CRIME Times

Linking Brain Dysfunction to Disordered/Criminal/Psychopathic Behavior

Volume 10, Number 3, 2004

Conduct disordered children show severe language deficits

A startling study reports that two-thirds of male children diagnosed with conduct disorder (CD) exhibit pragmatic language impairments and other behavioral features "similar in nature and degree to those of children with autism."

Jane Gilmour and colleagues evaluated 142 children referred to a clinic with a diagnosis of either autism spectrum disorder or conduct disorder, comparing them to a group of typically developing children. In addition, the researchers evaluated 54 children excluded from elementary schools due to conduct problems. The researchers focused on male children with CD, who outnumber CD females by a ratio of nine to one.

Parents and teachers rated the children using the Children's Communication Checklist. In both CD groups, the researchers say, two-thirds of the children exhibited marked defects in pragmatic language, regardless of IQ. Pragmatic language involves skills that allow an individual to communicate in a way that is appropriate to a social situation—for instance, proper initiation of conversation, use of contextual clues, ability to gauge a listener's interest, and ability to maintain rapport.

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Food additives again implicated in childhood hyperactivity

A large-scale study of three-year-old children offers new evidence that common food additives can cause hyperactive behavior.

John Warner and colleagues assessed nearly two thousand preschoolers for symptoms of ADHD (attention deficit hyperactivity disorder), and for signs of allergy. The researchers then divided 277 of the children into four groups: those with both allergies and hyperactivity, those with neither condition, those with only hyperactivity, and those with only allergies.

> "We were surprised by the results," Warner says, "because the effect was not just in one group. We showed there was an effect on perfectly normal children."

Warner et al. then placed all of the children on a diet free of artificial additives. During the next three weeks, the children were randomly assigned to receive a placebo or a daily drink containing colorings and preservatives, with each child participating in both an additive challenge and a placebo phase. The children's behavior was rated through parent questionnaires and clinical observation, with neither parents nor clinicians knowing which children were receiving the additive-laced drinks at each stage.

The researchers report, "The observed effect of food additives and colorings on hyperactivity in this community sample is substantial, at least for parent ratings." In fact, they note, the effect of the additive-free diet on parent ratings of hyperactivity was "similar to that for [the drug] clonidine in the treatment of children with ADHD" as measured by other studies. Clinicians did not report significant changes, but the researchers say that the parents observed the children over a longer period of time and saw their reactions in a variety of settings, giving them "a greater opportunity to observe the child's hyperactive behavior."

The amounts of additives given to the children were "on the low side of normal," Warner says, noting also that exposure to the additives caused increased behavior problems in allergy-free and ADHD-free children as well as the other groups. "We were surprised by the results," he says, "because the effect was not just in one group. We showed there was an effect on perfectly normal children. If that is confirmed by further research then there is a public health issue."

The findings are similar to those of Katherine and Kenneth Rowe (see *Crime Times* Vol. 1, No. 3, 1995, p. 5), who found that a significant number of hyperactive children reacted very negatively to tartrazine, one of the food colorings investigated by Wagner's group. The new research also supports earlier findings by Bonnie Kaplan et al. (also cited in *Crime Times* 1/3), whose placebo-controlled cross-over study found that hyperactive children placed on diets free of additives, artificial colors and flavors, chocolate, MSG, preservatives, and caffeine had significantly

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Pedophiliacs exhibit signs of early neurological problems

A large-scale study reveals that pedophiles exhibit significant neurological deficits suggestive of early neurodevelopmental disturbances.

James Cantor and colleagues tested 473 male sex offenders seen at a Canadian mental health center. The researchers compared the pedophiliacs to men with atypical non-pedophilic sexual urges, and to men with histories of sexual offenses against adults, to ensure that any abnormalities they detected could be attributed to pedophilia rather than to criminal tendencies or atypical sexuality in general.

