ADANA Presentation Abstracts

Morning Session: Advances in Diagnosis, Etiology, and Management of ADHD (TDAH)
Presenter: Russell A. Barkley, Ph.D.

This presentation will focus on recent research and clinical developments. Dr. Barkley will discuss the current DSM-IV diagnostic criteria for ADHD, the flaws that have been identified in its clinical use, and the ways in which these flaws need to be addressed to make clinical diagnosis more rigorous and sensitive to the disorder across the lifespan. Advances in the understanding of the etiologies of ADHD will then be discussed including developments in neurology and neuro-imaging, behavioral and molecular genetics, and pre- and post-natal brain injuries that may contribute to risk for disorder. The presentation will conclude with a discussion of advances in the management of the disorder, including limitations of psychosocial treatments, the invention of new medical delivery systems for existing medications, and the advent of new medications for management of the disorder.

Afternoon Session: ADHD, Executive Functioning, and Self-Control: Its About Time

This presentation will describe Dr. Barkley's theory of ADHD as a disorder of self-regulation. This theory emphasizes the critical role of behavioral inhibition in the development and performance of four executive brain functions. These brain functions permit humans to regulate their behavior across time and especially to direct such behavior toward future events. Dr. Barkley will show how each executive ability develops and what it likely contributes to important areas of human social functioning. He will explain how ADHD disrupts this developmental process giving rise to the symptoms and other impairments associated with the disorder. Chief among these impairments as the adverse affect of ADHD on the ability to sense and use time in the management of behavior toward long-term goals. Many implications for treatment of the disorder come out of this theory that will be reviewed by Dr. Barkley.

Advances in Diagnosis, Etiology, and Management of ADHD (TDAH)

Russell A. Barkley, Ph.D.

I would like to highlight several important developments in the understanding and management of attention deficit hyperactivity disorder (ADHD) in children and adults. Since 1902, and certainly since the 1980s, ADHD has been conceptualized as a disorder involving hyperactive behavior, inattention, and poor impulse control. The disorder has been known to affect 3-8% of school-age children. Once thought to be just a childhood disorder outgrown by adolescence, research in the past 20 years has documented persistence of the disorder into adulthood in at least 50-66% of cases or more, and studies of adult populations have found a prevalence of ADHD of at least 4-5%. Several thousand studies have been published on ADHD, indeed nearly 1,000 of them since I published the last edition of my clinical handbook on ADHD in 1978. I know because I had to read most of them in order to update this volume for its third edition to be published later this fall. Among the many developments that have occurred in the past decade in clinical and basic research on this disorder, I have selected three of these to highlight today. I do so only to highlight the extraordinary vibrancy of research on this disorder and not to elevate these developments over any I may have to ignore given my time constraint of only 10 minutes for this presentation.

The first development worth noting has been an evolution in the way we conceptualize the disorder itself. Whereas we once thought of the disorder as largely one of restless and hyperactive-impulsive behavior combined with inattention, we are broadening this view considerably. Indeed, this old view now seems to be a relatively shallow one capturing only its most obvious yet superficial elements. Our new view stems from numerous studies into the neuropsychology of the disorder along with efforts to develop theoretical models of ADHD. The latter is a sure sign that a field of science is maturing – when it moves into developing theories about an area of science. This view holds that ADHD is a disorder of behavioral inhibition and self-regulation that is associated with deficits in executive functioning that permits self-regulation. Executive functioning and self-regulation are social adaptations in humans that seem to exist to permit social cooperation and the organization of behavior toward social goals to as to achieve a net long term maximization of social consequences. If ADHD disrupts these functions, then it creates impairments in the ability to cooperate with others and to organize behavior across time toward the social future. The individual is left stuck in the social "now" and less able to direct behavior toward later consequences or deferred gratification. Seen another way, ADHD is the consummate disorder of time management as the individual with it can not organize their behavior relative to time and the social future that likely lies ahead of them. There seem to be at least four executive abilities besides behavioral inhibition, each of which is a form of self-control used to guide behavior toward a goal: (1) nonverbal working memory, or sensing-to-the-self, chiefly visual imagery and private audition [rehearing]; (2) verbal working memory, or private speech to the self; (3) emotional self-regulation, or emotion and motivation to the self that creates intrinsic motivation or willpower; and (4) planning and generativity, or private self-directed play, that permits problem-solving and innovation in goal directed behavior. If ADHD disrupts executive functioning than these are the mental actions with which it is likely interfering and these may account for many of the symptoms we see in those with the disorder. This broader conceptualization of ADHD has numerous testable predictions as well as implications for its management relative to the old attention deficit perspective of ADHD.

