

Richard Davidson

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Davidson, Richard J.

Dec. 12, 1951- Neuroscientist; educator

Like many of his colleagues in the field of neuroscience, Richard J. Davidson has spent much of his career studying the brain activity of individuals suffering from depression, anxiety, or phobias. Unlike most other neuroscientists, however, he has also investigated the brain patterns of people who appear to be happy. Davidson is a pioneer in affective neuroscience, the study of the relationships between the brain and emotions: that is, the links between the activities of the billions of neurons that make up the brain and the intangible positive and negative feelings that humans define as emotions: excitement, distress, happiness, anger, and a myriad of others. Among his most significant findings, he has discovered that the left frontal cortex is associated with feelings of good will and happiness, and it is more active in the brains of people who are generally optimistic, cheerful, and enthusiastic than in those of individuals who are usually pessimistic, gloomy, and dispirited; it is also more active in men and women who meditate than in those who do not. Moreover, he has found, activity in those areas of the brain indicates in babies as young as 10 months the nature of their apparently inborn temperaments. He has also discovered that training in meditation can lead to measurable changes in the brain, along with increases in a person's feelings of well-being and confidence and decreases in feelings of stress and insecurity.

Davidson became interested in the physiology of mental processes and emotions years before he earned his doctoral degree, in 1976. He persisted in his experimentation and data gathering at a time when psychological research was firmly in the grip of behaviorists, who "scorned the study of any internal experience and argued that only actions that could be observed should be the subject of scientific investigation," as Daniel Goleman wrote in his book *Destructive Emotions: How Can We Overcome Them?: A Scientific Dialogue with the Dalai Lama* (2003). Davidson has worked closely with the current Dalai Lama, Tenzin Gyatso, the spiritual leader of the Tibetan people and winner of the 1989 Nobel Peace Prize, who has written and spoken extensively on such aspects of human nature as compassion, kindness, and forgiveness and has cited Davidson's work in his book *The Art of Happiness* and elsewhere. Davidson has conducted extensive research on the effects of meditation on veteran Tibetan Buddhist monks--"the Olympic athletes, the gold medalists, of meditation," as he described them to Stephen S. Hall for the *New York Times Magazine* (September 14, 2003)--and novice monks. His other subjects have included people of all ages, among them those considered normal as well as those who have been diagnosed as having psychological, neurological, or genetic disorders. Davidson is the William James and Vilas Research Professor of Psychology and Psychiatry at the University of Wisconsin at Madison, where he was instrumental in founding the W. M. Keck Laboratory for Functional Brain Imaging and Behavior, which he has directed since its opening, in 2001. In recognition of his vital role in advancing psychology and neuroscience, he has received many honors, among them, in 2000, the highest tribute of the American Psychological Association: the Distinguished Scientific

Contribution Award, for lifetime achievement.

Richard J. Davidson, called Richie by all who know him, was born on December 12, 1951. He attended Midwood High School, in the New York City borough of Brooklyn, a public school for academically gifted teenagers. During his years there he worked as a volunteer in the sleep laboratory at Maimonides Medical Center, also in Brooklyn; his assigned task was to clean the electrodes that had been affixed to subjects' scalps, torsos, arms, and legs as a means of studying their neurological and other physiological activity while they slept (or tossed and turned) at night. As Daniel Goleman pointed out in his book *Destructive Emotions*, "Just such electrodes have been a basic tool of his trade ever since." In 1968 Davidson enrolled at New York University, in New York City. While there, along with Judith Rodin, a fledgling assistant professor of psychology (she is now the president of the University of Pennsylvania), he conducted research on mental imagery. After he earned a B.A. degree, in 1972, he entered the graduate program in psychology at Harvard University, in Cambridge, Massachusetts. He had chosen Harvard in part because he wanted to study with Gary E. Schwartz, an expert in psychophysiology, and learn from Daniel Goleman, who had just returned to Harvard's graduate program after 15 months of travel in India, where he had interviewed Hindu yogis and other practitioners of meditation; Davidson had read Goleman's accounts of his research in India in the little-known *Journal of Transpersonal Psychology*. On his first day at Harvard, in a seminar given by Schwartz, Davidson met Goleman; the two became friends immediately. The photos of Indian spiritual teachers that Goleman had pasted on the dashboard of his car, and the realization that he and Goleman shared an identical fascination with meditation and its physical, emotional, and intellectual effects, "just shattered my mind," Davidson said years later, as quoted by Goleman. His ride in Goleman's car that day, according to Goleman, "symbolized for Richie the beginning of his alternative graduate education."

