CRIME Times

Linking Brain Dysfunction to Disordered/Criminal/Psychopathic Behavior

Volume 9, Number 1, 2003

Maternal nutrition strongly linked to children's IQ, behavior

Maternal diet during pregnancy and lactation can strongly affect IQ and early infant behavior, according to two recent studies. Both IQ and early behavior are powerful factors in determining a child's academic and social success, as well as the risk for delinquency or criminality, in later life.

Omega-3 supplements raise offspring's IQ

In a randomized, double-blind study, Ingrid Bergliot Helland and colleagues measured the IQs of children whose mothers received supplements of omega-3 fatty acids during pregnancy and lactation (in the form of cod liver oil), comparing them to children of mothers who received omega-6 fatty acids in the form of corn oil supplements. Mounting evidence indicates that many people are deficient in omega-3 fatty acids, which are essential to the normal development of the brain and eyes, while consumption of omega-6 fatty acids is adequate or even excessive.

Helland and colleagues began giving a group of women either omega-3 or omega-6 long-chain fatty acids during the 18th week of the women's pregnancies, and continued the supplements

continued on page 4

Two studies reveal differences in brains of adolescents with conduct disorder, oppositional defiant disorder

Adolescents with disruptive behavior disorders (DBDs) appear to have different brain structures than other adolescents and show different brain activity when exposed to violence, according to two recent studies by the same research group.

> "This is the first evidence," Matthews says, "that adolescents with aggressive, disruptive behavior disorders have brain activation patterns that are different from non-aggressive adolescents."

In the first study, Vincent Mathews and colleagues used functional magnetic resonance imaging (fMRI) to evaluate brain activation patterns in normal teens and those with DBDs in response to stimuli from violent or non-violent video games. Subjects included 19 controls and 19 adolescents with either conduct disorder or oppositional defiant disorder. (Conduct disorder is characterized by violent behavior, physical or sexual aggression, substance abuse, cruelty to animals and people, and related behavior, while oppositional defiant disorder is characterized by verbal aggression, hostility, impulsiveness, and defiance of authority.)

The researchers detected different amounts and patterns of brain activity in the troubled teenagers, who showed less overall brain activation, and in particular less activation in the frontal lobes, in response to violent games. "This is the first evidence," Mathews says, "that adolescents with aggressive, disruptive behavior disorders have brain activation patterns that are different from non-aggressive adolescents."

Initial results from a related study by this research group indicate that structural brain differences underlie the unusual responses of adolescents with DBDs. Mathews et al. evaluated 18 controls and 11 teens with DBDs using magnetic resonance diffusion tensor imaging (DTI) to map white matter structure and connections between brain regions.

The researchers report that preliminary findings show that adolescents with DBDs have abnormal white matter development in the brain's frontal lobes. "Potentially, the structural differences we found in the brains of the adolescents diagnosed with disruptive behavior disorders could account for their behavior problems," says Mathews. "This may be part of the explanation as to why we see differences in activation through fMRI and also differences in behavior in society."

According to the researchers, five to ten percent of children have oppositional defiant disorder, and four percent of teenagers between the ages of 13 and 16 are diagnosed with conduct disorder.

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"Violent video games trigger unusual brain activity in aggressive adolescents," Vincent Mathews et al., presentation to the annual meeting of the Radiological Society of North America, Dec. 2, 2002.

Response to SSRI treatment indicates serotonin system role in pedophilia in females

Several years ago, researchers reported laboratory evidence that pedophilia involves a disturbance of the serotonergic system (see *Crime Times* Vol. 7, No. 3, 2001, page 7). A recent case study supports this finding, by showing that treatment with a selective serotonin reuptake inhibitor (SSRI) can dramatically reduce pedophilic urges in women.

Eva Chow and Alberto Choy treated a 23-year-old single mother who was convicted of sexual assault and sexual interference after confessing to molesting two young girls while babysitting them. The woman also experienced bouts of rage, and was an impulsive shopper. She felt extreme shame over her pedophilic acts, and expressed concern that if she ever had female children, she might hurt them.

