

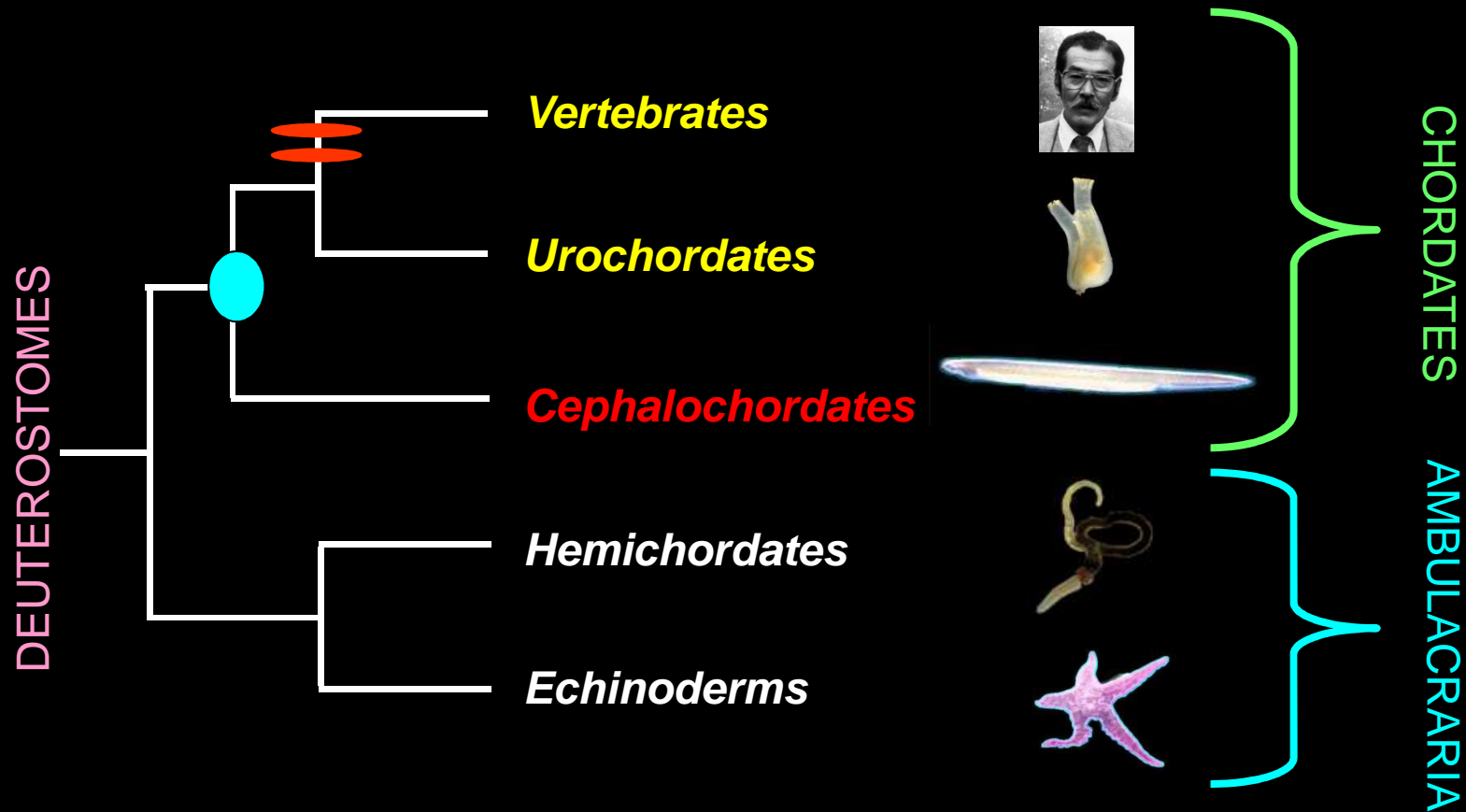
The Mediterranean amphioxus, *Branchiostoma lanceolatum*, an emergent animal model for Evo-Devo studies



From the
National
Geographic Society

Héctor Escrivà
Groupe Evolution et Développement des Chordés
Observatoire Océanologique de Banyuls sur Mer

