GETTING BACK ON TRACK
UNDERSTANDING AND TREATING EXECUTIVE DYSFUNCTION & Specific Learning Disorder with Impairment in Reading

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Amgen, Inc.

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Executive Functions

"The basis for the concept of executive functioning (EF) arose in the 1840s in the initial efforts by scientists to understand the functions of the frontal lobes generally and the prefrontal cortex (PFC) specifically…The concept of EF was first defined by default as what the prefrontal lobes do…The term EF came out of these earlier efforts to understand the neurolopsychological functions mediated by the prefrontal or premotor regions of the brain"(p. 1).

--Barkley, R.A. (2012).

Phineas Gage

“In September 1848, in Cavendish, Vermont, an incident occurred which was to change our understanding of the relation between mind and brain. Phineas P Gage, a 25 year old railroad foreman, was excavating rock. In preparation for blasting he was tamping powder into a drill hole when a premature explosion drove the tamping iron—1.1m long, 6 mm in diameter, and weighing 6 kg—through his left cheek and out of the vault of his skull with such force that it threw him on his back and fell several rods behind, “smeared with brain.” Despite his injuries he remained conscious and only a few minutes later was sitting in an ox cart writing in his work book. He recognized and reassured Dr Harlow, who had been summoned to the scene…”

Phineas Gage

"… He was blind in the left eye and had left facial weakness but no focal neurological deficits…. What made the event historic, however, was Dr Harlow's subsequent observations of the change in Gage's personality. Immediately after physical recovery he described Gage as follows: "Remembers passing and past events correctly, as well before as since the injury. Intellectual manifestations feeble, being exceedingly capricious and childish, but with a will as indomitable as ever; is particularly obstinate; will not yield to restraint when it conflicts with his desires." Dr Harlow reports that Gage's employers, "who regarded him as the most efficient and capable foreman ... considered the change in his mind so marked that they could not give him his place again..."

Phineas Gage

“He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint or advice when it conflicts with his desires.... A child in his intellectual capacity and manifestations, he has the animal passions of a strong man.... His mind was radically changed, so decidedly that his friends and acquaintances said he was ‘no longer Gage’…” (P. 1673-1674).

O’Driscoll, K., and Leach, J.P. (December 19, 1998)--

Executive Function Defined

Denckla defined executive functions as, "…the proactive elements of interference control, effortful and flexible organization, and strategic planning—that is, anticipatory, goal-oriented 'preparedness to act.' Executive function also may be construed to include working memory…, highlighting as it does the elements of delay between stimulus and response or maintenance of internal representations to guide actions" (p. 117-118).

Denckla, M.B. (1994)--

Where is Executive Function?

“Prefrontal regions have been most widely emphasized as a related to executive function…, and striatal regions are up-and-coming candidates” (p. 118).

Denckla, M.B. (1994)--

Frontal Lobes

"When one compares the brain anatomy of today's humans to that of other primates, early hominids, or even Neanderthal man, a salient feature in our species is the disproportionate expansion of our frontal lobe. The prefrontal cortex, which lies in the frontmost part of the cerebral hemispheres, is a key player in the vast networks of associative areas that also include the inferior parietal and anterior temporal regions. These regions are up to forty times larger in humans than in macaques" (p. 318).

Dehaene, S. (2009)--

Frontal Lobes

"Some long-distance connections, such as those that link the inferior prefrontal cortex to the occipital pole, may exist only in humans. Human prefrontal neurons show a clear adaptation to this massive increase in connectivity: their dendritic trees, which receive incoming inputs, are brushier, and synaptic contacts are massively more numerous than those of other primates. One category of neuron, the giant fusiform cell, seems only to exist in *Homo sapiens and* other great apes. These neurons are located in a part of the frontal lobe, the anterior cingulate cortex, and send extremely long axons to other distant regions of the cortex" (p. 318).

Dehaene, S. (2009)--

Frontal Lobes

“Our prefrontal cortex functions like a primative ‘Tuning machine.’ It operates slowly and make frequent mistakes, but the novel synthesis it generates can be genuinely creative. Its inventions, accumulated through cultural transmission over many thousands of years, go far beyond the competence that our species inherited through biological evolution. In the midst of many cultural treasures, reading is by far the finest gem – it embodies a second inheritance system that we are duty-bound to transmit to coming generations” (p. 324).

Dehaene, S. (2009)--

Baddeley's Executive Function Theory

"The term working memory refers to a brain system that provides temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning, and reasoning. This definition has evolved from the concept of a unitary short-term memory system. Working memory has been found to require the simultaneous storage and processing of information. It can be divided into the following three subcomponents…" (p. 556).

Baddeley's Executive Function Theory

- **Central Executive**: **"The central executive, which is assumed to be an attentional-controlling system, is important in skills such as chess playing and is particularly susceptible to the effects of Alzheimer's disease; and two slave systems, namely…" (p. 556).**

The Central Executive

"The current theory, however is that the brain dedicates specific circuits to the coordination of its own networks. These curcuits largely rely on areas located in the front of the brain, notably the prefrontal cortex. They contribute to the supervision of novel, nonautomated behaviors—planning sequential ordering, decision making, and error correction. It has been said that they constitute a kind of "brain within a brain, "a" central executive who autonomously regulates and manages behavior" (p. 185).

