

Specific Learning Disorder-Reading/ Dyslexia Update

Kevin T. Blake, Ph.D., P.L.C.
Tucson, Arizona
Cross Country Education
Brentwood, Tennessee

Dyslexia is NOT new!

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



Shaywitz, S. (2003). Overcoming
Dyslexia. New York, NY: Knoff.

Dyslexia & “Nonverbal Paralanguage”

- About 80% of those with Learning Disorders have some type of Reading Disorder/Dyslexia which is a language disorder.

Shaywitz, S. (2003). Overcoming Dyslexia. New York, NY: Knopf.

- Part of language is Non-verbal Paralanguage which includes humming, voice quality, loudness and noises between words.

Nowicki, S. and Duke, M. (2002). Will I Ever Fit In? New York, NY: Free Press.

Dyslexia and Gender



- Sally Shaywitz (1996) reported:
 - ◆ Women's brains appear to have bilateral phonological processing.
 - ◆ This may explain why women tend to have fewer language deficits after left brain strokes.
 - ◆ It may also explain why more women than men compensate for dyslexia.

Shaywitz, S.E. (1996). Dyslexia. Scientific American, 275 (5), pp. 98-104.

THE CONTROVERSY OF ADULT AD/HD AND DYSLEXIA: REAL ANSWERS AND SOLUTIONS FOR THERAPISTS

Although 5 percent of our adult population suffers from AD/HD, a neurobiological disorder first recognized in 1902, there continues to be controversies, misunderstandings and myths about this disorder and its treatment. As a result, many adults with AD/HD struggle with chronic difficulties in relationships and in school and in work settings. Without proper treatment, they are at risk for school failure and drop out, career failure, failed marriages, anxiety disorders, affective disorders and substance abuse.



What Is The Readability Level of The Previous Passage?

- Flesch-Kinaid Grade Level=12.0
- The Readability of the New York Times is 13th to 16th grade

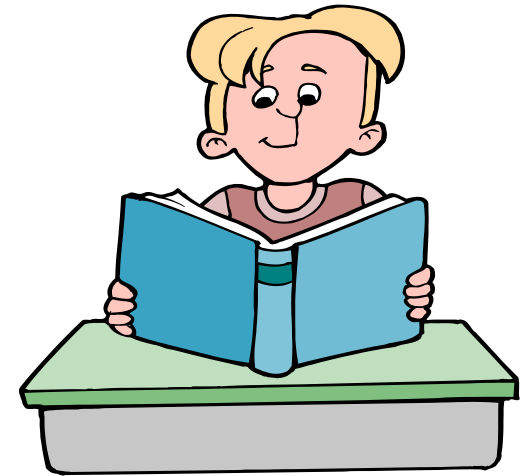
WriteltNow (3/12/04). From website: www.ravensheadservices.com/readability.htm, p. 3.

- Reader's Digest: 9th grade

The English Language Learner KnowledgeBase (3/12/04). From website: www.helpforschools.com/ELLKBase/practitionerships/Fog_Index_Readability.shtml .

- 1 in 5 Americans reads below the 5th grade level and the average American reads at the 8th grade level!

Pfizer Clear Health Communication Initiative (3/12/04).
Improving Health Literacy. From website: www.pfizerhealthliteracy.com_fry.html



THE CEREBELLUM



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). **Functional Diversity of the Cerebellum**. Paper presented at the New Angles on Motor and Sensory Coordination in Learning Disabilities Topical Medical Workshop; Learning Disabilities Association, International Conference, Washington, DC; Infomedia, tape R130-W1A, Garden Grove, CA.

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...”

The Cerebellum & Social Interaction (Continued)



“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). A User’s Guide to the Brain: Perception, Attention, and the Four Theaters of the Brain. New York, NY: Vintage.

Dyslexia and The Cerebellum

80% of dyslexics show signs of cerebellar problems!



Fawcett, A. J. and Nicolson, R. I. (2001). Dyslexia and The Role of The Cerebellum.

In A. J. Fawcett (Ed.), Dyslexia: Theory & Good Practice. Philadelphia, PA: Whurr, pp. 89-105.

Fawcett, A. J. (August 11, 2010). Personal Communication.

