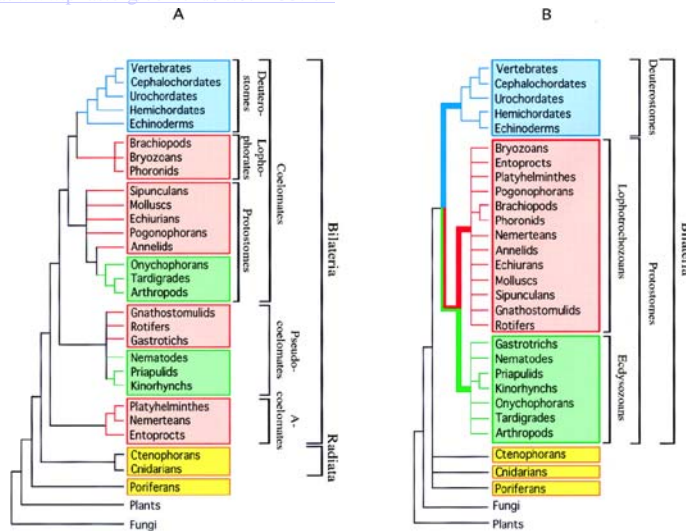


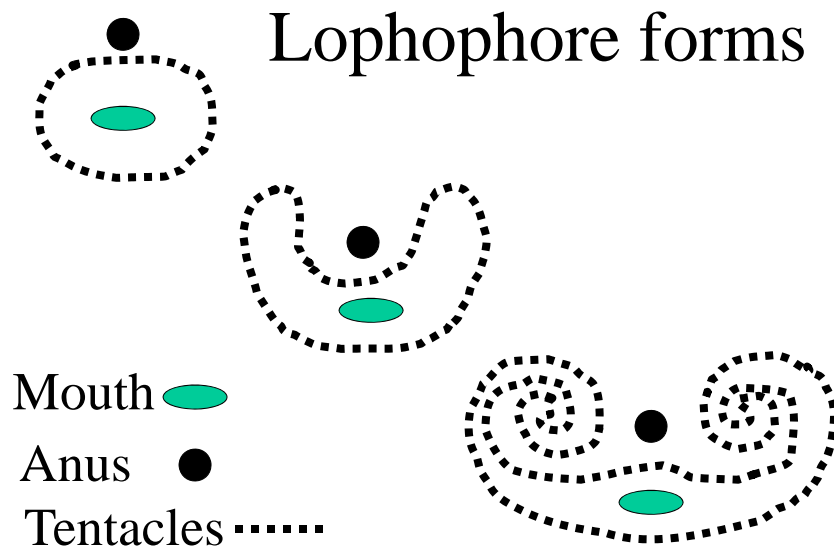
Metazoan phylogenies. (A) The traditional phylogeny based on morphology and embryology, adapted from Hyman (11). (B) The new molecule-based phylogeny. A conservative approach was taken in B: i.e., some datasets provide resolution within some of the unresolved multifurcations displayed, but we have limited the extent of resolution displayed to that solidly provided by rRNA only.

<http://www.pnas.org/content/97/9/4453.full>



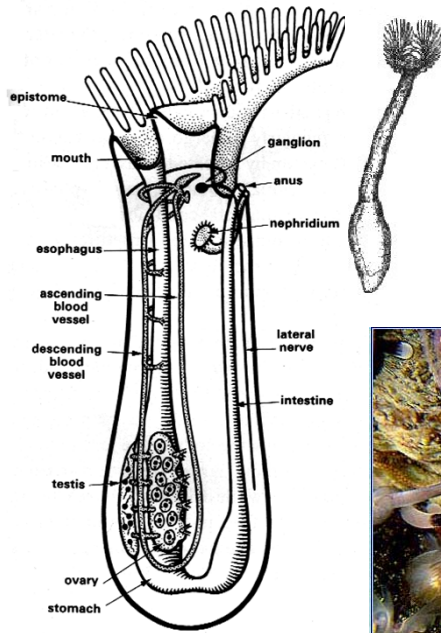
# Lophophorates

- Protostomes
- 3 suspension-feeding Phyla possessing a lophophore: a ring of ciliated tentacles, used for suspension feeding.
- The tentacles contain extensions of the body cavity (coelom)
- The mouth is inside of the ring, the anus is outside.



