**Brain Functioning in ADHD**

ADHD is not the result of laziness, poor motivation, low intelligence, disobedience, poor upbringing or selfishness—to name a few. Although having ADHD doesn’t exclude you from having some of these difficulties, these problems do not cause chronic inattention, hyperactivity and impulsiveness—the core symptoms of ADHD. ADHD is a medical disorder, and it can be caused by a number of factors that affect how the brain develops and functions.

Current research indicates the frontal lobe, basal ganglia, caudate nucleus, cerebellum, as well as other areas of the brain, play a significant role in ADHD because they are involved in complex processes that regulate behavior (Teeter, 1998). These higher order processes are referred to as executive functions. Executive functions include such processes as inhibition, working memory, planning, self-monitoring, verbal regulation, motor control, maintaining and changing mental set and emotional regulation. According to a current model of ADHD developed by Dr. Russell Barkley, problems in response inhibition is the core deficit in ADHD. This has a cascading effect on the other executive functions listed above (Barkley, 1997).

What factors could account for neurological differences in brain development and functioning that could contribute to ADHD? The main factors studied to date have been: fetal exposure to toxic substances (e.g., alcohol and tobacco) during pregnancy, exposure to lead, trauma to the brain from head injury or illness and differences that could be attributed to heredity. These causes are discussed below.

**Heredity as a Cause of ADHD**

Heredity is the most common cause of ADHD. Most of our information about the heritability of ADHD comes from family studies, adoption studies, twin studies and molecular genetic research.

***Family Studies:*** If a trait has a genetic basis we would expect the rate of occurrence to be higher with the biological family members (e.g., brown-eyed people tend to have family members with brown eyes). Dr. Joseph Biederman (1990) and his colleagues at the Massachusetts General Hospital have studied families of children with ADHD. They have learned that ADHD runs in families. They found that over 25% of the first-degree relatives of the families of ADHD children also had ADHD, whereas this rate was only about 5% in each of the control groups. Therefore, if a child has ADHD there is a five-fold increase in the risk to other family members.

***Adoption Studies:*** If a trait is genetic, adopted children should resemble their biological relatives more closely than they do their adoptive relatives. Studies conducted by psychiatrist Dr. Dennis Cantwell compared adoptive children with hyperactivity to their adoptive and biological parents. Hyperactive children resembled their biological parents more than they did their adoptive parents with respect to hyperactivity.

***Twin Studies:*** Another way to determine if there is a genetic basis for a disorder is by studying large groups of identical and non-identical twins. Identical twins have the exact same genetic information while non-identical twins do not. Therefore, if a disorder is transmitted genetically, both identical twins should be affected in the same way and the concordance rate—the probability of them both being affected—should be higher than that found in non-identical twins. There have been several major twin studies in the past few years that provide strong evidence that ADHD is highly heritable. They have had remarkably consistent results in spite of the fact that they were done by different researchers in different parts of the world. In one such study, Dr. Florence Levy and her colleagues studied 1,938 families with twins and siblings in Australia. They found that ADHD has an exceptionally high heritability as compared to other behavioral disorders. They reported an 82 percent concordance rate for ADHD in identical twins as compared to a 38 percent concordance rate for ADHD in non-identical twins.

***Molecular Genetic Research:*** Twins studies support the hypothesis of the important contribution that genes play in causing ADHD, but these studies do not identify specific genes linked to the disorder. Genetic research in ADHD has taken off in the past five years. This research has focused on specific genes that may be involved in the transmission of ADHD. Dopamine genes have been the starting point for investigation. Two dopamine genes, DAT1 and DRD4 have been reported to be associated with ADHD by a number of scientists. Genetic studies revealed promising results, and we should look for more information about this soon.

**Exposure to Toxic Substances as a Cause of ADHD**

Researchers have found an association between mothers who smoked tobacco products or used alcohol during their pregnancy and the development of behavior and learning problems in their children. A similar association between lead exposure and hyperactivity has been found, especially when the lead exposure occurs in the first three years. Nicotine, alcohol, and lead can be toxic to developing brain tissue and may have sustained effects on the behavior of the children exposed to these substances at early ages. However, it is unlikely that such exposure accounts for differences in brain development in the vast majority of children and adolescents with ADHD.

**Injury to the Brain from Trauma, Brain Tumors, Strokes or Disease**

Injury to the brain can be the result of trauma (serious blow to the head), brain tumor, stroke or disease. These factors can cause problems with inattention and poor regulation of motor activity and impulses. While such circumstances can result in a diagnosis of ADHD, the occurrence of such is atypical.

**What Does Not Cause ADHD**

***Diet:*** In the 1970’s it became popular to view ADHD as resulting from allergies or sensitivities to certain food substances. However, much of the research done over the past two decades was unable to support the claim that diet played a significant role in causing ADHD. Despite this, the popular media continues to discuss the role of food in ADHD, particularly that sugar may cause children to become hyperactive and impulsive. There is no research to back up this claim. In fact, Dr. Mark Wolraich and his colleagues found no significant effects of sugar on either behavior or learning in children.

***Hormones:*** No studies have found any significant connection between problems with hormone functioning and hyperactivity or ADHD.

***The vestibular system:*** . For a number of years some clinicians have proposed the theory that ADHD and some learning and emotional problems could be the result of problems within the vestibular system of the brain which affects balance. They contend that treatment with anti-motion sickness medicine could correct these problems. This theory is unsupported by scientific research and is inconsistent with what is known about ADHD and the vestibular system.

***Poor parenting or problems in family life:*** No studies support the idea that ADHD is the result of poor parenting practices or other family environment variables. While parents of children with ADHD are likely to give more negative commands to their ADHD child and less positive attention, this may be due to the fact that ADHD children are often non-compliant and, therefore, parents are more likely to be more negative in their interaction with them. Furthermore, the interactions of parents of ADHD children whose behavior was not oppositional were no different than they were from non-ADHD children. It is important to note, however, that symptoms of ADHD and the degree to which such symptoms can impact the child’s functioning, can be reduced by parents who provide appropriate accommodations and interventions.

***Television:*** No studies have found any connection between television viewing and ADHD. Nor have any studies indicated that children with ADHD watch more television than do those without ADHD.

**Summary**

There is no single cause for ADHD. Scientists agree that ADHD is a medical disorder affecting the several areas of the brain with the frontal area likely having the greatest involvement. Those areas involved are responsible for certain executive functions that control the regulation of behavior, working memory, thinking, planning and organizing. Heredity is the most common cause of ADHD. This has been confirmed in studies looking at the rates of occurrence of ADHD within families, studies of adopted ADHD children and twin studies. Molecular genetic research has focused on the specific genes that may be responsible for characteristics of ADHD. Other risk factors for ADHD have to do with factors that can influence brain development and functioning such as exposure to toxic substances in the developing fetus and acquired brain injury due to trauma or disease. Factors such as diet, vestibular dysfunction, television viewing and parenting have not been proven to be causes of ADHD.