Sex over survival: Reproductive trait in fish impedes tissue regeneration

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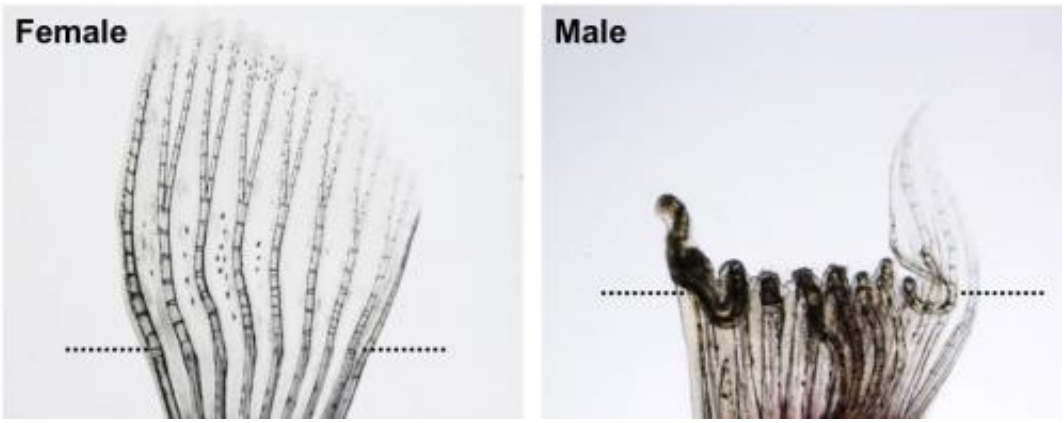

Female zebrafish regenerate their pectoral fins after amputation injury, while a high percentage of male zebrafish show defective regeneration. Credit: *Developmental Cell*, Kang et al.

New research on the reproductive habits of zebrafish offers an explanation as to why some animals' bodies repair tissues. The research team previously noticed that male zebrafish regenerate their pectoral fins poorly, as compared to females. Their latest findings, publishing in the October 14 issue of the Cell Press journal *Developmental Cell*, reveal the basis for this sex-specific regenerative deficiency: structures that are used to improve reproductive success. The scenario represents an example of the tradeoffs between reproduction and survival.

Led by first author Junsu Kang, the scientists identified anatomical

structures that male fish use during mating that produce a signal that impedes regeneration of the pectoral fins after injury. As such, fish appear to trade an ancient ability to regenerate tissue easily for a new-found way of enhancing reproductive success. This valuable information could help scientists begin to explain why humans are less able to regenerate tissue and could also be used to improve the body's tissue regenerative capacity.

"We discovered that male zebrafish have a very important set of structures on their pectoral fins that they use for breeding and that these structures secrete a potent molecular inhibitor of a key signaling pathway to aid their cycles of regular replacement," explains senior author Kenneth Poss of Duke University Medical Center.

Higher vertebrates like mammals generally have a diminished capacity for tissue regeneration compared with lower vertebrates like fish and salamanders. "The biology we describe here suggests a new paradigm for how tissue regenerative capacity may be lost during species evolution," says Poss. The researchers speculate that natural selection acting on traits like sexual features could have detrimental effects on tissue regenerative potential. For example, male zebrafish with more numerous or more effective breeding ornaments—and thus lower regenerative potential—might contribute more to the gene pool, phasing out regenerative potential over generations.

Spiked structures on male zebrafish pectoral fins are important for mating but also produce a potent signaling inhibitor. Presence of this inhibitor disrupts regeneration of fin tissue after amputation injury. Credit: *Developmental Cell*, Kang et al.

Poss notes that growing attention in the field of tissue regeneration is being paid to factors that block signaling pathways. "Our results indicate that the presence or restriction of a pathway inhibitor is critical to whether regeneration occurs normally, providing new fuel for ideas of how to promote regeneration after injury in humans."

More information: *Developmental Cell*, Kang et al.: "Local Dkk1 Crosstalk from Breeding Ornaments Impedes Regeneration of Injured Male Zebrafish Fins." dx.doi.org/10.1016/j.devcel.2013.08.015

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