Dehaene, S. (2011)--

Baddeley's Executive Function Theory

- **Phonological Loop: "The phonological loop, which stores and rehearses speech-based information and is necessary for the acquisition of both native and second-language vocabulary" (p. 556).**

Baddeley, A. (January, 1992)--

Baddeley's Executive Function Theory

- **Visual-Spatial Schetchpad: "…which manipulates visual images" (p. 556).**

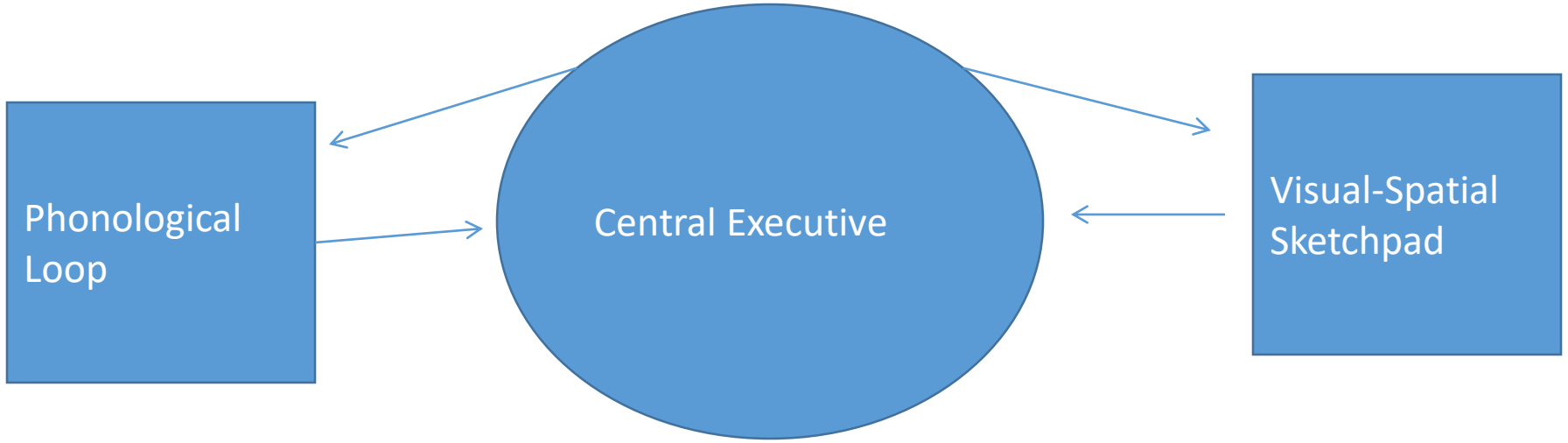
Baddeley, A. (January, 1992)--

Baddeley's Executive Function Theory

These systems, "…allow humans to comprehend and mentally represent their immediate environment, to retain information about their immediate past, to support he acquisition of new knowledge, to solve problems, and to formulate, relate, and act on current goals"(p. 28).

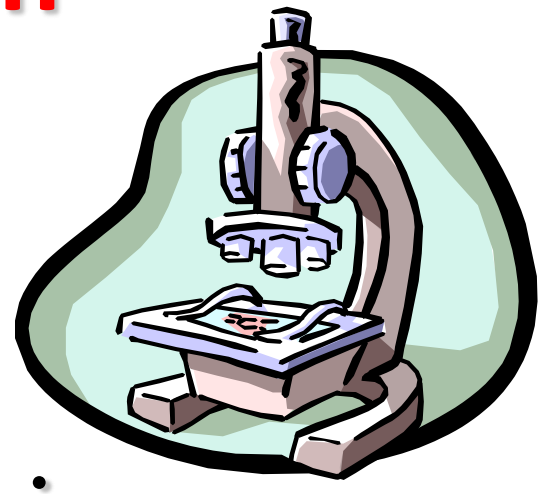
Baddeley, A. (January, 1992)--

Baddeley's Executive Function Theory



Baddeley, A. (January, 1992)--

Summary of Barkley's Theory Of Executive Function



Step 1: ***Response Delay***

Step 2: ***Prolongation***

Step 3: ***Rule Governed Behavior***

Step 4: ***Dismemberment of the Environment***

Barkley, R.A. (1997), (2006)

Barkley's Hierarchy of Executive Capacities

- **Spatial: Spatial distance to achieve goal & means to attain it**
- **Temporal: Time event horizon**
- **Motivational**
  - **Hot: Emotional**
  - **Cold: Informational**
- **Inhibatory: Capacity to restrain action**
- **Conceptual/Abstract: Abstractness of rules being considered**

Barkley's Hierarchy of Executive Capacities

- **Behavioral-Structural: Motor consequences and behavioral complexity to achieve a goal over time**
- **Social: Cooperating with others to achieve goal**
- **Cultural: The degree that one's culture plays a part in attaining a goal (p. 68-70)**

Barkley, R.A. (2012)--

Summary of Tom Brown's Theory Of Executive Function

1. Organizing and activating for work
2. Sustaining attention and concentration
3. Sustaining energy and effort
4. Managing affective interference
5. Utilizing working memory and accessing recall
6. Being able to predict the reaction of others due to their behavior (Forethought)

Brown, T.E. (1995), (2013)--

Executive Function Defined

“The use of self-directed actions so as to choose goals and to select, enact and sustain actions across time toward those goals usually in the context of others often relying on social and cultural means for the maximization of one’s long-term welfare as a person defines that to be.” (p. 171)

Barkley, R.A. (2012)--

Brain Areas Involved in EF

"But EF (executive function, sic.) is not exclusively a function of the PFC (prefrontal cortex, sic.) given that the PFC has various networks of connections to other cortical and subcortical regions as well as to the basal ganglia, amygdala and limbic system, and cerebellum" (p. 1).