Among those influential in Davidson's traditional graduate education was Harvard's pathbreaking behavioral neurologist Norman Geschwind, whose work included observations of brain-injured people whose trauma had resulted in marked changes in their emotions. Davidson also studied with a Massachusetts Institute of Technology professor, Walle J. H. Nauta, a leading authority on the brain's anatomy. Among the many structures that comprise the human brain are the brain stem, a stalklike structure that connects nerves inside the skull to those outside it (most importantly, those in the spinal cord); the cerebellum, a relatively small part that lies in back of the brain stem and controls balance and coordination; and the largest part, the cerebrum, which is divided into left and right hemispheres. The topmost layer of each hemisphere is the cerebral cortex, which has multiple folds and four lobes: the frontal, the parietal, the temporal, and the occipital. (The frontal cortex is sometimes referred to as the prefrontal cortex.) In the early 1970s conventional wisdom held that emotion was under the control of the oldest parts of the brain, evolutionarily speaking: the limbic system, which is deep within the brain and is present in amphibians, fish, and reptiles as well as humans, and the brain stem. Walle Nauta's research, however, had led him to believe that connections existed between those parts of the brain and the frontal cortex--a possibility that fascinated Davidson.

Working with Goleman and Schwartz at Harvard, Davidson conducted experiments on attentional ability--the power to concentrate on a particular task, idea, or anything else

despite distractions. He discovered that training in meditation can help people improve their capacity to focus their attention and keep their minds from wandering. During his stint in graduate school, he took a leave of absence from Harvard to travel in Sri Lanka and India, to learn firsthand about Eastern meditation techniques. He earned his Ph.D. in 1976. Before he left Harvard he received from his mentor, the psychologist David C. McClelland, advice that helped him keep his spirits up during the next decade, when he often tried in vain to obtain research grants or find journals willing to publish his papers: in Goleman's words, McClelland told him that "if he felt he was on to something, he should trust his scientific intuition, believe in himself, and not worry about what the rest of the world thought--eventually they would catch up."

After he completed graduate school, Davidson obtained a teaching position at the State University of New York at Purchase. During the next eight years or so, he accumulated evidence connecting brain-activity patterns and moods. (As has often happened in science, researchers elsewhere were making similar discoveries--in this case, Don M. Tucker and his co-workers in the Department of Psychology of the University of Oregon. "Probably neither one of us would have believed it if we observed it just in our own lab," Tucker told Daniel Goleman for the New York Times in 1991. "No one expected that there should be such a tie between activity in the frontal lobes and emotions.") In 1984 Davidson joined the faculty of the University of Wisconsin at Madison, where, in a welcome change, "the scientific climate was very open to his research interests," according to Goleman. He currently holds professorships in both the medical school and the Department of Psychology. Assisted by others at the college, he raised sufficient funds (\$10 million) to build the W. M. Keck Laboratory for Functional Brain Imaging and Behavior (named for one of the donors, a petroleum-industry executive and philanthropist). The laboratory is affiliated with two other facilities at the university: the Waisman Center, which is devoted to research into developmental difficulties, and the HealthEmotions Research Institute, where scientists investigate the links between emotions and illness or health.

Davidson has studied the relationships between brain activity and emotions in a wide range of adults and children, both those judged to be normal and those suffering from any of a variety of abnormalities or maladies, such as autism or fragile-X syndrome in children, and mood, anxiety, or personality disorders in adults. To record patterns of and changes in brain activity, he uses state-of-the-art electroencephalographs, which produce records known as EEGs; functional magnetic resonance imaging (fMRI), which records changes in the chemical composition of brain areas or changes in the flow of fluids occurring over timespans ranging from seconds to minutes; and positron emission tomography (PET), in which the distribution of positrons (a type of elementary atomic particle) from a radioactive substance illuminates the biological processes occurring within tissue, also over a period of time.

Davidson's studies have revealed a striking relationship between brain activity and emotional well-being. In one experiment, in which he analyzed the brain activity of 99 women who were sitting quietly, he compared the 15 women whose left frontal cortexes showed the most pronounced activity with the 15 whose right frontal cortexes were most active. As revealed afterward by a "personality scale," a psychological test used to determine an individual's behavioral and emotional characteristics, the former group had a more positive outlook on life than average, while the latter had a relatively negative

outlook. Davidson and his colleagues repeated similar experiments with other females and males of various ages and states of mental health. In one, he showed that he could predict which 10-month-old babies would cry when their mothers left the room for one minute, based on whether their left or their right frontal cortexes were generally more active. Without exception, all those with more activity on the right cried, while none of those with more activity on the left did. In another experiment, described in the *Journal of Abnormal Psychology* (November 1991), Davidson compared the brain patterns of people who had recovered from depression after professional treatment with those of people who had never been depressed (that is, persistently sad or unable to feel pleasure or interest in daily life for more than a couple of weeks) and knew of no family members who had suffered from depression. Those who had been depressed showed less activity on the left side of the brain and more on the right than those who had never been depressed. Moreover, as Davidson explained to Daniel Goleman for the *New York Times* (February 12, 1991), "You find similar brain patterns in people who are depressed, or who have recovered from depression, and in normal people who are prone to bad moods. We believe that in the face of life stress like losing a job or a divorce, they are likely to be particularly susceptible to depression. Someone with more left frontal activity, though, would be more resilient to the same stress."