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). Dyslexia and The Role of The Cerebellum. In A.J. Fawcett (Ed.), Dyslexia: Theory & Good Practice. Philadelphia, PA: Whurr, pp. 89-105.

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...”

Dyslexia and The Cerebellum (Continued)



“...of hours that’s the sort of thing in which dyslexic children are particularly adversely affected.”

Nicolson, R., and Fawcett, A. (November, 2000). Dyslexia, The Cerebellum and Phonological Skill . Paper presented at the International Dyslexia Association Annual Conference, Washington, DC.

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). Dyslexia and Learning. Paper presented at the 55th International Dyslexia Conference, Philadelphia, PA, from handout of slides, Number 45.

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). Dyslexia, Learning, and the Brain. Cambridge, MA: MIT Press, pp. 68-69.

More of Nicolson and Fawcett's



**Nicolson, R.I., and Fawcett, A.J. (2008).
Dyslexia, Learning, and The Brain. London,
England: MIT Press.**

THE NEUROLOGY OF READING DISORDER- DYSLEXIA



The Neurology Of Reading Disorder-Dyslexia

- an irregularity in the cellular architecture of the posterior planum temporale region of Wernike's area in the left temporal lobe
- they have ectopias and dysplasias in far greater numbers
- results of 9 autopsies of dyslexics

Duane, D.D. (1993). Developmental Disorders of Learning, Attention, and Affect. Videotape prepared by the Institute for Behavioral Neurology, 10201 North 92nd Street, Suite #300, Scottsdale, AZ.

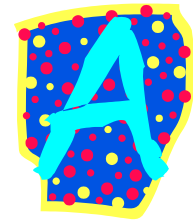
Riccio, C.A., and Hynd, G.W. (1996). Neurological Research Specific to the Adult Population with Learning Disabilities. In N. Gregg, C. Hoy, and A.F. Gay (Eds.), Adults with Learning Disabilities: Theoretical and Practical Perspectives. New York, NY: Guilford, pp. 127-143.

Planum Temporale and Dyslexia

- * 2/3rds of normals have asymmetry of planum temporale (Lt > Rt).**
- * Dyslexics' planum temporale are symmetrical.**
- * These differences are important as this area is related to one of the functional difficulties of dyslexia—language.**

Fiedorowicz, C., et. al. (2001). Neurobiological Basis of Learning Disabilities. Learning Disabilities, 11 (2), pp. 61-74.

“Vana May I Buy A PHONEME?”



- Smallest part of speech
- 44 in English language
- All words spoken or read must be broken down by the brains phoneme module to be processed, remembered, etc.

Shaywitz, S.E. (November, 1996). Dyslexia. Scientific American, 275 (5), p. 98-104.

The Core Phonological Deficit

- Phonological deficits continue in adulthood.
- Phonological instruction promotes learning to read.
- Spelling is poor and reading rate is slow into adulthood—time pressure make them worse.

Pugh, K.R., et. al. (2001). Neurorimaging Studies of Reading Development and Reading Disability. Learning Disabilities Research & Practice, 16 (4), pp. 240-249.

Duane, D. (1991). Dyslexia: Neurobiological and Behavioral Correlates. Psychiatric Annals, 21 (12), pp. 703-716.

Phonemic Awareness And Genetics



- This may be related to anomalies on Chromosome 6.
- Single word reading – anomalies on Chromosome 15 (long arm)

Lyon, G.R. (1999). In Celebration of Science in the Study of Reading Development, Reading Disorders and Reading Instruction. Paper presented at the International Dyslexia Association 50th Annual Anniversary Conference, November 4, 1999, Chicago, IL.

Fiedorowicz, C., et. al. (2001). Neurobiological Basis of Learning Disabilities. Learning Disabilities, 11 (2), pp. 61-74.

Other Differences In The Dyslexic Brain

- Increased posterior symmetry
- Dyslexics with severe language delay have reversed parietal-occipital asymmetry – rt planum > lt
- Dyslexics tend to have a larger right hemisphere than left in adulthood.