Barkley, R.A. (2012)--

The Cerebellum, Executive Function & AD/HD

“One such area is the cerebellum which contributes not only to motor coordination, but also to language, verbal working memory, Processing of emotions, and other executive functions. Structural abnormalities have been found in the cerebella of persons with ADHD” (p. 28).

Brown, T.E. (2013)--

What The Cerebellum Does

Allen indicated neuroimaging studies show the Cerebellum is involved in the following functions:

- **Attention**
- **Forms of Learning**
- **Memory tasks**
- **Conditional anxiety**
- **Complex reasoning and problem solving**
- **Sensory and Motor Tasks**

Allen, G. (March 11, 1998)--

The Cerebellum & Social Interaction

"The Cerebellum has only recently been implicated in the normal functioning of social behavior…new research has shown that the cerebellum is important as a mediator in cognition. To perceive an object or event, we must pull together the various sensory qualities and any relevant memories or thoughts in a carefully timed way…the cerebellum assists in delaying or accelerating these associations, and regulates attentional states. Coordinating associations and attention is essential to entering into a relationship with another human being. Communication, conversation and graceful social interaction all depend on being able to pay attention to another person and to one's own internal states and to alternate easily back and forth between them." (p. 305)

Ratey, J.J. (2001)--

Working Memory & Anxiety

There are experienced skydivers with many jumps who died because they are so stressed just prior to their jumps they fail to pull their cords. This is due to their working memories being so overcome with fear. "Acute stress can almost halve a person's mental capacity."

Klingberg, T. (2013)--

Memory Problems Everyone Has

- **Transience: problems accessing memory over time**
- **Absent-mindedness: lapses in attention**
- **Blocking: tip of the tongue experience**
- **Suggestibility: the incorporation of misinformation into memory**
- **Bias: altering memory to fit beliefs**
- **Misattribution: believing you heard something you didn't.**

Murray, B. (October, 2003); Schacter, D. (2001)--

Two General Memory Systems

- ***Declarative Memory***: **Remembering the what, i.e. Facts and Events**
- ***Procedural Memory:*** **Knowing how to do something**
- **Proficient Reading is a skill and is a product of procedural memory.**
- **With procedural memory robust gains in knowledge are made after training is terminated.**
- **Train until the person's new behavior plateaus, stop training then allow to sleep. The next day they will have improved behavior and less errors.**

Two Memory Systems (Continued)

- **This will not happen if the person is not allowed to sleep and/or if they are then taught a competing task.**
- **If the training situation is considered novel, learning will continue to increase.**

Karni, A. (1994), (November 3, 2004)--

Sleep and Memory

- **"…sleep allows us to process and retain new memories and skills." (p. 58)**
- **Deprive sleep/block training improvement in skill**
- **"Evidence for sleep's effect on declarative memory is much weaker than its effect on procedural memory." (p. 59)**

Winerman, L. (January, 2006); Stickgold, R. (2005)--

Sleep & Memory

“The brain does not retain all the information it encodes in a day. Much is forgotten, and of those memories retained, their subsequent evolution can follow any of a number of pathways. Emerging data makes clear that sleep is a compelling candidate for performing many of these operations. But how does the sleeping brain know which information to preserve and which to forget? What should sleep do with that information it chooses to keep?”

Sleep & Memory

"… For information that is retained, sleep can integrate it into existing memory networks, look for common patterns and distill overarching rules, or simply stabilize and strengthen the memory exactly as it was learned. We suggest such 'memory triage' lies at the heart of a sleep-dependent memory processing system that selects new information, in a discriminatory manner, and assimilates it into the brain's vast armamentarium of evolving knowledge, helping guide each organism through its own, unique life" (p. 139).

Strickgold, R., et al. (January 28, 2013)--

Sleep & Memory

“Our results provide evidence for a prominent role of hippocampal SPW-Rs (sharp-wave ripple, sic.) in memory consolidation” (p. 1222).

Grardeau, G. et al. (September 20, 2009)--

Sleep & Memory

“During SWS (slow wave sleep, sic.), slow oscillations, spindles and ripples — at minimum cholinergic activity — coordinate the re-activation and redistribution of hippocampus-dependent memories to neocortical sites, whereas during REM sleep, local increases in plasticity-related immediate-early gene activity — at high cholinergic and theta activity — might favour the subsequent synaptic consolidation of memories in the cortex” (p. 114).

