

**Attention Deficit Disorders:  
A Neurological Diagnostic Perspective**

by  
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## Prelude

My intention for this publication is to offer those very important individuals, whether they are parents, professionals or students, with necessary and current information regarding Attention Deficit Disorders:  
Providing the ability to understand and transact informed decisions.

As a teacher and professional the most aggravating words I can still hear from other professionals is “this kid needs Ritalin to control his behavior.” There still exist many misconceptions in this industry of guarding our most precious resource, even in this world of information. It is time to break loose from the stereotypes of the early 20<sup>th</sup> century and recognize Attention Deficit Disorders as a true, neurological dysfunction. And although we have no definitive cause or cure, as many diseases humanity is afflicted, does not mean it isn’t real. Let us also remember an accurate diagnosis is crucial. We are quite sure Attention Deficit Disorders does not stem from bad parenting however; children with bad behavior do not always have Attention Deficit Disorder.

*Dedication*

*Although there are many in my life who have influenced my  
continued educational and writing pursuits, all would  
have been in vain without the love and support  
of friends and the “Princess”.*

*To my friends . . . Thank you!*

*To my “Princess” . . . I love you!*

## PREFACE

The effects of attention deficit disorders seem to touch many people's lives today, and the questions surrounding this disorder are many. Unfortunately, the answers we have are difficult to explain, particularly when describing the cause (etiology) of Attention Deficit Disorders. Optimistically, however, there is more information regarding this disorder than at any time in its history. Unfortunately, there is just as much misinformation surrounding the facts of this disorder as ever.

Although I am optimistic, I am a realist as well. And I am aware the information presented here will not satisfy all those with inquisitive minds or in need of resolution. For some, the information may be too technical. Others still, may be disappointed it wasn't technical enough. My only hope is that this will in some way unveil a few misconceptions surrounding Attention Deficit Disorders: logically, medically, and more important scientifically. At the very least, I can only hope that those in professional positions responsible for our children's welfare (teaching, nursery schools, childcare, parenting, etc.) may gain an understanding of the neurophysiologic propensity of this disorder.

## FORWARD

Occasionally, information one wants to learn just doesn't get through no matter how much one tries. Have you ever been in a situation where the light bulb wouldn't turn on until it was presented to you in a different way? I am reminded of my torturous times in high school algebra class. I flunked this course three times before I finally passed with a "C" grade. Was the information different? Or was it the new teacher and his way of presenting the material? In my experience I believe the latter was true, a scenario played out in many instances of our learning experience, both in childhood and adulthood. I also believe that those searching for an understanding of this historical and ever-increasing disorder may be asking very simple, legitimate questions. Likened to myself in algebra class, another way of presenting the information may be all that is necessary.

One word of caution, if I forget to mention it numerous times throughout this text, is that not all children exhibiting poor attention or unmanageable behavior suffer from attention deficit/hyperactive disorder. Clearly, and for the time being, we must rely on professionals to appropriately diagnose any form of this disorder: A diagnosis not always as accurate as one may think. However, scientific research and technological advancements are paving the way for definitive neurological

diagnostic procedures. Our understanding of this investigative process and technology will help researchers in their endeavors as they continue to solicit the public for volunteers with their on-going studies. Without research studies, it becomes nearly impossible to define, analyze and resolve the issues surrounding this disorder.

I am, once again, reminded of my earlier learning experiences during my second semester of college in microbiology class. One of the course required readings titled “Microbe Hunters” by P. DeKruife also became one of my favorite readings. I was amazed at the process, discoveries (most accidentally) and, dedication of the people in the scientific community of the time. Confronted with lethal microbes they, too, stood by almost helplessly witnessing the devastating results of these unknown entities. Their continued research (mistakes and all) led to the discovery of vaccine for rabies, tetanus, polio, to name a few. Impressive alone was the discovery of this tiny world of microbes, leading to a dramatic reduction of deaths merely by convincing doctors to wash their hands in between patients. Above all, one of the secrets to their success was the cooperation and involvement of the public; providing sufficient study groups thus reducing research time. We can only hope the same will be true for those investigating Attention Deficit Disorders.

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## Description of Terms

**Attention Deficit Disorder.** A childhood syndrome characterized by impulsiveness and short attention span, which often leads to learning disabilities and various behavioral problems.

**Attention Deficit Hyperactivity Disorder.** The same as Attention Deficit Disorder with the additional hyperactivity segment.

**Neurochemistry.** The study of the chemical composition and processes of the nervous system and the effects of chemicals on it.

