Cambrian and Ordovician periods

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Late Proterozoic 650 Ma

- Snowball earth
- Slushball earth

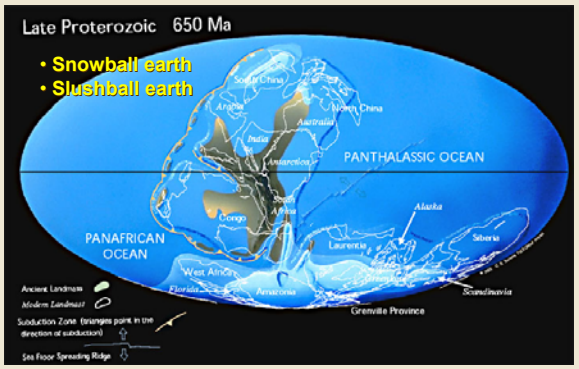

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Figure 20.9

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2

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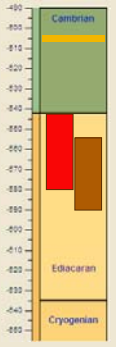
Early animal evolution



Burgess shale fossils
505 Ma

Ediacara fossils
580-542 Ma

Doushantou fossils
580-542 Ma

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Doushantuo fossils
590-565 Ma

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4
8:34 AM

Ediacaran fossils
580-542 Ma
(Mistaken point NFLD)

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Colonial choanoflagellates

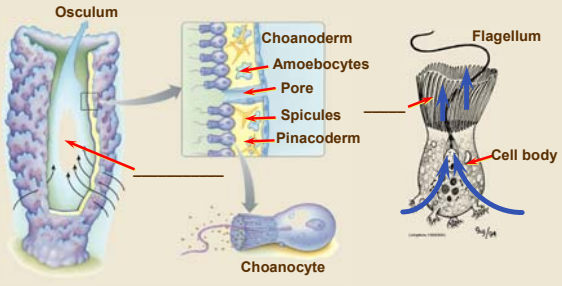

Figure 26.8

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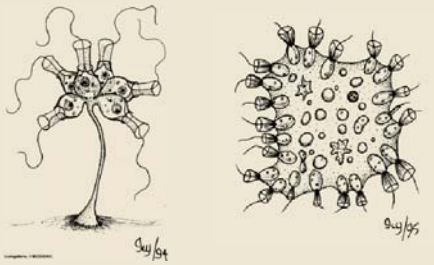
_____ choanocyte ancestor



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Sponge sex

- Choanoctyes become sperm
- _____ (sponge stem cells) form egg

http://www.waterexplorer.com/il_cool102.htm

Figure 26.7

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Corals ?

