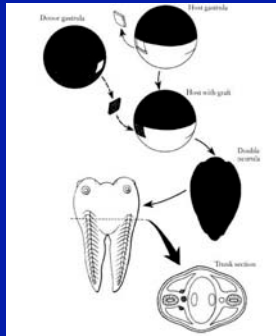


Part 3. How did the Chordate get its chord (notochord)?

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The Spemann experiment and the vertebrate specific development



What about the notochord?

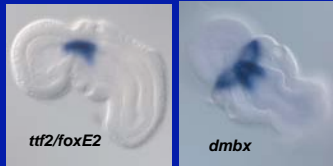
- The crux of Bateson's argument that hemichordates were essentially chordates.
- Virtually every marker of the vertebrate notochord is present in the hemichordate (*chordin*, *noggin*, *admp*, *brachyury*, *hedgehog*...)
- Small problem, they are not in the hemichordate stromachord.

Interpretation: Hemichordates may have no “notochord”.

But does it have a Spemann Organizer?

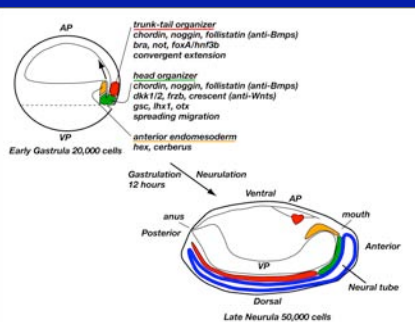
Though the organizer gives rise to the notochord in vertebrates, it is in fact also a complex signaling center.

The hemichordate expresses genes of the chordate prechordal endo-mesoderm (*otx*, *dmbx*, *tff2*, *hex*, *gsc*...), and at the appropriate A/P map position.

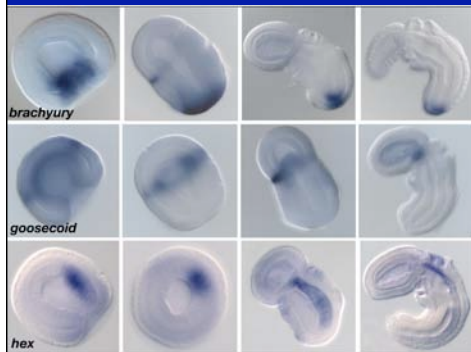


Interpretation: as a signaling center, the hemichordate has an organizer

The vertebrate organizer is a tripartite structure of signaling centers



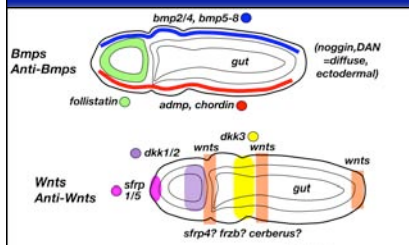
But these organizer signaling centers are initially dispersed in hemichordates



The vertebrate organizer is a composite of three distinct signaling centers in hemichordates

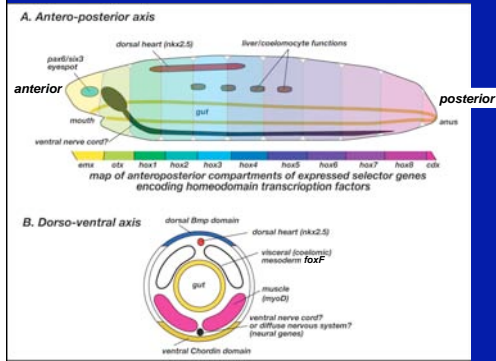
- The vertebrate organizer is complex, since it conflates dorsal/ventral and anterior/posterior signaling
- The disaggregated hemichordate organizer corresponds to signaling centers in other more primitive bilateral organisms

The basic body plan of the hemichordate is built on the body plan of perhaps all bilaterians



By comparing the deuterostomes to other animals, we now have a glimpse of the first bilaterians, 600 Mya

Bilateral ancestor, deep pre-Cambrian, hypothetical, from deuterostome-protostome shared traits



What may have uniquely evolved in the chordate line?

1. Dorsoventral inversion of the body with
2. Movement of the mouth to the opposite ("ventral") side.
3. Centralization of the nervous system to "dorsal" side.

What may have uniquely evolved in the chordate line?

4. Centralization of mesoderm to the “dorsal” side; evolution of the notochord from endomesoderm (gut midline?) and concentration of convergent extension in the notochord precursors.

5. Clustering of antagonists of Bmp and Wnts into the notochord-endomesoderm to form the “organizer”.

Evolution of the Hemichordate Project:

The Founders

John Gerhart (UC Berkeley)
Marc Kirschner (Harvard Medical School)
Chris Lowe (University of Chicago)

Evolution of the Hemichordate Project: It takes a village!

The Founders

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