The researchers say their results "confirm the association between pedophilia and poor brain functioning." Pedophilia was significantly associated with lower full-scale IQ; lower scores on all six subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) used in the evaluation; impairment in immediate and delayed verbal free-recall memory; and impairment in immediate and delayed visuospatial free-recall memory.

In addition, pedophiliacs had a significantly higher incidence of non-right-handedness. The higher rate of non-right-handedness remained significant when the researchers controlled for age and intelligence, indicating that the finding was not simply due to the increased risk of low IQ in non-right-handed people.

The researchers say their evidence suggests that "a perturbation occurs in early brain development and causes each of the characteristics measured [by the study]: lower cognitive capacity, decreased rates of right-handedness, and pedophilic interest."

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"Intelligence, memory, and handedness in pedophilia," James M. Cantor, Ray Blanchard, Bruce K. Christensen, Robert Dickey, Philip E. Klassen, A. Lee Beckstead, Thomas Blak, and Michael E. Kuban, *Neuropsychology*, Vol. 18, No. 1, 2004, 3-14. Address: James M. Cantor, CAMH-Clarke Site, 250 College Street, Toronto, Ontario M5T 1R8, Canada, james_cantor@camh.net.

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Conduct disordered children have severe language deficits

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The deficits seen in the CD children, the researchers say, were comparable to those seen in children with autism, a neurodevelopmental disorder that causes severe deficits in language and social skills. "Our data show that a subset of children presenting as CD actually have an unidentified autism spectrum disorder," they say. "There are still further children with CD who do not reach a formal autism spectrum disorder diagnosis but who nonetheless have pragmatic problems."

Gilmour et al. conclude, "The results indicate that a significant minority of children with disruptive behavior in the community have significant, previously unidentified social communication difficulties." They note that other studies have shown an overlap between autistic deficits and conduct problems; one study by Speltz et al., for instance, found that preschool boys with oppositional defiant disorder had poorer vocabularies for describing emotional states than typical children did, even when the researchers controlled for general vocabulary knowledge and test-taking behavior. Gilmour et al. say it also is interesting that both autism and CD affect far more boys than girls.

The researchers say their findings suggest that the educational interventions used for children with autism—interventions aimed at reducing language and social disorders stemming from neurological deficits—are likely to be more effective than current interventions for CD, which have proven disappointing.

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"Social communication deficits in conduct disorder: a clinical and community survey," J. Gilmour, B. Hill, M. Place, and D. H. Skuse, *Journal of Child Psychology and Psychiatry*, Vol. 45, No. 5, 2004, 967-78. Address: Jane Gilmour, Sub-Department of Clinical Health Psychology, University College London, Gower Street, London WCIE 6BT, UK.

National survey reveals heavy burden of adult ADHD

The idea that children with attention deficit hyperactivity disorder "outgrow" their problems is false, according to a recent survey.

The results of a national survey, conducted by the Roper polling firm

> The survey found that adults with ADHD are twice as likely as other people to have been arrested, with 37 percent of the ADHD individuals who participated in the survey reporting that they had at least one prior arrest.

and reported at the annual meeting of the American Psychiatric Association, show that:

—Adults with ADHD are more likely than adults without ADHD to engage in antisocial or harmful behaviors. Over 60 percent are smokers, and 52 percent have used recreational drugs. Adults with ADHD are twice as likely as other people to have been arrested, with 37 percent of the ADHD individuals who participated in the survey reporting that they had at least one prior arrest.

—Adults with ADHD are more likely than other people to have a poor self image, with only half (compared to 76 percent of non-ADHD adults) saying that they like being themselves and accept themselves for who they are.

—Adults with ADHD are three times more likely to suffer from depression or stress than non-ADHD adults. About one in four of the ADHD group surveyed said their poor mental or physical health prevented them from fully participating in normal activities for approximately one-third of the days in each month, compared to only 9 percent of non-ADHD respondents.

—Adults with ADHD were twice as likely to be divorced or separated as non-ADHD adults.

—Adults with ADHD are less likely to be high school or college graduates, with 17 percent (compared to 7 percent of controls) reporting that they had not finished high school.