**Neurobiology.** The biological study of the nervous system or any part of it.

**Comorbidity.** The co-existence of other disorders for example; children diagnosed with attention deficit disorder have an increased incidence of obsessive compulsive disorder or, oppositional defiant disorder.

**Modality.** A therapeutic method or agent, such as surgery, chemotherapy, or electrotherapy, that involves the physical treatment of a disorder.

**Neuroanatomy.** The branch of anatomy that deals with the nervous system.

**Neurobiology.** The biological study of the nervous system or any part of it.

**Neurochemistry.** The study of the chemical composition and processes of the nervous system and the effects of chemicals on it.

**Neuropsychology.** The branch of psychology that deals with the relationship between the nervous system, especially the brain, and cerebral or mental functions such as language, memory, and perception.



# Chapter 1

## Introduction

As I watched 12 year old Jason (not his real name) moving from work bench to work bench in my vocational education shop, I could see why the teacher said he was having such a tough time in classes. He was swinging his arms and legs relentlessly, opening and closing the bench vise to everyone's annoyance, all the while talking or interrupting nonstop. When I encouraged him to join a few of the other students learning about hand tools, he grabbed one of the other student's tools and took over the conversation. He continued to drift away to other activities going on in the shop, causing the other students to become frustrated and complain. Even when Jason was settled on a wood project for himself, he continued to fidget aimlessly becoming more and more frustrated with any written or oral details. Once I examined his files, my suspicions were confirmed: Jason had been diagnosed with Attention-deficit Hyperactivity Disorder (ADHD).

Since the early 1900's, physicians and psychiatrists have applied various labels to children who exhibit hyperactive, impulsive and inordinately inattentive symptoms as; "fidgety Phils", "minimal brain dysfunction" (MBD), "minimal brain damage" (MBD), "hyper-kinetic reaction or syndrome",

“hyperactive child syndrome” and most recently, attention deficit/hyperactivity disorder (ADD/ADHD). The many name changes reflect just how uncertain researchers have been about the underlying causes or even the precise diagnostic criteria for this disorder. And, though significant, these conceptual changes have been inadequate.

Today’s view of the basis of this condition is strikingly different from that of just a few years ago. Researchers are finding that ADD/ADHD (Attention Deficit/Hyperactivity Disorder) is not a disorder of attention per se, as had long been assumed, nor is it the result of poor parenting, moral degradation, or life’s experiences. Within the past several years, research has made great strides in clarifying etiology, symptoms, diagnostics and treatments for ADD/ADHD. Huge numbers of people are affected. Most studies estimate that between 2% and 9% of all school age children have been diagnosed with ADD/ADHD; researchers have identified the disorder in every nation and culture studied. Moreover, the condition once thought to ease with age often persists into adulthood.

To help children and adults, researchers, psychiatrists, psychologists and physicians must continue to better understand the cause, diagnosis and treatments effective for ADD/ADHD. Unfortunately, as the condition gains more publicity, there is and will be a compounding of the confusion and incorrect

information. In 1992, the Americans with Disabilities Act included ADD/ADHD as a disability.

I view this action with mixed emotions since my own research has led me to consider ADD/ADHD as a neurological difference in brain structure and not a psychiatric disorder or a “disease” as has been erroneously supposed in the past. My position, however, does take into consideration reasons of comorbidity. I am grateful that this formal recognition will allow people to receive appropriate treatment as well as continued neurological research grants.

Although no immediate cure is in site, a new understanding of ADD/ADHD may be just over the horizon. Using a variety of research tools and methods, researchers are beginning to uncover new information on the role of the brain. For example, animal studies are also adding to our knowledge of ADD/ADHD in humans. These subjects make it possible to study some of the possible causes in ways which cannot be studied in people. In addition, animal research allows the safety and effectiveness of experimental new drugs to be tested long before they can be administered to humans.

As the body of knowledge grows, scientists may someday learn how to prevent these differences, or at least how to effectively treat them. Such research will ultimately result in

improving the personal fulfillment and productivity of people with ADD/ADHD. No one knows the direct and immediate cause or the difficulties experienced by those with ADD/ADHD; advances in neurological imaging techniques and genetics promise to clarify this issue over the next five years. It has become a matter of fitting the pieces of the puzzle together; one I have chosen to explore within this book.

### Limitations and difficulties of performing research

One of the most difficult tasks associated in researching the topic of Attention Deficit Disorders is maintaining focus on a specific area or specialty. Medical evaluations, psychological testing and assessment, controversial treatments and pharmacology interventions, cognitive behavior therapy, school management, gender differences and ADD/ADHD, neurological aspects and condition, the list of research and analysis surrounding attention deficit disorder seems almost endless. A nearly limitless stockyard of resource and reference connections, along with an equally long list of contradictions is encountered by researchers and the affected alike.

