It's a unisex brain with specific signals that trigger 'male' behavior

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Cartoon of remote-controlled fly. Credit: G.Miesenboeck

Research by Yale scientists shows that males and females have essentially unisex brains — at least in flies — according to a recent report in Cell designed to identify factors that are responsible for sex differences in behavior.

The researchers showed that a courting “song and dance” routine that only male flies naturally perform — one wing is lifted and wiggled to make a humming “song” — can also be triggered in female flies by artificially stimulating particular brain cells that are present in both sexes. It isn’t what you’ve got — it’s how you use it, the authors say.

“It appears there is a largely bisexual or ‘unisex brain.’ Anatomically, the differences are subtle and a few critical switches make the difference between male and female behavior,” said senior author Gero Miesenboeck, formerly of Yale University and now at the University of Oxford.

According to the authors, most male animals have to perform elaborate courtship displays to try to convince the female that they are worthy mates. Their study was designed to see what neurons were responsible for behavior in the courtship dance of flies, and how the neural circuits in males and females differed. To do this, they genetically engineered specific neurons in the fly to respond to light. This optical trick allowed them to activate the neural circuits that control the behavior pattern directly.

Using a flash of laser light as a “remote control” for the brain cells, the researchers first identified which nerve cells control the courting behavior in males. Next, they showed that the cells were present and functional in both males and females, even though only males do the song and dance.

“Surprisingly, when the brain cells of female flies were flashed with the laser cue we found that even the female flies that never normally behaved this way, began to sing,” said Dylan Clyne, a Yale post-doctoral associate and primary investigator of the study. “Our work shows that the brains not only look similar but are functionally similar. The females have all the equipment to sing, but normally don’t use it because their song circuit doesn’t get the appropriate activating signals.”

Asked about the relevance of this study to humans, Clyne said, “You have to be careful about how much you can extrapolate from studying flies. But, the basic principle should hold up – that is, the idea that we don’t need big sex-differences in the brain to explain why it seems that

men are from Mars and women from Venus."

The authors' next goal is finding the controls that set the flies' brains to the male or female mode. They hope that by studying examples like sex-specific behaviors, they can clarify the still poorly understood relationships between genes, which are the targets of natural selection, and behavior, which is the product of evolution. Ultimately, this line of research could also shed light on how genes underlie behavioral variation and perhaps even specific mental illnesses.

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Source: Yale University