Male-specific neurons directly linked to gender-specific behaviors

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New research identifies a few critical neurons that initiate sex-specific behaviors in fruit flies and, when masculinized, can elicit male-typical courtship behaviors from females. The study, published by Cell Press in the September 11th issue of the journal *Neuron,* demonstrates a direct link between sexual dimorphism in the brain and gender differences in behavior.

In the fruit fly, Drosophila melanogaster, males display a series of complex and stereotypic behaviors when they are courting a female. Males chase the female while vibrating their wings, producing a love song that has an aphrodisiac influence on the female, who would otherwise take action to escape the male's advances. Later steps in the male courtship behavior involve the initiation and completion of copulation.

"Although previous studies have identified a few key brain areas, such as the dorsal posterior brain, that appear to play a pivotal role in initiating male sexual behavior, nothing is known about the identity of neurons and their circuits in the brain sites which are central to the generation of male courtship behavior," says lead study author Professor Ken-ichi Kimura of the Hokkaido University of Education in Japan.

Professor Kimura and colleagues made use of a sophisticated technique that allowed them to identify, manipulate, and study small groups of cells in the fruit fly brain. The researchers focused on neurons that expressed a gene called fruitless (fru), a known sex-determination gene. The male-

specific Fru protein is expressed in the brains of male flies, but not females. Studies have indicated that fru functions in parallel with another sex-determination gene called doublesex (dsx) and that fru may function as a kind of master control gene to direct organization of brain centers for sexual behavior.

A fru/dsx-expressing cell cluster, known as P1, was identified as an important site for initiating male courtship behavior. P1 cells are fated to die in females through the action of a feminizing protein called DsxF. Interestingly, genetic manipulation of females so that they possessed male P1 neurons effectively provoked male-typical courtship behavior in the females, even when other parts of the brain were not masculinized.

"P1 is located in the dorsal posterior brain and is composed of 20 neurons that have projections which communicate with the bilateral protocerebrum," explains Professor Kimura. "We found that the masculinizing protein Fru is required in the male brain for correct positioning of the projections from the P1 neurons."

Taken together, these findings demonstrate that the coordinated action of sex-determination genes dsx and fru confer the unique ability to initiate male-typical sexual behavior on P1 neurons. This research represents one of only a few examples presenting direct evidence for sexually dimorphic mechanisms that underlie gender-specific behavior and is the first to identify a specific cluster of cells that initiate courtship.

Source: Cell Press

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