



October 2006 Articles of the Month

This month's article selection is by Kyle D. Johnson, MDiv,
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Phelps, E. A. and LeDoux, J. E. [Center for Neural Science, New York University].
"Contributions of the amygdala to emotion processing: from animal models to human behavior." *Neuron* 48, no. 2 (October 20, 2005): 175-187.

Dobbs, D. **"Mastery of emotions."** *Scientific American Mind* 17, no. 1 (February/March 2006): 44-49.

[*EDITOR'S NOTE: Chaplain Johnson's perspective on this material illustrates how scientific research, that at first might look to be quite disconnected from the world of chaplaincy, can inform pastoral practice. See especially his section on Pastoral Care Implications.*]

INTRODUCTION: The purpose of this Article-of-the-Month is to introduce chaplains to the changes that cognitive neuroscience is bringing to our understanding of the human brain and mind, led by the work of Joseph LeDoux. I encourage readers to look at the extensive reference list in "Contributions of the Amygdala..." and notice the number of articles written after 1990. The discoveries of just the past 10-15 years have been transformative to the fields of psychology and psychiatry, and they have the potential to influence the field of pastoral care.

"Contributions of the Amygdala..." employs quite a number of highly technical terms from biochemistry and anatomy, but most chaplains should find it readable as long as those terms aren't allowed to obscure the overall gist of the article. The companion piece, "Mastery of Emotion," coming from a popular science magazine, is written for a more general audience and should be helpful in explaining some of the recent cognitive neuroscience advances. Since Joseph LeDoux's career and cognitive neuroscience's advancements are interconnected, "Mastery of Emotion" works largely as a simpler version of "Contributions of the Amygdala..."

Before moving into the Phelps and LeDoux article itself, I would like approach the subject of cognitive neuroscience by way of a few words about Sigmund Freud. Freud developed his theory of psychoanalysis in the late 19th and early 20th Centuries. He came at psychoanalysis from the perspective of a neurologist, though at the time neurology had a highly *uninformed* view of the brain and its functions. Freud developed a scientific theory of the human mind despite the limitations of early neurology, and to compensate for these limitations, he divided the functions of the brain into three groupings or organizational structures: id, ego, and superego. He

did not believe that the brain could be broken down into three *anatomical* structures, so he used metaphors to describe the behaviors that he observed and attributed to the brain. Id, ego, and superego were metaphors used to compensate for the knowledge limits of neurology.

Today we have extensive knowledge of the brain about which Freud could only dream. In the 21st Century, cognitive neuroscience utilizes modern imaging tools such as MRI and PET scanners, which are becoming more powerful year after year. Thus, cognitive neuroscience's understanding of how the human brain works is increasing dramatically, extending beyond Freud's metaphors. Our understanding of the human brain has progressed to the point that we can build models based on actual human neurobiology. For example, we now have a quite sophisticated understanding of the front part of the brain just behind the eyes, called the Prefrontal Cortex (PFC). We know that the PFC is the location of the brain's executive function and working memory--the tools that make possible complex human behavior, such as human thinking and reflection.

BACKGROUND and CONTEXT: "Mastery of Emotion" sets the context for this month's main article, "Contributions of the Amygdala...." The human amygdala plays a crucial role in fear and in emotion generally, and Joseph LeDoux has been a pioneer in the cognitive neuroscientific study of emotion, especially fear. LeDoux discovered that the traditional way of looking at emotion in the brain had been incorrect. The brain did not have a "limbic system." Rather, a small almond-shaped structure called the amygdala, buried deep inside the brain, played a tremendous role in our emotions and especially our fears. While other brain structures play roles here, the amygdala is pivotal.

Think for a minute about the "fight-or-flight response." This response occurs when a person is startled or scared and must decide to stand or run. Breathing accelerates, the heart beats faster, and the muscles tense in order to be ready for immediate action. All of this is started by that small almond-shaped structure called the amygdala.

LeDoux learned that the amygdala has a kind of mind of its own, so to speak. Information from the outside reaches the amygdala before reaching the PFC (prefrontal cortex). The ears, eyes, nose, and other sensory organs give their information to the amygdala before giving it to the PFC, so the amygdala can sound the alarm before the PFC has a chance to react. If someone has a tendency to be startled easily, that person likely has a very active amygdala.

We--and our PFC's--are not totally at the mercy of the amygdala, however. The PFC can learn to quell fears and settled down the amygdala. A person may initially be afraid to swim or pet dogs, but after learning to swim one step at a time, or after having petted several dogs without incident, the person's fear subsides. This is the PFC turning down the fear responses of the amygdala.

Today, cognitive neuroscientific research into the amygdala is conducted at universities around the world, and all of this research builds on the work of Joseph LeDoux.

ARTICLE SUMMARY: "Contributions of the Amygdala to Emotion Processing: From Animal Models to Human Behavior," looks at how studies of the amygdala in animals helped set the stage for understanding the human amygdala. It appears that evolution has not changed much on the amygdala from alligators to Einstein. The evolutionary philosophy here seems to be, "if it ain't broke, don't fix it."