Amphioxus as a model



Basal position in the chordate lineage (before genome duplications)
Less derived developmental features (inductive/determinate) than tunicates
Good model of the chordate ancestor

Amphioxus is the best available model to study vertebrate innovations both at the morphological and the genomic levels



Halocynthia roretzi

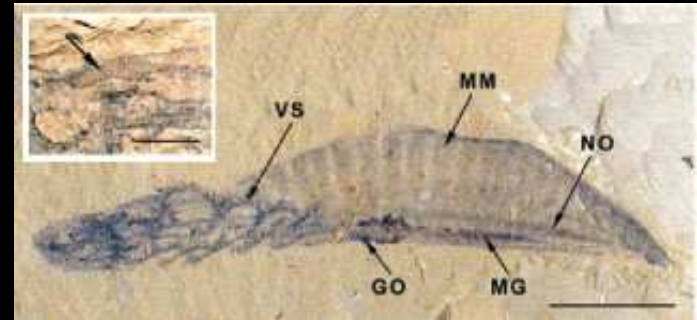


B. lanceolatum

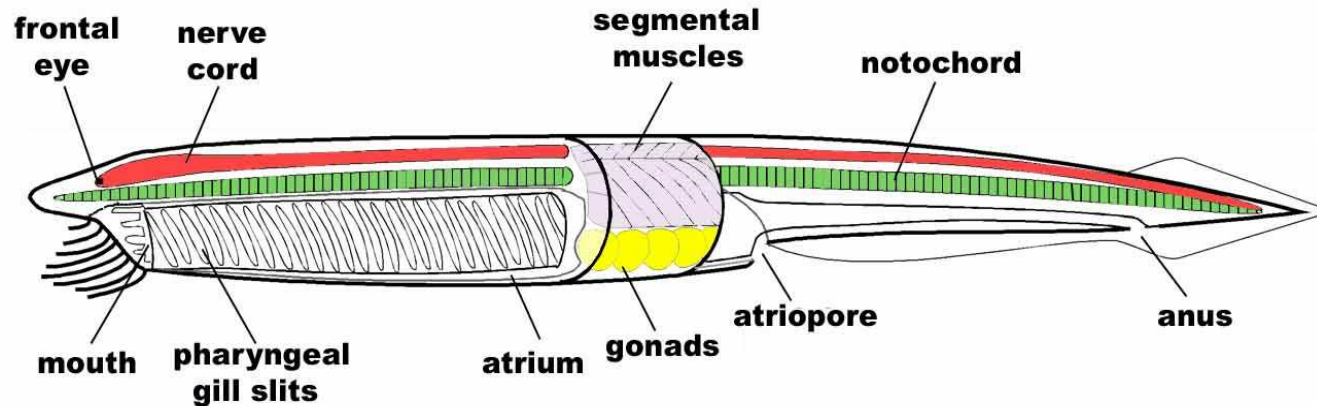
Pikaia



Haikouella



Amphioxus Is vertebrate-like but simpler

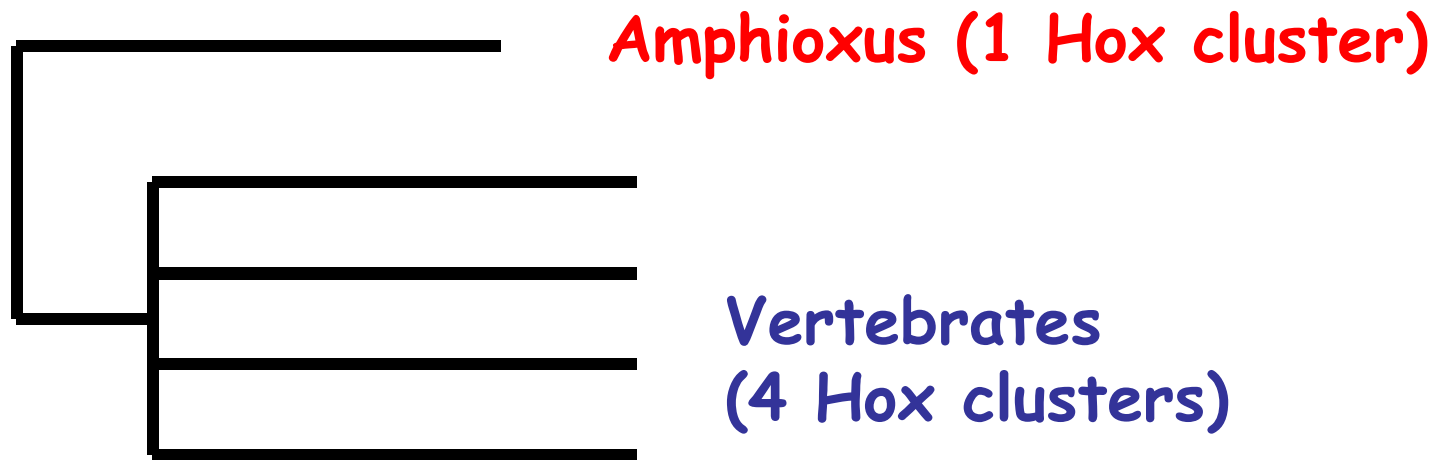


Amphioxus has

- segmental muscles
- segmental gonads
- pharyngeal gill slits
- dorsal hollow nerve cord
- notochord
- pronephric kidney
- pituitary and thyroid homologs
- a prototypical vertebrate genome

Amphioxus lacks

- paired, image-forming eyes
- ears
- limbs
- neural crest
