

# Reading Difficulty and Disability



Shortly after World War II, a team of researchers attempted to build a machine that could scan text and read it to the blind. After two decades of research, they learned that human speech was far too complex for the technology of the time to duplicate. However, these efforts provided the basis for a new research field that led to an understanding of why many children have difficulty with reading and how best to help them.

## Yesterday

- Breaking down words into individual bits of sound, researchers found they could identify 40 individual components, or phonemes, in the English language. They then learned that recognizing individual phonemes is an important step toward learning to read: Beginning readers who can distinguish the sounds of *cat* from *bat* and *bad* from *bed* will more easily recognize the difference between these words in a book. In fact, tests of children's ability to manipulate phonemes predicted later reading aptitude. They also found that simple techniques to help children learn phonemes led to reading improvements. These advances helped teachers develop effective techniques for helping children learn to read.
- In the 1990s, NIH-funded researchers used brain imaging to identify activity in three brain regions in the brain's left hemisphere during reading. The three brain centers work together to process phonemes, map the connection between a phoneme and the letters that represent it, and store that information in memory. Once a word is learned, this three-part "reading center" recognizes it automatically.
- Brain scans have shown that as readers become more skilled, this automatic recognition center becomes more active. Poor readers, however, have difficulty accessing the automatic recognition center and instead rely on the phoneme center and the mapping center to process the words they see. For poor readers, recognizing words is not an automatic process. Further research showed that, over time, prior instruction in phonemic awareness, phonics, and other reading skills led to improvements in the

automatic recognition of words. After undergoing such training, brain images of people who were once poor readers began to resemble those of good readers.

- In 1997, Congress directed the NIH to review the scientific evidence on reading and identify the most effective ways to teach children to read. In response, the NIH established the National Reading Panel. Along with explicit instruction in phonics and phonemic awareness, the panel outlined other effective approaches for teaching children to read. One approach, guided oral reading, involves having children read aloud while receiving guidance from skilled readers. Other approaches involve teaching children vocabulary and strategies for comprehending text. The panel's findings have contributed to nationwide standards in education.

## Today

- NIH-sponsored research has helped define reading disability as a specific, brain-based difficulty in learning to recognize and decipher printed words. Up to 10 percent of people have difficulty reading, including those of average and even above average intelligence.
- Environmental factors—children's experiences in the classroom, for example, or whether they were read to every day as preschoolers—can play a significant role in most types of reading difficulty. The majority of poor readers often need more intensive, explicit reading instruction. Instruction in school can be supplemented by literacy activities at home or in other out-of-school settings.
- In addition, research suggests that difficulty with reading may be linked to a person's genetic makeup, and therefore passed on from one generation to the next. For example, some cases of reading disability are associated with one or more alterations in genes which play a role in prenatal brain development.

## Tomorrow

- The NIH funds multidisciplinary Learning Disability Research Centers

(<http://www.nichd.nih.gov/research/supported/ldrc.cfm>) to undertake studies on defining, classifying and understanding learning disabilities and related disorders. Currently, researchers at four centers are actively engaged in investigating various aspects of reading disabilities. In addition, these centers continue to examine the effectiveness of Response to Intervention (RTI) as a means of identifying and teaching students with reading difficulties.

- Researchers continue to add to the body of scientifically tested learning techniques that offer effective instruction for beginning readers. Their efforts to assess new and existing approaches include evaluating RTI models for kindergarteners, older children, adolescents, and bilingual groups.
- Advances in brain imaging technology now allow investigators not only to look at activity in individual regions of the brain, but to examine how brain regions associated with reading ability work together to process text. How these connections form and change over time and how they are impaired in individuals who have difficulty reading are current topics of research.
- Imaging studies are examining the differences between fluent readers and those with difficulty reading, tracking changes in brain patterns that occur as children progress from beginning to advanced readers. Researchers are using many different types of brain imaging technology to more fully understand the brain-based differences between good readers and people with reading disability.
- Development of reading ability is influenced by many genes. Researchers continue to look for genetic clues into the basis of reading development. An understanding of how genes interact with other genes and with the environment to influence reading ability may contribute to more effectively identifying individuals at risk and developing the means to improve their reading ability or prevent reading problems.
- Often, reading disabilities appear in conjunction with other learning disabilities or disorders. For example, people with a reading disability frequently also have trouble developing writing skills, and many have been diagnosed with attention deficit hyperactivity disorder (ADHD). NIH recognizes the importance of studying

the association of reading difficulties with other learning disorders to identify common factors that may underlie them.

- Beginning readers have been the focus of much research on reading disabilities. However, recent findings suggest a subset of children has difficulties with reading comprehension that first appear in the fourth grade or later. A study funded by the NIH now is looking at what might interfere with reading comprehension in this group of children.
- Ongoing research studies also are investigating the development of writing skills and the relationships among reading, spoken language, and writing. Researchers are investigating the learning processes underlying the acquisition of basic writing skills, spelling ability, and complex processes like composing lengthy manuscripts.
- The Individuals with Disabilities Education Act (<http://idea.ed.gov/>) is the primary federal program authorizing state and local aid for educating children with learning disabilities and other special educational needs. The act was revised in part as a result of NIH-funded research that the standard criterion for providing special educational services—a discrepancy between I.Q. and achievement scores—failed to identify many children with reading difficulty or disability, and was a barrier to early intervention services.
- The IDEA Act now allows for the use of RTI models in schools to identify, assess and provide educational services to children. RTI consists of tiered instruction where children who have difficulty learning to read after having received high-quality reading instruction are ultimately provided with intensive instruction in small groups. Those who need more targeted intervention may receive one-on-one special education. This approach seeks to provide each child with the level of instruction appropriate for his or her individual needs.

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