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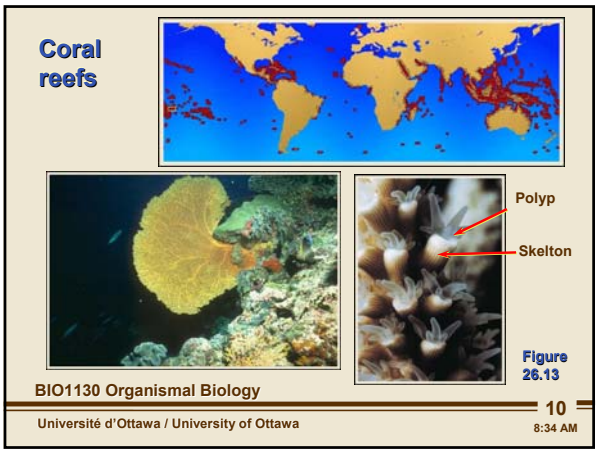
Coral reefs
Polyp
Skelton
Figure 26.13
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10
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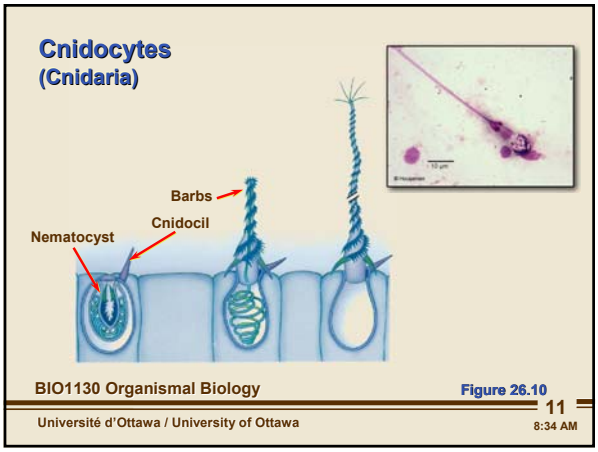
Cnidocytes (Cnidaria)
Barbs
Cnidocil
Nematocyst
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Figure 26.10
11
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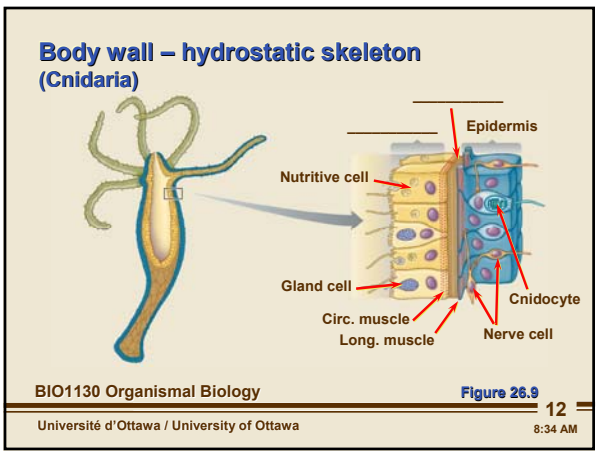
Body wall – hydrostatic skeleton (Cnidaria)
Epidermis
Nutritive cell
Gland cell
Circ. muscle
Long. muscle
Cnidocyte
Nerve cell
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Figure 26.9
12
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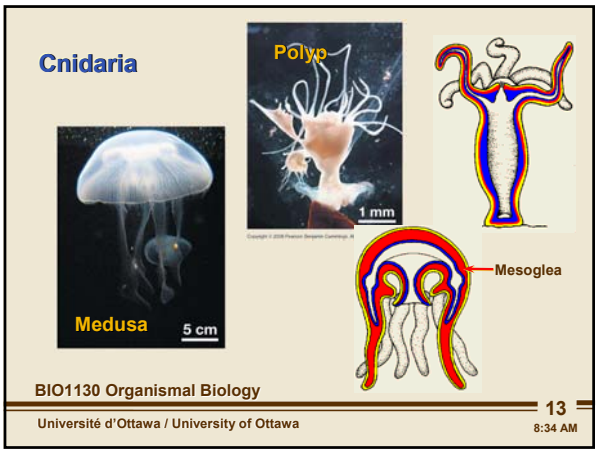
Cnidaria
Polyp
1 mm
Medusa
5 cm
Mesoglea
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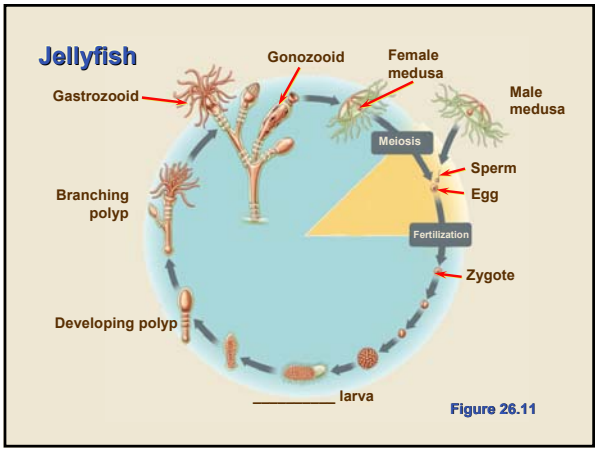
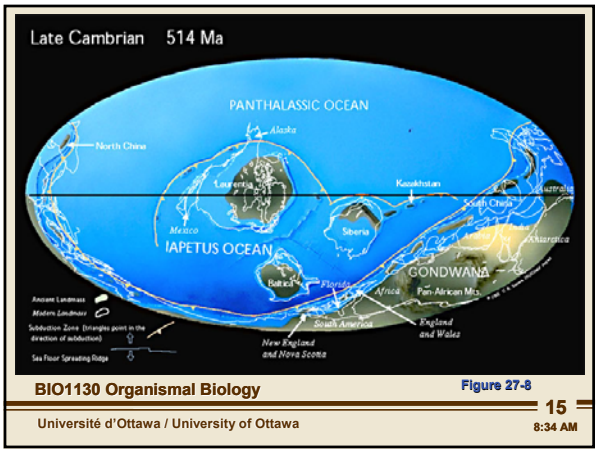
13
8:34 AM


Jellyfish
Gonozooid
Female medusa
Male medusa
Gastrozooid
Meiosis
Sperm
Egg
Branching polyp
Fertilization
Zygote
Developing polyp
larva
Figure 26.11


Late Cambrian 514 Ma
PANTHALASSIC OCEAN
North China
Alaska
Kazakhstan
South China
Australia
Mexico
Siberia
Antarctica
IAPETUS OCEAN
GONDWANA
Baltica
Florida
Africa
Pan-African Mts.
South America
England and Wales
New England and Nova Scotia
Figure 27-8
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Burgess shales – Yoho National park

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Burgess shales

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Burgess shales
and its unusual invertebrates

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Video 1, 2

18

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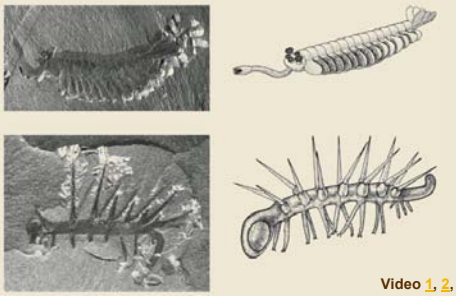
Burgess shales and its unusual invertebrates