The doctors treated the woman with sertraline, an SSRI, and report that she experienced a gradual decline in her urges to commit pedophilic acts. "Although her pedophilic interests did not completely disappear at the end of one year of treatment," they say, "she reported only infrequent sexual thoughts of children. When she had such thoughts, she stopped or resisted them easily." In addition, she experienced fewer bouts of rage or impulsive shopping.

These changes, the researchers say, "are consistent with the treatment success of serotonergic agents reported in men with paraphilia, and in patients with aggression and anger management difficulties or other impulse control disorders."

The researchers say the case "provides further support that serotonergic system dysfunction is implicated in paraphilic and impulse control disorders."

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"Clinical characteristics and treatment response to SSRI in a female pedophile," Eva W. C. Chow and Alberto L. Choy, *Archives of Sexual Behavior*, Vol. 31, No. 2, April 2002, 211-15. Address: Eva W. C. Chow, Law and Mental Health Program, Centre for Addiction and Mental Health, Clarke Site, 250 College Street, Toronto, Ontario, Canada, M5T 1R8, eva.chow@utoronto.ca.

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Post-traumatic stress disorder, small hippocampus linked

Many soldiers survive violent combat experiences without developing mental problems, while many others suffer from post-traumatic stress syndrome (PTSD) that leaves them psychologically crippled for decades. A new study suggests that while the severity of stress plays a strong role, innate brain vulnerabilities also are a factor in determining who develops PTSD and who does not.

Mark Gilbertson and colleagues performed magnetic resonance imaging scans on 40 Vietnam War veterans, all of whom had identical twin brothers who did not experience combat. Seventeen of the veterans suffered from chronic PTSD.

Comparing veterans with PTSD to those who were mentally healthy, the researchers found that the PTSD group had a hippocampal volume significantly smaller in relation to total brain size. In addition, those with the most severe PTSD had the smallest relative hippocampal volume.

Significantly, the PTSD veterans' twins, who had not been in combat situations and did not have symptoms of PTSD, also had smaller relative hippocampal volumes than twins of psychologically healthy combat vets. The hippocampus is a brain region involved in memory and learned responses to fear.

When Gilbertson et al. refined their results by eliminating data from subjects who had experienced childhood abuse, the differences remained significant, helping to rule out early trauma as a factor in the development of post-war PTSD.

Previous studies also have revealed smaller hippocampal volume in PTSD sufferers than in controls, leading researchers to suggest that chronic high stress levels damage the hippocampus. The findings of Gilbertson et al., however, indicate that many people who develop PTSD are innately vulnerable to the disorder due to biological differences in their brains. Gilbertson notes, however, that the severity of combat experience still is a better predictor of PTSD, and that hippocampal volume is not an accurate marker for the risk of developing PTSD.

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"Smaller hippocampal volume predicts pathologic vulnerability to psychological trauma," Mark W. Gilbertson, Martha E. Shenton, Aleksandra Ciszewski, Kiyoto Kasai, Natasha B. Lasko, Scott P. Orr, and Roger K. Pitman, *Nature Neuroscience*, Vol. 5, November 2002, 1242-7. Address: mark.gilbertson@med.va.gov.

—In The News—

Brain tumor leads to pedophilia

An egg-sized brain tumor caused a man with no history of pedophilia to begin molesting children, according to a report presented recently at the annual meeting of the American Neurological Association.

The 40-year-old man, a married teacher, had never exhibited abnormal sexual impulses. When he began visiting child pornography websites, visiting prostitutes, and making sexual advances to young children, his wife left him. Eventually he was convicted of child molestation, and entered a treatment program for pedophiles. He continued to display inappropriate sexual behavior, and was expelled from a rehabilitation program after propositioning the women attending the program.

Shortly afterward, the man visited a hospital complaining of headaches and telling hospital staffers that he feared that he would rape his landlady. Doctors noted that he exhibited balance problems, had lost the ability to write or copy drawings, and showed a lack of concern when he urinated on himself.

