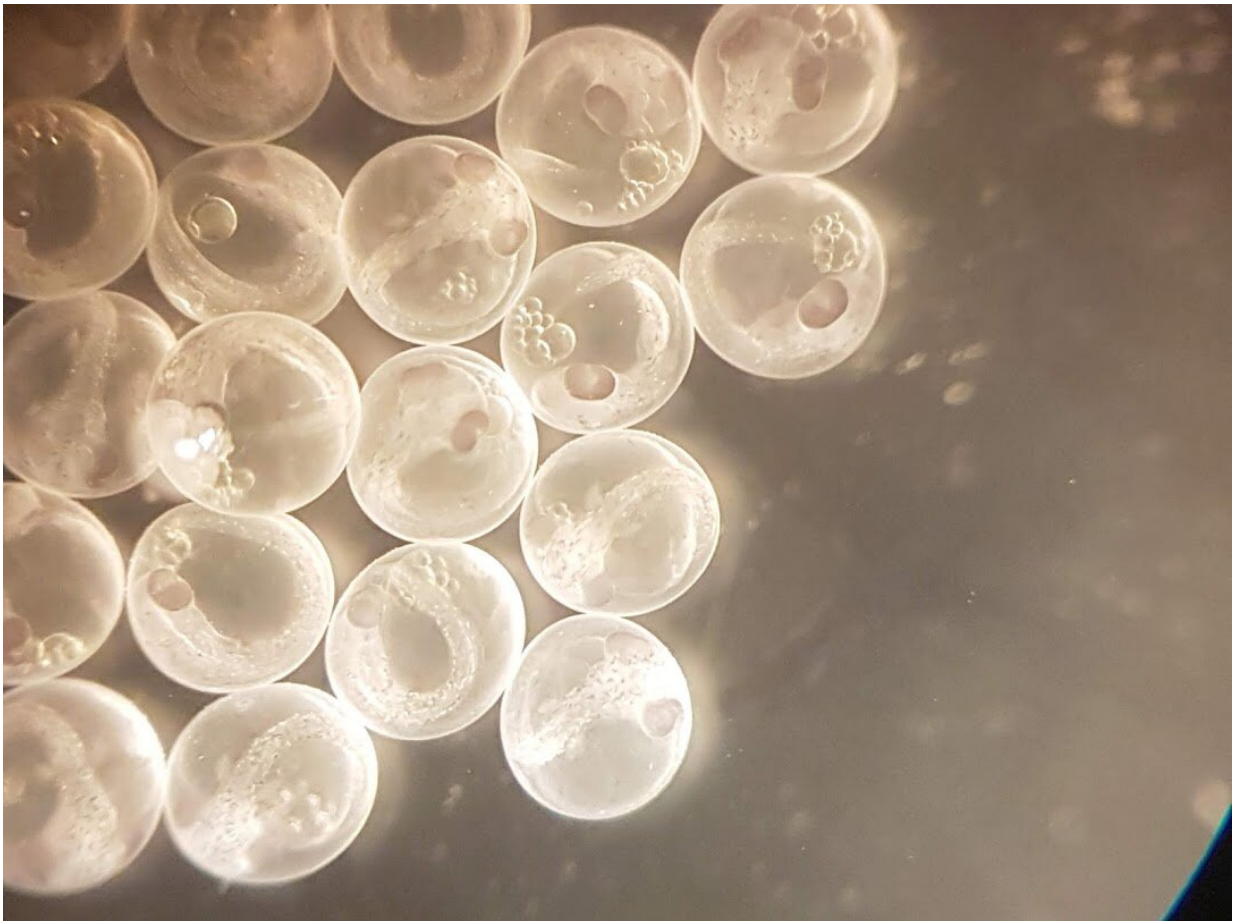


Scientists solve mystery of a fish called Mary's 'virgin' birth

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Mary's embryos about to hatch. Credit: ©Dr. Laura Dean

A female stickleback fish, nick-named 'Mary', has produced offspring

from eggs that appear to have been fertilised while they were still inside her, according to scientists at the University of Nottingham.

