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What model organisms can teach us about emotion

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Scientists know little about how the brain creates and controls emotions - an uncertainty that presents a major obstacle in the effort to develop treatments for emotional disorders. "The study of the brain science of emotion is in its infancy," says Howard Hughes Medical Institute (HHMI) investigator David Anderson, "yet emotional and psychiatric disorders continue to take an enormous toll on human society."

Today, at the American Association for the Advancement of Science's Annual Meeting in San Diego, Anderson, a neuroscientist at the California Institute of Technology, will discuss how studies of model organisms such as mice and fruit flies can improve scientists' understanding of the neural basis of emotion. That understanding, he says, is essential for developing more specific therapies for emotion disorders such as depression, anxiety, or attention deficit hyperactivity disorder (ADHD).

Anderson explains that while functional magnetic imaging (fMRI) studies of the human brain have linked neural activity in specific regions of the brain to particular emotional responses, there are limits to what can be learned from these types of studies. "We cannot tell which of these hotspots represents the actual cause of an emotional response, and which of them represents a reaction to the response," he says.

To makes that distinction, scientists must alter the activity of brain circuits in a targeted way, and then determine the consequences of the changes on emotional behavior. Such experiments are not possible on

human subjects, and so scientists turn to model organisms. Anderson, whose own studies at Caltech and HHMI's Janelia Farm Research Campus explore the link between neural circuitry and emotional behaviors such as fear and aggression in both mice and fruit flies, will discuss the power and limitations of these types of experiments.

"We are in the midst of a revolution in the development of new technologies for experimentally manipulating brain circuitry," he says. Molecular and genetic tools that allow scientists to control when specific neurons are turned on in model organisms is already beginning to transform scientists' understanding of many aspects of brain function, including sensation, perception, cognition, and motor control. Anderson's presentation will address how to best apply these tools to the study of emotion.

"We need to know which animals are most suitable for studying this complex subject," he says. The laboratory mouse is amenable to powerful genetics techniques and it has a brain structure that is fundamentally similar to that of humans. But, he says, mouse research is slow, costly, technically difficult, and presents ethical challenges. Invertebrate model organisms, like the fruit fly *Drosophila melanogaster,* have simpler brains, more powerful genetic tools, and allow for faster, less expensive studies. "But can one study emotional behavior in a fly?" Anderson asks.

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