

# ADHD: A Biologically or Environmentally Based Disorder?

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*It is estimated that 3 to 5 percent of the school-age population in the present-day United States has been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and that approximately 60 percent of those so identified will continue to have symptoms throughout their adult life. It is important to understand the underlying causes and potential treatments of this disorder since it has a significant effect on one's ability to participate in society; those diagnosed with ADHD often have difficulty in completing college, maintaining employment, being an effective spouse or parent, and following societal norms. This paper examines the question of whether ADHD is a biologically or environmentally based disorder and the social implications of supporting only one of the two arguments. Support of one approach over the other depends on popular culture, societal values, and the vested interests of those making the assessment at any given point in time. It is concluded that there can be both biological and environmental factors involved in the development of ADHD. By focusing on only one argument, valuable insight into other causes and alternative treatments may be ignored. Consequently, all aspects of the underlying origins and effective management of the disorder should be considered.*

**A**LTHOUGH EVERYONE IS OCCASIONALLY DISTRACTED and restless, some people are continually inattentive. At one time they might have been described as brain-damaged. Over the last forty to fifty years, however, psychologists and sociologists have identified these behaviors as symptoms of a disorder known as Attention Deficit Disorder (ADD). Common symptoms of ADD include inattention, daydreaming, slowness to respond, withdrawal, and passivity. Although many people believe that the terms ADD and Attention Deficit Hyperactivity Disorder (ADHD) are synonymous, they were designated as separate disorders in 1987. ADHD is characterized by hyperactivity, inattention, impulsivity, aggression, over-reaction, and low self-esteem.<sup>1</sup> Although hyperactivity seems to be the primary difference between the two disorders, another less easily defined characteristic of those diagnosed with ADHD is that they "simply do as they please"<sup>1</sup> without regard to consequences or the opinions of others.

Since the clinical symptoms of ADHD were first described and recognized in the early part of the twentieth century, scientists and educators have argued whether this disorder is caused

by biological or environmental factors. This paper will examine the background of ADHD, its diagnosis and treatment, parties that have competing interests in ADHD, the argument for biological causes of the disorder, the argument for environmental causes of the disorder, and the social implications of supporting only one of these two arguments.

## BACKGROUND

ADHD, the disorder formerly known as hyperactivity, was first described by Sir George Frederick Still and Alfred F. Tredgold in the early 1900s.<sup>2</sup> They suggested that this behavior was caused by either a biological defect or a brain injury. The belief that hyperactivity was associated with brain damage persisted through the middle of the twentieth century. For example, after an encephalitis epidemic spread throughout Europe and the United States in 1917 and 1918, many professionals found that children who had survived the disease became hyperactive and developed learning disabilities.<sup>2</sup>

By the end of the 1950s, "the concept of brain damage as a single causative factor in the causation of [hyperactivity] was challenged."<sup>2</sup> At

that time, clinicians put forward other ideas concerning the cause of hyperactive behavior including environmental factors such as poor parenting. By the 1980s, as a result of continued research in the area, "hyperactivity came to be seen as a condition with a strong hereditary component, chronic in nature and causing significant handicap in the areas of academic achievement and socialization."<sup>2</sup>

As can be seen by the swings in thinking about ADHD over the last century, support for either a biological or an environmental cause of ADHD shifted over time. This can be attributed to the lack of supporting evidence for one argument over the other. And even though ADHD is perhaps the most and best studied of all psychological disorders of children, this continues to be the case; an understanding of its causes and nature is still incomplete.<sup>3</sup>

In the present-day United States, it is estimated that 3 to 5 percent of the school-age population is diagnosed with ADHD.<sup>1</sup> Through early adolescence, it is diagnosed four times more often in males than in females. But by college age, men and women are diagnosed with equal frequency. Most children do not outgrow the disorder; approximately 60 percent of those identified as having ADHD during their childhood continue to have symptoms as long as they live.<sup>4</sup>

#### DIAGNOSIS AND TREATMENT

At this point in time, there is no simple diagnostic tool to determine whether or not one has ADHD. It cannot be determined from either a blood test or a simple IQ test. The most common methods of diagnosis are by observation of the classic ADHD behaviors in a child by a parent or the reporting of unusual or disruptive behavior by a teacher.<sup>2</sup> Either may lead to the evaluation of the child by a qualified medical professional.