A second development worth highlighting is the advances in understanding of the etiology of ADHD coming out of neurology, specifically neuro-imaging, and genetics. These fields are often considered separate from each other but researchers in ADHD are beginning to combine them together to link specific candidate genes associated with ADHD with their neuro-imaging and neuropsychological "signatures" or distinct patterns of structure and function. We have had evidence for more than 15 years that ADHD is associated with reduced brain volume and especially reduced psychophysiological activity in the frontal lobes, basal ganglia, and cerebellum and that these structures involve a network responsible for behavioral inhibition. A fourth region, the anterior cingulated, may also be involved in ADHD and, along with the dorsolateral aspects of the frontal lobe, may assist with working memory, problem-solving and conflict resolution, and the executive aspects of attention. Research has also shown for more than 30 years that ADHD runs in families, suggesting a strong pattern of inheritance to the disorder. More recent studies involving large samples of twins of repeatedly documented the striking contribution of

genetics to this disorder and its associated traits, making it among the three most genetically influenced psychiatric disorders currently known (the others appear to be bipolar disorder and autistic spectrum disorders). On average, 80% or more of individual differences in the traits underlying ADHD are the result of genetic effects, with there being minimal or no evidence of any contribution from shared, within family influences, while there is a small degree of influence for unique, non-shared events. The latter could easily be the result of biological hazards the individual encounters during development that have deleterious effects on the brain, such as maternal smoking and alcohol use during pregnancy, premature delivery and associated bleeding into the brain, and numerous post-natal hazards such as traumatic brain injuries. Just recently, researchers have linked particular candidate gene polymorphisms to differences in patterns of EEG activity and even results of neuropsychological tests in samples of ADHD children. Others have begun to show that response to stimulant medications may be partially determined by which version of these gene variants the individual possesses. Currently, other investigators including myself are sorting there samples of ADHD children and adults into groups based on the version of the gene they possess so as to study the psychological phenotype or life course events that may be associated with that particular gene variant within those having the disorder. Such research will eventually permit the subtyping of ADHD, not based on crude behavioral indicators as we do not in the DSM-IV, but on specific genetic variants that will likely reveal differences that are clinically important among these genetic subtypes, possibly including predicting medication response. And it is my hope that before my career is over we may have genetic testing to supplement our diagnostic procedures to provide us with a more accurate means for identifying and subtyping those with ADHD.

Yet a third development in the field has been in the area of treatment. While we have seen no new psychological treatments for ADHD in the past 20 years, researchers have examined the combinations of those we have including combining them with medications, to evaluate and added benefits such combinations may provide. Such research suggests that while medications, particularly the stimulants, may be the most effective treatments that we have for the disorder, the combination of medications with behavioral and psychosocial treatments and accommodations are useful for some subsets of ADHD, depending on the comorbid disorders and demographic factors. One noteworthy development in the area of treatment has been the advent of once-daily delivery systems for the stimulant medications. No new stimulant medications have been identified or approved by the Food and Drug Administration. The original immediate release versions of the stimulants, such as methylphenidate and the amphetamines, were helpful be problematic because of their short time course, often providing therapeutic benefit fro just 3-5 hours. This resulted in the need for dosing of patients several times per day and especially at mid-day in school. That, of course, was associated with the potential for increased humiliation of stigma of child patients but also increased alarm over schools storing and dispensing Schedule II potentially addictive drugs. Two technologies were developed and eventually FDA approved that have permitted once-daily dosing such that the medication remains in the body for much longer periods than the original drugs. One invention, Concerta, was of a miniature osmotically driven pump that looks like a small capsule but in essence is a device that squeezes out a liquid methylphenidate sludge over a period of 8-12 hours providing greater management of ADHD symptoms across the day. Another invention, used in Medadate CD and Adderall XR, among others, was a pellet time release technology in which small pellets of the drug were coated with varying time-release coatings that dissolved at different times of the day with some dissolving immediately, others in an hour, still others in two hours, and so on. This technology can also provide symptomatic control for 8-12 hours thus eliminating mid-day dosing at school. Though not yet approved available, a skin patch for methylphenidate has also been invented that eliminates the need to swallow the medication. Undoubtedly, other ingenious technologies will follow to create a wider selection of medication and delivery system options that can tailor treatment better to the individual needs of patients.

In the area of treatment, we have also witnessed the development and FDA-approval of the first new medication for ADHD in 25 years. That medication is atomoxetine, or Strattera, invented by the Eli Lilly Co. Strattera was also the first drug FDA-approved for treatment of adult ADHD besides being used for child and adolescent ADHD. Atomoxetine is not a stimulant. It is a highly selective norepinephrine re-uptake inhibitor that increases the availability of norepinephrine outside the nerve cell. Interestingly, it does have a secondary result of increasing dopamine in the prefrontal cortex, but not in the striatum or nucleus accumbens that undoubtedly accounts for its lack of addiction potential. Research demonstrates

significant improvement in ADHD symptoms and related difficulties similar to though not always identical to the effects seen in the stimulant medications. In particular, the medication may be of use in cases of comorbid anxiety disorders and nervous tics given that the medication seems to actually treat anxiety and does not exacerbate tics as stimulants may do, though in a minority of cases.