Video 1, 2, 3

Flat worms (Platyhelminthes)

Figure 26.16

Flat worms (Platyhelminthes)

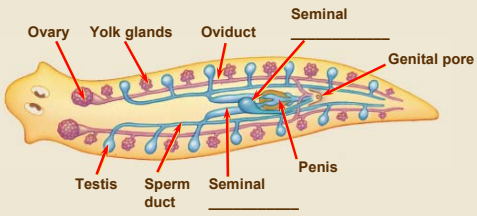
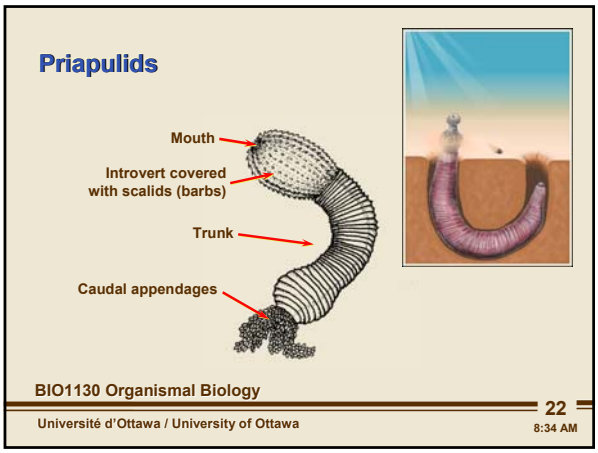


Figure 26.16


Priapulids
Mouth
Introvert covered with scalids (barbs)
Trunk
Caudal appendages
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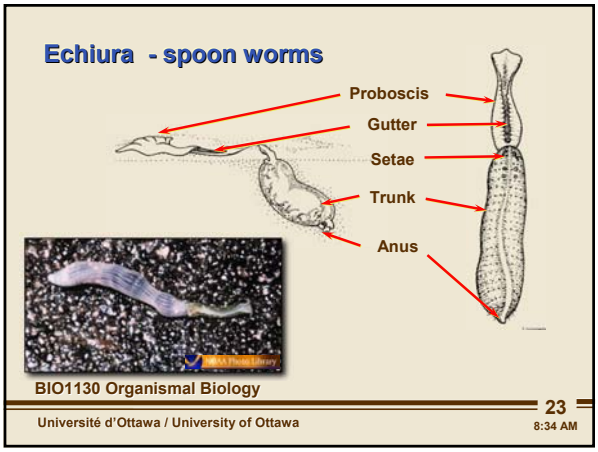
8:34 AM


Echiura - spoon worms
Proboscis
Gutter
Setae
Trunk
Anus
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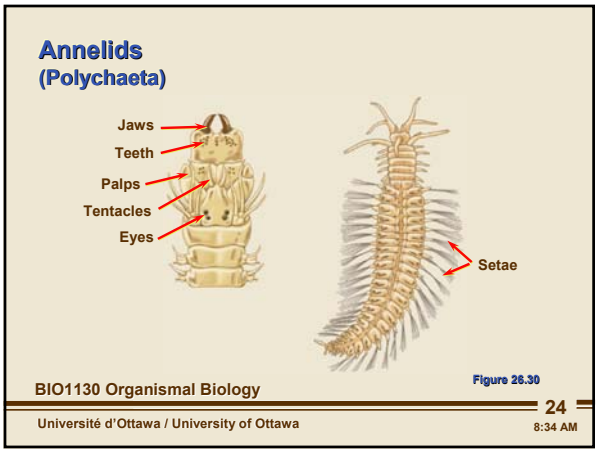
8:34 AM


Annelids
(Polychaeta)
Jaws
Teeth
Palps
Tentacles
Eyes
Setae
Figure 26.30
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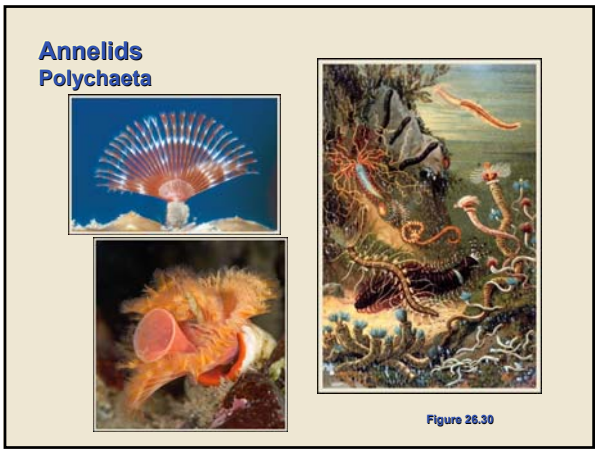
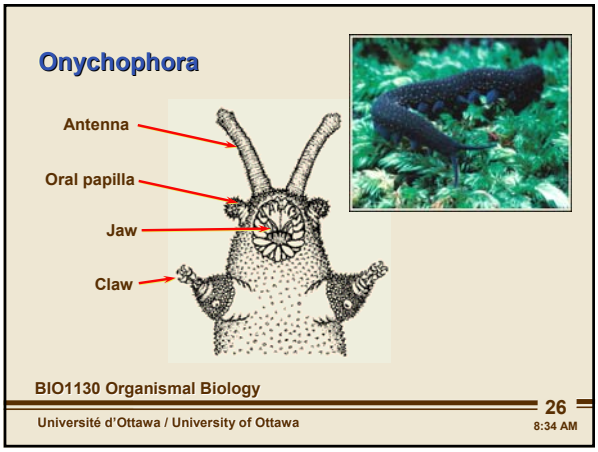
24
8:34 AM