—Only 52 percent of ADHD respondents were currently employed, compared to 72 percent of non-ADHD respondents.

"The importance of diagnosing and helping adults with ADHD has often been debated by individuals, health care professionals and by society in general," says Harvard Professor of Psychiatry Joseph Biederman. "The compelling results of this survey reinforce the fact that ADHD is a serious medical condition causing significant, life-long impairments. ADHD can no longer be dismissed as a 'fake' or 'made-up' disorder."

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"Survey of adults reveals life-long consequences of ADHD," news release, Porter Novelli, May 6, 2004.

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Genes buffer children against effects of poverty

Genes play a strong role in determining the fate of children growing up in poverty, according to a new study of twins.

Julia Kim-Cohen and colleagues studied 1,116 mothers and their five-year-old same-sex twins, all participating in a long-term study of environmental and genetic effects on behavior. The researchers analyzed the economic situation of each family, as well as each mother's level of warmth and supportiveness. To determine the effects of genes and environment, they compared monozygotic twins (who are virtually identical genetically) to dizygotic twins, who share only half their genes.

Their data, the researchers report, show that 70 percent of the variability in the children's "behavioral resilience"—that is, their ability to overcome the effects of poverty—could be attributed to genetic influences. In addition, 46 percent of the variance in cognitive ability could be attributed to genetic factors. Environment played a key role, too, with mothers who provided their children with more stimulating environments being more likely to have children with higher IQs.

The researchers conclude, "[Our] findings add new information by demonstrating that resilience is partly heritable and that protective processes operate through both genetic and environmental effects."

—

"Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation," Julia Kim-Cohen, Terrie E. Moffitt, Avshalom Caspi, and Alan Taylor, *Child Development*, Vol. 75, No. 3, May 2004, 651-68. Address: Julia Kim-Cohen, Julia.kim@iop.kcl.ac.uk, or Terrie Moffitt at t.moffitt@iop.kcl.ac.uk.

Soy-fed male monkeys become more aggressive, less social

Soy is widely praised for its health benefits, but a new study warns that too much soy may have dangerous effects on male behavior.

Neal G. Simon and colleagues studied adult male macaques living in stable social groups, dividing the monkeys into three groups. For 15 months, the researchers fed one group of the macaques a diet free of soy, while the other two groups ate soy protein-based diets containing either low or high levels of soy isoflavones. (Isoflavones are phytochemicals, present in high levels in soy, which bind to estrogen receptors and mimic some of estrogen's effects.)

> Monkeys in the high-soy group committed 67 percent more highly aggressive acts and were far less social, spending 30 percent more time alone.

The researchers report that rates of aggression increased dramatically in the group fed the high-soy diet, with the monkeys in this group committing 67 percent more highly aggressive acts and 203 percent more submissive acts (the latter occurring in response to increased aggression). In addition, the monkeys fed a high-soy diet were far less social, spending 68 percent less time in direct physical contact and 50 percent less time in close proximity to other monkeys, while spending 30 percent more time alone.

The researchers note that estrogens play a key role in facilitating aggressive behavior in male rodents. Their findings, they say, suggest that soy isoflavones alter male behavior by diminishing the effects of one form of estrogen receptor (ER beta) that appears to modulate the effects of another type of receptor (ER alpha). They also cite evidence that reduced ER beta activity leads indirectly to reduced serotonin function. Reduced serotonin function, in turn, is strongly linked to increases in aggressive and impulsive behavior in both animals and humans.

Simon and colleagues did not detect any changes in the hormone levels of the monkeys fed high levels of isoflavones. This indicates, they say, that soy isoflavones can significantly affect behavior even at concentrations below those needed to produce other physiological changes.

The researchers say the amount of isoflavones fed to the high-soy group of monkeys (125 mg per day) is comparable to levels found in many dietary supplements sold in the United States. When it comes to soy, they say, "There is the thought that what is good for some is good for all and more is better." But they caution, "The present findings suggest that careful attention will be required to balance beneficial and potentially adverse effects."