- the extensive gene duplications characteristic of vertebrates



46,573

415-73

COLUMBIA UNIVERSITY BIOLOGICAL SERIES. II.

AMPHIOXUS AND THE ANCESTRY
OF THE VERTEBRATES

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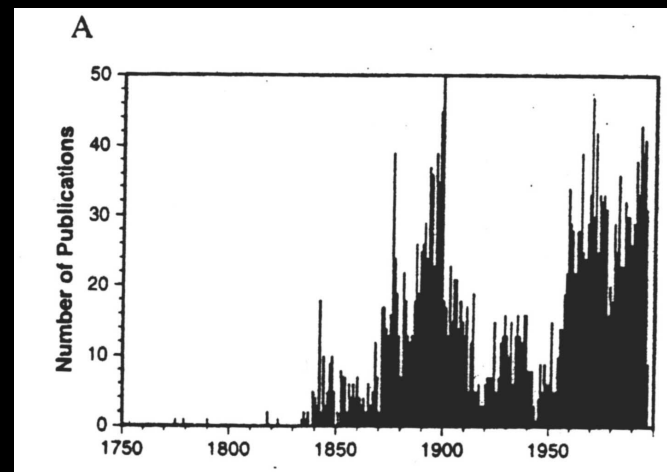


New York
MACMILLAN AND CO.
AND LONDON
1894

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Amphioxus:
Phylum: Chordata
Subphylum: Cephalochordata

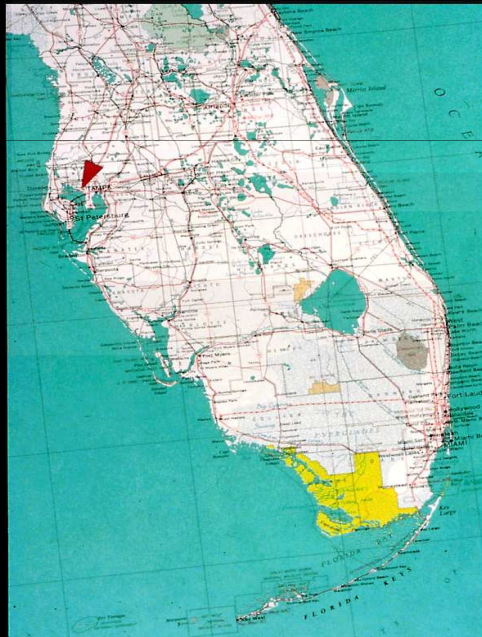
- Genus *Branchiostoma*, ~30 species
- Genus *Epigonichthys*, 1 specie
- Genus *Asymmetron*, 2 species
- Widely distributed in tropical and temperate seas
- Adults in sandy and shell-sand habitats
- 0,5-40? m deep
- Sexual reproduction,
- Separate sexes



Branchiostoma floridae



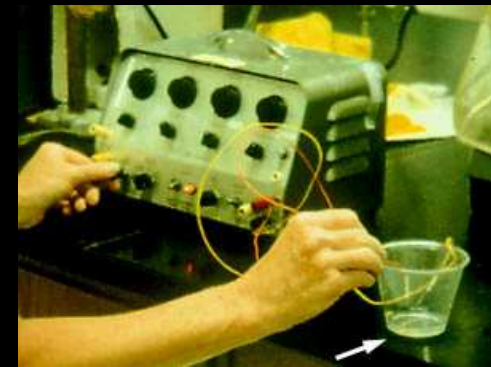
Old Tampa Bay,
Florida



The 1st meiotic
division occurs in
early afternoon.