The problem with a diagnosis based on observation is that it is not objective because it depends on who is doing the observing. For example, different people look on the activity

l e v e l s of children in different ways. This can account for the reason that children in the upper and middle classes are more often diagnosed with ADHD than those in the lower socioeconomic classes.<sup>2</sup> The upper and middle classes tend to be more concerned about the education of their children and react strongly to comments by teachers about disruptive classroom behaviors. Parents who are in the lower socioeconomic class are apt to look upon hyperactive or inattentive behaviors as phases of growing up and are less likely to seek medical opinions or intervention. To them, over-activity and day-dreaming are neither unusual nor cause for alarm. Even if they are concerned, they may not have health insurance or they may not be able to take time off from work to have a child's behavior evaluated.

In an effort to find a truly objective physical diagnosis for ADHD, scientists began to use modern technology, including brain scans, which can be used to compare the brains of those diagnosed with ADHD to those of "normal" individuals. This was first done after reviewing results of primate research conducted in the late nineteenth century. The data indicated that "frontal lobe ablation in monkeys produced excessive restlessness and poor concentration."<sup>2</sup> Since these symptoms mimic those of individuals with ADHD, CT scans and MRIs were used to examine specific regions of the brain, especially the frontal lobes. In one brain-scanning experiment undertaken at Massachusetts General Hospital in 1999, a chemical imbalance was found in the brains of six adults diagnosed with ADHD as compared to thirty normal volunteers. These results were greeted with relief from some doctors studying ADHD, as they welcomed a test for a condition whose diagnosis had been based on "observation and psychological testing, so there [had been] an element of ambiguity about it."<sup>5</sup>

Although this particular study shows promise, it was performed on a small group. Therefore, it should be replicated in order to

determine the precision of the results. Additionally, some individuals have criticized the use of modern diagnostic tools such as brain scans because of potential adverse side effects, including allergic reactions to dyes used during the tests. Furthermore, exposure to low-dose radiation required by CT scans could increase chances of future leukemia or brain tumors. However, it can be argued that hospital radiologists have been working with these technologies for years and have generally determined safe radiation levels; furthermore, severe allergic reactions are extremely rare and usually can be reversed in the hospital or clinic where the tests are administered.<sup>2</sup>

At this time, the primary course of treatment for children diagnosed with ADHD is medication. Ironically, even though hyperactivity is one of the symptoms of ADHD, the drugs of choice are the stimulants Ritalin and Dexedrine.<sup>1</sup> Stimulant medications act on transmission signals in the brain that control attention impulses and regulate behavior. By activating neurotransmitters, the stimulant medications have been shown to reduce hyperactivity, decrease impulsivity, and improve the ability of children to focus.<sup>6</sup> This also leads to improvement in classroom performance.<sup>7</sup>

Medication for ADHD patients is often supplemented with training for parents and other caregivers in behavioral management, and with psychotherapy to deal with the patient's low self-esteem. Some studies indicate that teachers who reinforce positive behaviors and academic successes of individual hyperactive children successfully affect change in the classroom behavior of these children.<sup>2</sup> The implication of these studies is that the children benefit from individual attention and instruction. The reality is that special education programs for academically challenged children are often cut back or eliminated when school budgets are under-funded. Additionally, not all children with ADHD receive the same educational opportunities. For example, children who live in wealthy suburban cities and towns have access to more special

education programs and individual attention than those who live in poor urban school districts because the wealthy cities and towns spend more money on the school system.<sup>2</sup>

Adults with the disorder are encouraged to establish support systems or join support groups in order to learn how to make friends and to reduce the impact their symptoms have. Adults are also encouraged to use planning and organizational tools as a means of imposing external controls on their lives.<sup>1</sup>

### COMPETING INTERESTS

Is ADHD caused by biological or environmental factors? And which is more important? It is particularly difficult to answer these subjective questions because a number of different interests, in addition to those diagnosed with the disorder, are invested in the answer. Among these groups are parents, the education industry, the government, the drug industry, and the medical industry.

Since ADHD is a childhood disorder, parents are actively involved. Many parents lobby educators and the government in their attempts to deal with the effects of the disorder, particularly as they are manifested in an educational setting. Teachers are involved because they have to balance the special needs of those who have ADHD with those of the rest of the class. The "private" education or tutoring business has a financial interest in ADHD; entities such as Sylvan Learning Center, Kaplan, and Princeton Review advertise the advantages of individual instruction for children. Government agencies are involved in establishing criteria and defining the parameters of diseases and disorders as well as funding research for them. Additionally, since the government pays for treatments through various federally and state-funded insurance programs, it has a financial incentive to try to control and limit costs.

