A new male-specific gene in algae unveils an origin of male and female

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By studying the genetics of two closely related species of green algae that practice different forms of sexual reproduction, researchers have shed light on one route by which evolution gave rise to reproduction though the joining of distinct sperm and egg cells.

The findings, which indicate that a gene underlying a more primitive system of reproduction was likely co-opted during evolution to participate in sex-specific sperm development, are reported by Hisayoshi Nozaki and colleagues at the University of Tokyo, Rikkyo (St. Paul's) University, and Osaka University. The paper appears in the December 19th issue of the journal *Current Biology*, published by Cell Press.

The familiar notion of the separate male and female sexes exhibited by animal and plant species is based in part on the anatomically and genetically distinct gametes, sperm and egg, produced by members of each sex. But the evolutionary origin of oogamy—reproduction though joining of distinct sperm and egg cells—is in fact poorly understood. In particular, it has remained unclear how oogamy arose from isogamy, a more simple form of sex in which very similar reproductive cells take on different "mating types" but do not differentiate as distinct sperm and egg. The transition from isogamy to oogamy has apparently occurred multiple times during the evolution of animals, plants, and some algae, but how did such transitions occur"

In their new work, the researchers established a genetic connection between male sexuality of an oogamous multicellular green algae

species, Pleodorina starrii, and one of the mating types of its isogamous ancestor, the unicellular alga Clamydomonas reinhardtii.

In C. reinhardtii, isogamous sexual reproduction occurs through "plus" (MT+) and "minus" (MT-) mating types. MT- represents a "dominant sex" because a particular gene, MID ("minus-dominance") of C. reinhardtii is both necessary and sufficient to cause the cells to differentiate as MT- isogametes. However, no sex-specific genes related to MID had been identified in closely related oogamous species. The researchers now report that they have successfully identified a version of the MID gene in Pleodorina starrii. This "PlestMID" gene is present only in the male genome, and it encodes a protein localized abundantly in the nuclei of mature sperm. The findings indicate that P. starrii maleness evolved from the dominant sex (MT-) of its isogamous ancestor. This breakthrough in understanding provides an opportunity to address any number of extremely interesting questions regarding evolution of oogamy and the origins of male-female dichotomy.

Source: Cell Press