These any many other developments in the field of ADHD demonstrate the exceptional vibrancy, creativity, and productivity in the science of ADHD and the broader domain of clinical psychology and serve to showcase the clinical value of a scientifically grounded approach to the understanding and management of disorders such as ADHD. Let me thank, once again, the members of the board of ABPP for having chosen me as a 2004 award recipient. I am truly honored and grateful for this distinguished award.

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Further Reading:

Barkley, R. A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford Publications (Guilford.com).

Barkley, R. A. & Murphy, K. R. (2006). *Attention deficit hyperactivity disorder: A clinical workbook (3rd ed.)*. New York: Guilford Publications.

The ADHD Report: A bimonthly clinical newsletter. Founding editor: Barkley, R. A. New York: Guilford Publications.

ADHD, Executive Functioning, and Self-Control: Its About Time

Russell A. Barkley, Ph.D.

Until recently, ADHD has lacked a reasonably credible scientific theory to explain its basic nature and associated symptoms and to link it with normal developmental processes. Consequently, the vast majority of research into the treatment of ADHD has remained exploratory or descriptive in nature rather than based upon any theory of the disorder. Treatments were tried principally because they had shown some efficacy for other disorders (i.e., behavior modification with the mentally retarded) or were discovered to have beneficial effects primarily by accident (i.e., stimulant medications). Thus, treatment decisions have not been guided so much by a scientific theory but by pragmatics; whatever seems to work is retained, whatever doesn't is discarded with little guidance from any sound theoretical rationale. The field of ADHD has reached a point, however, where the neuropsychological, neuro-imaging, and genetic studies cited above are coming to set clear limits on theorizing about not only the origins of ADHD but theories of its nature as well. Any credible theory on the nature of ADHD must now posit neuropsychological constructs that are related to the normal development of inhibition, self-regulation, and executive functioning and explain how they may go awry in ADHD. And such a theory will need to argue that these constructs arise from the functions of the prefrontal-striatal network and its interconnections with other brain regions that appear to subserve the executive functions and self-control, such as the cerebellum. Those cognitive functions will be shown to have a substantial hereditary contribution to individual differences in them given the results of twin studies on the genetic contribution to variation in ADHD symptoms.

The presenter has been working on just such a theoretical conceptualization of ADHD over the past 10 years (see Barkley, 1997d, 2005). The model is founded on the premise that ADHD consists mainly of a developmental delay in behavioral inhibition that disrupts self-regulation; an assertion for which there is substantial research support. This theory links behavioral inhibition to the executive functions and shows them to provide for self-regulation. Behavioral inhibition occupies a foundation in relationship to four other executive functions that are dependent upon it for their own effective execution. Self-regulation is defined as any self-directed action used to change one's own behavior so as to alter the probability of a delayed (future) consequence. The executive functions are seen as forms of behavior-to-the-self – the actions one uses to change themselves so as to change their future.

Four executive functions are theorized to exist and to permit self-regulation, bringing behavior (motor control) progressively more under the control of internally represented information (forms of self-directed action), time, and the probable future and wresting it from control by the immediate external context and temporal now. Such self-control functions to maximize future consequences for the individual over merely immediate ones. The model applies only to the Combined Type of ADHD to date. This presentation will review the nature of ADHD, inhibition, and self-regulation and describe a theory of executive functioning that applies to ADHD. These four functions are nonverbal working memory, verbal working memory, self-regulation of emotion, and reconstitution or planning. Barkley has hypothesized that all four are forms of self-directed behavior that, like the internalization of speech, becomes turned on the self during development and eventually is privatized.

Over development, as the executive functions develop, they permit the construction and execution of increasingly, lengthy, complex, hierarchically organized, and novel chains of goal-directed behavior, protecting them from disruption by interference until they have been completed. This is achieved by generating internally represented information that serves to take over the control of behavior from the moment and immediate setting and direct behavior toward time and the probable or anticipated future. Such internal control over behavior not only creates a greater purposefulness or intentionality to behavior, but also a greater flexibility. The executive functions grant behavior both a more determined, persistent, reasoned, intentional, and purposive quality while permitting greater shifting of behavior as needed to achieve one's goals -- an appearance of volition, choice, and will arising from internally guided behavior. The impairment in behavioral inhibition occurring in ADHD is hypothesized to disrupt the efficient execution of these executive functions thereby delimiting the capacity for self-regulation they provide. The result is impairment in the cross-temporal organization of behavior and in the guidance and control of behavior by internally represented information. This inevitably leads to a reduction in the maximization of long-term consequences for the individual. This theory, if correct, provides a much deeper insight into the nature of the disorder, and a much broader perspective on its likely impairments along with a litany of implications for its management. In essence, ADHD is not so much an attention

disorder from this perspective but a disorder of executive functioning – of internally guided and regulated behavior across time and toward future events – leaving the individual to be more affected by external events of the moment and more governed by concerns for immediate than delayed gratification.

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Further Reading:

Barkley, R. A. (1997/2005). *ADHD and the Nature of Self-Control*. New York: Guilford Publications.

Barkley, R. A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford Publications (Guilford.com).