In the July 28, 2000 issue of *Science*, Davidson and his co-workers released the results of a research project that focused on people with a history of violent behavior. They examined data concerning 500 violent individuals, some of whom suffered from antisocial personality disorders (in particular, they exhibited unusual levels of aggression on personality tests) and childhood brain injuries, and compared that information with data on people who had rarely if ever behaved violently. The researchers discovered distinct differences in the two groups' brains. Davidson believes that in the latter group, who were representative of most people, the brain is hardwired to prevent overreaction to fear, anger, and other negative emotions. In violent people, that control mechanism is somehow short-circuited. The study also found dysfunction in the same regions of the brain in 41 murderers and in groups of people unable to control their aggressive impulses. In addition to the frontal cortex in violent subjects, the activity of the amygdala (a small, almond-shaped, evolutionarily ancient structure deep within the brain that produces automatic responses to threats and has been linked to the emotion of fear) "essentially ran out of control, while other brain regions could calm it down in normal people," Davidson and his colleagues found.

Davidson has also investigated the effects on brain activity of meditation, which, "in Buddhist tradition . . .," as he explained to Stephen S. Hall, "is a word that is equivalent to a word like 'sports' in the U.S. It's a family of activit[ies], not a single thing," and each requires a particular skill. Since 1992, at the invitation of Tenzin Gyatso, the 14th Dalai Lama, he and his co-workers have conducted experiments involving Tibetan Buddhist monks in India, where the Dalai Lama and his followers currently reside in exile, and in the U.S. The researchers have focused on three forms of meditation: focused attention, in which one tries to concentrate on one thing for a long time; the cultivation of the feeling of compassion, in which one thinks of an event that sparks negative feelings and then tries to "transform it and infuse it with an antidote, which is compassion," as Davidson put it to Hall; and "open presence," which he defined as "a state of being acutely aware of whatever thought, emotion or sensation is present, without reacting to it." Davidson has

found signs of unusually high activity in several areas of the monks' left frontal cortexes.

The beneficial results of meditation were also revealed in an experiment Davidson performed in collaboration with Jon Kabat-Zinn, the founder of the Mindfulness-Based Stress Reduction Clinic at the University of Massachusetts Medical School, in Worcester. In that study he measured the effects of an eight-week, 45-minute-a-day course in Buddhist-style meditation on a group of employees from a high-pressure biotechnology firm. The electrical activity of the subjects' brains was measured before they began the course; they were also given flu shots, to ascertain whether the training would affect their immune systems. At the end of the eight weeks, the researchers measured the participants' brain activity while the subjects wrote about negative and positive life experiences. They then compared those data with data obtained before the course. Davidson and his colleagues found that not only did the subjects report feeling less anxious about day-to-day stresses, but, in addition, their brains showed a marked shift of activity from the right frontal cortex to the left. Measurements of the subjects' antibodies indicated that their immune systems had grown stronger.

Davidson has published more than 150 articles in professional journals and edited or co-edited 12 books, among them *Consciousness, the Brain, States of Awareness, and Alternate Realities* (1979); *Psychobiology of Affective Development* (1984); *The Nature of Emotion* (1994); *Anxiety, Depression, and Emotion* (2000); *Visions of Compassion: Western Scientists and Tibetan Buddhists Examine Human Nature* (2002); and *The Asymmetrical Brain* (2003). His many honors include a National Institute of Mental Health (NIMH) Research Scientist Award; an NIMH Merit Award; an Established Investigator Award from the National Alliance for Research in Schizophrenia and Affective Disorders; and the Hildale Award from the faculty of the University of Wisconsin at Madison, for distinguished professional accomplishment. In 2004 Davidson and his colleagues at the University of Wisconsin earned a \$10.7 million grant from the NIMH to research emotions in people during difficult periods of their lives.

For many years Davidson has practiced Vipassana meditation, which, according to various sources, focuses on mindful self-awareness or "self-transformation through self-observation" and aims to help people see things as they really are or recognize that the self and all other objects, thoughts, and phenomena are impermanent. In 1996 he turned down an offer to chair Harvard's Department of Psychology. In offering the reasons for his decision, he told Samara Kalk for the *Capital Times* (December 13, 1999), a Madison, Wisconsin, newspaper, "One of the things which is so important about the work I do, and so characteristic of the work I do, is that it is highly interdisciplinary. They don't grow egos as large in the Midwest as they do in Cambridge, Massachusetts. It allows people to get together and work together without all the obstacles that I think would have been present had I moved." He also said that his family loved living in Madison; their happiness, he said, "was too precious a thing to disrupt."