At this point, doctors ordered an MRI scan that showed a large tumor in the right orbitofrontal cortex. The tumor was removed, and the man successfully completed his therapy and returned home. When his aberrant sexual thoughts and behaviors began resurfacing later, an MRI scan showed that the tumor had returned. When it was removed, the man's behavior again returned to normal.

Russell Swerdlow and Jeffrey Burns, the University of Virginia Medical School doctors who reported the man's case, say that the location of the tumor was critical, because it compromised the function of a brain region responsible for judgment, social behavior, and self-control. They note, however, that brain tumors are unlikely to be the cause of pedophilia except in rare cases involving individuals with no prior history of aberrant behavior.

Behavioral neurologist David Rosenfield, commenting on the case study, suggests that hormonal alterations stemming from the tumor also could have played a role in the man's behavioral changes.

We're dealing with the neurology of morality here," says Swerdlow. Noting that the tumor caused few physical symptoms, he says, "It's one of those areas where you could have a lot of damage and a doctor would never suspect something's wrong."

Other crimes, including homicides, have also been linked to brain tumors. One of the most infamous cases was that of Charles Whitman, who killed 15 students at the University of Texas by firing on them from the school's bell tower. An autopsy showed that Whitman had a tumor in his amygdala, a brain area involved in emotional reactions.

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"Brain tumour 'caused paedophilia,'" BBC News, October 21, 2002.

—and—

"Brain tumour causes uncontrollable paedophilia," *New Scientist*, October 21, 2002.

Early head injury may increase pedophilia risk

Early accidents serious enough to cause unconsciousness may increase the risk of developing pedophilia, according to a new study.

R. Blanchard et al. studied 1206 individuals referred to a clinic for assessment of their sexual preferences. Of these, 413 were classified as pedophiles and 793 as non-pedophiles. The researchers collected data on the subjects' early head injuries and neurodevelopmental problems, and on parental histories of psychiatric treatment.

The researchers report, "The results showed that childhood accidents that resulted in unconsciousness were associated with pedophilia and with lower levels of intelligence and education." The association was significant, however, only for childhood accidents occurring before the age of 6. Blanchard et al. say this may indicate either that childhood head injuries increase the risk of pedophilia, or that early neurodevelopmental problems contribute both to the risk of head injury and to the risk of pedophilia.

In addition, subjects with pedophilia reported a higher incidence of maternal psychiatric treatment. "This finding," the researchers say, "suggests that pedophilia may be influenced by genetic factors, which are manifested in women as an increased risk of psychiatric problems, and in their sons as an increased risk of erotic interest in children."

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"Retrospective self-reports of childhood accidents causing unconsciousness in phallometrically diagnosed pedophiles," R. Blanchard, B. K. Christensen, S. M. Strong, J. M. Cantor, M. E. Kuban, P. Klassen, R. Dickey, and T. Blak, *Archives of Sexual Behavior*, Vol. 31, No. 6, Dec. 2002, 511-26. Address: R. Blanchard, Centre for Addiction and Mental Health, Toronto, Ontario, Canada.

Maternal diet affects children's intelligence, behavior

(continued from page 1)

throughout pregnancy and the first three months after delivery. When the women's children reached the age of four, the researchers measured their IQs using the Kaufman Assessment Battery for Children (K-ABC). A total of 84 children completed the IQ testing.

The researchers report, "Children who were born to mothers who had taken cod liver oil during pregnancy and lactation scored higher on the Mental Processing Composite of the K-ABC at four years of age as compared with children whose mothers had taken corn oil." Further analysis showed that maternal intake of the omega-3 fatty acid DHA (docosahexaenoic acid) during pregnancy was the only statistically significant variable influencing the children's mental processing scores.

The researchers say their findings support their hypothesis "that maternal intake of DHA during pregnancy and lactation is marginal and that high intake of this fatty acid would benefit the child."

