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Scientists uncover new mechanism for the amygdala in fear recognition

06 Jan 2005

A look of fear on another person's face is instantly recognizable. The split-second ability of the amygdala, a small, almond-shaped structure deep in the brain, distinguishes fear in facial expressions. In particular, the amygdala relies heavily on visual information contained in the eye region to detect fear.

A new study by scientists at the University of Iowa, the California Institute of Technology and their colleagues sheds more light on how the amygdala works. The study, published in the Jan. 6 issue of Nature, suggests that the mechanism by which the amygdala contributes to processing visual information about facial expressions is by actively directing a person's gaze to the eye region to seek out and fixate on the critical visual cues for fear.

"People often think of the brain as passively receiving information from the senses about the world. This study shows that there are mechanisms in the brain that allow us to actively seek out information in the environment in the first place," said Ralph Adolphs, Ph.D., UI adjunct professor of neurology and professor of psychology and neuroscience at the California Institute of Technology.

The study extends the group's decade-long investigation involving patients who are essentially unable to recognize fearful expressions because of a damaged amygdala. The current series of experiments showed that a particular patient fails to make use of information about the eyes in faces, and one reason for that is that she fails to look at the eyes in faces in the first place.

The researchers found that they could restore the patient's ability to distinguish fear in facial expressions to normal levels by specifically instructing her to look at the eye region. However, this instruction had to be given each time the patient viewed a face otherwise she resumed her abnormal gaze pattern, did not fixate on the eyes and was not able to discern fear.

The findings suggest that the amygdala damage disrupts the patient's ability to direct her own gaze toward the eyes in other people's faces, which deprives her of the critical visual cues to detect fearful expressions.

If the patient could be trained to always look at the eyes, the researchers suggest that her impaired fear recognition could be rescued permanently. The study may have implications for conditions such as autism, where patients also show abnormal fixation on facial features and have a disrupted ability to interpret emotion from facial expressions.

"That the amygdala is critical for recognizing fear expressions has been evident from prior studies," said Antonio Damasio, M.D., Ph.D., the Maurice Van Allen Professor and head of neurology at the UI Roy J. and Lucille A. Carver College of Medicine. "The new findings, however, suggest a specific mechanism for the impairments of fear recognition that can be found in patients with amygdala damage."

"This study tells us how it is that the amygdala plays a role in recognizing fear and in so doing it shows us that the amygdala isn't specialized just to detect fear in faces but really serves a more abstract and general role in seeking out potentially

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Bipolar disorder
Breast cancer
Bronchitis
Colorectal cancer
COPD (Chronic obstructive pulmonary disease)
Crohn's disease
Depression
Diabetes
Dyspepsia
Emphysema
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important and salient information in the environment," Adolphs added.

In addition to Damasio and Adolphs, the UI researchers involved in the study were Tony Buchanan and Daniel Tranel, Ph.D., professor of neurology and psychology. Frederic Gosselin at the University of Montreal, Canada and Phillippe Schyns at the University of Glasgow, Scotland, were also part of the research team. The study was funded by grants from the National Institute of Neurological Disorders and [Stroke](#) and the National Institute of Mental Health and a Twenty-first Century Science grant from the James S. McDonnell Foundation.

University of Iowa Health Care describes the partnership between the UI Roy J. and Lucille A. Carver College of Medicine and UI Hospitals and Clinics and the patient care, medical education and research programs and services they provide. Visit UI Health Care online at <http://www.uihealthcare.com>.

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