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Sex detected in placozoans

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This week, scientists reported the first evidence that one of the most ancient surviving animal lineages, placozoans, have sex. The finding, published in the *Proceedings of the National Academy of Sciences*, suggests placozoans could prove an excellent model organism for understanding metazoan evolution, co-author Ana Signorovitch at Yale University in New Haven, Conn., told *The Scientist*.

For instance, researchers could breed placozoans and chart their complete life cycle, then observe which development stages are shared between placozoans and sponges, Signorovitch noted. This exercise "could help answer questions such as what the relationships between the basal groups are," she explained.

Placozoans could also prove to be an essential model organism, Signorovitch added, since they are "easier than fruit flies" to culture in the lab, requiring only seawater, food such as red algae and light, and petri dishes kept at room temperature.

Since their discovery over a century ago, it has been unclear whether placozoans, the simplest free-living metozoans, could sexually reproduce. Researchers have spotted them forming egg-like structures, but have never observed sperm, fertilization or complete development.

In a sexually reproducing population, nucleotide variation both within and between individuals is expected to be roughly equal, on average, since homologous gene regions are constantly recombining during meiosis and pairing during syngamy (gamete fusion). In contrast, levels of variation within asexual individuals should generally be high, since, without recombination and syngamy, homologous gene regions tend to accumulate mutations over time. At the same time, variation between individuals should be lower, on average, since asexual reproduction gives rise to identical individuals.

During this study, Signorovitch and her colleagues analyzed seven genes from 10 placozoans collected from a mangrove island near Belize, and found nucleotide variation levels typical of sexually reproducing organisms. These seven loci also showed no pattern of complete linkage, while all regions of the genomes of obligate asexuals are completely linked due to the absence of recombination and genetic exchange.

In addition, the researchers found that some placozoans were homozygous for two different alleles of the *Unknown P1439* locus, while others were heterozygous for the same two alleles. This pattern of homozygosity and heterozygosity is often found in sexually reproducing populations, the authors note. In contrast, obligate asexuals would require 61 nucleotides in *Unknown P1439* to produce the same genetic pattern across multiple individuals, they add.

"A very big question in evolutionary biology and genetics is: what is the role of sexual reproduction in populations?" Nancy Moran at the University of Arizona in Tucson, who did not participate in this study, told *The Scientist*. "Finding out there is sexual reproduction even in these primitive organisms underscores how important it is to have recombination for some reason."

Alexey Kondrashov at the National Center for Biotechnology Information in Bethesda, Md., also not a co-author, told *The Scientist* he found the evidence of sex in placozoans "convincing," but felt it will be difficult to find cues that can trigger sex in the lab.

Signorovitch and her colleagues say they plan to isolate placozoans with potential cues such as lack of food, temperature increases or salinity spikes. Hopefully, this will enable them to observe placozoan sex directly, measure the frequency of sexual reproduction, and determine whether there are parthenogenic and resting stages, she noted. Scientists should release the genome sequence of the placozoan *Trichoplax* this year, which could enable others to study the genes involved in placozoan sex and embryonic development, Signorovitch added.

Matthew Meselson at Harvard University in Cambridge, Mass., who did not participate in this study, told *The Scientist* that some theorists believe sex evolved to keep retrotransposons from increasing unchecked. Consequently, it would be interesting to discover whether placozoans possess retrotransposons, he explained. "I would predict placozoans do, and that's what's maintaining the sex."

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