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"Increased aggressive behavior and decreased affiliative behavior in adult male monkeys after long-term consumption of diets rich in soy protein and isoflavones," Neal G. Simon, Jay R. Kaplan, Shan Hu, Thomas C. Register, and Michael R. Adams, *Hormones and Behavior*, Vol. 45, April 2004, 278-84. Address: Michael R. Adams, Dept. of Pathology/ Comparative Medicine, Wake Forest University School of Medicine, Medical Center Blvd., Winston-Salem, NC 27157-1040, madams@wfubmc.edu.

—and—

"In male monkeys, too much soy has adverse effects," news release, Wake Forest University Baptist Medical Center, April 30, 2004.

Psychopaths: new evidence of brain abnormalities

New studies add to evidence linking psychopathic behavior to abnormalities in brain structure and function. Among the recent findings:

• Edelyn Verona and colleagues found that male offenders with high scores on affective-interpersonal psychopathic traits (e.g., superficial charm, manipulativeness, and absence of remorse or empathy) showed reduced skin conductance response to both pleasant sounds, such as a baby laughing, and unpleasant sounds, such as screaming. Their skin conductance responses also revealed a failure to differentiate between pleasant and unpleasant sounds. This, the researchers say, adds to "a growing body of evidence indicating that high psychopathy individuals do not discriminate normally between non-emotional and emotional cues, whether pleasurable or aversive, in basic physiological response systems."

• Adrian Raine et al. report that psychopaths who are caught and convicted show an exaggerated asymmetry of the hippocampus (with the right side larger than the left), compared to either successful psychopaths or normal controls. This finding remained significant, they say, when they controlled for schizophrenic symptoms, head injury, substance use, early exposure to abuse or other trauma, and additional demographic and behavioral factors. Their data lend support, the researchers say, "to a neurodevelopmental model of unsuccessful psychopathy."

The hippocampus plays a key role in regulating aggression, as well as in "contextual fear conditioning"—the learned knowledge of which situations cause fear and should thus be avoided in the future. Raine et al.

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Book Review:

BIOSOCIAL CRIMINOLOGY: Challenging Environmentalism's Supremacy

Edited by Anthony Walsh and Lee Ellis
Nova Science Publishers, 2003

Treatment for mental illness today is often woefully inadequate, as is our understanding of the roots of mental disorders. Perhaps the word "mental" is part of the problem, because most people, including professionals, tend to think of "mental" as synonymous with "mind." Instead, as this book helps to demonstrate, they should be thinking of mental illness as a *brain* problem—a problem far better addressed by physiological interventions than by psychological approaches.

Walsh and Ellis, authors of innumerable books on the subject of mental illness, have provided a comprehensive multidisciplinary review of biosocial criminological theory. Included in this book, in addition to their own information, are chapters by Kanazawa, Tibbetts, Moffitt, Comings, Quadagno, Fishbein, Scarpa, Raine, Gove, and Wilmoth. The book is divided into four parts: "A Theoretical Overview," "Evolutionary Psychology," "Behavior Genetics," and "Brain Functioning: Neurochemistry and Criminology."

Although not as easily readable as some texts, this book will greatly expand the reader's understanding of mental illness as a biologically-rooted problem. It should be required reading, and spark enlightened discussion, in criminology classrooms across America.

Quotes from "Biosocial Criminology"

Edited by Anthony Walsh and Lee Ellis

Critics are quite right, there are no genes "for" crime, and no biosocial scientist claims that there are. There are genes, however, that lead via various neurohormonal routes to traits (e.g., low levels of empathy, IQ, self-control, conscientiousness, and fear, and high levels of sensation-seeking, egoism, negative emotionality, and aggression) that increase the *probability* of criminal behavior.