The two biggest interest groups involved in ADHD are the drug and medical industries. Drug companies are in business to make a profit. They profit from this disorder as long as they

can convince medical professionals and the general public that their products can help alleviate the symptoms of ADHD. If one of their products no longer generates a profit, they try to develop a new product to take its place or create a need for their product in another group of people. This can be illustrated by actions taken by the drug manufacturer Eli Lilly. When the manufacturer realized that the number of ADHD children was not going to increase substantially, they turned their attention to adults with the disorder. Since adults with ADHD do not respond as well to stimulant medications as children do, Lilly developed and received FDA approval to market the first non-stimulant drug, Strattera, to treat the disorder. According to a story on CBS' "Sixty Minutes," physicians wrote one million prescriptions for Strattera during its first six months on the market.<sup>8</sup> Lilly created an informational website for the drug which includes a simplistic self-evaluation that visitors to the site can take to determine whether they might have ADHD, though the company does suggest seeking the advice of a doctor to confirm the diagnosis.<sup>9</sup> Additionally, Lilly's website for Strattera emphasizes the genetic causes of the disorder, thereby dismissing possible environmental causes for it. The claim that there is a genetic cause suggests that medication will work to alleviate the symptoms of ADHD. If the cause is environmental, it might be possible to eliminate these triggers and, therefore, the need for a drug. It can be argued, then, that the drug company is emphasizing genetic causes to increase drug sales.

The medical industry also has a vested interest in the disorder. As long as a biological or physical cause for the disorder can be suggested, medical professionals can be actively involved in its diagnosis and ongoing treatment. Medical professionals are able to influence this perception of ADHD by publicizing their beliefs by writing books, giving lectures, and appearing on television and radio. An example of this is the flood of popular literature over the past decade postulating a genetic basis for ADHD. For

example, in *The Edison Gene*, Thom Hartmann suggests that the symptoms of ADHD (creativity, impulsiveness, and distractibility) are components of a highly adaptive and useful skill used by our hunter-and-gatherer ancestors rather than signs of a disorder.<sup>10</sup> This is a leap in evolutionary psychology for which there seems to be no basis. Another researcher, Russell Barkley, Ph.D., told a group of mental health care providers that ADHD is a genetic disorder and a life-long disability.<sup>11</sup> It is possible that one of the reasons he was invited to speak was the popular success of his book, *Taking Charge of ADHD*. Additionally, Edward Hallowell, M.D., has authored books dealing with ADHD. In his works, *Driven to Distraction* and *Answers to Distraction*, Hallowell states that the United States has a higher rate of diagnosed ADHD than European countries. He attributes this fact to the type of people who colonized and settled the United States and to a collective gene pool with a greater concentration of ADHD genes.<sup>12</sup> However, there is no data to support this speculation. A more reasonable explanation may be that there is a difference in the way in which Americans and Europeans approach individual behaviors that have societal implications.

One common factor in these books is the pronouncement that the cause of ADHD is genetic. These authors dismiss the possibility of social or environmental factors as contributors to the disorder, effectively minimizing personal and societal responsibility for ADHD. Again, one must consider the bias of the source of this information; it is possible that the authors feel they will sell more books by promoting the idea that ADHD is an inborn trait and cannot be blamed on food, parents, or society. Speculation that some historical figures, including Thomas Edison (hence the "Edison gene"), may have had the symptoms of ADHD may help sell books and may help those with the disorder feel better about themselves, but it is not necessarily good science. The authors and the drug companies also seem to supply simplistic answers to the problem—a pill for every ill.

Although there is some evidence to support their conclusions, there is no definitive proof of a genetic cause for the disorder. In this instance, one can compare the belief in a genetic cause of ADHD with the assertion that there is a genetic cause of breast cancer. In truth, some genes predispose women towards breast cancer, but not everyone who has the gene will develop the disease. For example, "mutation carriers who have a risk of developing breast cancer that may exceed 50 percent comprise no more than 5 to 10 percent of breast cancer cases."<sup>13</sup> In many instances, women with a breast cancer gene will not develop the disease unless they are also exposed to an environmental insult. Similarly, some genetic researchers have concluded that ADHD "is associated with the presence of the DRD4/7R allele"<sup>14</sup> but again, the presence of the gene is no guarantee of future ADHD. While any information linking genes to diseases receives a great deal of publicity, that information may not be accurate or thorough. Individuals may be harmed if they make medical decisions without full understanding of the condition. For example, most people taking the self-evaluation on Eli Lilly's Straterra drug website will be convinced that he or she has ADHD. Without additional research into the condition, some may come to believe they have it—and seek unnecessary treatment—when in fact they do not.

