

SchwabLearning.org asks:

As a neuroscientist and an educator, what is your vision of dyslexia? What key points should we understand?

Gordon Sherman Answers:

Four points are crucial:

- The brains of people with dyslexia are different.
- We can design educational environments to prevent or diminish reading disabilities in people with dyslexia and to elicit their strengths.
- There may be a connection between dyslexia and certain abilities.
- The toughest challenge in teaching students with dyslexia and others at risk for reading failure may be a product of the mind, not of the brain.

Let's examine each of these points. My perspective may surprise you.

The brains of people with dyslexia are different

Decades of research show people with dyslexia have brains that are structured differently, function differently, and learn differently. Dyslexia begins with a complex gene-environment interaction that initiates developmental changes in the nervous system before birth. The result is an atypically organized brain that processes information in unique ways.

Microscopic analyses of the brains of individuals with dyslexia show structural variations in left-hemisphere language networks, symmetry between the left and right hemispheres, and, sometimes, changes in sensory systems. Neuroimaging studies support microscopic analyses and show characteristic and distinct functional differences in dyslexic subjects -- less engagement of left-hemisphere language areas and more bilateral processing. Finally, educational research catalogues a number of distinctive learning differences among individuals with dyslexia, chief among them are language-system difficulties -- weaknesses in phonological processing (producing/interpreting language sound patterns) and difficulties learning alphabetic skills (written symbols representing speech). These learning deficits set the stage for problems learning academic skills, which often lead to negative educational, emotional, and social consequences.

It is important to remember, though, that even with the consistency of findings about structural, functional, and learning differences, people with dyslexia are a diverse group. Dyslexia varies from individual to individual in the combination and degree of strengths and weaknesses due to the intricacies of brain development and countless environmental variables. These factors and overall cognitive capacity influence a person's ability to compensate for dyslexia. And, yes, people with dyslexia **can** overcome its "disabling" effects. While dyslexia is brain-based and life-long, it is amenable to educational intervention.

We can design educational environments to prevent or diminish learning disabilities and to elicit strengths

Environmental variables play a key role in dyslexia. The educational environment can translate a distinct learning difference into a profound learning disability or it can offset neural weaknesses and encourage latent strengths to blossom into competencies and talents. Neuroimaging studies show that brain functioning in subjects with dyslexia can change in response to structured-language intervention, functioning more like the brains of non-impaired readers. This adds further weight to decades of educational research demonstrating that effective early instruction can prevent and diminish reading disabilities in children with dyslexia and forestall associated academic problems. Good news, particularly since structured-language instruction also benefits most learners!

The environment provides the context in which certain brain-based attributes not only are rendered good or bad but also are judged good or bad. Thinking about dyslexia from another perspective -- as brain diversity -- illuminates this point. Nature loves diversity. Diversity feeds evolution by permitting adaptability to various environments. Human diversity may be more than a politically correct principle.

Certainly, parents and educators must recognize that dyslexia is a distinctly different brain organization that can be profoundly disabling, particularly in the context of poorly designed educational environments. On the other hand, brain diversity may benefit our species. History and science tell us environments inevitably change. Who knows what kinds of minds our species may need in the future?

Is dyslexia a biological mishap? Nature's design?

There may be a connection between dyslexia and certain abilities

Having dyslexia does not preclude having strengths and exceptional abilities. In fact, people with dyslexia sometimes are gifted and accomplished. But are they gifted and accomplished in spite of their dyslexia or because of it?

Recently, a number of high-profile CEOs in business have discussed their school difficulties and personal experiences with dyslexia. So, too, have many artists and performers. Certainly, individuals with dyslexia excel in various fields at noteworthy levels. Do their talents surface more often in particular domains of cognitive function like the arts, business, athletics, medicine? Are certain gifts more commonly seen in people with dyslexia than in non-dyslexics? Is a particular brain design predisposed for developing singular talents as well as for encountering difficulties learning to read? Or is something else at work -- an "I'll-beat-the-odds" drive born out of hardship or an attraction to certain fields and interests because doors to others are closed?

Many experts in learning disabilities (Rawson, Vail, West) have written about hidden strengths in dyslexia that blossom into gifts and result in great achievements. An infamous but unproven list of accomplished dyslexics circulates in the LD field and even includes a number of individuals diagnosed posthumously! Educators often mention

remarkable abilities outside the language domain in their dyslexic students. None of this is scientific evidence, but it prompts intriguing questions.

Is dyslexia the unintended byproduct of a mechanism in nature designed to ensure cognitive diversity and talent? Or is our impression of characteristic gifts in dyslexia skewed because strengths stand in stark contrast to weaknesses? In the last years of his life, the eminent neurologist, Norman Geschwind, M.D., often discussed the relationship between giftedness and dyslexia, speculating nature may have strategies for creating giftedness that may have drawbacks.

