BIO 221
Invertebrate Zoology I
Spring 2010

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http://www4.nau.edu/isopod

Lecture 25

The Colonial Theory

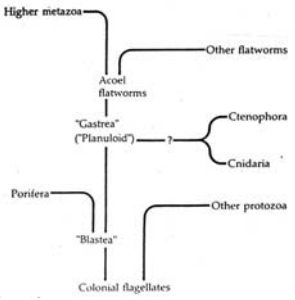
Gastraea

2. Two lineages proposed to have arisen:

a. Radiate phyla

b. Bilateral phyla.

3. Both of these apparent lineages recapitulate these stages in their development.



Evidence For:

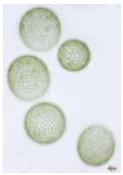
a. Many living examples of colonial aggregations of flagellated cells

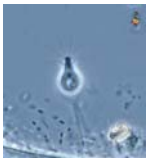
1. Algae

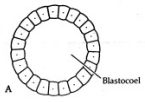
2. Choanomastigotes

3. Porifera - multicellular, flagellated cells.

b. Developmental evidence.





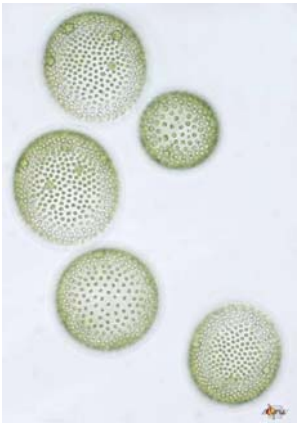


Evidence Against:

a. Problems with ontogeny-phylogeny analogy

1. Examples used resemble embryonic stages, not adults.

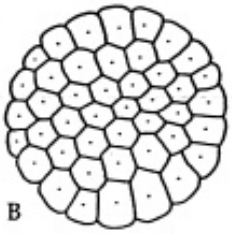
2. But later same argument used to show that developmental programs are conservative.



Evidence Against:

b. Cnidaria

1. gastrulas are *solid* not *hollow*.



Revision by Metschnikoff (1887)

a. Suggested that blastea didn't invaginate, it underwent *ingression*.

b. Generated the solid gastrula characteristic of cnidarians.

1. called ancestor a *Planuloid*

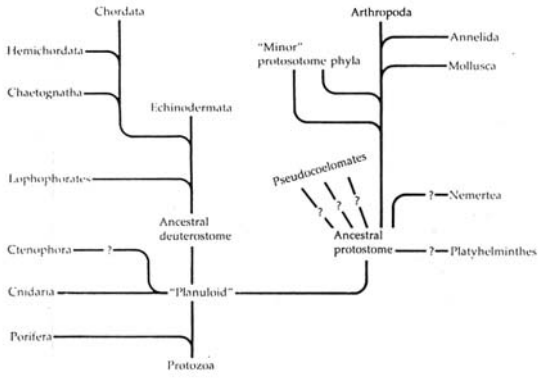
ELIE METCHNIKOFF, 1845-1916

The Planuloid Theory

a. An ovoid, solid mass of cells with exterior flagella, radial symmetry.

b. No mouth, exterior phagocytosis, materials shunted inward.

2. Very similar to cnidarian planula larva.



Evidence For:

a.Accounts for solid gastrula of Cnidaria.

b. Is structurally similar to cnidarian planula.

Evidence Against:

a. No living representatives other than the planuloid life stage of cnidaria.

The Plakula Theory

1. Otto Butschli (1883) suggested that no model explains why a digestive layer should evolve in the first place.

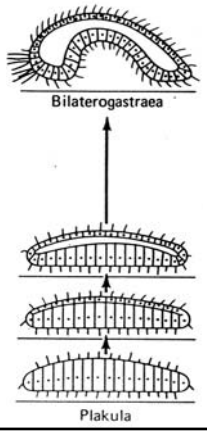
a. Why should an interior cavity be any more likely to be associated with absorption than external?

Otto Butschli (1848-1920)

The Plakula Theory

b. Why if cnidarians have solid planula should gastrulation occur?

c. Proposed a multicellular ancestor called a *plakula*.



The Plakula Theory

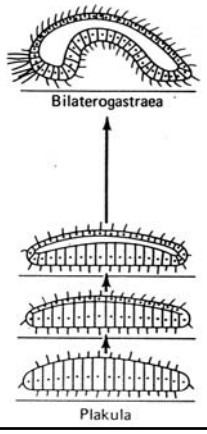
2. Characterisics

a. A flat, mass of cells, two cell layers thick.

b. Creeps on substrate, ventral surface modified for absorption.

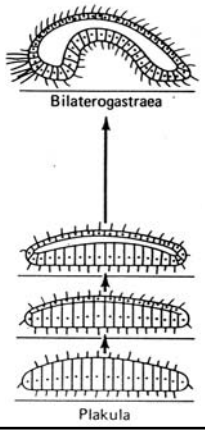
c. Hunches up to capture, digest food.