#### THE ARGUMENT FOR BIOLOGICAL CAUSES

A significant amount of research has been done in an attempt to determine if there is a biological basis for ADHD. Some studies examine the possibility of an abnormality in the way the brain works, while others have focused on the possibility of a genetic or heritable link to the disorder. Scientists in search of a malfunctioning brain have turned their attention to the neurotransmitter dopamine.<sup>2</sup>

Researchers have long suspected that dopamine levels in the brain are involved in ADHD because the stimulant drugs used to

treat children with ADHD calm them down instead of exciting them. Speculation is that stimulant drugs compensate for a dopamine deficiency.<sup>2</sup> Consequently, researchers are now examining genes that affect dopamine communication.<sup>15</sup> One of the problems with studies of individual genes involved in dopamine transmission is that the results have not been uniformly duplicated and therefore adequately confirmed. Additionally, even though researchers have identified several genes—including DAT1, DRD2, and DRD5—with the potential to have a significant impact on dopamine transmission, closer examination reveals that no single gene has a significant impact on increased ADHD incidence. Recent research has revealed that no matter how much so-called ADHD genes affect dopamine transmission, they do not cause the disorder alone; scientists have estimated that they only add a 1 to 3 percent increased chance of developing ADHD.<sup>15</sup> It is likely that a number of genes act in concert to establish a significant genetic increase in ADHD because no single gene appears to be critical in altering outcomes.

"Over the past decade, more than ten studies of twins in far-flung locations have suggested that ADHD has a strong genetic component."<sup>15</sup> Other research indicates that "heritability for ADHD—meaning that if one identical twin has it, the other will too—ranges from 65 to 90 percent."<sup>15</sup> One potential problem with conducting research on the heritability of ADHD using twin studies is that it is impossible to discount the impact of environment. For example, some twins are placed with different members of the same family. This means that their environments are very similar, which makes it impossible to separate the impact of genes and those of the environment on the individual. Additionally, twins have the same prenatal environment. It is possible that similarities in the behavior of twins may be attributed to their prenatal environment and not their genes.

The same problem of differentiating between a genetic and an environmental basis for disorders arises in family studies. The asser-

tion is that if a parent has ADHD, a child is more apt to have the disorder than a child who has no ADHD parents.<sup>12</sup> This may be because either the child inherited ADHD traits from a parent or they developed ADHD because they are exposed to the same environment as their parents. Much research needs to be done in order to separate, isolate, and identify the effects of genes and the environment on ADHD because no studies provide conclusive evidence that there is only a biological basis for the disorder.

#### THE ARGUMENT FOR ENVIRONMENTAL CAUSES

The major nonbiological factor that may cause ADHD symptoms, either alone or in concert with biological factors, is the environment, particularly the parents. Some studies have focused on the mother's physical and emotional health during pregnancy. For example, a prospective study of Scandinavian women provides evidence that "prenatal exposure to stress and smoking is independently associated with later symptoms of ADHD in human children, particularly for boys."<sup>16</sup> Another study examined the effect of maternal anxiety on the development of ADHD in children after birth and concluded that prenatal exposure to maternal anxiety without smoking also results in ADHD symptoms in eight and nine year olds.<sup>17</sup> This particular study indicates that maternal anxiety during the twelfth to twenty-second week of pregnancy is particularly significant. Further research in the area of anxiety seems advisable since both of these studies were conducted in Europe, and cultural biases do have an impact on the type of research proposed and the manner in which it is conducted. For example, Europeans have a cultural bias in favor of environmental and social causes for ADHD.<sup>2</sup> Additionally, these studies suggest that the mother may be to blame for the child's disorder. While this may be discomfoting to some—especially mothers of children with ADHD—the role of the mother cannot be completely discounted, since the prenatal envi-

ronment may play an important role in contributing to the development of ADHD.

Most research into the relationship between the family environment and ADHD is inconclusive. Virtually all the research indicates that relationship problems exist between hyperactive children and other family members. However, much of the debate on the role of the family is reminiscent of the question, "which came first, the chicken or the egg?" One school of thought contends that the presence of a hyperactive child distorts familial relationships, while others contend that a child's hyperactivity comes from a lack of parental response, particularly that of the mother, to child-initiated interactions.<sup>2</sup> Other studies suggest that the family environment has little to do with the development of ADHD.<sup>2</sup> Clearly, more research is needed to make a valid assessment of the role of the family in the development of ADHD.