Annelids
Polychaeta
Figure 26.30


Onychophora
Antenna
Oral papilla
Jaw
Claw
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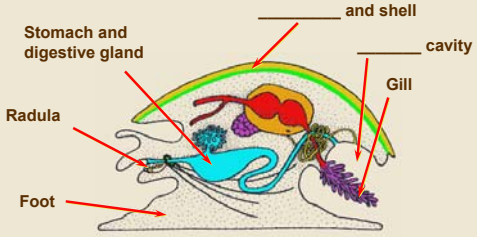
Molluscs

Mollusc traits



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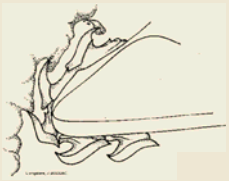
Mollusc Radula

Radular teeth



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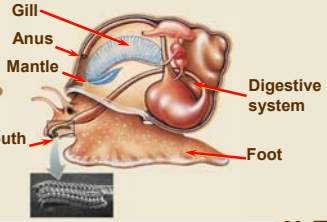
Snails (Gastropods)



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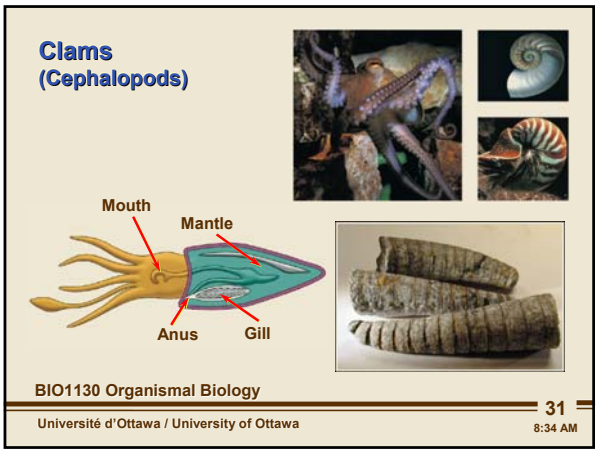
Clams
(Cephalopods)
Mouth
Mantle
Anus
Gill
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8:34 AM

Ammonites
BIO1130 Organismal Biology
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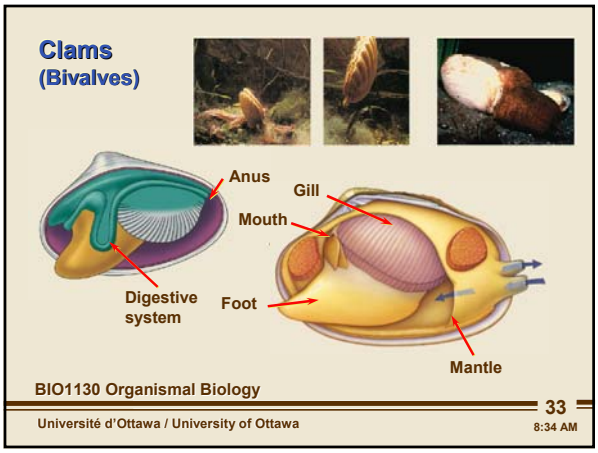
8:34 AM


Clams
(Bivalves)
Anus
Gill
Mouth
Digestive
system
Foot
Mantle
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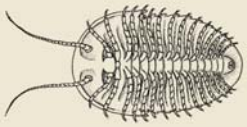
8:34 AM

Arthropods (Trilobites)



Video

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Cambrian explosion

- Snowball earth
- Burrowing
- Shelled arms race
- Developmental – *hox* genes

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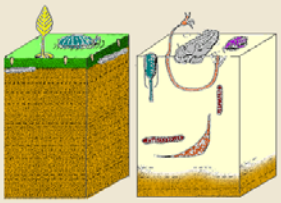
Cambrian burrowers

