

Developmental Biology

A little history & terminology

Classical Embryology

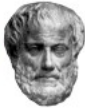
Development as a subset of anatomy
(4th BCE-today)



Anaxagoras

"How can hair be made of what is not hair, and flesh of what is not flesh?"

Preformation: The idea that the gametes contain a complete, preformed specification or even the complete physical form of the adult.



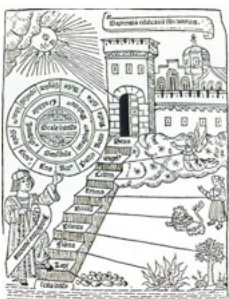
Aristotle

"Why not admit straight away that the semen...is such that out of it blood and flesh can be formed, instead of maintaining that semen is both blood and flesh?"

Epigenesis: the idea that organisms are formed by progressive development and differentiation of a relatively unorganized substance.

"Natural Philosophy"

Development expresses universal patterns
(19th CE)



Being ● God
● Angels
● Demons
● Man
● Woman
● Animals
● Plants
● Minerals

Realm of Being ●

Realm of Becoming ●

Non Being ●



Karl Ernst von Baer
(1792-1876)



Discoverer of

- The blastula stage
- The notochord
- The germ layer theory of development (with others)
- The mammalian ovum
- That mammals develop from eggs

von Baer's Laws

- The general characters of the group to which an embryo belongs appear in development earlier than the special characters.
- The less general structural relations are formed after the more general, and so on, until the most specific appear.
- The embryo of any given form, instead of passing through the state of other definite forms, on the contrary, separates itself from them.
- Fundamentally the embryo of a higher animal form never resembles the adult of another animal form, but only its embryo.

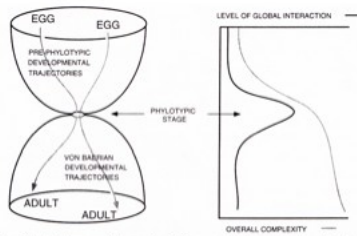


Figure 6.7. The developmental hourglass. The graph at the right plots the rise in overall complexity of an individual embryo moving through the hourglass. It also plots the level of interaction among modules. Interaction rises as the embryo approaches the phylotypic stage, and then declines as modules become more autonomous in later development.

Raff, 1996

Entwicklungsmechanik Experimental embryology (19th-20th CE)

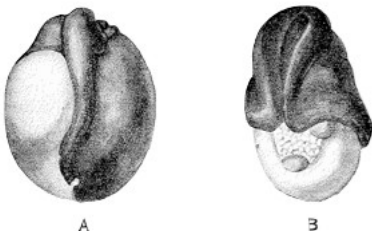
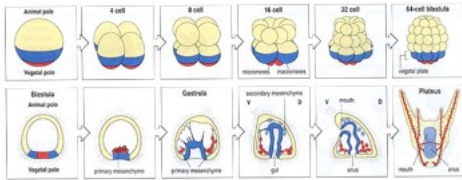


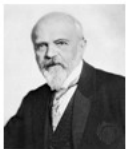
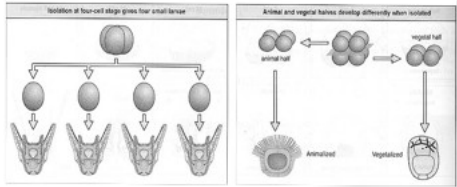
FIG. 34. A. Hamulembryo lateralis. B. Hamulembryo anterioris. (After Baer.)



Driesch and regulation



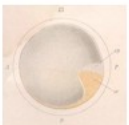
(A) Normal pluteus larva (B) Pluteus developed from single cells of 4 cell embryo



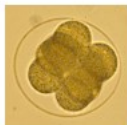
Hans Driesch
1867-1941

Driesch's interpretation: There must be an "entelechy," or guiding field or intelligence that directs the development of the organism. He called this "a unifying non-material mind-like something ... an ordering principle which does not add either energy or matter," and that "the mind may carry out a morphogenetic action at a distance."

Mosaic vs. Regulative Development



Mosaic development: The adult is 'mapped out' on the embryo by a pattern of **cytoplasmic determinants**.



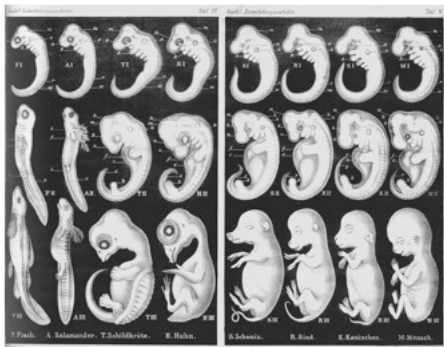
Regulative development: The early embryo is **unspecified** -- all the cells are equivalent, and contain the same cytoplasmic factors.

...embryology is to me by far the strongest single class of facts in favour of change of forms...

Charles Darwin



Ernst Haeckel



The Biogenetic Law of Haeckel

Ontogeny Recapitulates Phylogeny

Development is a process that repeats the evolutionary history of the organism; observation of development allows one to see the pattern of its evolution.

This law has been shown to be false!