Anthony Walsh in his chapter, "Introduction to the Biosocial Perspective"

Behavioral genetic studies have found that empathy is highly variable among individuals, with a heritable coefficient of around 0.68… Consistent with evolutionary theory and with what we know about the demographics of crime, these same studies found females and older males to be more empathetic (and altruistic) than younger males. The researchers attributed this finding to testosterone levels "that predispose toward aggressiveness, which in turn decreases empathy"…..

Chronic criminals remain young children….As they grew older, they retained their childhood priorities for instant self-gratification without having developed the emotional inner voice necessary to generate a sense of discipline, responsibility, and the recognition of the rights of others.

Stephen G. Tibbetts in his chapter, "Selfishness, Social Control, and Emotions: An Integrated Perspective on Criminality"

The common view is that the environment in which children were raised plays the major role in predicting criminal behavior. Adoption studies show that the major effect is derived from a combination of "bad genes" and "bad environment," not a bad environment per se. Placing a non-genetically predisposed child into a bad environment has relatively little effect on criminal outcome, suggesting that if the seed is not "bad," it will not grow. By contrast, the "bad seed" will grow in either environment but it sprouts fastest in a "bad environment." Two conclusions seem reasonable. First, social programs will have a maximum effect by targeting the combination of genetic and environmental effects. Second, problems with criminal behavior would be most effectively addressed by eliminating the effect of the genes rather than the effect of the environment.

David E. Comings in his chapter, "Conduct Disorder: A Genetic, Orbitofrontal Lobe Disorder that is the Major Predictor of Adult Antisocial Behavior"

Adult testosterone levels, cortisol levels, and the serotonin neurotransmitter system are all genetically influenced. Genes may therefore influence aggression and violence by affecting these variables throughout life.

David Quadagno in his chapter, "Genes, Brains, Hormones, and Violence Interactions within Complex Environments"

The greatest obstacle now standing in the way of advancement in biosocial understanding of criminal behavior is criminologists' lack of training in biology... Many decades from now, all students of sociology, criminology, and criminal justice will be taught that in the final analysis, all behavior is a biological phenomenon made possible by each individual's unique brain.

Lee Ellis in his chapter, "So You Want to Be a Biosocial Criminologist? Advice from the Underground"

Gene therapy reduces craving for drink in 'alcoholic' rats

Researchers at Brookhaven National Laboratory report that gene therapy markedly reduces alcohol consumption in rats bred to desire large amounts of ethanol.

Panayotis Thanos and colleagues worked with two groups of rats: a normal control group, and a group genetically engineered to exhibit a strong preference for alcohol. The rats bred to prefer alcohol drank more than five grams of ethanol per kilogram of body weight per day when allowed to choose between alcohol and water, while the control rats consumed less than one gram of ethanol under the same circumstances.

Thanos et al. treated both groups of rats by inserting the gene for the dopamine D2 receptor (DRD2) into a harmless virus and then injecting it directly into the rats' nucleus accumbens. The nucleus accumbens is a key part of the brain's "reward" circuitry, and releases large amounts of dopamine—a neurotransmitter that transmits feelings of pleasure and plays a strong role in addiction—in response to alcohol ingestion.

The researchers report that following the gene insertion, the alcohol-preferring rats cut their total alcohol consumption in half, and exhibited a 37 percent reduction in their preference for alcohol over water. The control rats also reduced their alcohol consumption and preference, but to a much smaller degree. The changes were temporary, with the rats returning to their previous consumption levels by the 20th day after gene insertion.

"These findings further support our hypothesis that high levels of D2 are causally associated with a reduction in alcohol drinking, and may serve as a protective factor against alcoholism," the researchers say.

Many scientists believe that low levels of dopamine can lead directly or indirectly to "reward deficiency syndrome," in which individuals are biochemically incapable of achieving adequate levels of pleasure from normal activities and thus are vulnerable to alcoholism or drug addiction. The genetically altered rats studied by Thanos and colleagues have 20 to 25 percent fewer dopamine D2 receptors than normal rats; in future studies, Thanos et al. plan to investigate the effects of completely depleting D2 receptors in mice.