Helland et al.'s findings are consistent with those of an earlier study (see *Crime Times* Vol. 6, No. 2, 2000, page 7) which compared newborns given standard infant formula to those given either formula enriched with DHA, or formula enriched with both DHA and AA (arachidonic acid, another essential fatty acid). In that study, the infants receiving the DHA-plus-AA formula had an average IQ of 105.6, those receiving the DHA formula had an average IQ of 102, and those drinking standard formula had IQs of only 98 (below the norm of 100). Similarly, a study by P. Willatts et al. found that full-term babies receiving fatty-acid-enriched formula for four months performed better on problem-solving tests at the age of 10 months than did babies who received standard formula.

Maternal B6 affects infant behavior

In a separate study, L. Mallory Boylan and colleagues analyzed the vitamin B6 content of mothers' "transitional" milk (the milk produced from approximately the seventh day after delivery to the second week after delivery, which is a transitional phase between the colostrum produced immediately after delivery and the "mature" milk produced later). Analyzing the milk's content of B6 vitamers (different chemical forms of the vitamin that have the same activity), they found that mothers with a high vitamin B6 intake had a higher level of one vitamer in particular, pyridoxal, than did mothers with lower B6 intakes. All but one of the 25 mothers, however, had B6 intakes considered adequate.

> Helland et al. report that supplementing pregnant women's diets with omega-3 fatty acids increased their children's IQs, while Boylan et al. found a strong link between infant behavior and the B6 content of their mothers' breast milk.

The researchers tested the mothers' infants during the second week after delivery, using the Brazelton Neonatal Behavioral Assessment Scale (NBAS). They found that infants whose mothers had the lowest levels of breast milk pyridoxal had the worst scores on the habituation and autonomic stability subtests of the NBAS, showing "greater evidence of tremors, startles, skin flushing, and irritability arising from difficulty regulating their levels of arousal in response to sensory stimulation."

Boylan et al. note that their findings are consistent with earlier research by McCullough et al., who found that breast milk vitamin B6 levels correlated significantly with infants' ability to be consoled, crying behavior, and response to aversive stimuli.

The researchers note that serotonin, dopamine, norepinephrine, and other neurotransmitters are synthesized via pathways that require B6. They also cite earlier research questioning the adequacy of vitamin B6 levels in breast-fed infants of mothers taking only standard vitamin supplements. They conclude, "All mothers should be counseled by a registered dietitian about the importance of consuming a nutritionally adequate diet during pregnancy and lactation and provided with information on good dietary sources of vitamin B6."

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"Maternal supplementation with very-long-chain omega-3 fatty acids during pregnancy and lactation augments children's IQ at 4 years of age," I. B. Helland, L. Smith, K. Saarem, O. D. Saugstad, and C. A. Drevon, *Pediatrics*, Volume 111, No. 1, January 2003, e39-44. Address: I. B. Helland, Institute for Nutrition Research, University of Oslo, Oslo, Norway, ingrid.helland@rikshospitalet.no.

—and—

"Vitamin B6 content of breast milk and neonatal behavioral functioning," L. Mallory Boylan, Sybil Hart, Kathy B. Porter, and Judy A. Driskell, *Journal of the American Dietetic Association*, Vol. 102, No. 10, October 1, 2002, 1433-8. Address: L. M. Boylan, Department of Education, Nutrition, Restaurant, and Hotel Management, Texas Tech University, Lubbock, TX 79409, mboylan@hs.ttu.edu.

Low levels of dopamine metabolite found in recidivists

Murderers who commit additional crimes after their initial release show evidence of impaired dopamine system activity, according to a recent study.

Anna Maria Dåderman and Lars Lidberg measured levels of metabolites of the neurotransmitters serotonin, noradrenaline, and dopamine in 29 men convicted of murder and committed to a forensic psychiatric ward. Later, they conducted a follow-up study to determine which of the men committed additional crimes after being released. The men were followed for an average of 16 years after their original crimes.

Of the subjects, 14 committed additional crimes. Nine of these committed violent crimes, and one was convicted of another murder.