- Advantages
  - Feeding
  - _____
  - Protection



Ediacaran benthic zone

Cambrian benthic zone

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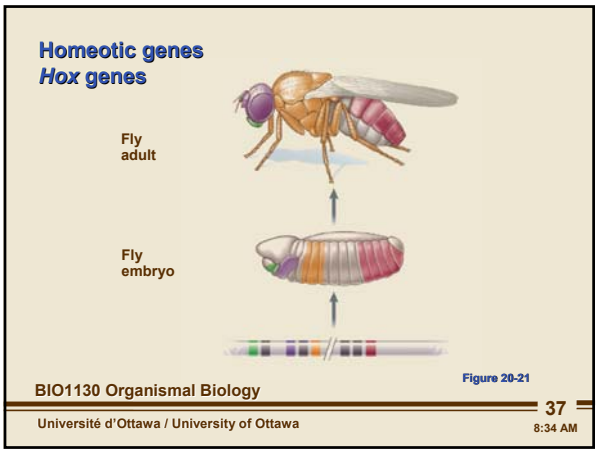
Homeotic genes
Hox genes
Fly
adult
Fly
embryo
Figure 20-21
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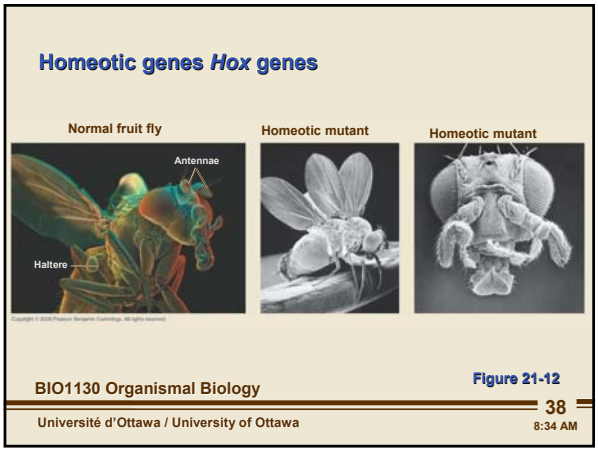
8:34 AM


Homeotic genes Hox genes
Normal fruit fly
Homeotic mutant
Homeotic mutant
Antennae
Haltere
Figure 21-12
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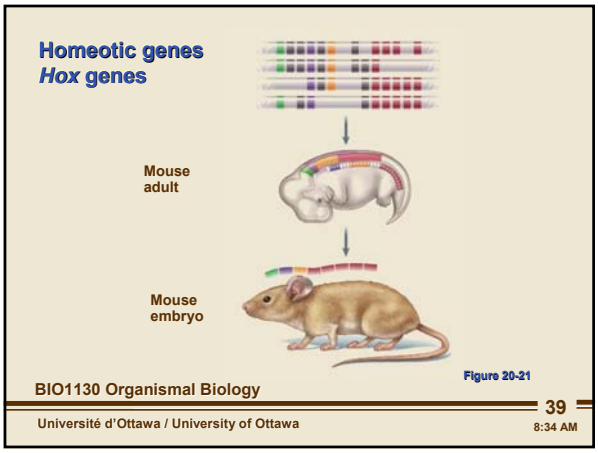
8:34 AM


Homeotic genes
Hox genes
Mouse
adult
Mouse
embryo
Figure 20-21
BIO1130 Organismal Biology
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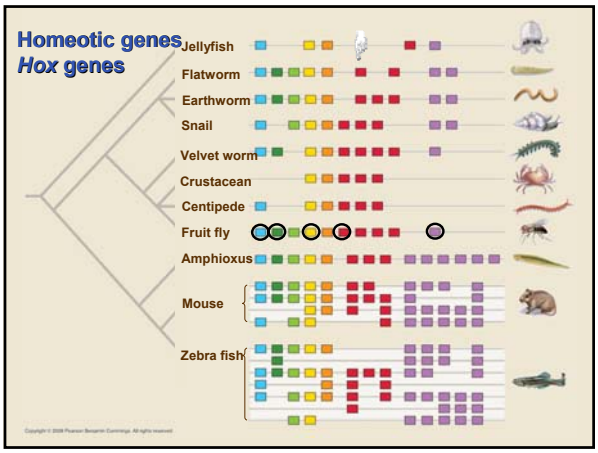
Homeotic genes
Hox genes
Jellyfish
Flatworm
Earthworm
Snail
Velvet worm
Crustacean
Centipede
Fruit fly
Amphioxus
Mouse
Zebra fish

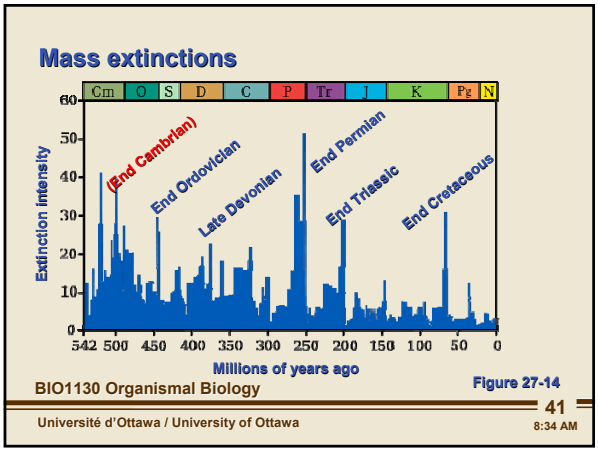
Mass extinctions
Cm
O
S
D
C
P
Tr
J
K
Pg
N
Extinction intensity
60
50
40
30
20
10
0
(End Cambrian)
End Ordovician
Late Devonian
End Permian
End Triassic
End Cretaceous
542 500 450 400 350 300 250 200 150 100 50 0
Millions of years ago
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Figure 27-14
41
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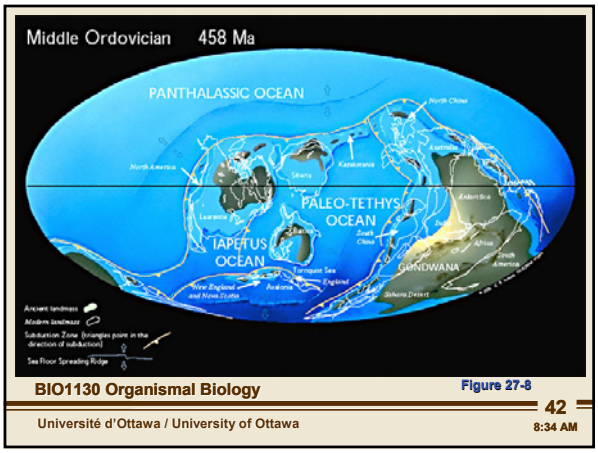
8:34 AM