Spawning occurs
after sunset, and
can be induced
by 50 volts DC.



Generation time = 6 weeks; each female spawns 1,000-5,000 eggs every 2 weeks throughout summer; no genetics; not yet in laboratory culture

Branchiostoma belcheri

• *Japan, China*

- Tanks with current sea water
- Naturally spawning of few animals, unknown frequency, June-August.
- Spawning time depending on natural sunset

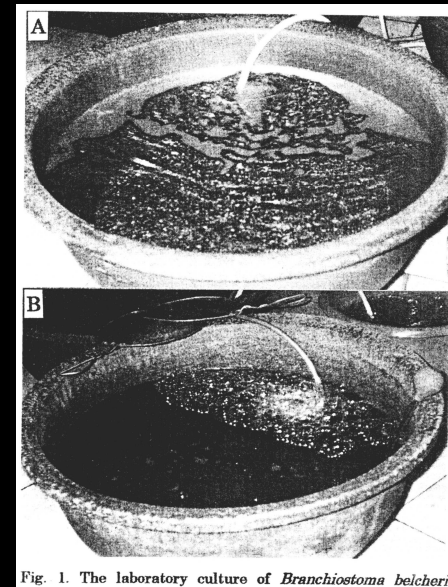
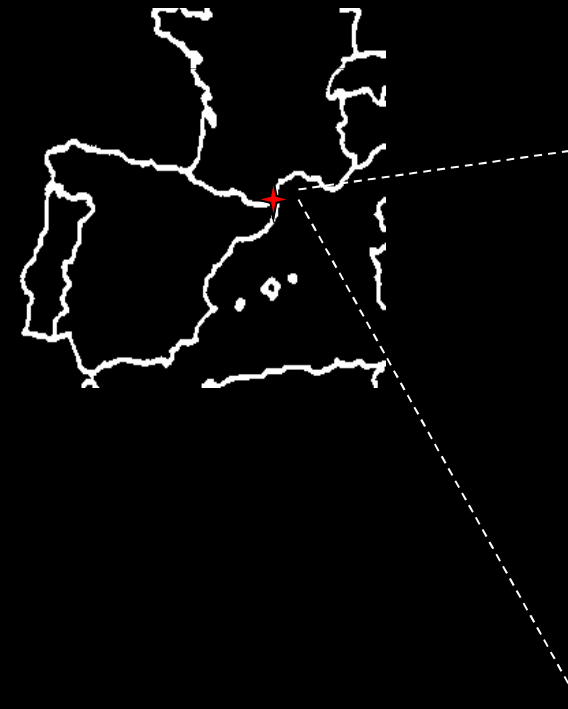
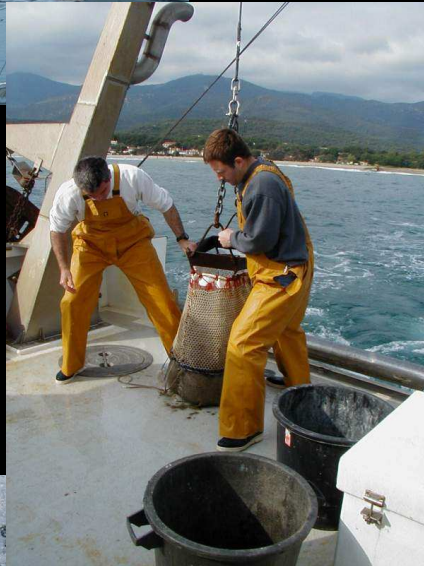
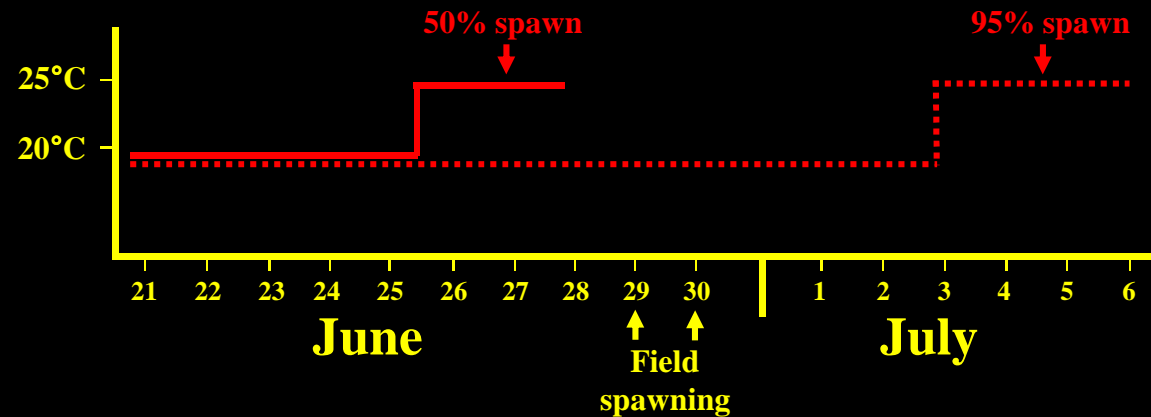