Unlike previous studies which found unusually low levels of the serotonin metabolite 5-HIAA in violent offenders who relapsed, Dåderman and Lidberg detected no significant reductions in 5-HIAA or the noradrenaline metabolite HMPG in repeat offenders. However, their data revealed a significant reduction in the dopamine metabolite HVA among recidivists.

This finding, the researchers say, "may be in line with the assumption that the level of dopamine is related to seeking potential reward or 'kicks.' Offenders who have a tendency to commit crimes characterized by danger and novelty seeking (such as robbery, weapons offenses and theft) may constitute such a group."

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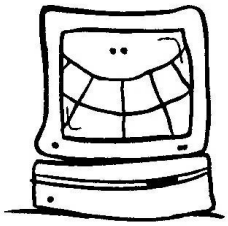
"Relapse in violent crime in relation to cerebrospinal fluid monoamine metabolites (5-HIAA, HVA and HMPG) in male forensic psychiatric patients convicted of murder: a 16-year follow-up," A. M. Dåderman and L. Lidberg, *Acta Psychiatrica Scandinavica*, Vol. 106, No. S412, June 2002, 71-4. Address: Anna Maria Dåderman, Department of Clinical Neuroscience, Occupational Therapy and Elderly Care Research, Division of Forensic Psychiatry, Karolinska Institute, Huddinge, Sweden.



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Bipolar adolescents significantly impaired in mathematics

Teenagers with bipolar disorder (manic depression) also show significant deficits in mathematical ability, according to a new study by Diane Lagace and colleagues.

The researchers compared 44 adolescents in remission from bipolar disorder to a control group of teens with no history of psychiatric disease and to another group in remission from major depressive disorder. Administering academic and IQ tests to all three groups, the researchers found that the adolescents with bipolar disorder had "significantly lower achievement in mathematics," took longer to complete mathematics tasks, and were much less likely to report above-average mathematics performance in school than the other test groups. Also, girls with bipolar disorder had much lower mathematics scores than bipolar males, while the gender difference was not as marked in the other groups. No differences were seen in reading, spelling, and nonverbal intelligence scores.

School records showed that the bipolar teens tended to exhibit drops in math scores about a year before receiving a psychiatric diagnosis, the researchers note, arguing against a medication effect and indicating that brain changes lead to both math impairment and bipolar disorder. Preliminary brain scans conducted by the researchers indicate that bipolar teens have reduced tissue volumes in a frontal brain region involved in math calculations.

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"Mathematics deficits in adolescents with bipolar I disorder," D. C. Lagace, S. P. Kutcher, and H. A. Robertson, *American Journal of Psychiatry*, Vol. 160, No. 1, January 2003, 100-4. Address: Diane Lagace, Dalhousie University, Halifax, Nova Scotia. Also, "Mental disorder may spur math problems in teens," Bruce Bower, *Science News*, January 11, 2003.

Crime Times is interested in hearing from readers conducting research pertaining to biological influences on criminality and psychopathology. Reprints of research papers are appreciated.

Australian study: common bread additive causes behavior problems in many children

A common bread preservative, calcium propionate, can cause aberrant behavior in children, according to a recent study in Australia.

Sue Dengate and Alan Ruben identified 27 children whose behavior improved when they were placed on the Royal Prince Alfred Hospital diet, which eliminates food additives, natural salicylates, amines, and glutamates. In a double-blind crossover study, the researchers measured each child's response to bread containing either a placebo or calcium propionate.

The researchers say, "A statistically significant difference existed in the proportion of children whose behaviors worsened with challenge (52 percent), compared to the proportion whose behavior improved with challenge (19 percent)." The adverse behavioral effects in the children receiving the bread containing calcium propionate occurred within days, and appear to be cumulative.

Dengate told ABC News in Perth, "What we found when we did this study is that [the effect] is not hyperactivity, which is what people think of when they think of children's behavior and food additives. It's irritability. So these kids will appear to be fine when they're enjoying themselves, but if they're asked to do something they don't like... then they will over-react." In addition, she says, "There is also restlessness and inattention, so they don't want to do their homework, they can't read properly, and there are also sleep disturbances."

