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Genetic Variation Linked to Individual Empathy, Stress Levels

ScienceDaily (Nov. 17, 2009) — Researchers have discovered a genetic variation that may contribute to how empathetic a human is, and how that person reacts to stress. In the first study of its kind, a variation in the hormone/neurotransmitter oxytocin's receptor was linked to a person's ability to infer the mental state of others.

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Interestingly, this same genetic variation also related to stress reactivity. These findings could have a significant impact in adding to the body of knowledge about the importance of oxytocin, and its link to conditions such as autism and unhealthy levels of stress.

Sarina Rodrigues, an assistant professor of psychology at Oregon State University, and Laura Saslow, a graduate student at the University of California, Berkeley, published their findings in the current issue of the *Proceedings of the National Academy of Sciences* (PNAS).

Rodrigues said oxytocin has already been significantly linked with social affiliation and reduction in stress. It is a peptide secreted by the pituitary gland and regulated by the hypothalamus of the brain and is best known for its role in female reproduction (it is important for labor and breastfeeding, for instance). It is also associated with social recognition, pair bonding, dampening negative emotional responses, trust, and love.

Rodrigues, who studies stress in humans, studied 200 college students, of diverse ethnicities and balanced gender. The students filled out self-reported questionnaires, as well as participated in laboratory-based sessions.

Individuals can have one of three combinations of this particular naturally occurring genetic variation of the oxytocin receptor. All humans get one copy of this gene from each



A genetic variation may contribute to how empathetic a human is, and how that person reacts to stress. (Credit: iStockphoto/Andrey Prokhorov)

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parent, thus the three possible combinations, labeled in the paper as AA, AG or GG allele. The AA and AG gene group were not statistically different, so they were grouped together and compared in all tests with the GG group.

Rodrigues said the tests included a standard stress reactivity test involving white noise blasts directed in headphones after countdowns presented on the screen. Heart rate was monitored through sensors throughout the laboratory session. In general, they found that women were overall more sensitive to the stress tests, but that both men and women in the GG allele group displayed a lower increase heart rate during this task, as compared to baseline heart rate measured at the beginning of the laboratory session.

One of the tests used to measure empathy included the "Reading the Mind in Eyes" test, created by Simon Baron-Cohen (cousin of actor/comedian Sacha Baron Cohen). Rodrigues said that this test is commonly used to discern how individuals can put themselves into the mind of another person, which overlaps with empathy, because it tests how well the participant can infer someone's emotional state by their eyes.

"In general, women do better on this test than men," Rodrigues said. "But we found a stark difference in both sexes based on the genetic variation." Those with the GG genetic variation were 22.7 percent less likely to make a mistake on the "Reading the Mind in the Eyes" test than the other individuals.

Rodrigues said previous research has shown that people with autism display lower scores on behavioral and dispositional empathy measures, and that a nasal spray with oxytocin increases scores in these areas.

"Our data lends credence to the claim that this genetic variation of oxytocin influences emotional processing and other-oriented behavior," she said.

However, Rodrigues cautioned against drawing too many conclusions just yet from the study's findings. She said these population trends should not be translated to individuals, meaning there are plenty of people in the AA or AG gene pool who are empathetic, caring individuals.

"I tested myself and while I am not in the GG group, I'd like to think that I am a very caring person with empathy for others," she said. "These findings can help us understand that some of us are born with a tendency to be more empathic and stress reactive than others, and that we should reach out to those who may be naturally closed-off from people because social connectivity and belongingness benefits everyone."

Natalia Garcia, Oliver P. John and Dacher Keltner, all with University of California, Berkeley, also contributed to the research, which was funded by the Metanexus Institute and the Greater Good Science Center. The studies were conducted in the laboratory of Dacher Keltner.

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