Larvaceans - 2 (Appendicularians)

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Microscopic observations are always rich in lessons and we will illustrate this with two examples: when we discover an interesting subject and after having identified it, we can search for information in specialized works or on the Internet to deepen our knowledge. The latter solution provides access to up-to-date and often high-level studies and research. The other example is the variability of samples depending on the seasons. We often see that specimens can be very different from one week to another in the same sampling location.

For example, on updating knowledge, I am going to return to a subject that I published more than 20 years ago on strange creatures such as larvaceae or appendicularians. These animals of the tunicate family are very abundant and present in practically all marine samples. Year 2002 article here.

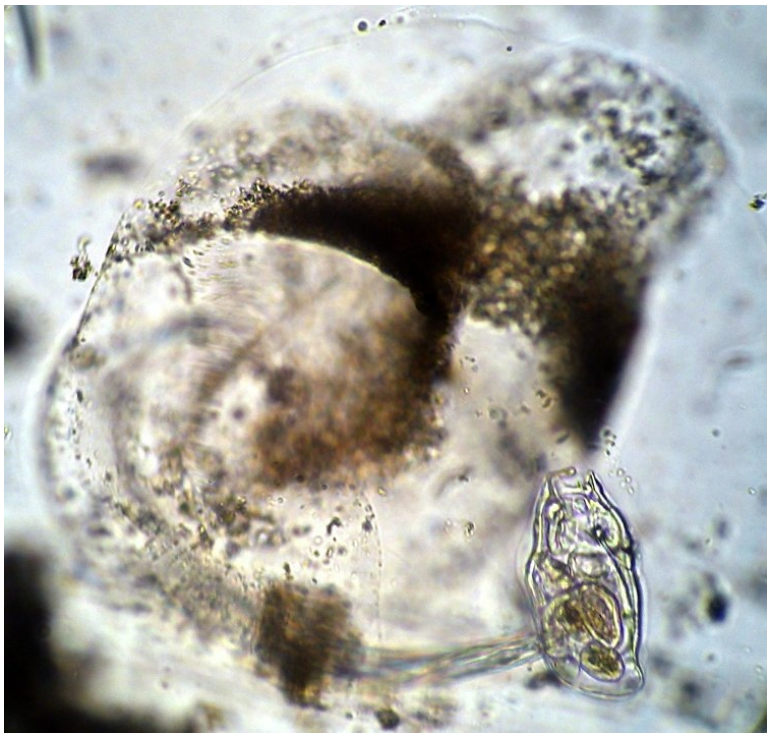
First, a presentation of a very common specimen: *Oikopleura dioica*. Here front and profile view of the same individual:

This species has remarkable properties that make it a widely studied model with regard to embryogenesis and evolution. It is one of the first representatives of the chordate lineage, making it an ancestor of vertebrates. In the tail is the notochord which allows movements and constitutes a precursor of the vertebral column. In addition, its life cycle of around a week, makes it possible to study several generations in vitro. Finally, its genome, made up of only 70 Mbases, is one of the smallest, which makes it easy to observe the possibilities of mutation.

For us, observers, the most extraordinary feature is the way they feed by building (practically every each 2 hours) a new, extremely sophisticated “house” to filter the microalgae or bacteria on which they feed. This set consisting of two levels of filters, is made of mucus and it is extremely fragile which makes it difficult to observe it intact. When the filters are clogged, the larvacea builds another house and the old one (made of polysaccharides) sediments to the bottom of the sea or is consumed by fishes.

The house is secreted by the epithelium of the body of the larvacean, each body zone generates a part of the house which explains the speed of its construction. In this a first primary filter retains large unnecessary particles and a second with finer mesh (0.2 to 1 µm) directs the nutrient particles towards the animal's mouth

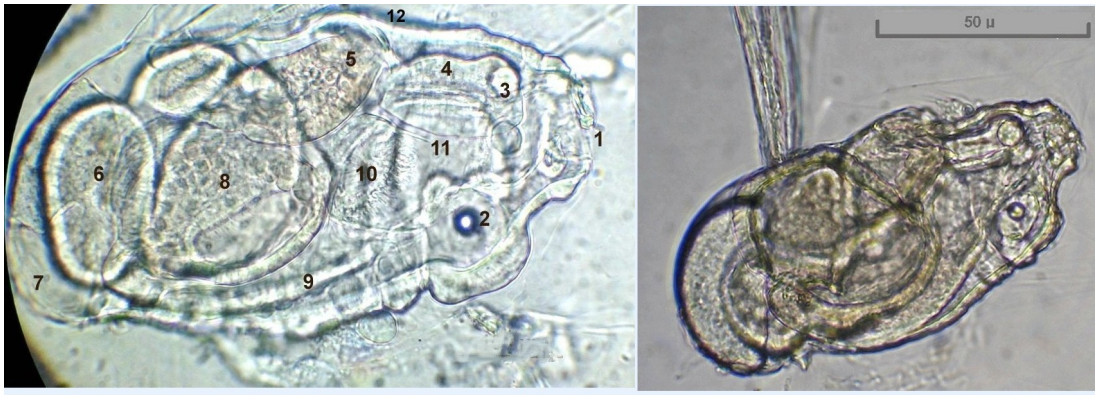
Here is an image of a specimen in its house, difficult to obtain because the animal moves a lot: We can see very clearly the two primary filters, which are very dark because they are clogged, the body of the individual and we can make out the blurred tail because of its movements .