There are new theories, concepts, causes or conditions released with each monthly periodical or professional magazine; many with valid answers to long asked questions and many just asking the same questions differently.



A few examples include: ADD/ADHD is often associated with problem pregnancies and with difficult deliveries. Maternal smoking, alcohol and drug abuse during pregnancy (Barkley, 1990) is also associated with a higher risk for ADD/ADHD. Some studies indicate that an increased risk also exists in children of women who were exposed during pregnancy to environmental toxins, including dioxins and polychlorinated biphenyls (PCB's).

There is ever increasing evidence that genetic factors increase susceptibility. Certain twin studies indicate 90% of children with a full diagnosis of ADD/ADHD shared it with their twin. It's likely more than one gene is responsible for inherited cases, which is not surprising since there is no consensus that ADD/ADHD is even a single disorder.

Studies on food and diets are controversial at best. Children suffering from malnutrition as infants, even if they receive enough food later on, may develop behavior problems which result in being diagnosed with attention deficit disorder. While one study suggests children diagnosed with ADD/ADHD had symptoms provoked by various food and additives (Finegold, 1973, 1975), another will indicated that less than 5% of children with ADD/ADHD are affected by food additives.

Allergies themselves have recently been associated with a higher risk for behavioral problems (Marshall, 1989).

As you can see, these examples show the diversity of research and provide only a hint of the type of research being performed today. Filtering through this maze of information (and sometimes misinformation) is difficult, specifically for the purpose of studying neurological advancements in Attention Deficit Disorders. As it is, a few of the aforementioned subject areas will be chronicled sporadically throughout this document providing important background information. Additionally, the subject matter of neurological diagnostics in Attention Deficit Disorders is new, thus self limiting due to the lack of available documented research advancements within recent years. As research and empirical studies continue using neurological diagnostic tools, many of these questions will have resolution.

### Purpose of this study

There has been much controversy over the frequent diagnosis of Attention Deficit Disorders in children and it has been described as a major public health problem (Greenhill, 1998). A nationwide estimate indicated the ADD/ADHD prevalence exists among 2% - 9% of the school age population (about two million children) and, a 30% - 50% of mental health referrals of children are for ADD/ADHD (Barkley, 1998; Gross, 1997).

Diagnosis of this disorder may be based on the characteristics as outlined in the Diagnostic Statistical Manual – Fourth Edition.

Currently, in order to insure the evaluation provides a reliable, accurate, and valid diagnosis, various behavioral assessment instruments are being utilized such as (but not limited to): the Connors Behavior rating Scale, the ADD-H Comprehensive Teacher Rating Scale (ACTeR's, the Attention Deficit Disorder Evaluation Scale, the School and Home Situations Questionnaire and the Achenback Child Behavior Checklist, and the latest, the Gordon Diagnostic System, an instrument reported to use tasks that are sensitive in the identification of impulsive, inattentive qualities of hyperactive children (Goldstein & Goldstein, 1992, Ingersoll & Goldstein, 1993). And yet, even with additional diagnostic implements such as developmental histories, medical histories, detailed observations and, familial histories, a diagnosis of ADD/ADHD may be made when there is just a mismatch between the environment or home expectations. This is a fragile process of diagnosis and one attained by subjective means.

Since the mid-1980's, there has been an explosion of activity within the neurosciences. Much of this activity has centered on the development of neuroimaging methods that have provided unprecedented views of the anatomical structures the human

brain and of how specific brain structures and neural networks function as behavior is produced.

Although many of the technical advances associated with neuroimaging have been addressed in the basic scientific literature, particularly from 1991 and on, little information about the clinical applications of different modalities has been published. This disparity is seen particularly within the area of children's developmental disorders. Much of the structural and functional neuroimaging in individuals with ADD/ADHD today is limited to research applications, and subsequently is not being utilized clinically as a diagnostic tool. Yet, the scientific value of brain imaging is bringing an exciting perspective to the possibility of diagnosis in attention deficit disorders.

Recent advances in computer technology and the applications in the medical community have enabled scientists to study neurological processes more effectively on living subjects without fearing damaging radiation or chemical exposure. Such advancements have enabled scientists to gather data that was once only available after the subject was deceased. Magnetic Resonance imaging (MRI and variations), positron emission topography (PET and variations), and electroencephalograph (EEG and variations) are a few of the methods of monitoring neurological activity which have created vast opportunities to learn how the human brain functions.

