

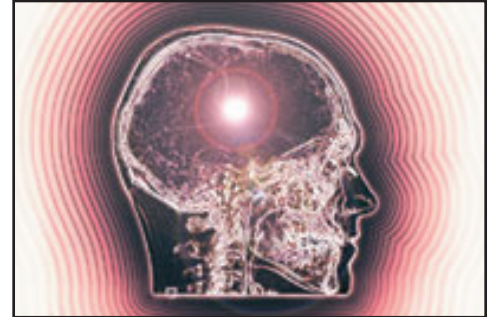
TEMPLETON REPORT

NEWS FROM THE JOHN TEMPLETON FOUNDATION

July 8, 2009

The Neuroscience of Creativity

Rex Jung has been studying the interaction between creativity and intelligence for a decade, hoping to discover whether creativity is the preserve of “a few geniuses like Einstein and Mozart” or can be found, in some form, in all individuals. Now, thanks to a three-year, \$600,000 grant from the John Templeton Foundation, Jung and his colleagues at the Mind Research Network (MRN) are beginning to find some answers.



With Jung as the principal investigator, researchers from MRN—a collaborative effort of Massachusetts General Hospital, the University of Minnesota, and the University of New Mexico (where Jung is a neuropsychologist in the department of neurosurgery)—have been performing MRI scans to determine how biological factors affect creativity in the human brain. The “psychological literature suggests that creativity and intelligence are linked at lower levels of IQ,” Jung told the *Templeton Report*, “but above a certain threshold, they don’t necessarily go hand in hand.” As he and his colleagues show in a paper published recently in the *Journal of Neuroscience*, people with high and low IQs appear to use their brains differently to achieve creativity.

The researchers conducted scans of 56 college-age students to measure levels of N-acetylaspartate (NAA), a chemical found almost exclusively in neurons. The subjects were then asked to do some exercises in creative thinking. Given a common object like a brick, they were asked, for instance, to think of as many different uses for it as they could. Some suggested building a house, displacing water in a toilet tank, or keeping a door open. But one noted that the brick could serve as a “mock coffin at a Barbie funeral.” Their answers, which measured “divergent thinking”—the ability to spin out many different responses to one particular problem—were then rated for creativity by a panel of their peers. High levels of NAA seemed to increase the likelihood of creativity in the brains of highly intelligent people, but in people of average intellect, lower levels of NAA predicted higher creativity.



Rex Jung

Jung believes that these findings can help “to foster the creativity of all individuals,” no matter their age or intelligence level. “My premise is that creativity, like intelligence, is on a normal distribution.” He believes that there are educational strategies that can help people of any age exploit their natural creativity. The findings of Jung and his team were described in recent articles in *New Scientist* and in the *New Mexican* (Santa Fe).

Arthur Schwartz, the executive vice president of the Templeton Foundation, was not surprised to see Jung’s work attract attention. “He is an emerging leader in the nascent field of ‘positive neuroscience,’ which focuses on what the brain does well.” Creativity is one of the Foundation’s core themes, Schwartz said, and fostering creativity and curiosity in the young was a priority for Sir John Templeton.

Jung’s team is now starting to look at other manifestations of creativity in the brain. A second paper, accepted just this week by *Human Brain Mapping* (the leading neuroimaging journal), looks at the neural cortex, also known as “gray matter,” to see which areas are thinner and thicker in creative people, like visual artists and engineers who use advanced mathematics. A third paper will look at how “white matter” (the “wires” of the brain, containing myelinated nerve fibers) affects creativity.

Jung was attracted to the Templeton Foundation for support because of its long view on scientific discovery. “It took intelligence researchers nearly a hundred years to create a plausible neuroscientific basis of intelligence,” he told the *Templeton Report*, “and it may take as long to build a neuroscience of creativity.”