Richardson, S.O. (1994). Doctors Ask Questions About Dyslexia: A Review of Medical Research (The Orton Emeritus Series). Baltimore, MD: Orton Dyslexia Society

Filipek, P.A., et.al. (1999). Structural and Functional Neuroanatomy in Reading Disorder. In D.D. Duane (Ed.), Reading and Attention Disorders: Neurobiological Correlates. Baltimore, MD: York, p. 48.)

Dyslexia And The Lateral Geniculate Nucleus

“...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).

Livingstone, M.S. (1999). The Magnocellular/Parietal System and Visual Symptoms in Dyslexia. In D.D. Duane (Ed.), Reading and Attention Disorders: Neurobiological Correlates. Baltimore, MD: York Press, pp. 81-92.

Dyslexia And The Lateral Geniculate Nucleus

- The Magnocellular system appears to be slower in some dyslexics.
- The Magnocellular system transmits arrangement and shape of words and letters—sight reading.
- The Parvocellular system transmits details of letters and syllables.

Richardson, S.O. (1994). Doctors Ask Questions About Dyslexia: A Review of Medical Research (The Orton Emeritus Series). Baltimore, MD: Orton Dyslexia Society.

Dyslexia And The Lateral Geniculate Nucelus

Research has demonstrated that dyslexics are slower at processing both visual and auditory information.

Richardson, S.O. (1994). Doctors Ask Questions About Dyslexia: A Review of Medical Research (The Orton Emeritus Series). Baltimore, MD: Orton Dyslexia Society.

The Double Deficit Hypothesis

- **Poor Rapid Automatized Naming (RAN)**
- **Some dyslexics have phonological and word attack problems only.**
- **Some dyslexics have RAN and comprehension deficits only.**
- **Some have both phonological deficits and poor RAN and thus have the “Double Deficit”**
 - **These are the most seriously impaired and hardest to habilitate.**

Wolf, M., and O'Brien, B. (2001). On Issues of Time, Fluency, and Intervention. In A.J. Fawcett (Ed.), Dyslexia: Theory and Good Practice. Philadelphia, PA: Whurr, pp. 124-140.

The Triple Deficit Hypothesis

“Orthographic dyslexia refers to a problem with the acquisition of decoding or encoding skills that is caused by difficulty with rapid and accurate formation of word images in memory” (p. 239).

Roberts, R., and Mather, N. (1997). Orthographic Dyslexia: The Neglected Subtype. Learning Disabilities Research & Practice, 12 (4), pp. 236-250.

The Triple Deficit Hypothesis

“In a synthesis of Samuel T. Orton’s work, June Orton...explained that for some students, visual memory is sufficient enough to recognize the printed word in reading, but not strong enough to recall the image of the word to reconstruct it for spelling” (p. 244).

Roberts, R., and Mather, N. (1997). Orthographic Dyslexia: The Neglected Subtype. Learning Disabilities Research & Practice, 12 (4), pp. 236-250.

The Triple Deficit Hypothesis

Those with Orthographic Processing deficits:

- **Have difficulty recalling sight words (i.e., was, etc.).**
- **Are slow to develop fluency and automaticity.**
- **Have difficulty storing mental representations of words.**
- **Rely on phonics for reading and produce misspellings that are phonemically regular for sight words.**

Roberts, R., and Mather, N. (1997). Orthographic Dyslexia: The Neglected Subtype. Learning Disabilities Research & Practice, 12 (4), pp. 236-250.

The Triple Deficit Hypothesis

**Anomalies on Chromosome
2 are related to problems in
orthographic processing in dyslexics.**

Lyon, G.R. (1999). In Celebration of Science in the Study of Reading Development, Reading Disorders and Reading Instruction. Paper presented at the International Dyslexia Association 50th Annual Anniversary Conference, November 4, 1999, Chicago, IL.



MORE ABOUT DYSLEXIA AND THE CEREBELLUM



Dyslexia And The Cerebellum

Fawcett and Nicolson reported research that dyslexic children have significant problems with phonology, working memory, speed of information processing, balance, and motor skills. With the exception of phonology the remaining symptoms can be attributed to cerebellar problems.

Fawcett, A.J., Nicolson, R.I. (2001). Dyslexia and The Role of The Cerebellum. In A.J. Fawcett (Ed.), Dyslexia: Theory & Good Practice. Philadelphia, PA: Whurr, pp. 89-105.