The team of researchers from the School of Life Sciences collected Mary on an expedition to the Outer Hebrides to gather wild sticklebacks which are fully genome-sequenced models for a wide range of scientific research.

In a paper published in *Scientific Reports* they present the first ever discovery of internal fertilisation and development of babies inside a normally egg-laying species, and their successful delivery.

The three-spined stickleback, *Gasterosteus aculeatus*, is a small fish that is common to both fresh and coastal waters in the Northern Hemisphere. In normal reproduction, the male stickleback builds a nest and, by performing a zig-zagging dance routine, lures a female to lay her [eggs](#) inside it. The male then chases the female away and fertilises the cluster. He then guards and takes care of the eggs by fanning them with his fins to aerate them for around 2 weeks until they hatch.

Mary's unusual pregnancy meant that the 'virgin' stickleback was egg-bound and close to death when her predicament was noticed so the decision was taken to save the lives of her young, by putting her to sleep and delivering the near-complete [embryos](#) by Caesarean section. 54 embryos were successfully delivered, hatched into fry and grew to adulthood in the aquaria in Nottingham where around 20 still survive nearly three years on. The team has also successfully bred from Mary's offspring in normal aquarium conditions.

Dr. Laura Dean, from the School of Life Sciences, said: "We were astounded at what we found when we examined Mary in our lab in the Outer Hebrides. She looked like an ordinary egg-bound fish so we couldn't believe it when we found she had almost completely developed

embryos inside her ovaries. This is pretty much unheard of in an egg laying species. The embryos were perfectly healthy, not deformed in any way, and most have gone on to live a normal adult lifespan."

This discovery is currently the only record of this kind of fertilisation and delivery of live offspring in any fish ever so the research team was very keen to investigate how this might have happened. There are three known mechanisms by which abnormal type of reproduction in fish can occur. The first is parthenogenesis which is where the fish clones herself, the second is that she could be hermaphrodite with both male and female sex organs.

Laura said: "We were able to rule these two possibilities out because, in parthenogenesis, her offspring would have been genetically identical to the mother, or, if hermaphroditism, they would have only had versions of genes that she had, with no genetic input from anywhere else. So, we did some very simple genetic testing on the offspring and found that they had versions of genes that Mary didn't have and so must have had a father.

"Our theory is that somehow sperm had got into the fish, fertilised the eggs and they developed into normal two-parent embryos. What has probably happened is that she has gone into a nest to lay her eggs where another female had already laid her eggs which had been covered with sperm by a male stickleback. Somehow some of the sperm in the nest must have got into Mary, presumably through her egg tube, and fertilised the eggs inside her but she never laid the eggs."



Mary's baby as a teenager in the aquarium at School of Life Sciences, University of Nottingham. Credit: ©Dr. Laura Dean

Andrew MacColl, Associate Professor of Evolutionary Biology, said:" Although this almost accidental find revealed a vanishingly rare phenomenon, it might help us to understand a really important change that has happened throughout the tree of life. Most animals lay eggs, but some (including almost all mammals, but few fish) retain their eggs inside and give birth to live young. Although this appears to be a difficult thing to achieve in evolution, this one little fish seems to have got there almost by itself!"

The finding of fertilised eggs inside a stickleback has only been recorded once before, in a paper published in the 1950s, but it was just recorded as a picture of the [fish](#) with no delivery of the embryos.

The researchers are now actively looking, on subsequent fishing expeditions to Scotland, for more female sticklebacks who may display the same phenomenon to see if there is a chance it may not just be a freak incident but could be an indication of an evolutionary or genetic change in the reproductive mechanism of the species.

They are also hoping to secure funding to investigate the internal mechanisms which allowed the embryos, which would normally have developed in water and been fanned and cared for by the father, to develop within ovarian fluid and without this care.

More information: *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-38584-w](https://doi.org/10.1038/s41598-019-38584-w)

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