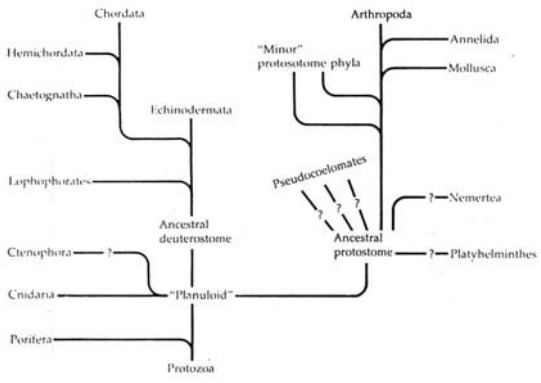
d. could give rise to other forms with more permanent cavity.



The Plakula Theory

e. Proposed progression: creeping existence -> bilateral symmetry -> *bilaterogastrea*





Evidence For:

a. *Trichoplax adhaerens* discovered soon after Butschli's hypothesis was articulated.

b. Similar appearance, habits, feeding behavior.

c. Hypothesis later revised by Grell (1969, 1985).

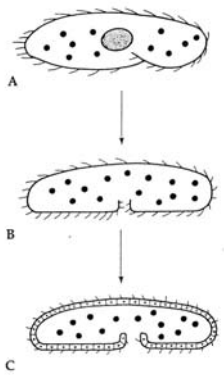
Evidence Against:

a. Still must account for appearance of radial symmetry in Cnidaria.

b. The jury is still out, but presence of extant example lends credence to idea of plakula ancestor -> bilaterogastrea.

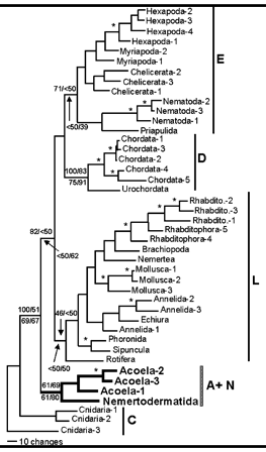
The Syncitial Theory

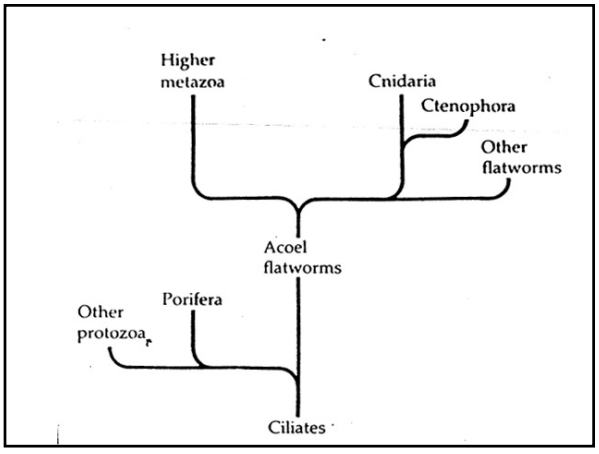
1. Previously popular, but recently discredited by molecular evidence suggesting that ciliates are only distantly related to Metazoa.



The Syncitial Theory

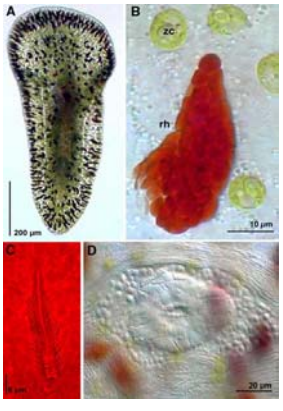
2. However, other evidence suggests that Acoel flatworms belong at the base of the Metazoan tree.





The Syncitial Theory

a. This need not suggest a link to ciliates, only that Acoels are simple in construction.



Sources of Coelom

a. Gonocoel theory

1. internal cavities of acoels containing gametes persisted and became body cavities.

2. Gametes and coelom often *are* associated

3. But: cavity usually appears to precede deposition of gametes into it.

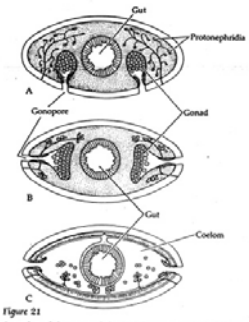
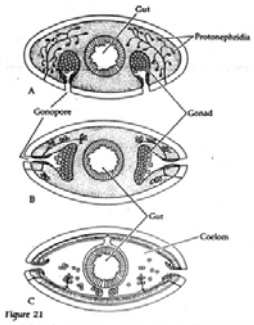


Figure 21

A version of the gonocoel theory (schematic cross sections). A, The condition in flatworms, which have mesodermally derived gonads leading to ventral gonopores. B, The condition in nemerteans, which have serially arranged gonadal masses leading to laterally placed gonopores. C, The condition in polychaetes, in which the linings of the gonads have expanded to produce coelomic spaces with coelomoducts to the outside. (After Goodrich 1946.)



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Sources of Coelom

Nephrocoel Theory

1. Excretory openings of acoels became modified to form body cavities

2. Same arguments as for gonocoel model.

3. Also require monophlyletic origin for all coelomate phyla

a. As we will see this is unlikely.