To illustrate the movement see animation of a specimen in its “house”: here “larva house”. Real-time image showing how quickly the tail beats. It is quite rare to collect a complete house with the specimen inside !

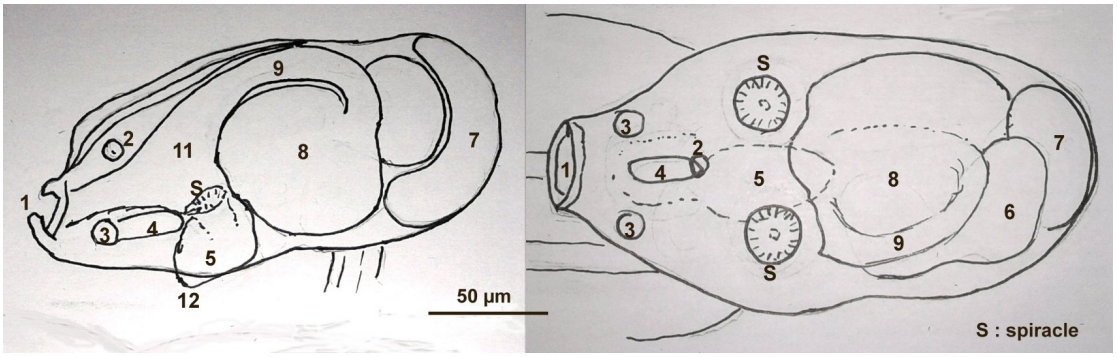
A detail of the body of a specimen that is beginning to build its house and secondary filter connected to its mouth and indicated by the arrow:

We'll take a closer look at the body's organs in below image. The image on the right is that of another specimen



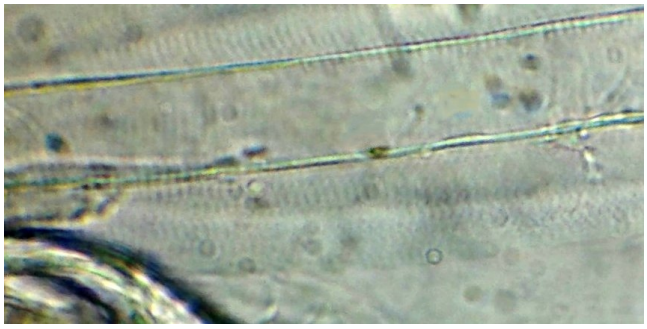
1 mouth 2 Stathocyst 3 buccal gland 4 endostyle 5 rectum
6 intestine 7 gonad 8 stomach 9 oesophagus
10 ciliated gills 11 pharynx 12 anus

Using my own observations and sketches found on the Net I tried to represent the organs in profile view and top view: we can distinguish two spiracles with ciliated rings which communicate the pharynx with the outside and are the source of the water current allowing the aspiration of the food. A sequential focus animation from top to below of the body: "MAPlarva"



See the very beautiful view of the organs in the darkfield video below: video that is not mine!: note the activity of the heart and the spiracles
https://www.youtube.com/watch?v=QzM-F9gYKb

A detail of the notochord showing the muscular bands and the neural tube in the middle (image with the x 40 objective)