Fig. 1. The laboratory culture of *Branchiostoma belcheri*

B. Lanceolatum collection site



A temperature shock induce spawnings in the lab.
These spawnings were not correlated with
the natural spawnings in the field

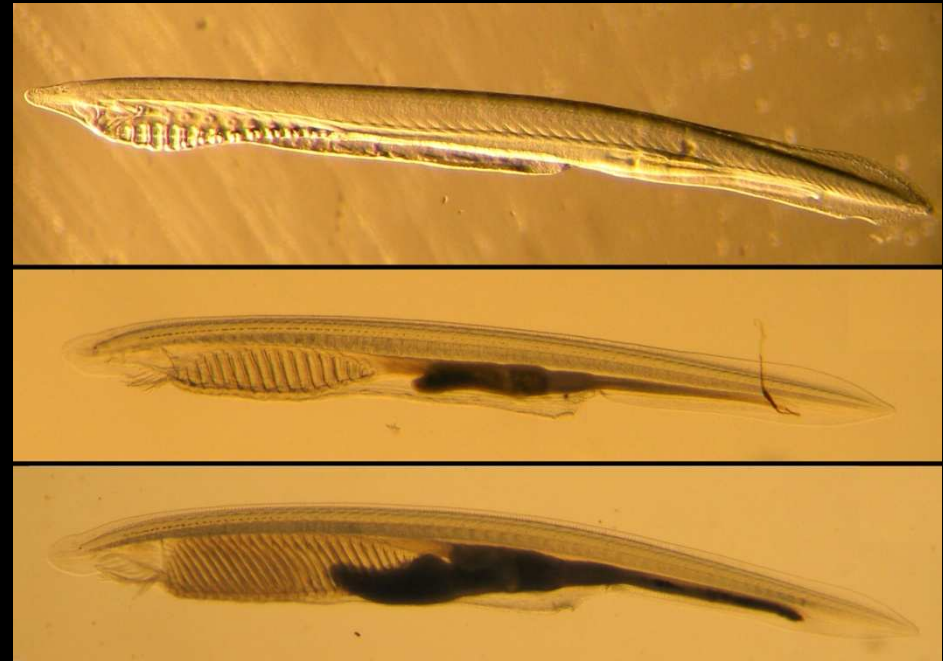
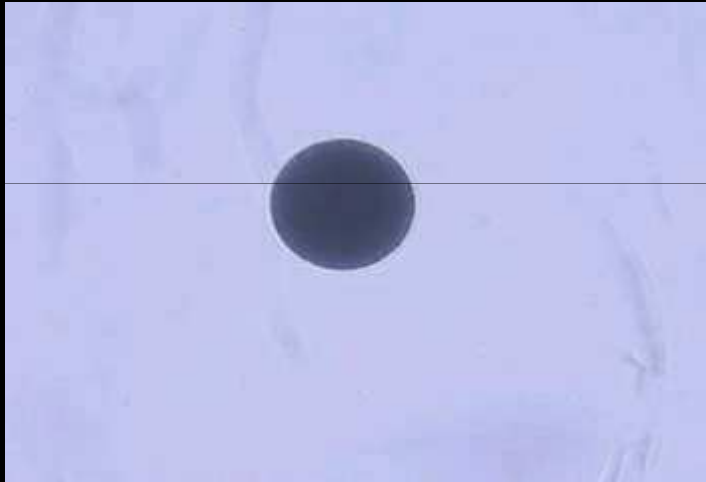


