

Penis worms uncover the evolution of the digestive system

A team of scientists that have been funded by ASSEMBLE has revealed that the enigmatic marine penis worms (priapulids) develop their intestine as humans, fish or starfish. This surprising finding shows that very different animals share a common way of forming a gut.

A collaboration led by Dr. Andreas Hejnl from the Sars International Centre for Marine Molecular Biology in Norway, examined the formation of the gut and the expression of genes needed to form the mouth and the anus in priapulid embryos.



“Surprisingly, priapulids form the gut like humans, fish and frogs, but also starfish and sea urchins –and all of them even use the same genes. It does not mean that these penis worms are now closely related to humans. Instead the fact that different animals share a common way of forming the gut suggests that the embryological origins of the human intestine and how it develops are much older than previously thought - most likely over 500 million years, when the first bilaterally symmetric animals appeared on Earth” remarks Hejnl.

The study, featured online on the 25th of October in the journal “Current Biology”, represents the first description of the entire embryonic development of these enigmatic animals.



“Priapulids are important to understand the evolution of animals, because they are thought to be among the first bilaterally symmetric animals and have changed very little since the earth’s Cambrian Period” says first author Dr José M. Martín-Durán.

“We sail the fjords dredging in areas where they are abundant, collecting animals and later getting embryos from them in the lab. Although thrilling, sometimes the collection trips turn into real adventures, with low temperatures, snow or even frozen waters” explains Martín-Durán.

The research, carried out by the developmental biologists Dr José M. Martín-Durán and Dr Andreas Hejnl at the Sars International Centre for Marine Molecular Biology in collaboration with Dr Ralf Janssen, Dr Sofia Wennberg and Dr Graham E. Budd (Uppsala University, Sweden), features online on the 25th of October in the journal “Current Biology”. The collection trips were funded by the European Union Infrastructures program “ASSEMBLE”.

Reference: Deuterostomic Development in the Protostome Priapulid *Priapulidus caudatus*. 2012. J.M. Martín-Durán, R. Janssen, S. Wennberg, G. E. Budd, A. Hejnl. *Current Biology*: doi:10.1016/j.cub.2012.09.037

Bilaterally symmetric animals (99% of all animals) are those with a left and right body side. Historically, they have been divided into two large groups based on major differences in the mode of how the gut develops in the embryo. The intestine is an essential organ, and that is why it is present in nearly all animal species. The gut develops very early, when some cells move towards the inside of the embryo, usually at a defined region that is called the ‘blastopore’.

The work shows how important it is to study the vast diversity of animals found in the oceans.

“The important point is that in some animals this region becomes the mouth, while in others it becomes the anus. For more than a century, this difference has captivated scientists, but there is not a completely satisfactory explanation for it yet” explains Hejnl.

“Priapulids still hide a lot of secrets to unravel, which will have a great influence on our understanding of the origin of other major organs, such as the brain, blood or legs” concludes Hejnl.

Priapulids are an obscure group of marine worms that live in shallow waters. They reproduce in winter time, so the scientists have to travel regularly to the west coast of Sweden during the ice-cold season.



Adult *Priapulidus caudatus*, the penis worm studied by the research team (credit: Bruno Vellutini, Sars International Centre for Marine Molecular Biology, Bergen, Norway).

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