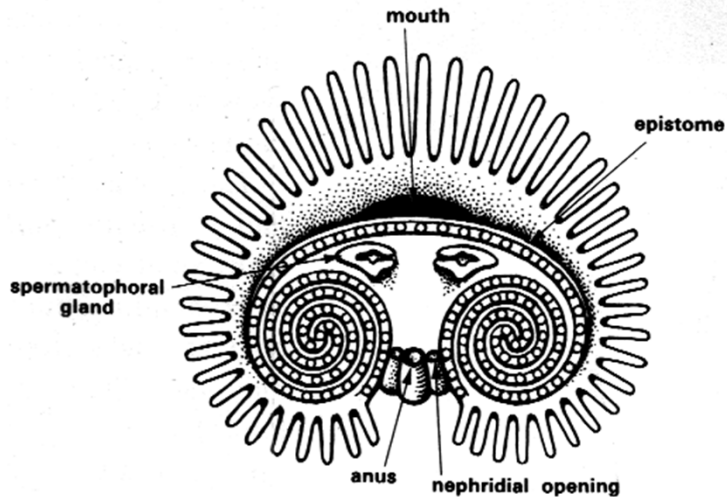
## Lophophorate phyla

- **Phoronida** (tube-dwelling marine worms)
- **Brachiopoda** (marine bivalves, mainly Paleozoic but some modern)
- **Bryozoa** (=Ectoprocta) marine and freshwater, colonial



## Phylum Phoronida

Small group of sessile, tubicolous, marine lophophorates



**Dorsal view** of a phoronid. The inner whorls of tentacles are cut off to reveal the coiled lophophore. The spermatophoral glands package sperms into spermatophores for transfer by water currents to other individuals. (Modified after Delage and Hérouard)

## Phoronids, cont.

- Worldwide distribution, marine sediments.
- Secreted tube of chitin lines the burrow.
- Morphologically convergent with tubicolous polychaetes



*Phoronopsis* up to 12 inches  
(most phoronids are much  
smaller)

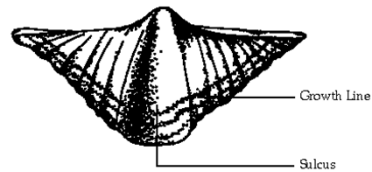
# Phylum Brachiopoda



- Only ~380 living species, but >30,000 Paleozoic species have been described
- Sessile, bivalve suspension feeders, superficially similar to bivalve molluscs
- Abundant and diverse fossils- important stratigraphic indicators

## Brachiopods, continued

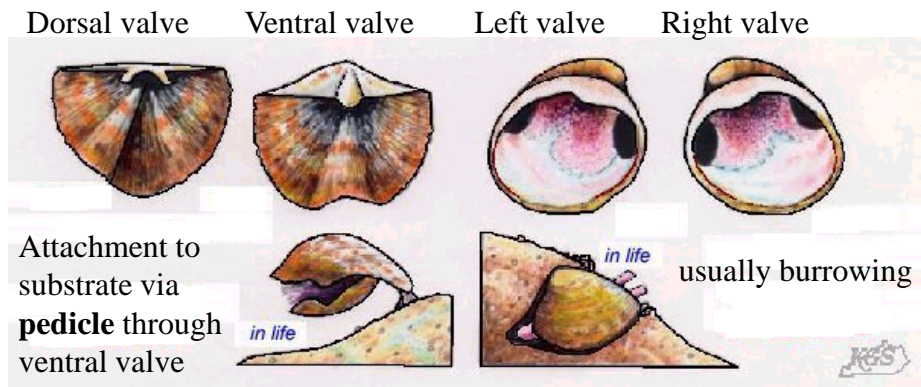
- Shells are divided dorso-ventral, with posterior hinge
- Attachment to substrate via **pedicle** (stalk)



Don't confuse with clams- Brachiopod shells are dorsal and ventral rather than left and right.