The physical environment has also been evaluated as a potential causative factor in the development of the disorder. Various studies have implicated food allergies, nutritional deficits, and long term exposure to television as causes of ADHD. For example, in *The Edison Gene*, Hartmann cites medical journals that contain studies linking mineral and fatty acid deficiencies and too much sugar and television to learning problems and hyperactivity.<sup>10</sup> Conclusions of this sort are generally well publicized and received favorably by the public. However, none of the studies linking food and hyperactivity have ever been duplicated, and it is now speculated that excessive television watching is a symptom, rather than a cause, of ADHD.<sup>2</sup>

#### SOCIAL IMPLICATIONS

ADHD has significant societal implications because individual behaviors have societal consequences. For example, individuals with ADHD have difficulty internalizing language, so they have problems with social norms as well as rules and instructions.<sup>1</sup> They also have trouble managing time, and this makes it difficult for them to obtain and retain jobs. Additionally,

these symptoms make it difficult to maintain social relationships and to be an effective spouse or parent. For example, ongoing research conducted by Barkley on a group in Milwaukee indicates that "only 5 percent of those with ADHD graduated from college compared with 35 percent of the others and that ... the ADHD group has worse driving records and are much more likely to have been fired from a job."<sup>18</sup>

In attempting to uncover the causes of the disorder, the decision to focus solely on either biological or environmental causes can have serious consequences, because ignoring some causes may result in more individuals whose symptoms are not relieved and whose lives continue to be negatively impacted by the disorder. If one believes that biological factors are the primary cause of ADHD, one would tend to use medication as the preferred treatment for it. Therefore, in an effort to find more effective medication, continued research would be encouraged. This would be an advantage to society because more research would eventually lead to a better understanding of ADHD and therefore a more effective treatment of it. It also could lead to a means of detecting who is most at risk and a method for curing it. Additionally, a belief that ADHD is biologically based will remove some of the negative social aspects of the disease because people will assume that those with it cannot help their behavior. However, focusing exclusively on the biological aspects of the disorder could lead to the discounting of other potential causative factors. For example, women may continue to smoke and ignore stresses during pregnancy. Also, school systems could be tempted to cut costs by eliminating behavioral support and one-on-one teaching if they believe the environment has nothing to do with the disorder.

Conversely, if one focuses solely on environmental factors, one would stress behavioral modification for those with the disorder and its prevention. These treatments would have some advantages regardless of their efficacy in treating ADHD, as anyone can benefit from healthy

lifestyle and diet changes, as well as from better teaching and parenting skills. However, ignoring the possibility of a biological basis may discourage individuals with ADHD from obtaining medication that may be beneficial to them. It may also discourage investment in research that could lead to a better understanding of the disorder. Additionally, teachers may resort to blaming parents for a child's behavior, while parents in turn blame the teacher.

There are reasons to both support and discourage pharmacological intervention for everyone with ADHD, either as the primary course of treatment or as an adjunct to behavior modification and lifestyle changes. Medication appears to be a viable option because of its apparent success in altering the behavior of children in the United States. However, there is also cause for concern, as 75 percent of American children with the disorder are medicated while virtually none of the European children are.<sup>2</sup> The possibility exists that these medications are overused in the United States, indicating that they may be used to modify the behavior of overactive children who do not have the disorder. This conclusion is reached by the fact that 5 percent of all American children take ADHD medications even though fewer actually have the disorder.<sup>2</sup> For example, some parents will search for a doctor who will prescribe Ritalin to their overactive child even though the child has not been diagnosed with ADHD. Additionally, there have been no studies that examine the effect of putting children on what is essentially speed and keeping them on it for the rest of their lives; it may be worth noting that the FDA banned amphetamines when they were used in diet pills. Perhaps there is no concern because of its low dosage and beneficial results, but it does seem appropriate to closely examine the nature of these substances and their long-term physiological and psychological impact.

#### CONCLUSION

ADHD is both a societal and an individual problem. The majority of cases result from a

biological source that can be affected by the environment. However, in a limited number of cases, ADHD can be caused purely by the environment.<sup>2</sup> Because the disorder is highly complicated and not completely understood, it is impossible at this point in time to focus on any one cause. Every individual has different genes, home environments, and school environments, so many causes for this disorder may act in concert with one another. Thus, all facets of the causation and management of ADHD should be investigated until a greater understanding of the disorder has been attained. Otherwise, individuals with ADHD will not be treated effectively and society will continue to bear the consequences.

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