Diekelmann, S., et al. (February, 2010)--

SLD-Dyslexia May Be Partially a Disorder of Procedural Memory

"Deficits in dyslexia are attributed to an intact declarative learning system combined with an impaired procedural learning system –a network that includes prefrontal language systems, basal ganglia, parietal and cerebellar structures." (p. 135)

Nicolson, R., and Fawcett, A. (2007), (2008)--

SLD-Dyslexia May Be Related In Part To A Sleep Disorder

"To our knowledge, this is the first study designed to analyze sleep architecture and EEG power spectra of the entire sleep in children with dyslexia. The main result of this study is the clear increase of spindle activity and sigma power in dyslexic subjects which seems to be correlated with their degree of dyslexic impairment. These findings, never reported before in the literature, seem to be consistent with the most recent reports on the role of sleep and of specific phasic events during non-rapid eye movement (NREM) sleep on learning and memory."

Bruin, O. et al. (October 1, 2009)--

Executive Function Memory Problems

- **Working Memory:**
  - **"…denotes a person's information-processing capacity" (p. 4-5)**
  - **Is the "memory buffer in the brain."**
  - **It allows for "theory of mind."**
  - **"Remembering so as to do."(non-informational)**

Wechsler Adult Intelligence Scale- Third Edition, Wechsler Memory Scale-Third Edition (1997); Brown, T. E. (October 11, 2001).;Frith, C. D. and Frith, U. (1999); Barkley, R.A. (2008)--

Possible Alternative Medicine Treatment for Working Memory Problems

- **Working Memory Training:**
  - **Torkel Klingberg, M.D., Ph.D.**
  - **Karolinska Institute- Stockholm, Sweden**
  - **CogMed software company (RM Program)**
  - **AD/HD deficient in visual spatial working memory (WM) that becomes worse with age.**
  - ***MAY* help relieve visual spatial WM difficulties and reading comprehension in Combined Type AD/HD.**
  - ***More Research is needed!*** **www.cogmed.com**

Klingberg, T. (February, 2006); Barkley, R. (February, 2006); Ingersoll, B. (October 26, 2006); Klingberg, T. and Anderson, M. (October28, 2006)--

Posit Science
http://www.positscience.com/

"OBJECTIVES: To investigate the efficacy of a novel brain plasticity–based computerized cognitive training program in older adults and to evaluate the effect on untrained measures of memory and attention and participant-reported outcomes… The experimental program improved generalized measures of memory and attention more than an active control program" (p. 594).

Smith, G.E., et al. (2009)--

Literature Review of Working Memory Training

"The literature review highlights several findings that warrant further research but ultimately concludes that there is a need to directly demonstrate that WM capacity increases in response to training. Specifically, we argue that transfer of training to WM must be demonstrated using a wider variety of tasks, thus eliminating the possibility that results can be explained by task specific learning. Additionally, we express concern that many of the most promising results (e.g., increased intelligence) cannot be readily attributed to changes in WM capacity. Thus, a critical goal for future research is to uncover the mechanisms that lead to transfer of training."

Shipstead, Z., Redick, T.S. and Randall, W.E. (2012)--

Richard Abby on Working Memory

- **Things that disrupt Working Memory:**
  - **Background noise**
  - **Distraction**
  - **Switching Attention**
  - **Too much information to encode by rote**
  - **Too much mental manipulation required to retain information**
  - **Never encoding it into Long-Term Memory**

- **What helps Working Memory:**
  - **Silent environment**
  - **White noise**
  - **Repeat over and over by rote**
  - **Associating it with something in Long-term memory**
  - **Rhyming, Mnemonics, chunking.**

Abby, R., et al (October 27, 2010)--

Memory and Testing

"…testing improves memory by strengthening keyword associations and weeding out clues that do not work." (p. 13)

Anderson, A. (January/February, 2011)--

Self-Imagining for Better Memory

"Recent research has demonstrated that self-referential strategies can be applied to improve memory in memory-impaired populations. However, little is known regarding the mnemonic mechanisms and relative effectiveness of self-referential strategies in memory-impaired individuals. This study investigated the benefit of a new self-referential strategy known as *self-imagination,* traditional self-referential strategies, and non-self-referential strategies on free recall in memory-impaired patients with acquired brain injury and in healthy control respondents. The data revealed an advantage of self-imagining in free recall…"

Self-Imagining for Better Memory

"…relative to all other strategies in patients and control respondents. Findings also demonstrated that, in the patients only, a self-referential strategy that relied on semantic information in self-knowledge was more effective than a self-referential strategy that relied on autobiographical episodic information. This study provides new evidence to support the clinical utility of self-imagining as a memory strategy and has implications for the future development and implementation of self-referential strategies in memory rehabilitation". (p. 1)

- **"Try to imagine you are acting out this personality trait." (p. 3)**

Grilli, M.D., and Glisk, E.L. (August 5, 2012)--

Treatments For Memory Disorders

- Mnemonics-memory tricks
- Diaries and Social Statements
- Technology-Watchminder Watch II, etc.- www.addwarehouse.com, etc.
- Check for sleep disorders.*
- Nootropic Medications

Nosek, K. (1997); Smith, L. and Godfrey, H.D.P. (1995). Barkley, R.A. (1998); Fawcett, A.J. (October 29, 2010); Goldstein, S. and Goldstein, M. (1997)--

Good Resources for Mnemonic Techniques

- www.doctormemory.com
- **Doctor memory**
- **Lucas, J. and Lorayne, H. (1974). The Memory Book. New York, NY: Ballantine.**

Technology for Memory Difficulties

- Watchminder 2
  - Vibrates to remind student of deadlines
  - It can remind them to check to see if they are “on task.”

