Biological Basis and management of Dyslexia

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Dyslexia is a specific learning disability that is neurobiological 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

Studies of structural differences in the brains of people of all ages show differences between people with and without reading disabilities.people with dyslexia have less gray matter in the left parietotemporal area than nondyslexic individuals. Having less gray matter in this region of the brain could lead to problems processing the sound structure of language (phonological awareness).Many people with dyslexia also have less white matter in this same area than average readers, which is important because more white matter is correlated with increased reading skill .Having less white matter could lessen the ability or efficiency of the regions of the brain to communicate with one another.

Several studies using functional imaging techniques that compared the brain activation patterns of readers with and without dyslexia show potentially important patterns of differences. We might expect that readers with RD would show under activation in areas where they are weaker and over

activation in other areas in order to compensate, and that is exactly what many researchers have found.

Recent researches proposed that dyslexia actually has a biological origin ,but regarding the nature of the disease, its only discoverable after the child is at the age of school , and start to suffer the consequences of this disability, researches emphasized that early intervention gives much better results especially before school age ,this in turn raised the question of the possibility of screening these children at very early age .

Also there is effective psycho educational training programs that helps these children overcome their disability ,psychiatric intervention exceed this role to also help children who developed co morbid psychiatric disorders as well.

Although treatment studies have shown that the majority of children respond to evidence-based treatment interventions, there are still a significant number of children who are resistant to treatment. They are the challenges for future research and the children who require more comprehensive evaluation and individualized interventions.

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BIOLOGICAL BASIS AND MANAGEMENT OF DYSLEXIA

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LIST OF ABBREVIATIONS

AA	Arachidonic acid
ABD	Atypical Brain Development
ADHD	Attention Deficit Hyperactivity Disorder
ART	Auditory Repetition Task
CDT	cerebellar deficit theory
DCD	Developmental Coordination Disorder
DCDC2	Doublecortin Domain Containing 2 Gene
DDAT	Dyslexia Dyspraxia Attention Treatment
DGLA	Dihomo-gamma-linolenic acid
DHA	Docosahexaenoic acid
DIBELS	Dynamic Indicators Of Basic Early Literacy Skills
DRD4	Dopamine D4 Receptor Gene
DSM IV TR	Diagnostic And Statistical Manual Of Mental Disorders. 4th Ed. Text Rev.
DTI	Diffusion Tensor Imaging
DYX(1-9)	Dyslexia Susceptibility Gene (1-9)
DYX1C1	Dyslexia Susceptibility 1 Candidate 1 Gene
EEG	Electro encephalogram
EFA	essential fatty acids
EPA	eicosapentaenoic acid
ERP	Event Related Potential
FMRI	Functional Magnetic Resonance Imaging

HUFA	Highly unsaturated fatty acid
HUGO	Human Genome Organisation
ICD 10	International Classification Of Diseases
IDEA	Individuals With Disabilities Education Act
INPP	Institute For Neuro-Physiological Psychology
IQ	Intelligence Quotient
ISI	Inter-Stimulus Interval
KIAA0319	Part Of Dyslexia Susceptibility Gene 2
LALOT	Left Anterior And Lateral Occipito-Temporal Region
LD (GENETICS)	Linkage Disequilibrium
LGN	Lateral Geniculate Nucleus
LIPS	Linda mood Phoneme Sequencing Program
LPMOT	Left Posterior And Medial Occipito-Temporal Region
MBD	Minimal Brain Dysfunction
MDT	magnocellular deficit theory
MEG	Magnetoencephalography
MEG	Magnetoencephalography
MGN	Medial Geniculate Nucleus
MRI	Magnetic Resonance Imaging
MT	Middle Temporal
PDT	phonological deficit theory

PEDS	Parents' Evaluation Of Developmental Status
PET	Positron Emission Tomography
PLA2	phospholipase A2
RASCH	Reading Achievement Score For Children
RDK	Random Dot Kinematograms
ROBO1	Roundabout, Axon Guidance Receptor, Homolog 1 Gene
RTI	Response To Intervention
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SB-4	Stanford -Binet Test— Fourth Edition
SC	Superior Colliculus
SLI	Specific Language impairment
SLD	Specific Learning Disability
SSD	Speech Sound Disorder
TAAS	Test Of Auditory Analysis Skills
TALS	Test Of Awareness Of Language Segments
TCI	transient cognitive impairment
TOD	Test Of Dyslexia
WIAT-R	Wechsler Individual Achievement Test Revised
W-J III	Woodcock-Johnson Tests Of Cognitive Abilities And Tests Of Achievement Third Edition
WRAT	Wide Range Achievement Test
WRMT	Woodcock Reading Mastery Test