Dyslexia And The Cerebellum

“Our neuroanatomical analysis of the Orton Society brain bank showed 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). The PET study of motor sequence learning showed that there were abnormalities in cerebellar activation in automatic processing and in new learning, for subjects in our panel who had cerebellar signs...”

Dyslexia And The Cerebellum

(Continued)

“...Rather than the expected cerebellar activation in these tasks, the dyslexic subjects showed greater frontal lobe activation in new learning, suggesting they were by-passing the cerebellum to some extent, and relying on conscious strategies. These important findings confirm the behavioural evidence of cerebellar dysfunction, and suggest that the dyslexic subjects use different methods in sequential learning and automatic performance” (p. 98-99).

Fawcett, A.J., Nicolson, R.I. (2001). Dyslexia and The Role of The Cerebellum. In A.J. Fawcett (Ed.), Dyslexia: Theory & Good Practice. Philadelphia, PA: Whurr, pp. 89-105.

Dyslexia And The Cerebellum

**Anomalies on Chromosome
15 are related to problems
with automaticity in dyslexics.**

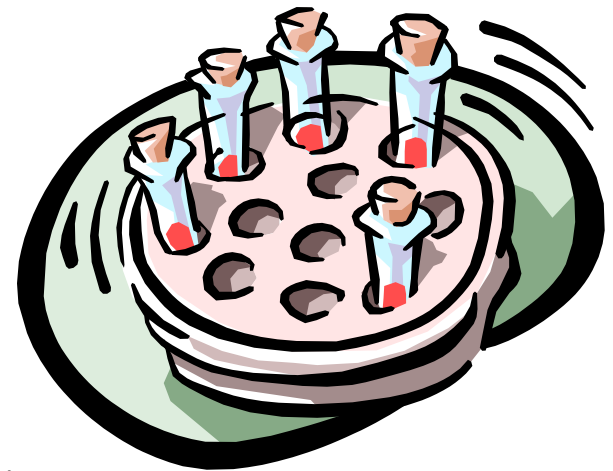


Lyon, G.R. (1999). In Celebration of Science in the Study of Reading Development, Reading Disorders and Reading Instruction. Paper presented at the International Dyslexia Association 50th Annual Anniversary Conference, November 4, 1999, Chicago, IL.

More Genetics and Dyslexia

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

Olsen, R.K. (November 11, 2005). Norman Geshwin Lecture-Genes, environment and dyslexia.
Paper presented at the 53rd Annual International Dyslexia Association Conference, Denver, CO.



How Do Dyslexics Read?

- As dyslexics mature they tend to over activate the Left Frontal Broca's region.
- This allows them to sub-vocalize what they read (The Broca's region is responsible for vocalization).
- They slowly “move” their way through reading.

Shaywitz, S. (2003). Overcoming Dyslexia. New York, NY: Knopf.

Why Don't Dyslexics Get Better With Age?

- **“The identical posterior disruption is observed in children and adults—neurologic proof that the problems do not go away. They are persistent, and now we know why.” (p. 82).**

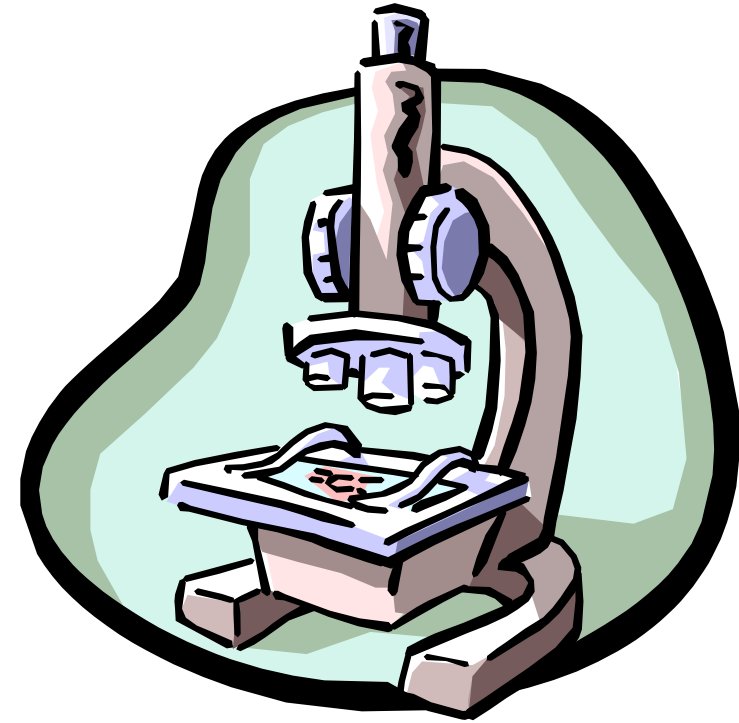
Shaywitz, S. (2003). Overcoming Dyslexia. New York, NY: Knopf.