Empty animals, fed in the laboratory redeveloped their gonads and spawned again

Today, *B. lanceolatum* embryos can be
obtained daily during 4 months per year

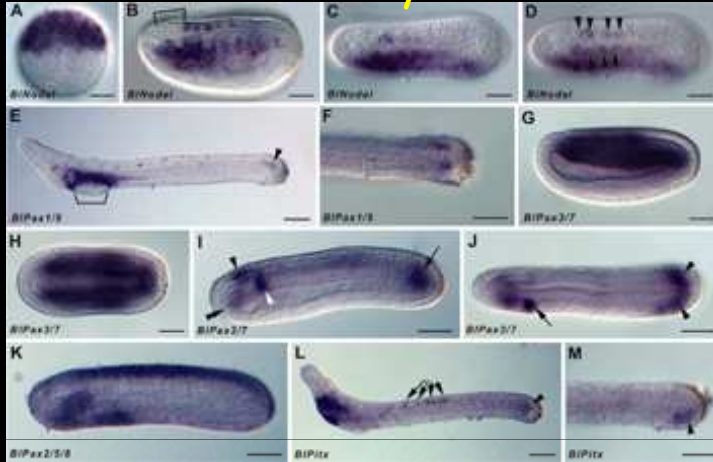
Mediterranean amphioxus are spawning today inland
(Paris, Lyon, Barcelona, Heidelberg)

Amphioxus embryonic development is very fast and metamorphosis occurs 1-3 months after hatching

