

Two from one: new research maps out evolution of genders from hermaphroditic ancestors

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Research from the University of Pittsburgh published in the Nov. 20 edition of *Heredity* could finally provide evidence of the first stages of the evolution of separate sexes, a theory that holds that males and females developed from hermaphroditic ancestors. These early stages are not completely understood because the majority of animal species developed into the arguably less titillating separate-sex state too long ago for scientists to observe the transition.

However, Tia-Lynn Ashman, a plant evolutionary ecologist in the Department of Biological Sciences in Pitt's School of Arts and Sciences, documented early separate-sex evolution in a wild strawberry species still transitioning from hermaphroditism. These findings also apply to animals (via the unified theory) and provide the first evidence in support of the theory that the establishment of separate sexes stemmed from a genetic mutation in hermaphroditic genes that led to male and female sex chromosomes. With the ability to breed but spared the inbred defects of hermaphrodites, the separate sexes flourished.

"This is an important test of the theory of the early stages of sex chromosome evolution and part of the process of understanding the way we are today," Ashman said. She added that the study also shows that plants can lend insight into animal and human evolution. "We have the opportunity to observe the evolution of sex chromosomes in plants because that development is more recent. We wouldn't see this in

animals because the sex chromosomes developed so long ago. Instead, we can study a species that is in that early stage now and apply it to animals based on the unified theory that animal and plant biology often overlaps."

Ashman reported in *Science* in 2004 that animals and flowering plants employ similar reproductive strategies to increase reproductive success and genetic diversity. These methods include large numbers of sperm cells in males, mate competition and attraction through fighting or natural ornamentation, aversion to inbreeding, and the male inclination to sire as many offspring as possible.

For the current study, Ashman and Pitt postdoctoral research associate Rachel Spigler worked with a wild strawberry species in which the evolution of separate sexes is not complete, so hermaphrodites exist among male and female plants. Sex chromosomes in these plants have two loci—or positions of genes on a chromosome—one that controls sterility and fertility in males and the other in females. Offspring that inherit both fertility versions are hermaphrodites capable of self-breeding. Plants that possess one fertility and one sterility version become either male or female. Those with both sterility versions are completely sterile, cannot reproduce, and, thus, die out.

The single-sex plants breed not only with one another but also with hermaphroditic plants and pass on the mutation, which can result in single-sex offspring. (Sterile plants also can result, but plants with genes that favor the production of fertile offspring will be more successful.) When inbreeding depression in hermaphrodites is also considered, Ashman said, a gradual decline in the number of hermaphroditic plants is to be expected. Consequently, fewer chromosomes with both fertility versions of the loci will be passed on and the frequency of single-sex individuals will increase.

Access this paper on the Heredity Web site at
www.nature.com/hdy/journal/va0...ull/hdy2008100a.html

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