Are There Dyslexics In Other Countries/Languages?

- **Yes!**
- **Cultures with less complex phonemically regular languages (i.e., Italian) will have dyslexics with less severe reading disorder symptoms, than English or French.**
- **However “...the neurologic mechanisms of dyslexia are similar regardless of native language” (p. 44).**

Geller, B. (May, 2001). Dyslexia: A Disease Without a Country. Journal Watch: Psychiatry, 7 (5), p.44.

Your Tax Dollars at Work

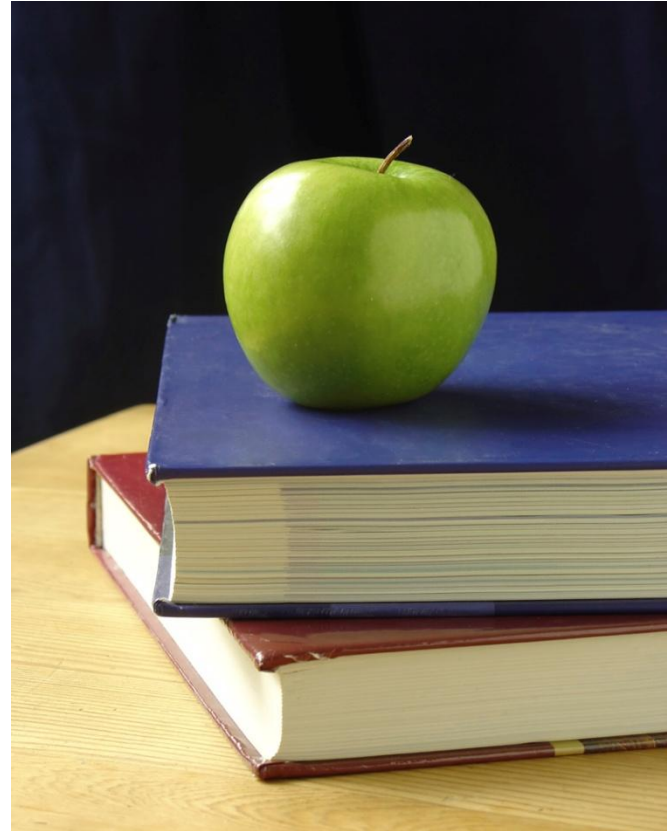


RESEARCH PROGRAM IN READING DEVELOPMENT, READING DISORDERS, AND READING INSTRUCTION

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). In Celebration of Science in the Study of Reading Development, Reading Disorders and Reading Instruction. Paper presented at the International Dyslexia Association 50th Annual Anniversary Conference, November 4, 1999, Chicago, IL.

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). Application of Scientific Research Methods to the Study of Naming Deficits: Systematic Interventions to Improve Fluency in Word Reading Skills and Comprehension. Paper Presented at the 40th Annual Learning Disabilities Association Conference, Chicago, IL, Session T-39.

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). A Summary of Current NICHD Research Findings in Math and Reading Development in English Speaking Children and Plans For Future Research. Seminar Presented at the 41st Annual Learning Disabilities Association of America International Conference, Atlanta, Georgia, March 17 to March 20, 2004.

Your Tax Dollars At Work



- 3 to 5% of community samples experience Major Depressive Disorder in lifetime.
- Dysthymic Disorder is 3%.
- 3 to 13% Social Phobia
- 3 to 5% Generalized Anxiety Disorder
- 0.4 to 1.6% Bipolar Disorder

American Psychological Association (1994). Diagnostic and Statistical Manual of Mental Disorders, IV Edition. Washington, DC: American Psychiatric Association.