## Brachiopoda

## Bivalvia (Mollusca)



## Brachiopods, continued

### Class Inarticulata

- Appeared and radiated early, includes modern *Lingula* and *Glottidia*
- Shells usually of apatite ( $\text{CaPO}_4$ ), not hinged, no brachidium

### Class Articulata

- Most extinct and living Brachiopods are in this class, eg. *Terebratula*
- Hinged shell of calcite, opened by diductor muscles, closed by adductor muscles
- Lophophore support (brachidium) on dorsal valve
- Lack anus

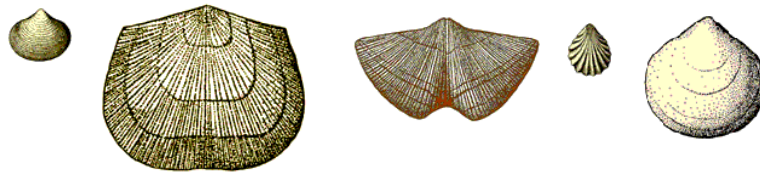
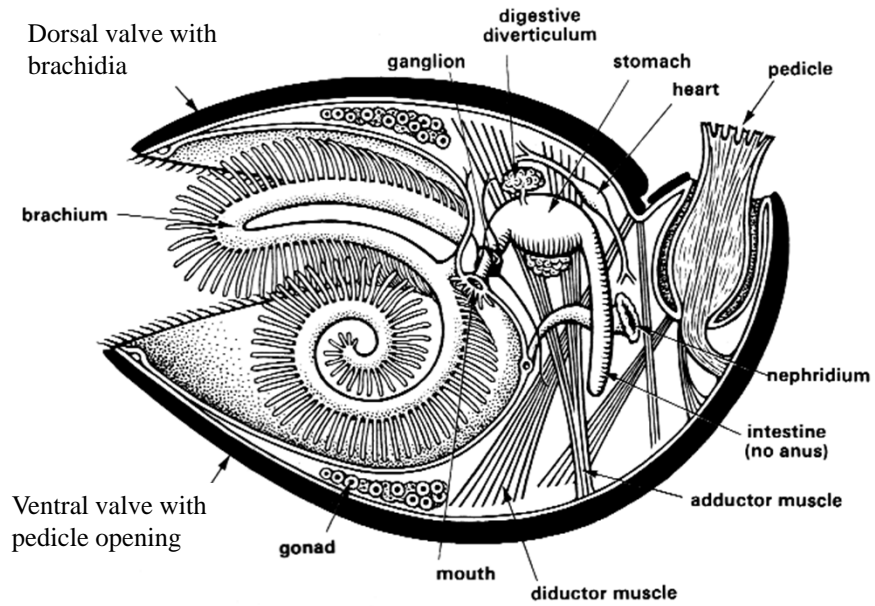




### Living articulate brachiopods



### An articulate brachiopod



Articulate brachiopod fossils from Kansas:  
*Phricodothyris*, *Derbyia*, *Neospirifer*, *Hustedia*, and *Composita*





## More Brachiopod lore

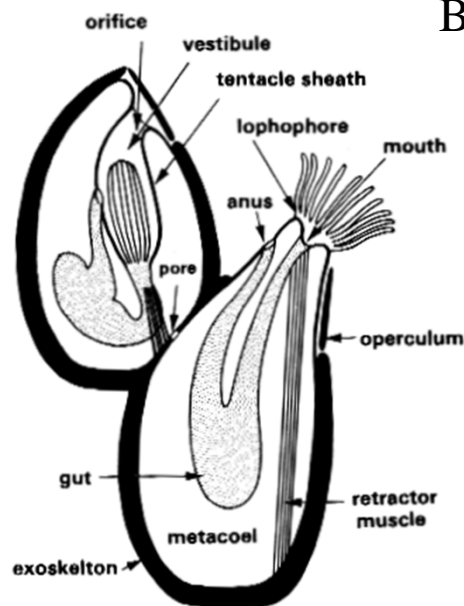
- Shell includes chitin
- Unlike the other lophophorates, brachiopods have no asexual reproduction
- The inarticulate brachiopod *Lingula* is considered to be a living fossil- little changed in over 400 million years.
- *Lingula* is common enough to be used as food in Thailand (“worms and dirty fingernails”)