Middle Ordovician 458 Ma
PANTHALASSIC OCEAN
PALEO-TETHYS OCEAN
IAPETUS OCEAN
GONDWANA
BIO1130 Organismal Biology
Figure 27-8
42
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8:34 AM

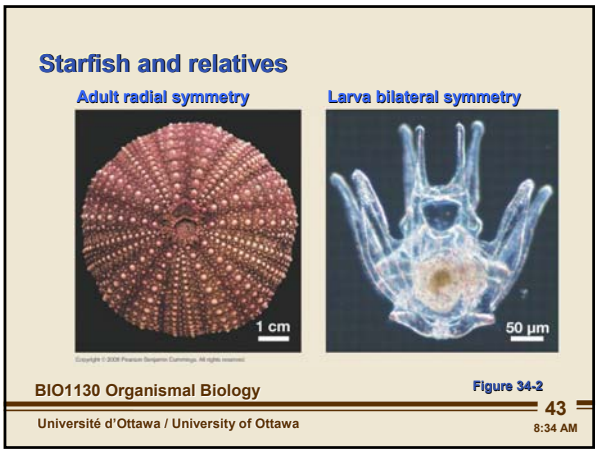
Starfish and relatives
Adult radial symmetry
Larva bilateral symmetry
1 cm
50 µm
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Figure 34-2
43
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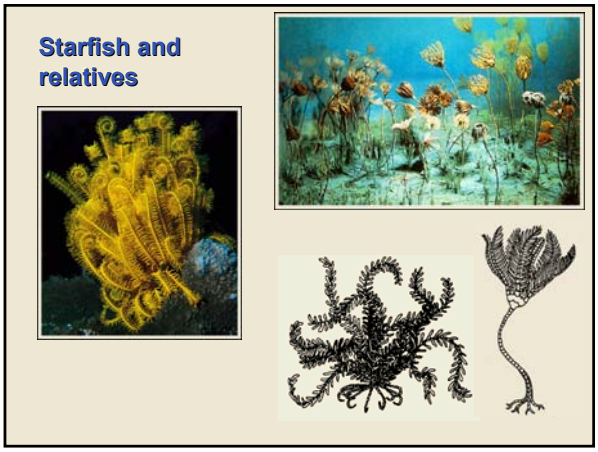
8:34 AM


Starfish and relatives

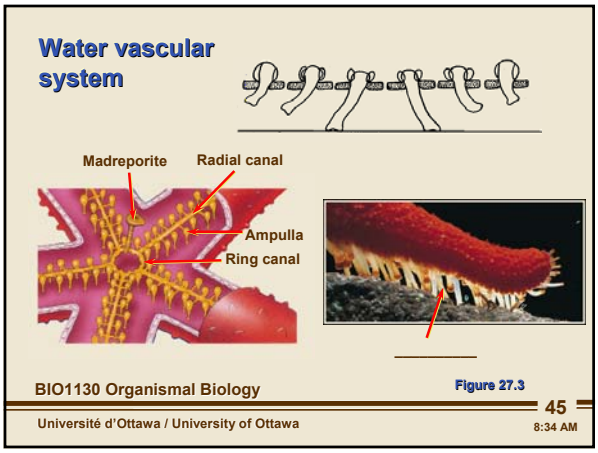

Water vascular system
Madreporite
Radial canal
Ampulla
Ring canal
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Figure 27.3
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8:34 AM

Brozoans
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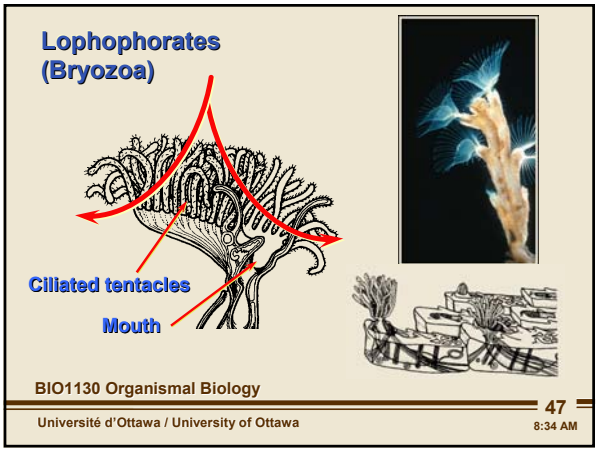
8:34 AM