NOTEBOOK

Templeton Positive Neuroscience Awards

The Positive Psychology Center at the University of Pennsylvania announced last week a new research initiative called the Templeton Positive Neuroscience Awards. Supported by a major four-year grant from the John Templeton Foundation, the program, under the direction of Dr. Martin E.P. Seligman, will grant up to 20 two-year awards averaging \$200,000 to methodologically rigorous projects that apply the tools of neuroscience to positive psychological concepts in the following core areas:



- *Virtue, strength, and positive emotion*: What are the neural bases of the cognitive and affective capacities that enable virtues such as discipline, persistence, honesty, compassion, love, curiosity, social and practical intelligence, courage, creativity, and optimism?
- *Exceptional abilities*: What is special about the brains of exceptional individuals and what can we learn from them?
- *Meaning and positive purpose*: How does the brain enable individuals and groups to find meaning and achieve larger goals?
- *Decisions, values, and free will*: How does the brain enable decisions based on values and how can decision-making be improved? What can neuroscience reveal about the nature of human freedom?
- *Religious belief, prayer, and meditation*: How do religious and spiritual practices affect neural function and behavior?

The Templeton Positive Neuroscience Awards are open to researchers worldwide who hold a Ph.D., M.D., or equivalent degree at the time of application and are no more than ten years beyond their doctorate or post-doctoral education. The deadline for applications is September 30, 2009. For more information, visit www.posneuroscience.org.

What Is Ultimately Possible in Physics?

The Foundational Questions Institute (FQXi), a major grantee of the Templeton Foundation, recently announced its new essay contest, on the question: “What Is Ultimately Possible in Physics?” The top-ranked essay, as determined by FQXi members and a panel of judges, will win a prize of \$10,000, with other winning essays earning prizes of \$1,000 to \$5,000 each. The mission of FQXi (see the October 1, 2008 issue of the *Templeton Report*) is to “catalyze, support, and disseminate research on questions at the foundations of physics and cosmology, particularly new frontiers and innovative ideas integral to a deep understanding of reality.”

Handwritten physics equations on a whiteboard. The equations include:

$$\frac{\hbar^2}{2m} \frac{d^2}{dx^2} \psi + U_0 \psi = E \psi$$

$$\psi_{in} = \cos kx \quad \psi_{total} = A \cos kx + B \sin kx$$

$$\frac{\hbar^2}{2m} (-k^2) \cos kx + U_0 \cos kx = E \cos kx$$

The essays are intended to explore “the limits of physics and the physics of limits.” Suggested topics include: What are the limits of physics’ explanatory and predictive power? What does this tell us about the world? What technologies are fundamentally forbidden, or may ultimately be allowed, by physics? What role do “impossibility” principles or other limits (e.g., sub-light-speed signaling, Heisenberg uncertainty, cosmic censorship, the second law of thermodynamics, the holographic principle, computational limits, etc.) play in foundational physics and cosmology?

FQXi’s previous essay contest on “The Nature of Time” received more than 150 submissions, with the first prize going to Julian Barbour, a visiting professor at Oxford University and the author of two books, *The Discovery of Dynamics* and *The End of Time*. Essays for the current contest are due by October 2, 2009. For more information, visit the FQXi website.

Barrow Wins Kelvin Medal

The Institute of Physics (UK) has announced that the winner of the 2009 Kelvin Medal is John Barrow of the University of Cambridge. A cosmologist and mathematician and the 2006 Templeton Prize laureate, Barrow is the author of more than a dozen science books for general readers, including the best-selling *Pi in the Sky* and *Theories of Everything*. The Kelvin Medal recognizes “the importance of promoting public awareness of the place of physics in the world, of its contributions to the quality of life and its advancement of an understanding of the physical world and the place of humanity within it.”



As the IOP noted in the citation for the award, “John Barrow has been a prolific populariser of physics and astronomy for over 25 years. . . . Barrow’s books cover a vast range of subjects that enlarge the appreciation of the historical, cultural, and interdisciplinary qualities of physics and astronomy. He combines and informs all this activity with high-level physics research, having published 435 papers in cosmology and astrophysics.”

For more information, write to communications@templeton.org.

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