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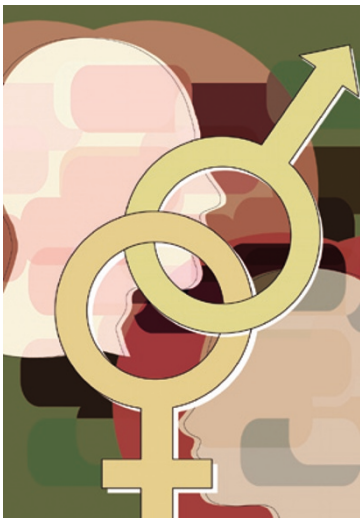
BEHAVIOUR

The subtle difference between the sexes



How is sexual dimorphism in behaviour represented in the brain? Numerous attempts to identify a unique brain structure or circuit that underlies sex-specific traits within one species have so far failed. Dulac and colleagues now show that vomeronasal neurons that express the Trpc2 ion channel are important for female-specific traits in mating and social behaviour in mice.

The current hypothesis regarding the development of sex-specific traits claims that female-specific brain centres form by default. In males, male hormones stimulate the formation of male-specific brain centres and prevent the formation of female-specific centres. The authors investigated sexual and social behaviour in female mice that lacked Trpc2 (*Trpc2*$^{-/-}$ mice) — an ion channel that is implicated in pheromone perception and is exclusively expressed in the vomeronasal organ (VNO) — or in which the VNO had been surgically removed (VNOx mice).

The lack of expression of Trpc2 caused females to display male sexual and courtship behaviour towards both sexes. The behaviour of these female mice was indistinguishable from that of male mice that lacked one or both *Trpc2* alleles. These mice also lost the ability to distinguish between different genders, but continued to display male-like sexual behaviour traits. Furthermore, the behaviour of *Trpc2*$^{-/-}$ females was similar throughout their oestrous cycle. Therefore, the authors concluded that the behaviour of *Trpc2*$^{-/-}$ females is the result of the expression of a male-like trait.

To determine whether sexual traits are established during development or are subject to adult plasticity, the authors surgically removed the VNO from adult animals. VNOx males displayed male-like sexual and courtship behaviour towards both females and males. Thus, they behaved like *Trpc2*$^{-/-}$ and *Trpc2*$^{+/-}$ males, which also no longer discriminated between the sexes. Removal of the VNO in adult females reversed their sexual behaviour, as they now showed male-like sexual display that was similar to that shown by *Trpc2*$^{-/-}$ females. The authors concluded that sex-specific behavioural traits do not stem from the formation of specific circuits during development, but that neural circuits that are targeted by VNO neurons are determinants for sex-specific behaviour.

In accordance with the observed male-like traits of *Trpc2*$^{-/-}$ and VNOx female mice, the authors also reported that maternal behaviour was largely repressed in these animals. Importantly, no significant changes in hormone levels were detected when *Trpc2*$^{-/-}$ and VNOx female mice were compared with wild-type females.

In summary, female mice that do not express *Trpc2* or that lack the VNO display male-like sexual and courtship behaviour and have reduced maternal instincts. These findings indicate that the VNO has a role in suppressing male-like behaviour in females. Based on their findings, the authors proposed a new hypothesis: that during development, both sexes form male- and female-trait centres in their brains. In adult females, pheromones activate the female-trait centres and inhibit the activity of the male centres, resulting in female-specific sexual behaviour. Similarly, pheromones in males specifically inhibit the activity of female centres and activate male centres. It remains to be determined whether *Trpc2*$^{-/-}$ or VNOx males display female traits.

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ORIGINAL RESEARCH PAPER Kimchi, T., Xu, J. & Dulac, C. A functional circuit underlying male sexual behaviour in the female mouse brain. *Nature* 05 Aug 2007 (doi:10.1038/nature06089)