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"Controlled trial of cumulative behavioural effects of a common bread preservative," S. Dengate and A. Ruben, *Journal of Paediatrics and Child Health*, Vol. 38, No. 4, August 2002, 373-6. Address: Sue Dengate, P.O. Box 85, Parap, Northern Territory 0804, Australia.

—and—

"Bread causes bad behaviour in children," ABC Perth, August 14, 2002.

Megadose nutrients reduce rage in children with PDD, OCD

High-dose vitamins, minerals and amino acids can markedly reduce rage and mood problems in some children with psychiatric disorders, according to a new study by researchers who previously reported similar findings for depressed subjects.

In a pilot study, Bonnie Kaplan et al. administered a supplement containing three dozen nutrients to two boys whose symptoms included explosive rage and mood swings. The children were part of a separate study (currently in press), but because they changed school programs and/or started new medications during the trial, the researchers could not be sure that benefits stemmed from the treatment. Therefore, Kaplan et al. observed the children's responses when they were later taken off the supplements, and then placed back on them.

One subject was an eight-year-old with atypical obsessive-compulsive disorder. Before beginning the supplements, the boy experienced episodes of explosive rage several times daily. He was depressed, withdrawn, irritable, anxious, and hyperactive, and had "an intense and pervasive preoccupation with guns and knives."

During the intervention, the number and duration of the boy's rage attacks declined significantly, his mood and behavior improved, and his obsessive thoughts about weapons virtually disappeared. Since the parents were not sure if the change was due to the boy's new school, they discontinued the supplement. Within three weeks, the boy began obsessing about guns, and within six weeks he was once again moody and disobedient and began throwing frequent tantrums. When the supplements were reinstituted, the boy improved dramatically, and at a one-year follow-up he had no significant behavioral or attentional difficulties. A second attempt to stop the supplements nine months later resulted in a similar regression, once again reversed when the supplements were reinstituted.

The second subject in the study was a 12-year-old with Asperger syndrome (a form of high-functioning autism). The boy exhibited attention deficit hyperactivity disorder (ADHD), learning problems, irritability, and explosive outbursts. He too improved on the supplements, becoming less moody, less negative, and less prone to temper outbursts. However, he also changed schools during the initial phase and began taking stimulant medication, making it difficult to determine if the benefits were due to the supplement. To analyze the effects of the nutrients, the parents experimented with discontinuing the dose. After three weeks, the boy's behavior had worsened significantly, and the family reported that his irritable moods and negative attitude "were once again the focus of family life."

The boy's parents began administering the supplements again, and within six weeks, his behavior problems decreased markedly. Eventually, his dose was reduced to one-quarter of the initial dose, with no ill effects.

continued on page 7

RESEARCH IN BRIEF

New findings again link lead, delinquency

A new study adds to evidence strongly implicating high lead levels as a risk factor for criminality.

Herbert Needleman et al. conducted a case-control study of 194 delinquents between the ages of 12 and 18, and 146 non-delinquent controls. The researchers controlled for a variety of socioeconomic factors including parent education and occupation, family structure, race, and neighborhood crime rate.

Measuring the children's bone lead using K-line X-ray fluorescence in order to determine cumulative lead exposure, the researchers found that after adjusting for socioeconomic variables, "adjudicated delinquents were four times more likely to have bone lead concentrations greater than 25 parts per million than controls."

They conclude, "Elevated body lead burdens, measured by bone lead concentrations, are associated with elevated risk for adjudicated delinquency."

The new findings are consistent with research reported several years ago by Needleman et al. (see *Crime Times* Vol. 6, No. 3, 2000, page 2). At that time, the researchers evaluated 216 delinquents and 201 non-delinquent youths and found that convicted juveniles were nearly twice as likely as control subjects to have high bone-lead levels.

