

# Brain Imaging Captures Pain of Social Rejection

**H**ey! Yo! Throw the ball to meeeeee!" It's a plea for inclusion heard floating on the breeze above hot asphalt playgrounds, weed-strewn vacant lots and neatly trimmed lawns across America. When the ball doesn't come with regularity, it can hurt every bit as badly as a skinned knee or twisted ankle.

And the pain of rejection isn't confined to kids' games. Relationships involving friends, family and careers all hold their share of pain for adults. No one likes to feel left out.

Naomi Eisenberger, a National Institute of Mental Health postdoctoral fellow in psychoneuroimmunology at the UCLA Cousins Center, is using functional neuroimaging and a computerized ball-tossing game, called "Cyberball," to investigate why social rejection hurts.

"We have learned that the pain of social rejection relies on many of the same brain structures that are involved

in physical pain processing," said Eisenberger, who will become an assistant professor of psychology at UCLA in July 2007. "These findings highlight the importance of social relationships for well-being. To the extent that social connection is important for

survival, feeling 'hurt' by social rejection may be an adaptive way to prevent future social separation."

And now Eisenberger and her colleagues are embarking on an examination of how activation of the immune system affects the brain's response to social rejection. The study is the first to investigate the effect of systemic inflammation on the brain's response to social and emotional processes, which may increase the risk of depression.

"These findings may have impli-

cations for understanding the role of inflammatory mechanisms in depression and have the potential to guide the development of new treatments for this disorder," she said.

Eisenberger's research requires the powerful functional magnetic resonance imaging (fMRI) equipment of the Ahmanson-Lovelace Brain Mapping Center at UCLA's Jane and Terry Semel Institute for Neuroscience and Human Behavior.

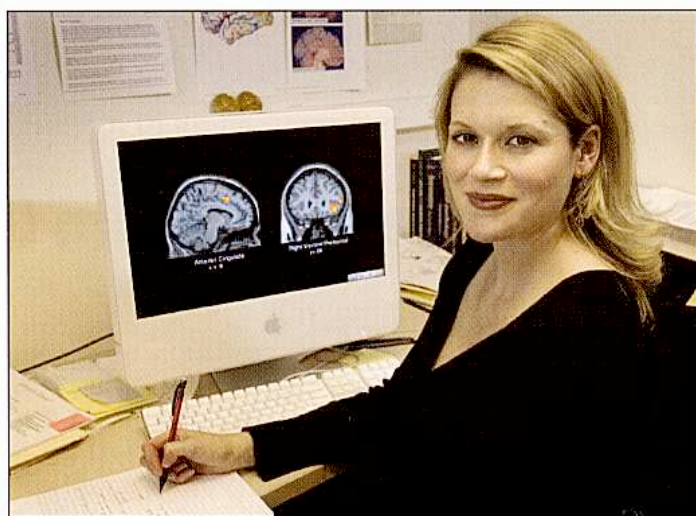
Research subjects are invited to engage in a ball-toss video game

projected on special goggles while undergoing fMRI. The imaging technique takes advantage of the magnetic properties of blood to measure brain activity as a function of blood flow — the greater the flow, the greater the activity.

While each subject believes the game of virtual catch involves two additional participants, "Cyberball" actually pits the subject against a computer program. The first game involves an equitable exchange of the ball,

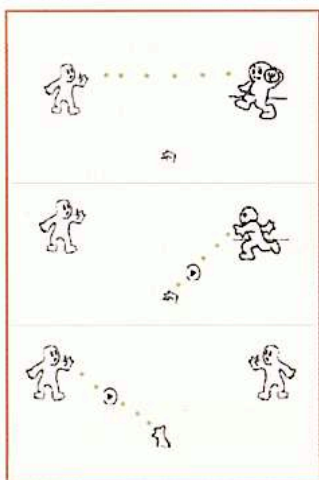
but the second degenerates into a frustrating game of "keep away," with the subject left out. So no one leaves distressed, each subject is advised of the "fix" after reporting on how they feel about their gaming experience.

Eisenberger's initial study found that the brain's dorsal anterior cingulate cortex (dACC), typically associated with physical pain distress, plays a role in the feelings associated with social rejection or social loss. Higher levels of self-reported stress correlated with greater activity in the dACC.



Naomi Eisenberger uses brain imaging to investigate why social rejection hurts.

Photo: Reed Hutchinson



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In a separate exploratory study, she also found that subjects with higher proinflammatory cytokine levels reported more distress and showed more dACC activity during social rejection. The body produces cytokines when attacked by infection, virus or other foreign agent. Cytokines help the body fend off the attack by causing disease-fighting inflammation, with accompanying fever, fatigue and other sickness behaviors that prompt social withdrawal.

In her upcoming study, healthy subjects will randomly receive endotoxin, which will increase proinflammatory cytokine activity, or a placebo before undergoing fMRI while facing rejection during the digital ball-tossing game.

Eisenberger hypothesizes that individuals exposed to the endotoxin will report more social distress and depression following rejection and will show more dACC reactivity during rejection.

The research is funded by NARSAD and the Dana Foundation. •