Lophophorates
(Bryozoa)
Ciliated tentacles
Mouth
BIO1130 Organismal Biology
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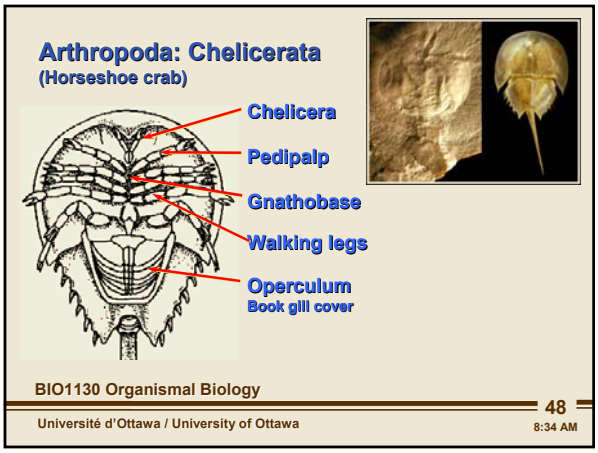
8:34 AM


Arthropoda: Chelicerata
(Horseshoe crab)
Chelicera
Pedipalp
Gnathobase
Walking legs
Operculum
Book gill cover
BIO1130 Organismal Biology
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8:34 AM

Mass extinctions

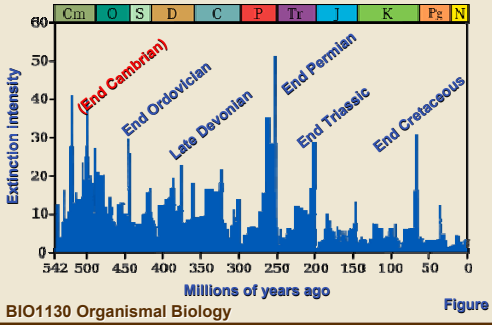

Figure 27-14

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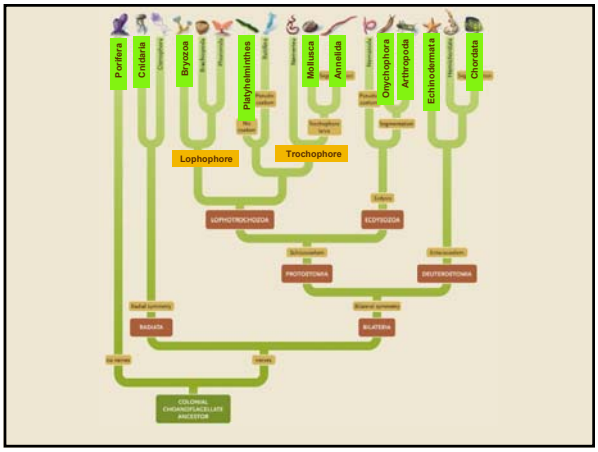
8:34 AM



Two main protostome groups

- Lophotrochozoa
  - Lophophore or
  - Trochophore larval stage
- Ecdysozoa

Figure 33-5

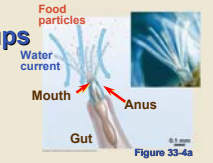


Figure 33-4a

Figure 33-4b

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8:34 AM

Animal architecture

- Symmetry and cephalization
- Tissues
- Embryology
- Body cavities
- Tube within a tube

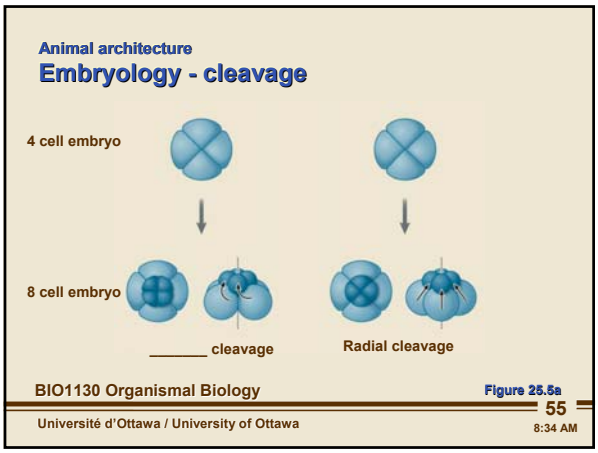
Animal architecture
Symmetry and cephalization

- Assymetric
- _____ symmetry
- _____ symmetry and cephalization

Figure 26.3

Animal architecture
Tissues

- _____ germ layers
  - Ectoderm and endoderm
- _____ germ layers
  - Ectoderm, mesoderm and endoderm