INTRODUCTION

For good readers, gaining meaning from print quickly and effortlessly, like breathing and speaking is a natural part of life. For these men and women, it is almost unimaginable how something that seems to come so naturally could be difficult for others. Without doubt, since ancient times when man learned to use printed symbols to convey words and ideas, there have been those who struggled to decipher the code. Just how many are affected, the basis of the difficulty, and most importantly, the most effective, evidence-based approaches to educating dyslexic children and young adults were questions that had to wait until quite recently for resolution. (**Shaywitz, 2008)**

Dyslexia was first described as "word blindness" in 1877, when Kussmaul reported a man who despite normal intelligence was unable to learn to read even though he received an adequate education. In the end of the 19th century, Hinshelwood and Morgan both described word blindness as a congenital defect, occurring in children with otherwise normal brains. These reports were based on studies of acquired dyslexia, or alexia, where neurological damage to certain brain areas result in loss of reading ability. In 1925, Orton described the first theory of specific learning difficulty. He hypothesized that the children's reading problems stemmed from a failure of the left hemisphere to become dominant over the right, and that a deficit in visual processing

was the cause for the reading difficulties. He termed the disorder " strephosymbolia", i.e., "twisted symbols" from the Greek words [strepho] =twist, and [symbolon] =symbol. The disorder was later more appropriately called dyslexia, "difficulty with words" (from Greek [dys] =difficult, [lexis] =words), as it was recognized that the condition is language-related, rather than a visual problem. In 1968 The Research Group on Developmental Dyslexia from The World Federation of Neurology recommended the earliest definitions of dyslexia used today, although they have since then been somewhat subjected to revisions and changes. (**Richardson 1992)**

DEFINITIONS

The current definition from the International Dyslexia Association states:

> *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 problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge*
>
> **(Adopted by the International Dyslexia Association Board of Directors, , 2002).**

Definition of the British Dyslexia Association

"Dyslexia is a specific learning difficulty which mainly affects 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 characterised by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities."

PREVALENCE

Reading difficulties are thought to be highly prevalent; the specific prevalence rate will reflect the particular definition and cut points established as criteria for identification. For example, results of the 2005 National Assessment of Educational Progress indicate 27% of high school seniors are reading below the most basic levels (minimum level at which a student can demonstrate an understanding of what she or he has read) **(Grigg et al. 2007).**

Even more primary grade students—36% of fourth grade children—are reading below basic levels **(Perie et al. 2005).**

However, Difficulties arise in determining the prevalence of dyslexia in this sense for the following reasons:

(i) The condition may show itself differently in different languages;

(ii) Full assessments on a scale necessary for arriving at a prevalence figure would place a heavy demand on resources;

(iii) The situation is further complicated by the fact that there are dyslexia variants -- mild cases sometimes occurring among the relatives of those more severely affected**.(Miles 2004)**

It has been suggested that up to 10% of the population (or even more) show some signs of dyslexia, particularly when it is present in other members of the family. **(Pennington .1991)**

A survey study of dyslexia in Kuwait highlighted the prevalence rate of dyslexia at 6.3% of the number of students attending primary schools. **(Kuwait Dyslexia Association, 2002)**

DYSLEXIA AMONG DIFFERENT LANGUAGES

A functional brain imaging study of adult dyslexics from different cultures (English, French and Italian) showed same abnormal patterns of brain activation during reading and phonological tasks across languages, i.e., reduced activity in the left hemisphere (**Paulesu et al. 2001**).The region showing most significant reduction in activation was the middle temporal gyrus, with marked decrease also in the inferior and superior temporal gyri and the middle occipital gyrus. Reduced activation in these regions has also been shown in MEG studies of Finnish dyslexics **(Salmelin et al. 1996)**. These results suggest common neurological