Available from:
www.watchminder.com/

Technology for Memory Difficulties

- Record lectures with a digital recorder
- Available from:
  - Walmart
  - Best Buy
  - Staples, etc.

Technology for Memory Difficulties

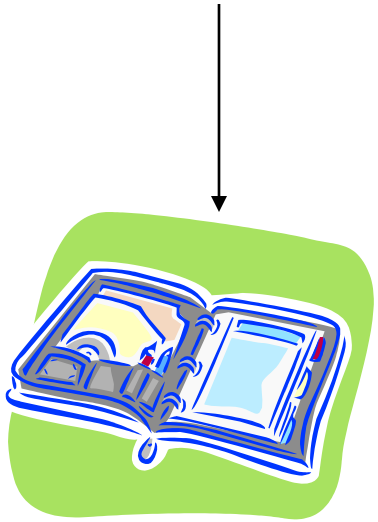
- **Digital Video Camera**
- **Smart Phone Camera/Audio Recorder**

Technology for Memory Difficulties

- Personal Digital Assistant (PDA)
- Smartphone

- Time Management Organizer

  www.**FranklinCovey**.com



Technology for Memory Difficulties

- **Rolodex Organizer:**
  www.franklin.com

- **Livescribe Smartpen:**
  www.livescribe.com

Technology for Memory Difficulties

- **Brookstone Wireless Keyfinder:**

  www.brookstone.com/Wireless-Key-Finder.html

Time Management Program

- FranklinCovey:

  www.franklincovey.com
- Professional Organizer:

  www.napo.org
- California Closets:

  www.californiaclosets.com
- Get 168 hour desk blotter

Professionals Who Can Help with Memory

- AD/HD Coaches: www.addbrain.com
- Professional Organizers: www.napo.net
- Psychiatrists: www.apa@psych.org
- Psychologists: www.apa.org
- Masters Level Counselors: www.nbcc.org
- Social Workers: www.naswdc.org
- Behavioral Neurologists: www.anpaonline.org
- Speech-Language Pathologists: www.professional.asha.org
- Association for Persons in Supported Employment (APSE): www.apse.org

Good Book on Treating Memory Problems

Dornbush, M.P. and Pruitt, S.K. (2009). Tigers, Too: Executive Functions/Speed of Processing/Memory-Impact on Academic, Behavioral and Social Functioning of Students with ADHD, Tourette Syndrome and OCD: Modifications and Interventions. Atlanta, GA: Parkaire.

What Does "Neurobiological" Mean?

- **Stephen Pinker – "The Blank Slate: The Modern Denial of Human Nature" or better stated, "The Lie of the Blank Slate."**

Pinker, S. (2002)—

"Although learning disabilities (specific learning disorder, sic.) may be exacerbated by other variables, such as ineffective teaching strategies or socioeconomic barriers, this paper supports the position that the essence of learning disabilities is neurobiological in nature." (p. 61)

Fiedorowicz, C., et.al. (2001)--

What Does "Neurobiological" Mean?

"Of particular relevance to this review is the compelling evidence in support of the neurobiological basis of learning disabilities. Studies employing widely divergent methodologies, e.g. research using genetic analysis, neuroanatomical neuroimaging, electrophysiological recording, pathological analysis of brain tissue at autopsy, and neuropsychological evaluation have yielded highly convergent conclusions in support of a neurobiological etiology." (p. 70)

Fiedorowicz, C., et.al. (2001)--

Specific Learning Disorder with Impairment in Reading/"Dyslexia" is *NOT* new!

Sally Shaywitz (2003) Reported that Rudolf Berlin a physician from Stuttgart, Germany wrote of "dyslexia" in 1887.

Shaywitz, S. (2003)--

What does "Neurobiological" mean?

- **60% of Specific Learning Disorder with Impairment in Reading/Dyslexia is genetic.**
- **Specific Learning Disorder with Impairment in Math/ Dyscalculia is highly genetic (60 to 70%) in twin studies.**
- **SLD 5% to 15% Children; 4% Adults**

Willcutt, E.G. and Gaffney-Brown, R. (Summer, 2004); Klingberg, T. (2013); Author (May 18, 2013)--

Differences in the Dyslexic Brain

- **An irregularity in the cellular architecture of the posterior planum temporale region of Wernike's area in the left temporal lobe[1]**
- **They have ectopias and dysplasias in far greater numbers[2]**
- **2/3rds of normals have asymmetry of planum temporale (Lt> Rt)[3]**
- **Dyslexics' planum temporale are symmetrical[3]**
- **Increased posterior symmetry[4]**
- **Dyslexics with severe language delay have reversed parietal-occipital asymmetry – RT planum > LT[4]**

Differences in the Dyslexic Brain

- **Dyslexics tend to have a larger right hemisphere than left in adulthood[5]**
- **"…several studies on low-level visual processing have found that people with dyslexia show visual abnormalities that implicate a deficit in the transient (magnocellular) subdivision of the visual pathway" (p. 81)[6]**
- **…differences in cell size and cell-size distribution in posterior and anterior cerebellar cortex, and inferior olive with no differences in the output areas (the dentate nucleus)"(p. 98-99)[7]**

References

Duane, D.D. (1993); Riccio, C.A., and Hynd, G.W. (1996); Fiedorowicz, C., et. al. (2001); Richardson, S.O. (1994); Filipek, P.A., et.al. (1999); Livingstone, M.S. (1999). Fawcett, A.J., Nicolson, R.I. (2001)--