## Lophophorate phyla

- Phoronida (tube-dwelling marine worms)
- Brachiopoda (marine bivalves, mainly Paleozoic but some modern)
- Bryozoa (= Ectoprocta) marine and freshwater, colonial

## Bryozoa (Ectoprocta)

- ~5,000 living species, many more extinct
- Mainly clonal colonies of interconnected individuals (zooids).
- colonies range from millimeters to meters in size, but the zooids seldom exceed 1 mm.
- Reproduction – budding, statoblasts, sexual
- bryozoans produce bryostatin, currently under testing as an anti-cancer and memory-enhancing drug. [link](#)



### Bryozoan body plan

Reproduction by budding yields colony of connected individuals (zooids)

Anus outside the lophophore (“ectoproct”)

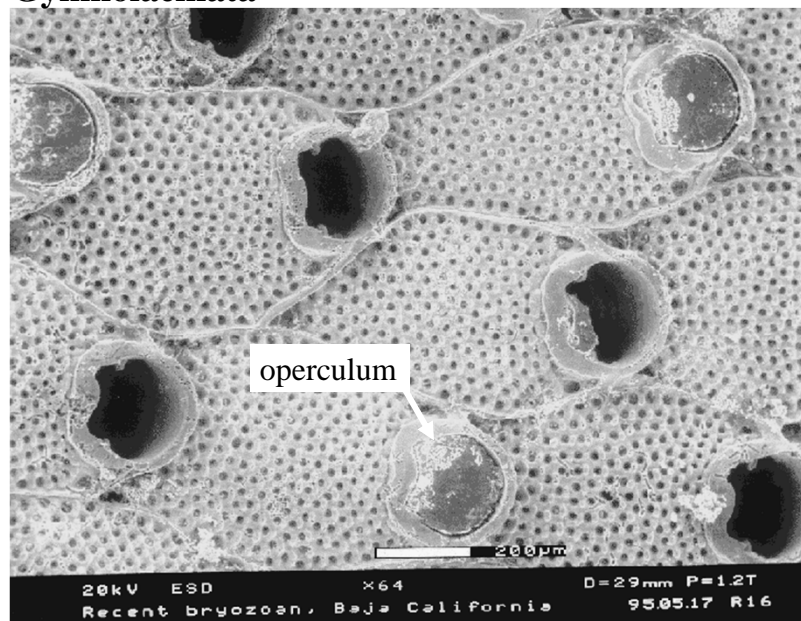
Calcified exoskeleton in many taxa

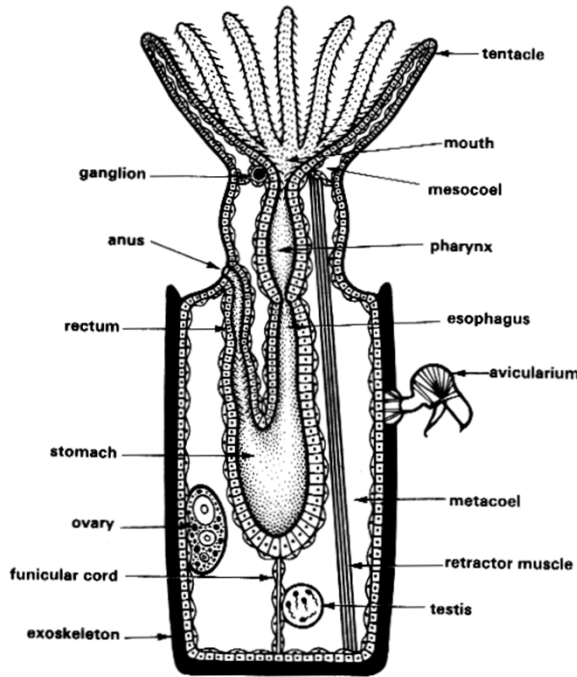
Each zooid has its own compartment & operculum

