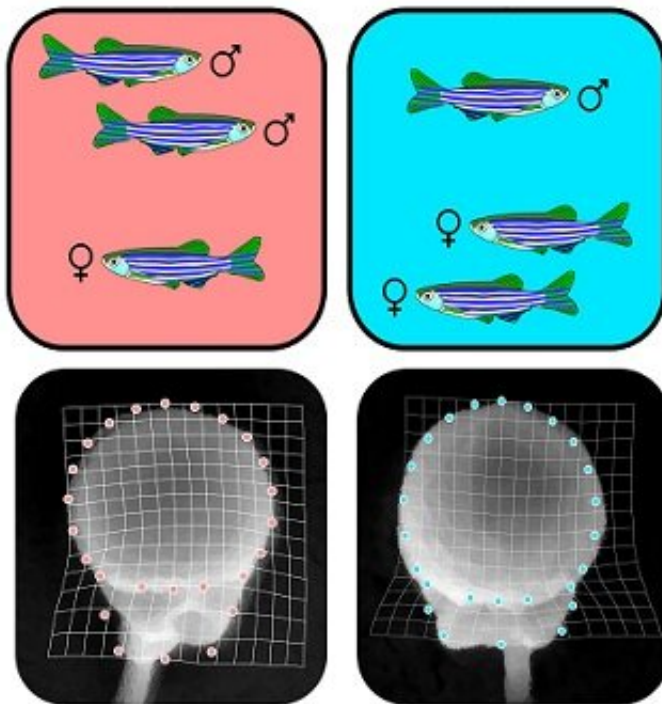


A study on zebrafish reveals how sexual rivalry can affect sperm function and quality

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Credit: Asociación RUVID

The presence of a rival male affects sperm quality, according to a research study led by the University of Alicante and the University of Upsala (Sweden). The work was carried out with adult zebrafish (*Danio rerio*) and reveals that male spermatozoa exposed to high competition (two males and a single female) present dramatic changes in phenotype resulting in faster and more competitive spermatozoa. However, this

phenotypic plasticity may incur a cost in the next generation as it has negative effects on DNA integrity.

According to lead author Paula Sáez, results are revealing, as this model provides detailed new data on the effect of sexual competence on sperm function and quality.

The [research methodology](#) involved exposing the male zebrafish to a high competition treatment for two weeks. Another group of two males with one female represented low competition, i.e. a male with two females. Although the presence of a rival male increases the competitiveness of spermatozoa, it has negative effects on DNA, Sáez added. A [possible explanation](#) for the difference in damage to [genetic material](#) is that males in highly competitive treatment experience higher stress levels, probably triggering greater production of reactive oxygen species. This increase could be triggering the damage observed in the DNA chains, affecting both the fertilisation success and the offspring survival, as stated by the UA researcher.

The work, published in the prestigious scientific journal *Journal of Evolutionary Biology*, proposes new experimental designs and analysis techniques in reproduction biology. Animal research is key for advancing knowledge of the mechanisms involved in the biology of human development. In this sense, as suggested by UA Research Chair in Human Fertility Director and coordinator of the study María José Gómez, zebrafish is an extraordinary model for studies due to its high level of fertility, the genetic similarity with humans, and the external fertilisation that produce transparent embryos

Variations in shape and size

The special structural organisation of sperm comes from complex morpho-genetic changes during spermiogenesis, when the nucleus is

extended and remains in the head of the sperm, the [mitochondria](#) are placed in the neck and the centrioles give rise to a flagellum or tail.

Alejandro Romero, co-author of the study and researcher at the UA Department of Biotechnology, says shapes and sizes of spermatozoa vary between species. However, the genetic influence on cell design and its relationship to sperm rivalry is still little understood. Romero also explained that through the application of geometric [morphometry](#), an analysis technique defined as the union between biology and geometry, the researchers painstakingly isolated variations in the sperm shape and size, also analysing their relationship with other cell signaling mechanisms.

Thus, the consequences of the presence of a rival male in zebrafish are spermatozoa with a phenotype characterised by smaller heads and an elongation of their intermediate pieces and flagella, as opposed to those exposed to low competition. In the processing of high rivalry, sperm appeared to be less sensitive to osmotic stress induced by water, according to the UA researchers. However, these sperm showed higher rates of DNA damage.

Reproduction is key to understanding species diversification and evolution. This is why the UA researchers insisted on the need to design biological models to understand aspects of sperm function and quality during [sperm](#) competition. Accordingly, interdisciplinary work between researchers from Alicante and Sweden suggests new experimental designs and analysis techniques in reproduction biology.

More information: Willian T. A. F. Silva et al. The effects of male social environment on sperm phenotype and genome integrity, *Journal of Evolutionary Biology* (2019). [DOI: 10.1111/jeb.13435](https://doi.org/10.1111/jeb.13435)

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