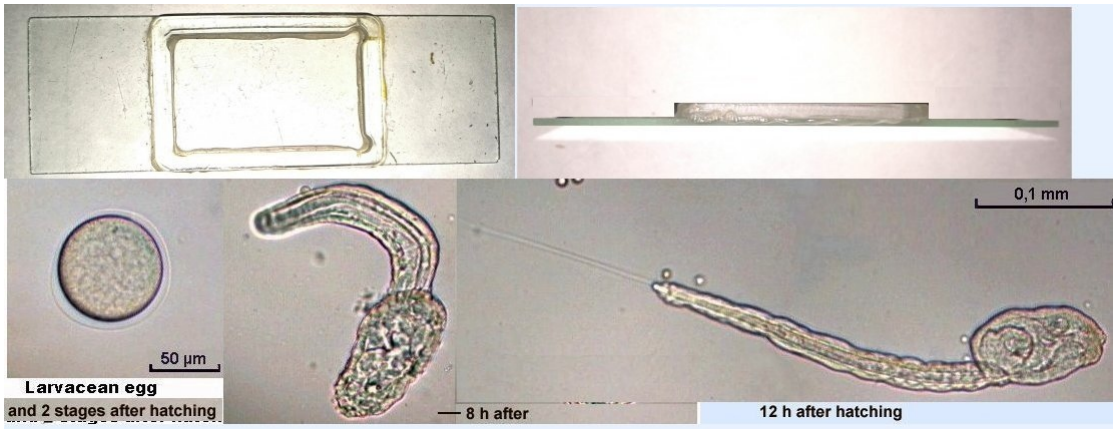


Oikopleura have a lifespan of around a week but reproduce itself by separate males and females in *O.* d*ioica*, other species are hermaphrodites. Eggs or sperm are contained in the gonads and are released by rupture of the wall.

It should be noted that during collection, the body's epithelium is often damaged, which no longer allows the animal to rebuild its home in vitro.

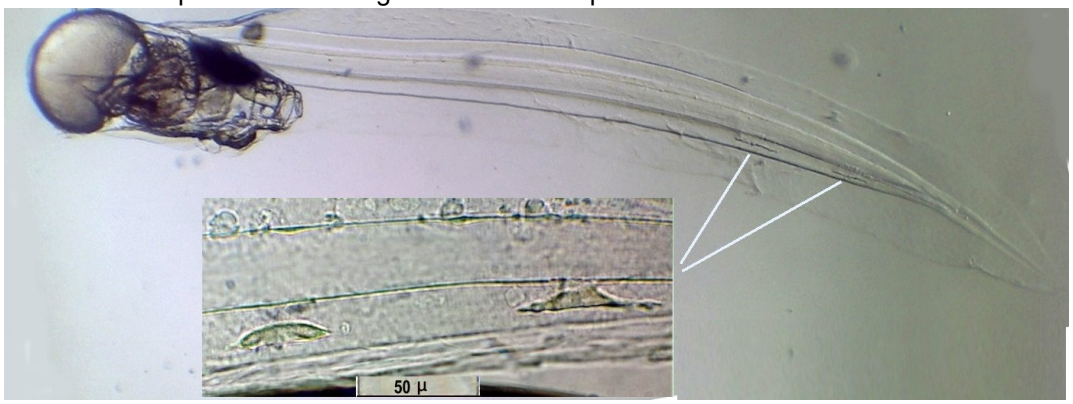
During the collection of mature individuals I was able to observe hatching and development of juveniles using an "aquarium" slide which allows sufficient water to be retained for around

twelve hours: see the slide below (DIY) used and 3 stages of development



A study about youngers development:
https://www.bio.sci.osaka-u.ac.jp/bio_web/lab_page/nishida/otamaboya-e.html

While researching their development, another characteristic that I had never noticed appeared: the presence in this species of two subcordal cells that I found in old images that I had taken a few years ago. Their function is still unknown: they synthesize proteins and are still linked to the presence of oral glands. The latter produce bioluminescence.



To illustrate the second example cited above, after dozens of samples from the same place where we always encountered *Oikopleura dioica*, a new species appears: *Oikopleura sicula*: hermaphroditic species.

Research on this species shows a strange peculiarity: they do not have an anus! Body detail below: The rectum appears as a dark mass. On a specimen accidentally crushed by the slide (right image) we can see the contents and the tip of the rectum which is closed: We also

notice the simplification of the other organs

To learn more:

Classification (WORMS database):
Animalia (Kingdom) → Chordata (Phylum) → Tunicata (Subphylum) → Appendicularia (Class)→ Copelata (Order) → Oikopleuridae (Family) → Oikopleurinae (Subfamily)→ Labiata (Tribe)→ Oikopleura (Genus)

3D pictures of the house:
https://cronodon.com/BioTech/larvaceans.html

Some drawings of other species:
https://www.researchgate.net/publication/250373343_Taxonomic_identification_of_appendicularians_collected_in_the_epipelagic_waters_off_northern_Chile_Tunicata_Appendicularia

Development:
https://www.researchgate.net/publication/5355017_Development_of_the_appendicularian_Oikopleura_dioica_Culture_genome_and_cell_lineages

For Sicula:
https://www.researchgate.net/publication/259370023_Gonadal_development_allometric_growth_and_ecological_impact_of_Appendicularia_sicula_Appendicularia_Fritillariidae_from_the_south-western_Atlantic_Ocean

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