Genetics and Dyslexia

- **Colorado Learning Disabilities Research Center:**
  - **Heritability linkage for dyslexia- Chromosomes 2, 3, 6, 15, 18**

Olsen, R.K. (November 11, 2005)--

Reading Centers in the Brain

"…Our results revealed distinct neural regions that supported different aspects of reading ability: whereas phonological decoding was associated with the GMV (grey matter volume, sic.) in the left superior parietal lobe extending to the supramarginal gyrus, form-sound association was predicted by the GMV in the hippocampus and cerebellum. Naming speed was associated with GMV in distributed brain regions in the occipital, temporal, parietal, and frontal cortices…"

Reading Centers in the Brain

"…Phonological decoding and form-sound association were uncorrelated with general cognitive abilities. However, naming speed was correlated with intelligence and processing speed, and some of the regions that were predictive of naming speed also predicted these general cognitive abilities. These results provide further insights on the cognitive and neural architecture of reading and the structural basis of individual differences in reading abilities" (p. 12,835).

Quinghua, H.e. et al. (July 31, 2013)--

Neurology of Dyslexia Differs in Males & Females

"…In a replication study of men, we obtained the same findings of less GMV in dyslexics in left middle/inferior temporal gyri and right postcentral/supramarginal gyri as reported in the literature. However, comparisons in women with and without dyslexia did not yield left hemisphere differences, and instead, we found less GMV in right precuneus and paracentral lobule/medial frontal gyrus. In boys, we found less GMV in left inferior parietal cortex (supramarginal/angular gyri), again consistent with previous work, while in girls differences were within right central sulcus, spanning adjacent gyri, and left primary visual cortex…"

Neurology of Dyslexia Differs in Males & Females

"… Our investigation into anatomical variants in dyslexia replicates existing studies in males, but at the same time shows that dyslexia in females is not characterized by involvement of left hemisphere language regions but rather early sensory and motor cortices (i.e., motor and premotor cortex, primary visual cortex). Our findings suggest that models on the brain basis of dyslexia, primarily developed through the study of males, may not be appropriate for females and suggest a need for more sex-specific investigations into dyslexia."

Reference

Evans, T.M., Flowers, D.L., Napoliello, E.M. and Eden, G.F. (April, 2013)--

Dyslexia and The Frontal Gyrus

"…adults who read well showed increased activation in temporoparietal areas (angular gyrus, Wernike's area) and occipito-temporal areas as demands for phonological analysis increased. Adults with dyslexia did not demonstrate this pattern, but showed more activation of anterior portions of the brain (inferior frontal gyrus—areas 44, 45). In addition, the readers with dyslexia showed reversed (right greater than left) hemispheric…"

Dyslexia and The Frontal Gyrus

"…asymmetries in activation in posterior temporal regions as compared with the group of non-impaired readers—a finding that corresponds with previous reports of atypical patterns of hemispheric asymmetry in regional metabolism in persons with dyslexia" (p. 116-117).

Fletcher, J.M., et al. (2007)--

Dyslexia and Phonological Working Memory

“The other cognitive process that is significantly related to word recognition skill and to dyslexia involves working memory for and/or acoustic (sound-based) information” (p. 91).

Fletcher, J.M., et al. (2007)--

SLD with Impairment in Reading: Dyslexia and The Cerebellum

80% of dyslexics show signs of cerebellar problems!

Fawcett, A. J. and Nicolson, R. I. (2001); Fawcett, A. J. (August 11, 2010)--

SLD: Dyslexia and The Cerebellum

- **Automaticity is the problem!**
- **When multitasking and rapid processing are needed**
- **Thinking is a frontal lobe function**
- **It is a problem of fluency**
- **"…fluency is in essence the ability to repeat previous actions or thoughts more and more quickly without conscious thought." (p. 101)**

Fawcett, A.J. and Nicolson, R.I. (2001)--

SLD: Dyslexia and The Cerebellum

Nicolson Said Bottom Line:

"…That means if you have a task that takes 4 hours for the non-dyslexic kid to learn, it will take twice as long for the dyslexic kid; 8 hours. But, its not linear. You have a task which takes 100 hours it will take 10 times as long. If you have a task that takes 10,000 hours it will take 100 times as long, and so on…Therefore if you have something like reading, writing and spelling which takes 100s…"

SLD: Dyslexia and The Cerebellum

"…of hours that's the sort of thing in which dyslexic children are particularly adversely affected."

