BEHAVIOUR

Fruitless aggression

In the animal kingdom, instincts help survival. How instincts manifest themselves in the genetic and neural blueprint of each animal is largely unknown. In the latest issue of *Nature Neuroscience*, Vrontou and colleagues link the gene *fruitless* (*fru*) to sex-specific aggressive behaviour and the formation of dominance relationships in *Drosophila melanogaster*.

The fruitfly *D. melanogaster* has been used in the recent past as a system to study the genetic basis of aggression. *D. melanogaster* display a stereotyped, sex-specific aggressive fight pattern: 'lunging' and 'boxing' are characteristic for male fights, whereas 'shoving' and 'head-butting' are characteristic for female fights. Furthermore, the outcome of male fights establishes a dominance relationship and therefore will influence the outcome of subsequent fights, whereas the outcome of female fights is independent of previous encounters.

fru is a sex-specifically spliced transcription factor and has a well-established role in courtship behaviour. Vrontou *et al.* used flies which expressed the *fru* allele of the opposite sex, namely fru^{M} females and fru^{F} males. These flies were paired either with each other or with control flies in a chamber where they had to compete over food, therefore triggering aggressive behaviour.

The researchers asked two main questions: do *fru* splice variants influence the style of aggression, and is *fru* involved in the formation of dominance relationships? Their experiments showed that fru^{F} males fought like females in that they shoved and head-butted, rather than lunged or boxed. They also had a greatly diminished ability to form dominance relationships. fru^{M} females tended to court other females and normal males, and only showed aggressive behaviour when paired with fru^{F} males. In these fights the females fought by lunging and boxing, showing typical male fight behaviour; however, they did not not form dominance relationships. Therefore, switching *fru* reversed the sex-specific, aggressive behavioural patterns in these flies.

> "…'lunging' and 'boxing' are characteristic for male fights, whereas 'shoving' and 'head-butting' are characteristic for female fights."

In conclusion, this study shows that *fru* genetically links aggression and courtship in *D. melanogaster*. Future studies will aim to identify further genes that are key components in either one or both of these opposing instincts in *D. melanogaster*. It will also be interesting to see if these studies can be easily translated into vertebrate and eventually human behaviour.

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ORIGINAL RESEARCH PAPER Vrontou, E. *et al.* *fruitless* regulates aggression and dominance in *Drosophila*. *Nature Neurosci.* **9**, 1469–1471 (2006)

NEUROIMAGING

Visions of faces

Sensory information can be ambiguous. Sometimes we see a face in a cloud or in a piece of burned toast. One theory of how the brain deals with such ambiguous input states that it tries to predict what the incoming sensory information represents by comparing it against an internal 'template' based on prior information. But where is this template located and how does it connect with other areas involved in the perceptual decision-making process? Summerfield *et al.* showed that the template for faces might be in the medial frontal cortex, sending top-down signals to face-sensitive brain areas.

While lying in a functional MRI scanner, individuals were shown greyscale images of faces, houses and cars that had been degraded to make them more difficult to recognize. They were first asked to indicate whether or not an image showed a face (face-set trials). In a second set of trials, they had to identify which pictures showed a house (house-set trials).

The images shown in the two sets of trials were similar, so the only difference between the sets was that in one, people concentrated on spotting faces, whereas in the other they focused on identifying houses. Only face-set trials resulted in specific activation in parts of the medial frontal cortex, regardless of whether the actual stimulus was a face, a house or a car. So, this area responded when individuals were making perceptual decisions about whether the image they saw was a face, indicating that the frontal cortex contains the face template against which incoming visual information was compared.

The amygdala and the fusiform face area also responded in face-set trials, and connectivity analyses suggested the possibility that top-down signals from the frontal cortex drove the increased activity in these two face-sensitive areas during face-set trials.

This study provides compelling evidence that, when deciding whether or not they see a face, humans compare a face template — located in the medial frontal cortex — to incoming visual information in the face-sensitive parts of the extrastriatal cortex. Similar matching of predictive codes with observed evidence might occur for other categories of visual stimuli.

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ORIGINAL RESEARCH PAPER Summerfield, C. *et al.* Predictive codes for forthcoming perception in the frontal cortex. *Science* **314**, 1311–1314 (2006)