## Bryozoan taxa

- **Phylactolaemata (“guarded throat”):** Freshwater, no zooid polymorphism, no calcification; form statoblasts (resting buds).
- **Stenolaemata (“narrow throat”):** Marine bryozoans with tubular zooids with calcified walls.
- **Gymnolaemata (“naked throat”):** Mostly marine with cylindrical or flattened zooids in calcified exoskeletons. Includes most living bryozoans.

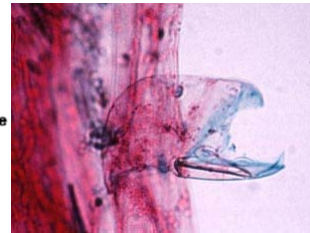
### Gymnolaemata





Some  
Bryozoa have  
polymorphic  
zooids

Note the  
defensive  
avicularium



**Phylactolaemata**

Freshwater  
bryozoan  
*Lophopus*



Phylactolaemata *Pectinatella magnifica*

17 Polypidesscattered or in double row along each lobe, the gelatinous base often 10 to 20 centimeters thick. *Pectinatella magnifica* Leidy 1851.

Tentacles 60 to 84 in number. Statoblasts about 1 mm. in diameter, provided with 11 to 22 hooks from 0.15 to 0.25 mm. long. Habitat, submerged branches or twigs of trees, wooden stakes, gates of dams, walls of reservoirs or stones in brooks. Shady situations, such as south walls of reservoirs, or wood-covered streams. From Maine to Mississippi.

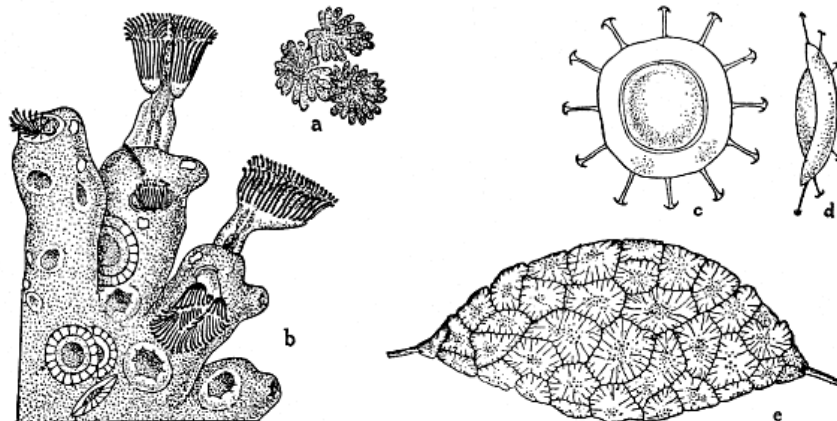


FIG. 1401. *Pectinatella magnifica*. (a) Young colony, natural size. (b) Section highly magnified. (c) Statoblast, ventral view. (d) Statoblast in profile.  $\times 15$ . (e) Colony on plant stem.  $\times 3$ . (After Kraepelin.)





Zooids of *Pectinatella*



Statoblasts- resting buds produced for dispersal and overwintering



Hooks may facilitate dispersal on wading birds, mammals or insects

## *Archimedes*

An extinct bryozoan that formed spiral colonies (Mississippian period)



Fossil bryozoans in chert from the Burlington formation (Mississippian period) in Greene County Missouri



Everlasting air fern...  
the wonder  
plant

- Dried, painted marine bryozoan sold as a plant
- NO care needed- no soil, no water!