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"DRD2 gene transfer into the nucleus accumbens core of the alcohol preferring and nonpreferring rats attenuates alcohol drinking," P. K. Thanos, N. B. Taintor, S. N. Rivera, H. Umegaki, H. Ikari, G. Roth, D. K. Ingram, R. Hitzemann, J. S. Fowler, S. J. Gatley, G. J. Wang, and N. D. Volkow, *Alcoholism Clinical and Experimental Research*, Vol. 28, No. 5, May 2004, 720-8.

—and—

"Gene therapy reduces drinking in rats with genetic predisposition to 'alcoholism,'" news release, Brookhaven National Laboratory, May 5, 2004.

Psychopathy (cont. from p. 4)

speculate that in unsuccessful psychopaths, disruption of the circuitry between the hippocampus and the prefrontal cortex may result in impaired contextual fear conditioning, and in "impulsive, disinhibited, unregulated and reward-driven antisocial behavior that is more prone to legal detection."

Earlier studies by Raine et al. (see *Crime Times* Vol. 1, No. 1, 1995, p. 1; Vol. 3, No. 4, 1997, p. 7; Vol. 6, No. 2, 2000, p. 1; and Vol. 10, No. 1, 2004, p. 6) have revealed a range of additional brain anomalies in psychopaths.

—

"Psychopathy and physiological response to emotionally evocative sounds," Edelyn Verona et al., *Journal of Abnormal Psychology*, Vol. 113, No. 1, 2004, 99-108. Address: Edelyn Verona, Department of Psychology, Kent State University, Kent, OH 44242.

—and—

"Hippocampal structural asymmetry in unsuccessful psychopaths," Adrian Raine et al., *Biological Psychiatry*, Vol. 55, 2004, 185-191. Address: Adrian Raine, Dept. of Psychology, University of Southern California, Seeley G. Mudd Building 501, Los Angeles, CA 90089-1061.

Quotable....

"During my career as a neurologist — which has often brought me out of the hospital and into contact with death-row inmates and juvenile offenders — I have searched for answers to aggressive behavior.

Consider a 26-year-old death-row inmate I once met. He was a seemingly nice guy who suffered immensely from attention-deficit hyperactivity disorder (ADHD) and dyslexia, which are two disorders common among the aggressive population.... He [never received treatment and] dropped out of school in 11th grade and, due in large part to his inability to hold a job because of his learning disabilities, he got involved in drug dealing. During a robbery, he impulsively killed someone. To me, this is tragic: a man whose boyhood medical problems — both of which are treatable — were ignored, resulting in destructive consequences.

[Such] stories of shattered lives — for inmates, victims and society-at-large — present the pressing need to forge ahead with neurological research that may shed light on root biological causes of violence and may lead to new remedies for the behavior."

—Pamela Blake, M.D., in "Trials and Treatment," Washington Times, *July 2, 2004*

RESEARCH: HORMONES AND BEHAVIOR

Synthetic progesterone linked to aggression, anxiety

A synthetic form of the hormone progesterone increases aggression and anxiety in female monkeys, according to research conducted at the Yerkes National Primate Research Center.

Medroxyprogesterone acetate (MPA), used in contraceptives and hormone replacement therapy, has been reported anecdotally to cause depression, mood changes, and loss of libido in some women. To determine if this finding could be substantiated in a research setting, Karen Pazol and colleagues tested six female pigtail macaques under three conditions, each lasting one week: estrogen only, estrogen plus natural progesterone, and estrogen plus MPA.

The researchers report that the monkeys exhibited significantly more aggressive and anxious behavior when taking estrogen plus MPA than they did in either of the other test conditions. They also were much less interested in sexual activity.

Pazol says, "In comparison to natural progesterone, MPA binds to glucocorticoid receptors with a much higher affinity and may have a greater impact on the brain's stress system." Also, unlike natural progesterone, MPA cannot be converted to allopregnanolone. Abnormal levels of allopregnanolone are tentatively linked to depression, anxiety disorders, and premenstrual mood disorders.