Nicolson, R., and Fawcett, A. (November, 2000)--

SLD: Dyslexia and Procedural Training

- The ***Square Root Rule:***

  "The extra time needed for a dyslexic child to master a task is proportional to the square root of the time a non-dyslexic child takes." (Slide 45)

Fawcett, A. (November 5, 2004)--

SLD: Dyslexia and Automaticity

- **DAD: Dyslexia Automaticity Deficit**
- **Dyslexics get tired more quickly when learning and/or performing a new skill than the norm.**
- **CC: "This states that, despite their more limited automaticity of skill, dyslexic children are able to perform at apparently normal levels most of the time by 'consciously compensating,' that is consciously concentrating (controlled processing) on performance that would normally be automatic." (pp. 68-69)**

Nicolson, R.I., and Fawcett, A.J. (2008)--

Your Tax Dollars at Work

RESEARCH PROGRAM IN READING DEVELOPMENT, READING DISORDERS, AND READING INSTRUCTION

Initiated 1965

A Good Book That Summarizes This

- **Fletcher, J.M., Lyon, G.R., Fuchs, L.S. and Barnes, M.A. (2007). Learning Disabilities: From Identification to Intervention. New York, NY: Guilford.**

Your Tax Dollars At Work

- **Run by the National Institute of Child Health and Development (NICHD)**
- **Which is part of the National Institute of Health (NIH)**
- **Study began in 1965 and continues today!**
- **As of 1999 over *$150,000,000.00* has been spent!**
- **Study now budgeted for *$15,000,00.00* per year!**

Your Tax Dollars At Work

- **Conducted at 42 sites in the U.S. and Europe**
- **Follow-up studies for over 14 years**
- **Much of the neurological research in this presentation comes from this study.**
- **China, England, Israel, Russia, Sweden and Turkey have conducted similar studies…**

Lyon, G.R. (1999)--

Your Tax Dollars At Work

- **30,000 scientific works from NICHD research**
- **44,000 studied, 5 years old and up; with 5 year follow-ups**

Lyon, G.R. (Thursday, February 27, 2003)--

Your Tax Dollars At Work

- **48,000 children have been in the study as of 2004. The follow-up study is now 21 years.**
- **3,800 in new adult study**
- **"2 to 6% of the population are the 'Hard Core' Dyslexics that will not improve with 'Good Instruction'. They have the full dyslexic neurology and need multi-sensory approaches."**

Lyon, G.R. (March 19, 2004)--

Your Tax Dollars At Work

- **7% of the population will meet criteria for Major Depressive Disorder in any year**
- **Persistent Depressive Disorder (Dysthymia) is 0.05.**
- **3 to 13% Social Anxiety Disorder (Social Phobia) is 7%**
- **0.9% in teens & 2.9% in adults Generalized Anxiety Disorder**
- **Bipolar Disorder 0.6%**

Author (2013)--

Specific Learning Disorder with Impairment in Reading/Dyslexia

"The idea that learning to read is just like learning to speak is accepted by no responsible linguist, psychologist, or cognitive scientist in the research community." (pp. 285-286)

Stanovich, K.E. (1994)--

Reading a Recent Cultural Invention

"As a relatively recent cultural invention in human evolution, reading is an important gateway to personal development and socioeconomic success" (p. 12,835).

Quinghua, H.e. et al. (July 31, 2013)--

Specific Learning Disorder-Dyslexia

The Symptoms of Dyslexia are:

1. Weak Phonemic Awareness

2. Slow, Rapid Automatized Naming

3. Poor Orthographic Processing

4. Exceptionally Poor Automatization

5. Poor Coordination

Fawcett, A.J. (2001)--

SLD-Dyslexia

- **Some Dyslexics had all the symptoms.**
- **Some only had one.**
- **Four had none of the aforementioned deficits.**

Reid, A.A. (November 11, 2006)--

Definition Of Dyslexia

"Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition as well as by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the lack of provision of effective classroom instruction. Secondary consequences may include…

Definition Of Dyslexia

…problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."

Adopted by the National Institutes of Health (NIH) and the International Dyslexia Association (IDA) 2002

International Dyslexia Association (April 20, 2005)--

THE PAOMNNEHAL PWEOR OF THE HMUAN MNID

- **Aoccrdnig to rscheearch at Cmabrigde Uinervisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm.**

Davis, M. (2003); Rawlinson, G. (1999)--

"LEXDEXIA"

"reversals" (seeing "was" as "saw") and "rotations" ("b" as "p"; "p" as "d", etc.) occur in most children up through fourth grade. This is typical in the development of visual orthographic memory.

- The brain automatically learns what something looks like in mirror image (this is an instinct).
- Only about 7% of adult dyslexics have this concern.

❖ Dyslexia is <u>not</u> seeing the word "WAS" as "SAW".

Anderson, C.W., Jr. (January 23, 2006); Dehaene, S. (2009); Badian, N. A. (2005)--

National Dyslexia Research

The NICHD Research Program in Reading Development, Disorders and Instruction

Lyon, G.R. (March 5, 2009). The NICHD Research Program in Reading Development, Disorders and Instruction. National Center for learning Disabilities. From website: http://www.ncld.org/ld-basics/ld-aamp-language/reading/the-nichd-research-program-in-reading-development-reading-disorders-and-reading-instruction

How To Help Those With Dyslexia To Reading

National Reading Panel

Panel of government funded experts released a report to United States Congress (April 13, 2000)

- Reviewed over 100,000 reading research articles published since 1966
- 10 to 15 percent of dyslexics will drop out of high school.