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"Bone lead levels in adjudicated delinquents: a case control study," Herbert L. Needleman, Christine McFarland, Roberta B. Ness, Stephen E. Fienberg, and Michael J. Tobin, *Neurotoxicology and Teratology*, Vol. 24, No. 6, November-December 2002, 711-17. Address: Herbert Needleman, Western Psychiatric Institute and Clinic, University of Pittsburgh School of Medicine, Keystone Building, Suite 310, 3520 Fifth Avenue, Pittsburgh, PA 15213.

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Can Viagra cause violence?

In a controversial research review, toxicologist Harold Milman and S. B. Arnold recently raised the possibility that the drug Viagra, used to treat erectile dysfunction, may contribute to violent behavior.

Milman and Arnold uncovered 274 reports of mental side effects linked to Viagra (sildenafil), including amnesia, aggression, and disorientation. In addition, they note that the drug has been suggested as a contributing factor in 22 cases involving aggression, 13 involving rape, and 6 involving murder.

Milman notes, "Published studies [report] that sildenafil crosses the blood-brain barrier, that it exerts various biochemical and physiologic effects in the brain, and that it affects information processing." He acknowledges that his data on behavioral side effects is anecdotal, but says, "It's clear that these men are behaving abnormally."

He concludes, "It is recommended that before prescribing sildenafil for erectile dysfunction, clinicians should caution their patients and their partners on the possibility of neurologic, emotional, or psychological disturbances; amnesia or loss of consciousness; or aggressive behavior."

The study's conclusions are challenged by several scientists, including Kevin McKenna who says studies of rodents suggest that Viagra would be likely to reduce aggression rather than increasing it.

—

"Neurologic, psychological, and aggressive disturbances with sildenafil," H. A. Milman and S. B. Arnold, *Annals of Pharmacotherapy*, Vol. 36, No. 7-8, July-August 2002, 1129-34. Address: Harold Milman, ToxNetwork.com, Rockville, MD 20853-2345.

—and—

"Scientists debate possible Viagra-aggression link," Todd Zwillich, Reuters, December 6, 2002.

Nutrients reduce rage

(continued from page 6)

He still requires stimulant medication to control his hyperactivity.

Kaplan et al. note that both boys continue to exhibit problems consistent with their diagnoses, but note that both have benefited dramatically from supplementation, with improvements in mood, reductions in rage, and reductions in obsessional symptoms. The researchers suggest that the supplements may address "inborn errors of metabolism in key neurobiological pathways, such as those responsible for neurotransmitter synthesis and uptake, membrane stabilization, second messenger signaling, and so on."

Earlier (see *Crime Times* Vol. 8, No. 1, 2002, page 3), Kaplan et al. administered the same nutrients to 11 adults diagnosed with bipolar disorder. All of the subjects in this earlier study were unresponsive to drug treatment, or unable to take drugs due to side effects. After six months of taking the nutrients, the subjects experienced symptom reductions of 55 to 66 percent, and their need for psychotropic medications decreased by more than 50 percent.

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"Treatment of mood lability and explosive rage with minerals and vitamins: two case studies in children," B. J. Kaplan, S. G. Crawford, B. Gardner, and G. Farrelly, *Journal of Child and Adolescent Psychopharmacology*, Vol. 12, No. 3, Fall 2002, 205-19. Address: Bonnie Kaplan, Alberta Children's Hospital, 1820 Richmond Road WS, Calgary, Alberta, Canada AB T2T 5C7.

QUOTABLE

"What we find out about the brain in the next 20 years is going to change the way we think about ourselves, and it is going to give us increasing power over parts of our mental, emotional, and physical life."

Neuroscientist, Zach Hall, former director of the federal government's Neurology Institute, in Brain in the News*, July 31, 2002*

"More than 5 percent of American adults have a serious mental illness—half are between the ages of 25 and 44—and most everyone agrees that traditional psychotherapy's ministrations have failed. According to the most recent statistics, mental illness' total estimated economic cost to American society is more than $200 billion a year, and growing. Other costs, such as reduced quality of life, torn families and loss of life, cannot be calculated."

Todd Ackerman, Houston Chronicle*, March 10, 2002*

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