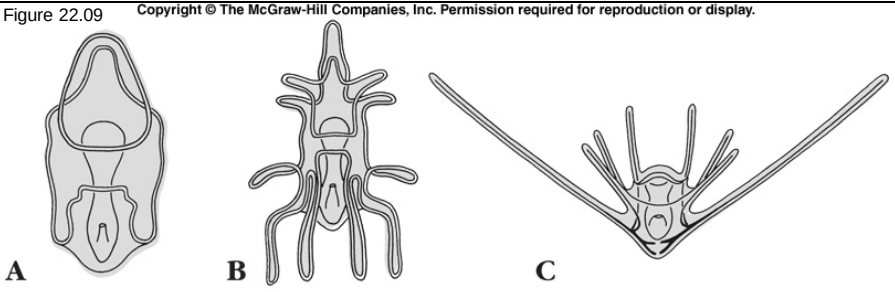
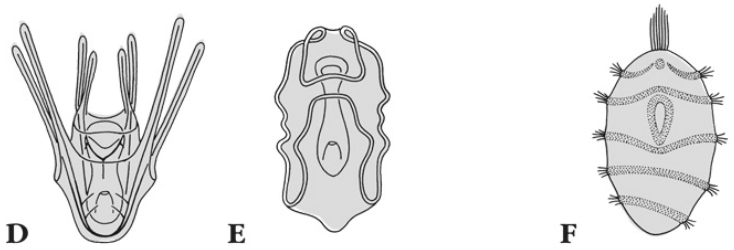


Figure 22.09



Bipinnaria → Brachiolaria
early sea star (Asteroidea) **late sea star (Asteroidea)**

Ophiopluteus
brittle star (Ophiuroidea)



Echinopluteus
sea urchin/sand dollar (Echinoidea)

Auricularia
sea cucumber (Holothuroidea)

Doliolaria
Sea lily (Crinoidea)

Importance of Echinoderms

I. Developmental biology

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

II. Ecology keystone species

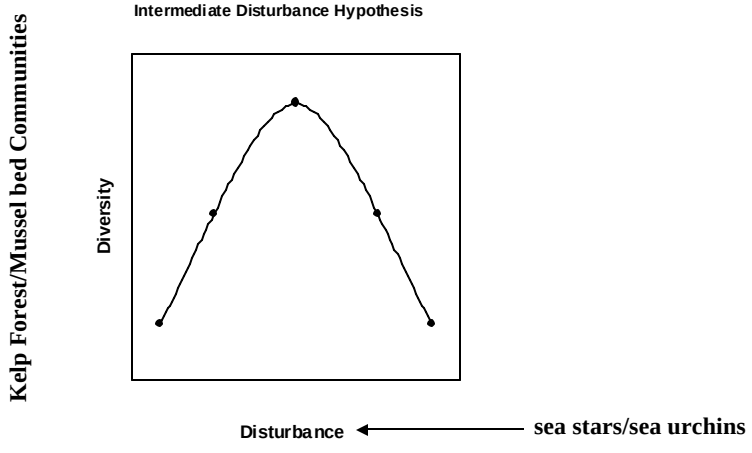


Figure 22.34