

The genetic basis of inbreeding avoidance in house mice

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A new study appearing online on November 8th in *Current Biology*, a publication of Cell Press, offers new insight into how wild house mice avoid mating with their relatives. The mice rely on a diverse set of specially evolved proteins in their urine, called major urinary proteins (MUPs), to identify relatives and avoid mating with them.

Mating between close relatives is avoided in many animals because it can lead faulty, otherwise hidden (or recessive) traits that are shared between them to surface in their offspring, a phenomenon known as inbreeding depression, the researchers explained.

“Mice use these variable proteins as a kind of genetic barcode that normally differs between individuals,” said Jane Hurst of the University of Liverpool. “Animals with the same sets of proteins can recognize each other as relatives, and so avoid mating with each other. It is not a perfect system—some close relatives will not share the same urine proteins. However, by simply checking the match between their own urine proteins and those of any animal they meet, they will be able to identify many of their closest relatives, even if they have never met them before.”

The researchers found no evidence in the current study that a gene family known as the major histocompatibility complex (MHC)—which has earlier been shown to influence individual scent in a broad range of vertebrates—plays a role in the mate choices of wild mice. The MHC is an extremely variable set of genes that allows the immune system to

identify and defend the body against foreign invaders.

Previous studies in humans and in laboratory mice had implicated the MHC in scent recognition. For instance, “T-shirt-sniffing studies”—experiments in which people are asked to sniff smelly shirts and say which body odor they “prefer”—showed that even humans, with their relatively poor sense of smell, tend to like the odor of individuals that have different MHC genes from their own, Hurst said. Studies in mice also found that animals prefer mates with MHC genes different from their own.

In the new study, the researchers let wild mice breed in outdoor enclosures, and they used parentage testing on the offspring to determine which animals had mated with each other.

“Surprisingly, we found that the MHC played no role in inbreeding avoidance at all,” said study collaborator Amy Sherborne, also of the University of Liverpool. “Instead, another specialized set of proteins, which are produced at high concentration in mouse urine, signal relatedness through their scent. It is these proteins that allow animals to avoid mating with their close kin.”

The results of the new study might differ from previous findings in mice because most of those studies were conducted in artificially inbred, laboratory mice that were genetically identical except for their MHC genes, Hurst said. “In dramatic contrast to wild mice, [laboratory mice] do not have individually variable MUP patterns in their urine,” Hurst said. “So no one working on lab animals would have known that they were important.”

“This study, the first to examine wild animals with normal variation in MHC, MUP, and genetic background, demonstrates that mice use self-referent matching of a species-specific signal to avoid inbreeding,” the

researchers concluded. The finding suggests that “recognition of close kin as unsuitable mates may be more variable across species than a generic vertebrate-wide ability to avoid inbreeding based on MHC.”

Source: Cell Press

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