

## The New Science of Reading

*By Sally Shaywitz, M.D.*

Reading is a code, and no matter who we are, each of us must somehow represent print as a neural code that the brain can decipher. Functional imaging makes this process transparent, allowing scientists to watch (and record) the neural systems at work as they attempt to transcribe letters into sounds. For most people this process is incredibly quick, smooth, and effortless. For others it's an entirely different story. Imaging provides the neurobiological-the physical-evidence of the difficulties that dyslexic readers have in transforming this written code into the linguistic code that is the key to reading.

Seeing these images leaves no doubt that the core problem in dyslexia is phonologic: turning print into sound. Only when dyslexic readers are asked to map letters into sounds do we see evidence of a fault in the circuitry. Neuroscientists now have the holy grail that we have been searching for a neural explanation for dyslexia.

Now that we have the ability to pinpoint the specific neural networks serving reading, our quest to understand, treat, and perhaps even prevent dyslexia has taken a quantum leap forward. There is now a neural target for reading interventions: the word form area. Having identified the neural networks engaged by reading and the anatomic location of the disruption in dyslexia, we are now probing deeper into these systems. In this exciting new frontier we are examining the basic chemistry of the neural cells in the disrupted brain regions. The technology of magnetic resonance spectroscopy may help us identify potential metabolic mayhem within the nerve cell itself. Such studies are now under way in our laboratory.

Dyslexia is a hidden disability, and because there was no physical proof of it, like a broken bone visible on X-ray, skeptics tried to explain it away. At long last, thanks to functional imaging, dyslexic readers have the proof they have been seeking. These remarkable images provide concrete evidence of the physical reality of their reading difficulty. They also explain how adolescent and young adult dyslexic readers can read accurately but slowly. In the future, functional imaging may allow early detection (and possibly prevention) of dyslexia-even before children learn to read-and its detection in bright adults. The application of functional imaging may also guide us in the development of more effective, more precisely targeted, treatments. Meanwhile, it is possible to use what we have learned about the basic phonologic weakness and the substantial strengths of the dyslexic reader to provide better solutions for struggling readers at all levels.

The new science of reading has direct application to identifying and treating reading difficulties. It allows us to spot early -warning signs of a reading problem; to know what specific clues to look for at any age; and to understand which are the most scientifically sound approaches to teaching reading. The science happily dovetails with practical everyday needs; this knowledge can be used to answer all the common questions concerning dyslexia. The possibilities for someone with dyslexia are just about limitless; the potential for success and for a happy, fulfilling life is greater than ever before. Applying all that we know allows virtually every dyslexic child to dare to dream.

Excerpted from the book OVERCOMING DYSLEXIA by Sally Shaywitz, M.D. With permission from Alfred A. Knopf, a division of Random House, Inc.

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