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Marine apprenticeships give UW undergrads role in animal-ancestor breakthrough

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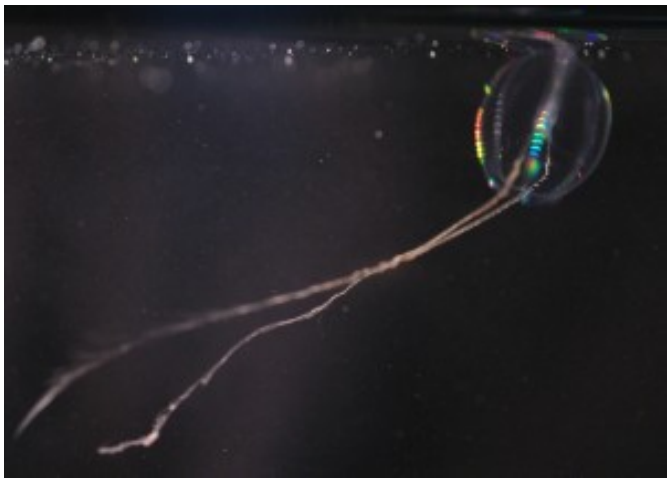
News and Information

Comb jellies – and not sponges – may lay claim as the earliest ancestors of animals, according to **Billie Swalla**, University of Washington professor of **biology** and interim director of **Friday Harbor Laboratories**. Her contributions helped decode the genomic blueprints for 10 ctenophore – or comb jelly – species, an analysis that suggests these beautiful sea creatures form the first branch on the animal kingdom's tree of life.

The **findings** published May 21 in Nature are based in part on analysis and work done at UW's Friday Harbor Laboratories including research accomplished by UW undergraduates and graduate students who spent intense quarters in 2008, 2010 and 2012 living at the lab and collaborating with visiting and UW faculty on this specific endeavor.



R Sanford

The Pacific sea gooseberry is crystal clear and about the size of a marble. The colors are from light refracting off the jelly's rapidly moving cilia.

The students worked under the direction of Swalla and **Leonid Moroz** of the University of Florida, who is the lead author of the paper, and seven former undergraduate students and teaching assistants for the research apprenticeships are co-authors.

Comb jellies are found throughout the world's oceans and range in size from just millimeters long to nearly 5 feet. They rely on cilia – fine hair-like projections that sweep in unison – to move through the water and are the largest animal using cilia for locomotion. Almost all are predators with prey ranging from larvae to small crustaceans.

The study focused on the comb jelly Pleurobrachia bachei, about the size of a marble and commonly known as a Pacific sea gooseberry, many of which were collected from the waters at Friday Harbor Laboratories in the San Juan Islands. UW biologist **Claudia Mills**, a co-author on the paper, is considered one of the world's top experts on comb jellies.

In a remarkable evolutionary twist, the gooseberry jelly and 10 other comb jellies appear to have independently developed complex organs, muscles and behaviors that are far more sophisticated than sponges, which previously were viewed as the earliest lineage of animals.

M Citarella

Billie Swalla, in yellow rain coat, works on San Juan Island with undergraduates during the 2010 research apprenticeship.

The findings would reclassify comb jellies, reshaping two centuries of zoological thought, and imply that there are many ways to "make an animal" with neural and muscular systems, Moroz said.

"For years, textbooks have started discussions of animals with sponges," Swalla said. "Then studies published in 2008 suggested that comb jellies might be at the base of the animal tree of life. It became a priority to sequence one of these species."

The result: The Pacific sea gooseberry is now the first Friday Harbor Laboratories animal to have its entire genome sequenced.

The classes of students helping with the project worked on such things as compiling gene lists and spent much of their time doing bioinformatics and laboratory experiments with Swalla and Moroz. For example, they collected embryos in the lab so

researchers could examine neurotransmitters and genes that were expressed at different times. Students also used jelly catchers to collect comb jellies from the waters around Friday Harbor for research purposes.

The students were part of a research apprenticeship program that's been underway at the labs since 1999. Instead of taking several classes as they do during a typical quarter, the students are immersed in current research projects by UW faculty and visiting scientists.

U of Washington

Alexander Fodor was a research apprentice working on the gooseberry genome and is currently a UW graduate student in Billie Swalla's lab and a co-author on the paper.

It gives students a chance to really see what marine science is about and learn team work, Swalla said. Along with working on the overall project, Swalla has students develop their own research projects that further the common goal. Some students also worked summers with funding from the National Science Foundation's BEACON For Evolution in Action program.

Co-authors on the paper include former undergraduate apprentices David Girado, Joshua Swore, Alexander Fodor, Rachel Sanford and Rebecca Bruders, four of whom have gone on to graduate school, and two of the teacher assistants for the apprenticeships Kevin Kocot and Matthew Citarella.

Along with reconfiguring the tree of life, the novel neurogenic and signaling molecules and receptors the researchers found also have implications for synthetic and regenerative medicine, they said. The findings could lead to new ways to investigate neurodegenerative diseases such as Alzheimer's or Parkinson's.

"Some ctenophores can regenerate an elementary brain – also known as the aboral organ or gravity sensor – in three and a half days," Moroz said. "In one of my experiments, one lobate ctenophore – Bolinopsis – regenerated its brain four times."

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Portions of this article were adapted from a news release from University of Florida.

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