How to Help Those With Dyslexia To Read

National Reading Panel

- First teach phonemic awareness (rhyming, clapping out word sounds, etc.)
- Second teach phonics (sound to symbol)
- Third teach Whole Language
- In this order with dyslexics

Na**tional Reading Panel (4/13/2000)--**

Multisensory Teaching Techniques

- Orton-Gillingham Approach
- Alphabetic Phonics
- Association Method
- Language!
- Lexia-Herman Method
- Lindamood-Bell

International Dyslexia Association (2005)--

Multisensory Teaching Techniques
(Continued)

- Project Read
- Slingerland
- Sonday System
- Sounds in Symbols
- Spalding Method
- Starting Over
- Wilson Foundations & Wilson Reading

International Dyslexia Association (2005)--

The “Dyslexia bd pq Phenomenon”

“When children learn to read they must “unlearn” mirror generalization in order to process ‘b’ and ‘d’ as distinct letters. In some children, this unlearning process, which goes against the spontaneous abilities inherited from evolution, seems to present a specific source of impairment.” (p. 253)

Dehaene, S. (2009)--

The “Dyslexia bd pq Phenomenon”

“Mirror writing occurs in all cultures, including China and Japan. It appears for a short period of time at the age when children first begin to write, and then it promptly vanishes. Unless this phenomenon extends beyond the ages of eight to ten, there is no cause for alarm. At this age, mirror errors are indeed more frequent in dyslexic children, though they can disappear later.” (p. 265)

Dehaene, S. (2009)--

Technology for Dyslexia

- Intel Reader: www.intel.com/pressroom/kits/healthcare/reader/
- Kreader Mobile: http://www.knfbreader.com/index.php
- Kurzwiel 1000: www.kurzweiledu.com/kurzweil-1000-v13-windows.html
- Dragon NaturallySpeaking: www.nuance.com/dragon/index.htm
- Ginger: www.gingersoftware.com
- WizcomTech Reading Pen 2TS: http://www.wizcomtech.com/eng/catalog/a/rp/
- Franklin Spelling Ace: www.franklin.com
- LearningAlly: www.learningally.org

The What Works Clearing House

- http://www.w-w-c.org
  - Established by the U.S. Department of Education to provide, "…a central, independent and trusted source of scientific evidence of what works in education."

From: Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide - Appendix A: Where to Find Evidence-Based Interventions. www.ed.gov/rchstat/research/pubs/rigorousevid/guide_pg9.html

The Promising Practices Network

- http://www.promisingpractices.net
  - Highlights programs and practices that scientific research indicates works with children, adolescents and families.

From: Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide - Appendix A: Where to Find Evidence-Based Interventions. www.ed.gov/rchstat/research/pubs/rigorousevid/guide_pg9.html

The International Campbell Collaboration

- http://www.campbellcollaboration.org/frallbrary.html
  - "…Registry of systematic reviews of evidence on the effects of interventions in the social, behavioral, and educational arenas."

From: Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide - Appendix A: Where to Find Evidence-Based Interventions. www.ed.gov/rchstat/research/pubs/rigorousevid/guide_pg9.html

Specific Reading Comprehension Disorder

“For S-RCD, the context-dependent functional interaction anomaly was most prominently seen in left IFG, which covaried to a greater extent with hippocampal, parahippocampal, and prefrontal areas than for TD for low- as compared to high-frequency words. Given the greater lexical access demands of low frequency as compared to high-frequency words, these results may suggest specific weaknesses in accessing lexical-semantic representations during word recognition. These novel findings provide foundational insights into the nature of S-RCD, and set the stage for future investigations of this common, but understudied, reading disorder” (p. 199).

Reference

Cutting, L.E. et al (2013)--

Functional Imaging of the Other Type of Specific Learning Disorder (Reading Comprehension)

"Specifically, TD (Typical Developing Readers, sic.) showed a higher-percent signal change within right IFG (inferior frontal gyrus, sic.) for low-versus-high frequency words as compared to both S-RCD (Specific Reading Comprehension Deficits, sic.) and DYS (dyslexia, sic.) . Using psychophysiological interaction analyses, a coupling-by-reading group interaction was found in right IFG for DYS, as indicated by a widespread greater covariance between right IFG and right occipitotemporal cortex/visual word-form areas, as well as bilateral medial frontal gyrus, as compared to TD…"

Functional Imaging of the Other Type of Specific Learning Disorder (Reading Comprehension)

"…For S-RCD, the context-dependent functional interaction anomaly was most prominently seen in left IFG, which covaried to a greater extent with hippocampal, parahippocampal, and prefrontal areas than for TD for low- as compared to high-frequency words. Given the greater lexical access demands of low frequency as compared to high-frequency words, these results may suggest specific weaknesses in accessing lexical-semantic representations during word recognition. These novel findings provide foundational insights into the nature of S-RCD, and set the stage for future investigations of this common, but understudied, reading disorder" (p. 199).

Reference

Cutting, L.E. et al (2013)--

Treatment of Specific learning Disorder with Impairment in Reading Comprehension

1) **Stimulant Medication**
2) **SQ4R**
3) **Bell, N. (1991). Visualizing and Verbalizing for Language Comprehension and Thinking. San Luis Obispo, CA: Grander Educational Publishing.**
4) **Cogmed (www.cogmed.com)**
5) **Work with a Speech Language Pathologist**

For Details go to:

Blake, K. (May, 2013). Two Common Reading Problems Experienced By Many AD/HD Adults, 2013 Edition. www.drkevintblake.com.

(Link on right side of home page)

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  - **Assessment and Treatment of Dyslexia in Adolescents and Adults: No Adult Left Behind***
  - **Building a Life Skills Tool Kit: Helping Prepare the Adolescent with Autism Spectrum Disorder for Adult Life**
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