

Nature-Nurture and Attention Deficit Hyperactivity Disorder

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If you have a child with Attention Deficit Hyperactivity Disorder (ADHD), do you see some of the symptoms of ADHD in yourself or your spouse? That is because ADHD is familial; it *runs in families*. ADHD occurs 5-7 times more often among siblings of an ADHD child than in the general population. The same is true for parents of an ADHD child with perhaps as many as 40-50% of families with an ADHD child having at least one parent with ADHD. This strong familiarity could be due to shared environment, or genes, or both. Twin studies suggest that most of the familiarity is due to genes, not shared environment. Together, twin and family studies support that 60-90% of the cause of ADHD is genetic. But, what does it mean to say, "ADHD is largely genetic?"

First, it is important to realize that ADHD is likely an extreme on a continuum of normal variability in the population. In the same way that people differ in height, weight, or IQ, people differ in their susceptibility to ADHD. We indirectly measure this susceptibility by counting symptoms of hyperactivity, impulsivity, and inattention. While we do not yet know what specific brain structures, functions, cognitive processes (such as attention or inhibition), or aspects of temperament underlie ADHD susceptibility, we do know that genes influence where you or your child falls on the "susceptibility" continuum of ADHD.

Second, we know that many genes influence the ADHD continuum; that is, no one gene causes ADHD. Because it is multifactorial, we know that 1) genes underlying ADHD will differ between families; 2) genes underlying ADHD will occur in people without ADHD as well; and 3) nurture (environment) can change nature (outcome of genetic susceptibility). Let's look at each of these points in detail:

Genes underlying ADHD will differ between families. Because there are many genes involved in ADHD, children with ADHD are not going to have the same set of genes every time. Thus, there will likely be a lot of genetic variability within ADHD, and these differences may be reflected in clinical differences, such as, some children being more hyperactive, while others may have more school related problems. Uncovering the specific genes in ADHD will help us develop better tests to identify specific genetic subtypes in ADHD that may improve diagnosis and treatment.

Genes underlying ADHD will occur in non-ADHD people. Uncovering genes underlying ADHD will lead to the discovery of genes involved in processes of learning, such as attention, inhibition, working memory, or other cognitive processes. Finding genes in ADHD will shed light on the genetic basis of learning in ADHD and non-ADHD individuals alike.

Nurture can change nature. Just because genes play a strong role in determining one's susceptibility does not mean that environment can't change outcome. In ADHD, the role of nurture in changing outcome is widely seen. Take for example, an inattentive child struggling in English class that excels

in art class, or the ADHD child who can't remember his homework but never forgets a videogame strategy. Same child, same genes — different environments, different outcomes. Nurture “changing” nature. Unfortunately, we can't always “change the environment,” particularly in our educational systems, but we can look for programs that maximize strengths and minimize weaknesses and look for tools (tutoring, therapy, medication, etc.) that may do so as well. Most importantly, we need to remember that difficulties in one domain may be strengths in another.

Gene discovery is rapidly underway in ADHD. Already, some genes involved in the dopamine system have been indicated to play a minor role in ADHD. New gene discovery is underway as many groups 'scan' or search through the human genome - our genetic complement of some 35,000 genes. In light of the rapid progress in gene discovery of ADHD, it is important to think about what gene discovery will mean. Finding genes for ADHD will likely uncover genes that contribute to differences in general, how we think, learn, and process information in the world. We know very little about the strengths of ADHD, most research has focused on the weaknesses (due to the therapeutic goal of reducing impairment associated with weaknesses). Gene discovery will not only identify differences that contribute to impairment but differences that contribute to strengths as well.

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