Two of the most controversial questions regarding attention deficit disorders are: What causes ADD/ADHD and, what is the best method to treat it? With these two questions in mind, current neurological research may lead researchers to definitive diagnostic methods for the identification and subsequent treatment of ADD/ADHD.

## Chapter 2

### An Overview Of attention deficit disorders

The first documented evidence of children exhibiting hyperactive symptoms was in 1848 in a children's book character called "Fidgety Phil":

*Fidgety Phil, He won't sit still,  
He wriggles, And Giggles,  
And then, I declare,  
Swings backwards and forwards,  
And tilts up his chair . . . .*

Through observing these symptoms of his young patients recovering from nervous system diseases or injuries, this German physician (Heinrich Hoffman) and author inadvertently labeled for the next fifty years children with this condition as "Fidgety Phils". In 1902, British pediatrician George Frederic Still documented specific symptoms similar to those describe in the "Fidgety Phil" character. In his lectures to the Royal College of Physicians and a subsequent publication in the British journal *Lancet*, Dr. Still described his observations of twenty children in his clinical practice as being aggressive, defiant and resistant to discipline and, who had difficulty paying attention and staying on task. He theorized that this behavior was not the result of poor

parenting or moral weakness, but was biological in nature and either inherited or caused by injury either in pre- or post birth.

It wasn't until after the 1917-1918 worldwide encephalitis outbreak when the first clinical term "Minimal Brain Dysfunction" appeared (after researchers determined children were not suffering from brain damage). Children, while recovering from this neurological disease, exhibited the same type of symptoms as documented by Dr. Still some years earlier. Finally, physicians were able to attach a name to the symptoms, thus allowing for some reasonable and measurable diagnosis. After a long history of name changes and diagnostic challenges, the American Physiological Association, in 1987, settled on the current diagnostic term for this condition currently known as "Attention Deficit/Hyperactivity Disorder."

Although the name is new, the behavioral symptoms of ADHD have been recognized since first documented by Dr. Still. The features of this syndrome gradually emerged from observations over many years from professionals working in pediatric medicine, neurology, education, and pharmacology. The core symptoms of hyperactivity, impulsivity, and inattention are a constant in the very earliest observations and throughout the numerous changes in terminology. Changes in diagnostic terminology, definitional boundaries, conceptions of etiology, and preferred modes of treatment reflect changing scientific

paradigms and professional allegiances, as well as empirical evidence derived from increasingly rigorous investigations (Conners, Erhardt, 1998).

Formal diagnostic criteria for the disorder underwent rapid changes as new synthesis and accumulation of data from field trials took place. The fact that ADHD has evolved with changing evidence should be taken as strength, not as a sign of unreliability or vague conceptualization. In other words, as certain facts were uncovered, more myths about Attention Deficit Disorders faded away. In the 1990's Attention Deficit Disorder research by the academic community, mental health care practitioners, pharmaceutical companies and others continued at an ever-increasing pace. However, the spotlight of this new research has been dimmed by newsworthy pharmacological interventions of choice prescribed by most physicians, resulting in Attention Deficit Disorders as one of the most controversial childhood conditions today; misunderstood, misdiagnosed, undiagnosed or inappropriately prescribed.

Comprehensive review of the evidence regarding diagnosis and treatment carried out by independent expert medical reviewers concludes that diagnostic criteria for ADHD are based on extensive empirical research and, if applied appropriately, lead to the diagnosis of a syndrome with higher reliability, good face validity, and high predictability of course and medication



responsiveness (Goldman, Genel, Bezman, et. al., 1998). However, the application of new technological breakthroughs in basic sciences on problems of children and adolescents presents great challenges to neuroscientists. Despite increasing concerns of using children in research, new advances in neurological, neurobiological, neuroimaging, neurochemistry and genetic diagnostic tools have been applied to children and adolescents diagnosed with attention deficit/hyperactivity disorder.

It is no secret that school is often the first place where characteristics of ADD/ADHD are noted or viewed as problematic. Often it is in that school setting that youngsters are first asked to stay seated for a long period of time, maintain extended attention to a live individual, perform a task either under verbal or written instructions or, have to wait one's turn. As a teacher, I have found each one of these applicable across the curriculum as well as the wood shop, art class and gym. Youngsters with ADD/ADHD historically experience difficulties in the areas necessary for academic and vocational success. Some examples include starting work assignments, completing tasks, interacting cooperatively with others, following directions, making smooth transitions, and managing multi-step tasks. The outward physiological apparitions may include; excessive activity levels, talkativeness, interrupting,