Reading Disorder- 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). Romance and Reality. The Reading Teacher, 47, pp. 280-291.

Reading Disorder-Dyslexia



The Symptoms of Dyslexia are:

- 1. Weak Phonemic Awareness***
- 2. Slow, Rapid Automated Naming***
- 3. Poor Orthographic Processing***
- 4. Exceptionally Poor Automatization***
- 5. Poor Coordination***

Fawcett, A.J. (2001). Dyslexia: Theory and Good Practice. Philadelphia, PA: Whurr.

Blake, K.. (2003) Personal Observation.

Reading Disorder-Dyslexia



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

Reid, A.A. (November 11, 2006). Cognitive Profiles of Individuals with Developmental Dyslexia: Insights From a Large Sample Study. Preliminary Findings . Paper presented at the 57th Annual International Dyslexia Association Conference, Indianapolis, IN.

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 and 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 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). IDA/NIH Adopts A New Definition of Dyslexia. From website:

www.interdys.org/serlet/compose?section_id=8&page_id=69, Page 1 Of 2

British Dyslexia Association: Definition of Dyslexia

“Dyslexia is a specific learning difficulty which mainly effects the development of literacy and language related skills.

It is likely to be present at birth and to be lifelong in its effects. It is characterized by difficulties with phonological processing, rapid naming, working memory, processing speed and automatic development of skills that may not match up to an individual’s other cognitive abilities.” (Continued)

British Dyslexia Association: Definition of Dyslexia (Continued)

“It tends to be resistant to conventional teaching methods, but its effects can be mitigated by appropriately specific intervention, including the application of information technology and supportive counseling.” (P. 1)

British Dyslexia Association (No Date). Dyslexia Research Information . From website: www.bdadyslexia.org.uk/about-dyslexia/further-information/dyslexia-research-info. Page 1 of 4.

THE PAOMNNEHAL PWEOR OF THE HMUAN MNID

- Aoccdrnig to rscheearch at Cmabrigde Uinervisy, it deosn't mttar 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). www.mrc-cbu.cam.ac.uk/~mattd/Cmabrigde/

Rawlinson, G. (1999). Reibadaily. New Scientist. 162 (2188), p. 55. From website:
www.mrc-cbu.cam.ac.uk/~mattd/Cmabrigde/newscientist_letter.html

“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.
- Only about 7% of adult dyslexics have this concern.
- **Dyslexia is not seeing the word “WAS” as “SAW”.**

Anderson, C.W., Jr. (January 23, 2006). Personal Communication.

Badian, N. A. (2005). Does a Visual-Orthographic Deficit Contribute to Reading Disability? Annals of Dyslexia, 55 (1), pp. 28-52.

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). Reading in the Brain: The New Science of How We Read.
New York, NY: Penguin.**

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). Reading in the Brain: The New Science of How We Read. New York, NY: Penguin.

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

National Reading Panel (4/13/2000). www.nichd.gov/publications/pubs/readbro.htm

Multisensory Teaching Techniques

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

International Dyslexia Association (2005).
Framework for Informed Reading and Language Instruction: Matrix of Multisensory Structured Language Programs.
Baltimore, MD: International Dyslexia Association.



Multisensory Teaching Techniques (Continued)

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

International Dyslexia

Association (2005).
Framework for Informed
Reading and Language
Instruction: Matrix of
Multisensory Structured
Language Programs.

Baltimore, MD:
International Dyslexia
Association.



Neural Tuning, Visual Word Form Area and Dyslexia

“Using fMRI rapid adaptation techniques, we provide evidence that the human left ventral occipitotemporal cortex (specifically the “visual word form area”, VWFA) contains a representation based on neurons highly selective for individual real words, in contrast to current theories that posit a sublexical representation in the VWFA”(p. 199.

Glezer, L.S., Jiang, X. and Riesenhuber, M. (April 30, 2009). Evidence for Highly Selective Neuronal Tuning to Whole Words in the “Visual Word Form Area”. Neuron, 62(2), 199-204.