

Pathological Aggression

Making a Difference Today

You may characterize the fights you had as a kid as nothing more than misdirected energy, but researchers are studying whether such scuffles contribute to a lifetime of aggressive behavior.

Aggression is a complex social behavior with multiple causes. In an individual, aggression generally comes from one of three categories: defensive aggression in response to a threat; predatory aggression against other species; and social aggression against the same species.

Researchers believe that genetic and environmental factors only add to the complexity of the issue. Will the spanking you got as a child trigger violent behavior later in life? Or do some brain mechanisms make people more susceptible to aggression? While experts believe that both can be true, no clear evidence shows us how much aggression may be attributed to the influence of our environment and how much may be determined by our genes.

Meanwhile, aggression and violence take a heavy toll on society. The cost of violence—including medical costs, quality of life, and loss of productivity—reached more than \$158 billion in 2000, according to the U.S. Department of Justice.

Research Leads to Improved Understanding

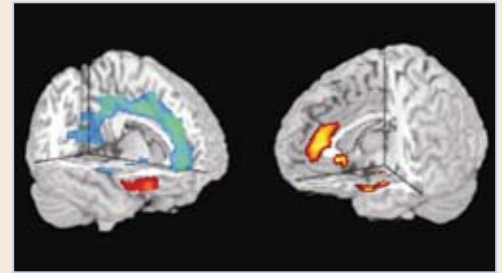
Researchers suggested links to aggression in the brain in the 1960s when scientists speculated that males born with an extra Y chromosome were more susceptible to violent behavior. Research later discredited this theory, and scientists identified the amygdala, a structure in the forebrain responsible for controlling emotions, especially fear, as the main brain structure for mediating violence.

The brain chemical serotonin, which modulates mood, has been linked to the development of violence. Studies funded by the National Institutes of Health (NIH), showed that female monkeys that had low levels of serotonin were aggressive toward their offspring. In turn, those offspring were violent toward their young, perpetuating the cycle of violence. The studies also revealed that environmental factors play an important role in establishing violent behavior. Monkeys reared away from their mothers exhibited more aggressive characteristics than those reared by their mothers. This antisocial behavior persisted well into adolescence and early adulthood.

Earlier breakthroughs in understanding the effects of low serotonin levels on behavior allowed scientists to identify specific abnormal genes responsible for weakening the brain's impulse control circuits. Although not directly responsible for violent behavior in individuals, a variant of a gene that breaks down serotonin biases the brain toward impulsive, aggressive behavior. When combined with a sufficiently stressful environment, this genetic tendency increases the chance that a person becomes aggressive or violent.

Better Targeted Medicine

Because aggression often can be a sign of another clinically defined condition, experts have prescribed drugs designed to treat the overall disorder. However, a recent study has focused on Risperdal (risperidone), a drug primarily used to treat schizophrenia, as a potential treatment of uncontrolled aggression in conduct disorder—repeated patterns of bullying, vandalism, cruelty to animals, stealing, or other aggressive behaviors. Children and adolescents with conduct disorder were given the drug daily. After seven weeks, doctors and parents noticed an improvement in the patients' aggressive behavior. Much work still needs to be done in order to selectively treat aggression while limiting side effects, such as nausea or insomnia.



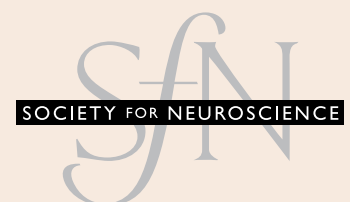
Structural (left) and functional (right) imaging data shows that subjects with a particular gene related to violent behavior had reduced volume and activity in a part of the brain (blue area in front part of brain at left and corresponding yellow area at right) that is thought to be the hub of a circuit responsible for regulating impulsive aggression.

Continued funding for research could lead to:

- A better understanding of the basic brain circuitry associated with violent behavior and possible techniques to attenuate violent tendencies.
- Clues to dietary adjustments that could reduce aggression.
- A greater understanding of the complexities and variations in behavioral disorders in people.
- Tailored medications for individuals with various forms of aggressive behavior.

For more information please email brss@sfn.org.

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Pathological Aggression

Making a Difference Tomorrow

Many aggressive people are afflicted with a condition much larger and more complex than they know. Many go undiagnosed. Some turn to substance abuse, commit criminal acts, attempt suicide or a combination of all three. The strain placed on the family in caring for a person with various forms of aggression is enormous. Social resources are usually under-funded or under pressure to serve all who need help.

Did you know that:

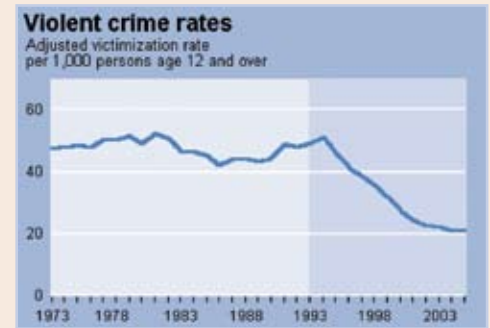
- Violence costs society an estimated \$158 billion yearly.
- In 2003, 5,570 young people, ages 10-24, were murdered in the United States—an average of 15 a day.
- Family violence accounted for 11 percent of all violence between 1998 and 2002.
- No drugs are FDA-approved for aggression.

Research Means Hope for the Future

The use of the brain imaging technique positron emission tomography (PET), has yielded interesting results on aggressive brain function. In one NIH-sponsored study, investigators imaged the brain activity of 41 convicted murderers, looking for patterns. The results suggest that reduced activity in certain regions of the brain, coupled with abnormal activity in the amygdala, thalamus, and medial temporal lobe, may contribute to a predisposition to violence in some individuals.

Recent studies on dietary intake have presented another approach to moderating or preventing aggression. One NIH-supported study revealed that a lack of certain Omega-3 fatty acids during prenatal and childhood neuronal development may increase the risk for aggressive behavior later in life. Observational and placebo-controlled trials with varying Omega-3 levels have shown encouraging results on people coping with stressful situations.

Certainly, genetics plays a role in the overall occurrence of aggressive behaviors. And although violence and aggression can spread through families, researchers unanimously agree that other factors—such as family lifestyle, societal and media influences, and even financial circumstances—can affect one's vulnerability to aggression. Far less certain, however, is the balance of influence that genetics and environment have on aggression. Continued NIH funding could lead to a greater understanding of the comprehensive function of all these factors.



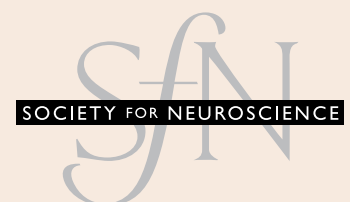
Violent crimes — including rape, robbery, aggravated and simple assault — are on the decline, and have reached its lowest levels ever in 2005. Even so, experts agree that violence is still a major problem that costs society billions of dollars every year.

Already research has led to:

- The identification of the areas of the brain and specific genes that affect the risk for aggression. Researchers have also identified specific chemical reactions in the brain linked to violent behavior.
- The discovery that low brain levels of serotonin – a brain chemical that strongly influences mood – affects impulsiveness in humans.
- Clinical trials of schizophrenic drugs for the treatment of conduct disorder.

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