The researchers say their findings suggest that "production of negative affect may be a particularly serious side effect of MPA."

—

"Medroxyprogesterone acetate antagonizes the effects of estrogen treatment on social and sexual behavior in female macaques," Karen Pazol, Mark E. Wilson and Kim Wallen, *Journal of Clinical Endocrinology and Metabolism*, Vol. 89, No. 6, June 2004, 2998-3006. Address: Karen Pazol, Yerkes National Primate Research Center, Emory University, 954 Gatewood Dr., Atlanta, GA 30322.

—and—

"Synthetic hormone used in contraceptives and HRT produces negative effects in monkey studies," news release, Emory University Health Sciences Center, June 7, 2004.

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Early aspirin, acetaminophen exposure may alter hormone effects, adult sexual behavior

Prenatal exposure to aspirin or similar drugs could markedly influence adult sexual behavior, according to a recent study.

Stuart Amateau and Margaret McCarthy exposed male rats immediately before or after birth to aspirin or indomethacin, two drugs that inhibit the production of prostaglandin E2 (PGE2). They report, "Without prostaglandins during brain development, male rats do not develop the brain wiring necessary to respond to testosterone as adults."

The rats exposed to aspirin shortly before or after birth exhibited mildly impaired sexual behavior as adults, while those injected with indomethacin shortly after birth were completely asexual when they reached adulthood. In addition, indomethacin-exposed rats had an abnormally small number of neural connections in a region of the brain called the preoptic area, which appears to play a role in sexual behavior.

In contrast, by exposing female mice to PGE2 shortly after birth and then giving them testosterone during adulthood, the researchers could cause the rats to exhibit masculine behavior, such as trying to mate with other females. The brains of these female rats contained a larger-than-typical number of synaptic connections in the preoptic area.

The researchers caution that human sexual behavior is much more complex than that of rats, and say more study is needed to investigate the possible effects of early exposure to PGE2-blocking drugs such as aspirin and acetaminophen on human sexual development.

—

"University of Maryland School of Medicine researchers find clues to male sexual behavior in the developing brain," news release, University of Maryland, May 23, 2004.

—and—

"Sexing brains up and down," Bruce Bower, *Science News*, Vol. 165, May 29, 2004, 340-1.

Food additives again implicated in hyperactivity

(continued from page 1)

fewer behavior problems, slept through the night more often, and had significantly less trouble falling asleep.

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"The effects of a double blind, placebo controlled, artificial food colourings and benzoate preservative challenge on hyperactivity in a general population sample of preschool children," B. Bateman, J. O. Warner, E. Hutchinson, T. Dean, P. Rowlandson, C. Gant, J. Grundy, C. Fitzgerald, and J. Stevenson, *Archives of Disease in Childhood*, Vol. 89, June 2004, 506-11. Address: John Warner, University Child Health, Southampton General Hospital, Tremona Road, Southampton SO16 6YD, UK, jow@soton.ac.uk.

—and—

"Artificial colorings and preservatives in food and drink boost levels of hyperactivity in pre-school children," *The Independent* (UK), May 25, 2004.

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QUOTABLE

Every 15 seconds, someone in the United States suffers a traumatic brain injury. Of the 1,000,000 people treated in hospital emergency rooms each year, 50,000 die and 80,000 become permanently disabled because of traumatic brain injury....

Many psychiatric delusions appear to be associated with mild traumatic brain injury. Examples include content-specific personality changes, such as when the patient believes that family members are impostors or identical doubles. An extremely common delusion among domestic abusers and stalkers is pathological jealousy and preoccupation with another person.

Brain injury causes lesions that appear and change over time in the prefrontal cortex and its pathways to the older regions of the brain. This explains the wide spectrum of complex neurobehavioral complaints following minimal traumatic brain injury: compulsive and explosive behavior, sensory anomalies, memory loss—as well as behavioral disinhibition, domestic violence, and alcohol intolerance.

—"The Human Brain," website of the Franklin Institute Science Museum

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