The authors explore five major areas of research: implicit emotional learning and memory, emotional modulation of memory, emotional influences on attention and perception, emotion and social behavior, and emotion inhibition and regulation. All five areas explore how animal research has led to a greater understanding of the human amygdala. For example, animal studies have guided MRI and PET studies on human brains by suggesting to researchers where to look and at what. Let us consider one area here: implicit emotional learning and memory.

The brain has multiple memory systems. Some store "explicit memories" that one can recall consciously. Some store "implicit memories" that never reach one's consciousness. Implicit memories are nonconscious or unconscious memories. Most emotion memories are implicit. Notice that the brain stores "emotion memories"

not "emotional memories." Emotion memories help emotion systems do their jobs. The main job of emotion systems is to keep one safe, and emotion memories tell emotion systems which behaviors are safe and unsafe.

The amygdala is one part of an emotion system that stores and uses emotion memories. So, for instance, if a person is walking through the woods and looks down and realizes that her left foot is about to step on a snake, the eyes feed the information to the amygdala before sending information to the PFC. The amygdala immediately sounds the alarm, and the body freezes before stepping on the snake. A split second later, the PFC gets the information and sets up a strategy for avoiding the snake, such as backing away slowly or very quickly. In this case, the amygdala uses an implicit emotion memory to take immediate action: "Freeze!" Then, the PFC uses an explicit emotion memory to set up an escape strategy. We see in this simple illustration how explicit and implicit memories work together in the same situation.

PASTORAL CARE IMPLICATIONS: Knowing that everyone has explicit and implicit emotion memories can be very helpful in pastoral care and counseling. Take, for example, the circumstance of an angry noncompliant patient: this person could be someone who is accustomed to being in control in every situation, but the medical setting does not allow patients the luxury of being in much control. Indeed, if this person has been subjected to a long parade of medical staff who poke, prod, and give orders; the amygdala's fight-or-flight response has probably kicked in. The patient stands and fights because escape is not a practical option. This person's explicit and implicit emotion systems are working at full force. Yet, when the chaplain enters the patient's room and takes a non-threatening posture, the patient's emotion warning systems are eased, though the patient may remain wary. As the chaplain helps the patient explore his fears, the amygdala is open to moderation by the thinking and reflective PFC. One option could be exploring how this person's faith could be a resource. The chaplain's goal is to help the patient's PFC form healthier options and lessen the amygdala's warnings of danger. The medical staff may remain an annoyance, but they might not subsequently be seen as the threat that they once were.

Explicit and implicit emotion memories are at work in all situations. These include awaiting surgery, learning of a terminal illness, being in labor, having medical tests and deciding on treatment options. In every situation, the more the chaplain can help a person's thinking and reflective PFC moderate the person's amygdala warning system, the more confident the person will be.

COMMENT: The implications of recent cognitive neuroscientific discoveries are numerous for pastoral care and counseling. Chaplains can have greater insight into patients by understanding more about how brains function. Patients who believe that God is punishing them in their hospitalization have an amygdala that sees God as a threat more than an ally. In CPE, interpersonal group (IPR) members can increase their understanding of the need for a non-threatening environment in order to enhance the thinking and reflective PFC's ability to moderate amygdala warnings.

Suggestions for the Use of the Article for Discussion in CPE:

The following questions may guide group discussion (especially for advanced students):

1. The CPE movement grew out of a psychodynamic-humanistic tradition. What implications do recent cognitive neuroscientific discoveries hold for CPE today?
2. What challenges to theological integration does cognitive neuroscience create?
3. How does cognitive neuroscientific work affect your theology of humanity?
4. How do you think Sigmund Freud would develop his work if he were alive today? Would he make any changes? If so, what would some of the changes be?
5. Do recent cognitive neuroscientific discoveries have any impact on ACPE training for Level I, Level II, and Supervisory Education? What are the implications for Supervisors?

Related Items of Interest:

I. Joseph LeDoux has two very readable introductory books, written for persons without training in cognitive neuroscience:

LeDoux, J. E. "*The Emotional Brain: The Mysterious Underpinnings of Emotional Life*." New York: Simon & Schuster, 1996. [This book is devoted to LeDoux's view of how emotion functions in the brain. This text does not, of course, treat discoveries made since the mid-1990s.]

LeDoux, J. E. "*Synaptic Self: How Our Brains Become Who We Are*." New York: Viking, 2002. [This is more up-to-date than *The Emotional Brain...*, and covers much of the material found in that earlier work.]

II. Michael S. Gazzaniga (who was LeDoux's doctoral advisor and mentor) is the lead author of a textbook that serves as an extensive introduction to cognitive neuroscience:

Gazzaniga, M. S., Ivry, R. B. and Mangun, G. R. "**Cognitive Neuroscience: The Biology of the Mind**." Second Edition. New York: W. W. Norton & Company, 2002.

III. More on Joseph LeDoux can be found through New York University's [Center for Neural Science](#). See especially:

The LeDoux Laboratory's [Publications](#) page for articles and books by LeDoux and colleagues.

LeDoux's [Curriculum Vitae](#), for an official listing of his publications.

If you have suggestions about the form and/or content of the site, e-mail Chaplain John Ehman (Network Convener) at john.ehman@uphs.upenn.edu .

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