Animal architecture
Embryology - cleavage
4 cell embryo
8 cell embryo
_____ cleavage
Radial cleavage
BIO1130 Organismal Biology
Figure 25.5a
55
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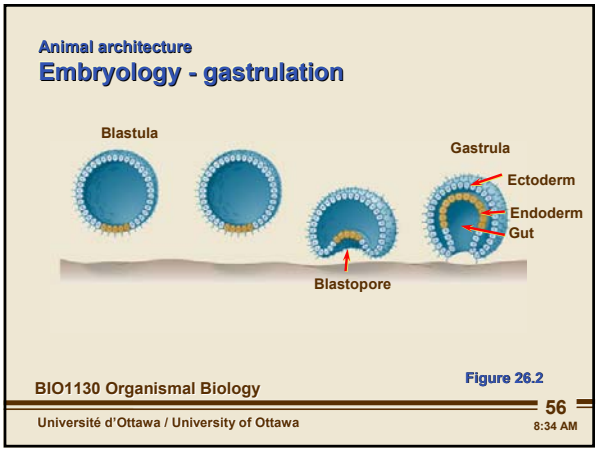
Animal architecture
Embryology - gastrulation
Blastula
Gastrula
Ectoderm
Endoderm
Gut
Blastopore
BIO1130 Organismal Biology
Figure 26.2
56
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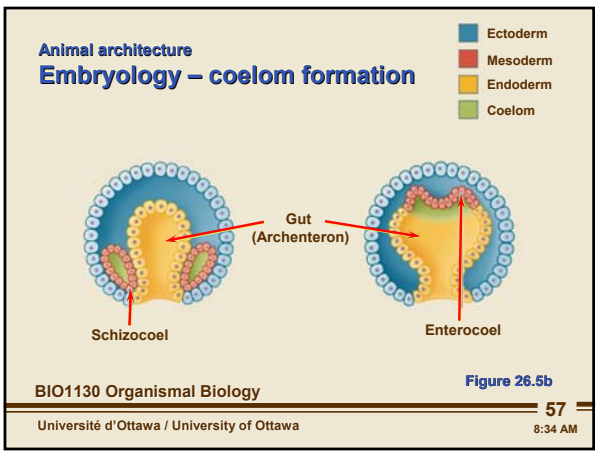
Animal architecture
Embryology – coelom formation
Ectoderm
Mesoderm
Endoderm
Coelom
Gut
(Archenteron)
Schizocoel
Enterocoel
BIO1130 Organismal Biology
Figure 26.5b
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Animal architecture

Body cavities

- _____
- Coelomate
- Pseudocoelomate

Animal architecture

Body cavities - Acoelomate

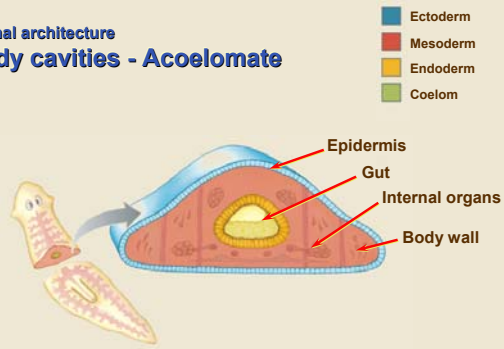

Figure 26.4a

Animal architecture

Body cavities - Pseudoelomate

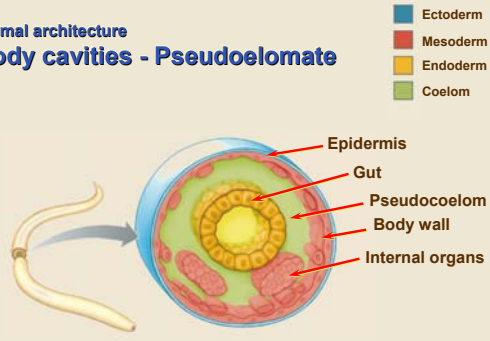

Figure 26.4b

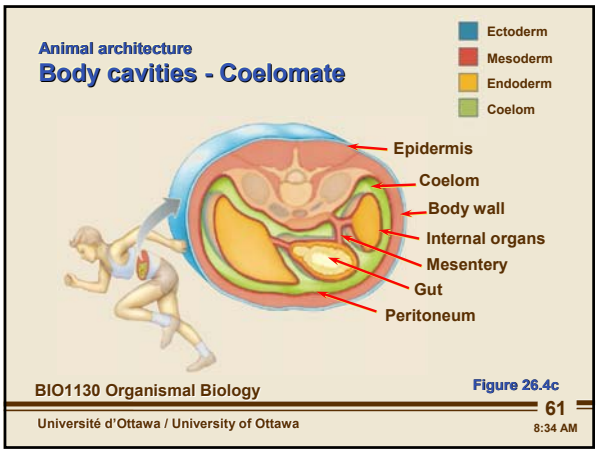
Animal architecture
Body cavities - Coelomate
Ectoderm
Mesoderm
Endoderm
Coelom
Epidermis
Coelom
Body wall
Internal organs
Mesentery
Gut
Peritoneum
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Figure 26.4c
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