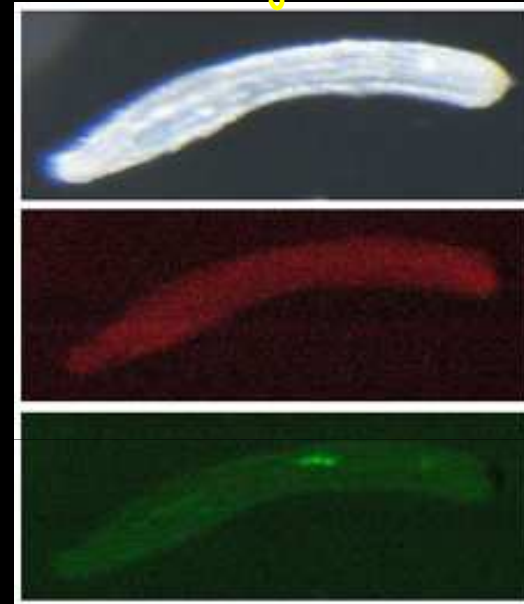


B. lanceolatum: a model for developmental studies

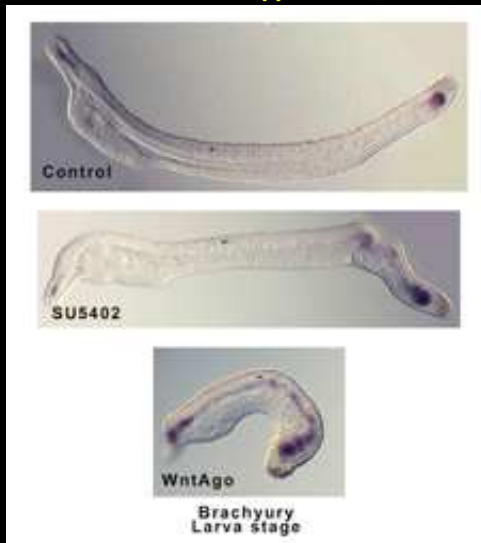
In situ in toto hybridization



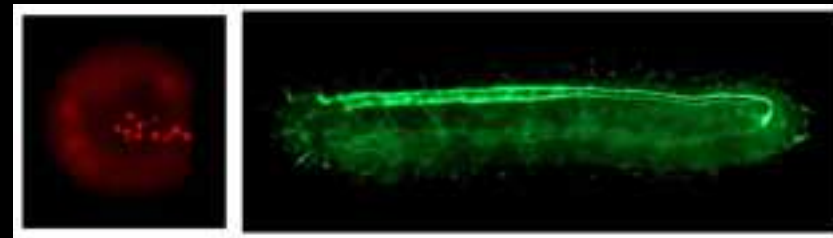
Microinjections



Treatments



Immunolocalizations



B. lanceolatum, genomic tools

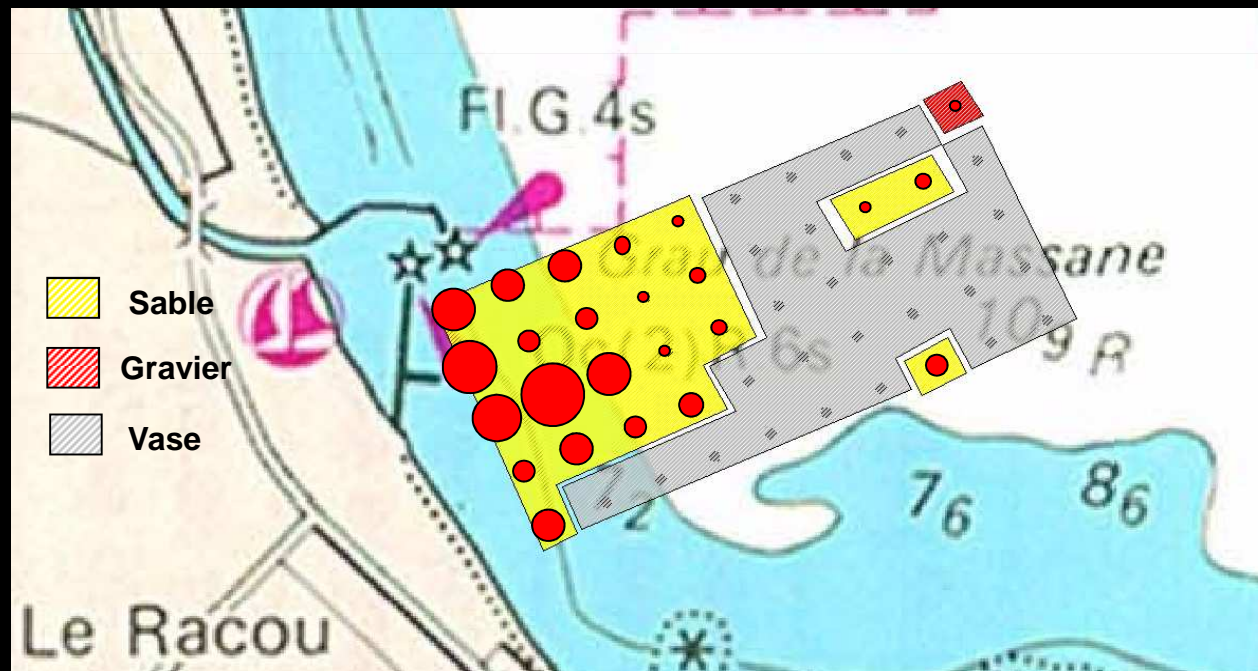
- Adult cDNA library
- Genomic library
- More than 160000 ESTs (454 sequencing, collaboration with Dr. Xu, China)

	Blastula	Cup shape neurula	Late neurula	Pre-mouth
Valid sequence cluster	29042	70321	57916	9034
Singletons	21719	18505	21719	6194
Contigs	3187	8734	8067	767
Average reads per contig	2,29	5,93	4,49	3,7

Reads	Blastula	Cup shape neurula	Late neurula	Pre-mouth
2	1619	4325	4398	502
3-5	1026	2875	2675	199
6-10	285	871	588	36
11-20	131	342	233	18
21-30	41	113	75	3
31-100	67	164	78	8
>100	18	44	20	1