Making talented brains is not simple. Nature probably has adopted many stratagems for the achievement of this end. . . The methods which create giftedness may not quite succeed and as a result . . . may produce giftedness in some areas and, at the same time, problems in others . . . (Geschwind, 1984)

The phenomenon of the savant, beautifully portrayed by Dustin Hoffman in the movie “Rainman,” is an extreme version of the cognitive paradox of talents and deficits existing in a single individual. Is dyslexia, at least as manifested in some individuals, a milder version of this cognitive paradox? For now, anything beyond speculation is premature. And certainly, it is irresponsible to suggest that everyone with dyslexia will demonstrate exceptional talent.

Only rigorous scientific exploration can establish any connection between certain talents and dyslexia. Thus far, evidence supporting any dyslexia-talent connection has proven elusive -- with a few fascinating exceptions. A series of studies explored the hypothesized spatial strengths in dyslexia. In batteries of tests designed to reveal such abilities, subjects with dyslexia did no better than controls and often did worse. However, in two studies, dyslexics performed a particular task (the Impossible Figures Test) just as accurately as controls, but **faster!**

Why? This task requires subjects to evaluate whether or not a particular configuration actually can exist. Do dyslexics perform more efficiently on this task because their brains process information more globally? Are there advantages to this mode of cognitive function? In this task at least, a global strategy may be better than a sequential, linear one. The toughest challenge in teaching students with dyslexia may be a product of the mind, not the brain

The learning disabled are not simply byproducts of diversity. They are probably a more variable population than those without special disability, and while they may well contribute disproportionately to society, they often pay a high price for their talents. It is our task to outwit nature by preserving the high talents without the disadvantages. (Geschwind, 1984)

Many mysteries surround dyslexia, but there are no mysteries about what constitutes effective instruction for those at risk for reading failure. We now know what it takes to “outwit nature.”

Effective methods for teaching reading and writing skills to children and adults with dyslexia do exist and incorporate several distinguishing features. These methods deliver a structured-language curriculum in a sequential, systematic, and cumulative way through a multisensory approach -- offsetting language, sensory, memory, and motor/attention processing differences. Indeed reading research tells us that effective early literacy instruction for **all** children includes most of these elements. Such instruction embodies the principles of “universal design for learning,” making curriculum accessible for all learners.

Research also tells us that effective early screening and intervention **can** prevent or diminish reading disabilities in children whose brain design predisposes them for reading difficulties. Imagine preventing reading failure in children with dyslexia! Reading failure has been dyslexia's most singular defining characteristic.

Unfortunately, circulating scientific evidence about what constitutes sound instruction is not enough to ensure children will receive it. Understanding the dynamics of school change and imparting essential competencies to teachers are among the conditions necessary for implementing effective research-based instruction for diverse learners. Time, money, and attitudes pose formidable barriers in fulfilling these conditions.

As a neuroscientist and an educator, I believe our toughest learning challenge is a product of the mind, not the brain. We disable our vision and cheat our future if we yield to the belief that we cannot alter learning environments to unlock potential and if we buy into the assumption that today’s apparent limitations govern tomorrow’s possibilities. Overcoming this mindset -- this learning handicap -- requires courage, tenacity, and imagination on the part of students, teachers, and schools.

We also **can and must** strive to identify and nurture strengths in children with dyslexia. Irrespective of the dyslexia-talent question, all children do have strengths and weaknesses. Strengths can be recruited as powerful avenues for instruction, and, in some individuals, may prove to be superior talent.

Can you imagine preventing failure in children with dyslexia? Can you imagine unlocking their potential?

I can.

Who is Gordon Sherman?

GORDON F. SHERMAN, Ph.D. is the Executive Director of [The Newgrange School and Educational Outreach Center](#) located in Mercer County, New Jersey. Before joining Newgrange he was Director of the Dyslexia Research Laboratory at Beth Israel Deaconess Medical Center, Boston, Massachusetts, and Assistant Professor of Neurology (Neurosciences) at Harvard Medical School. Dr. Sherman is the Immediate Past-

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He received his Ph.D. in Developmental Psychobiology from the University of Connecticut (Storrs, Connecticut) in 1980 and has over 25 years of research experience related to the development of the brain and the understanding of developmental dyslexia. He is the author and editor of over 65 scientific articles, reviews, and books. Dr. Sherman speaks nationally and internationally to parents and teachers about the implications of brain research for pedagogy with an emphasis on dyslexia and other diverse learning styles.