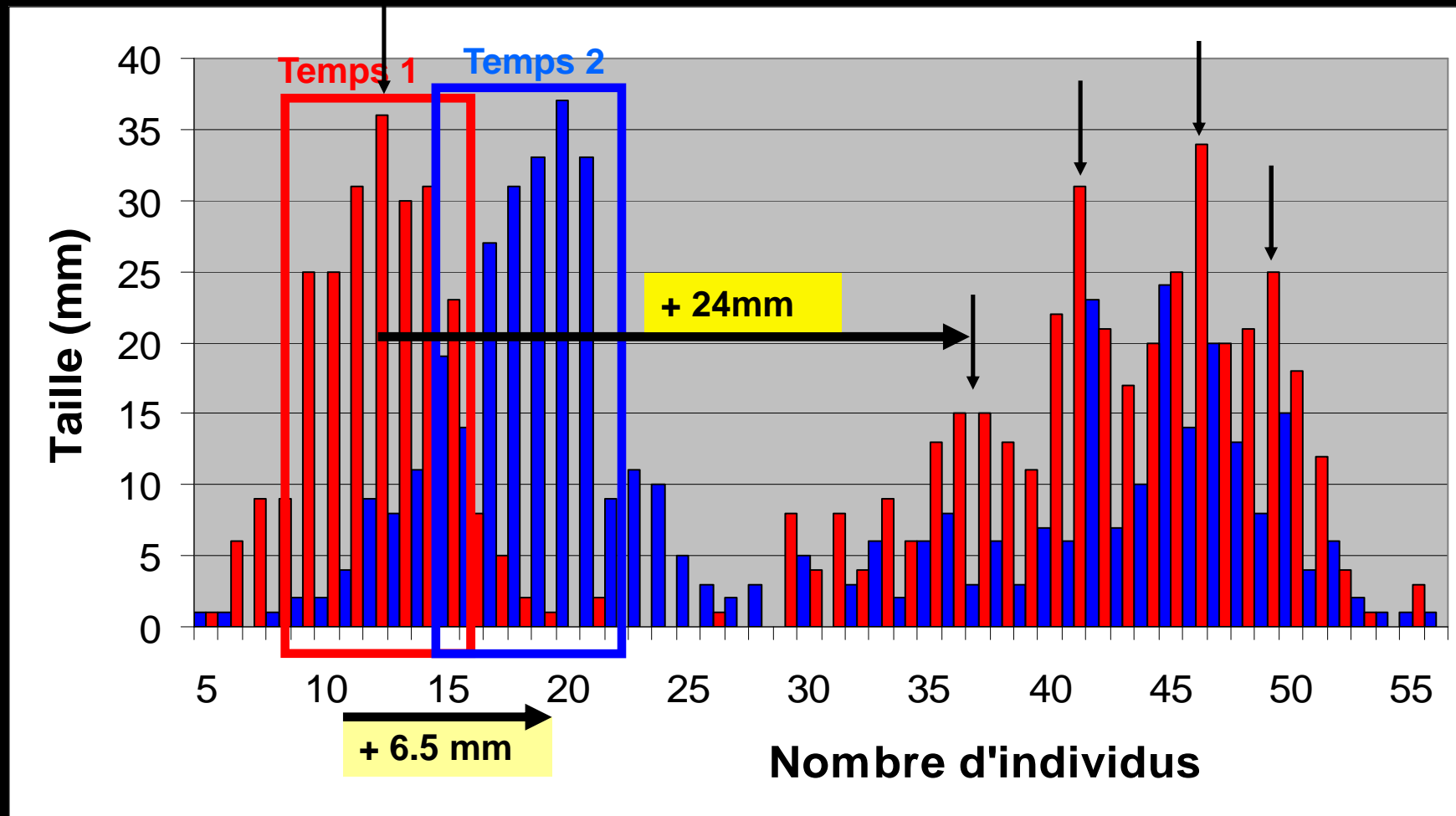
Amphioxus population study

- About 200 000m² of the 360 000m² studied are colonized.
- There is a direct correlation between population and granulometry.
- The average size decreases with depth



First "biological" data of the amphioxus in the wild

- Average size of smaller animals (1 year old) change (6,5 mm) between April/May
- Continuous increase of size (at a lower rate in older animals)



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B. lanceolatum



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