NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development
Healthy pregnancies. Healthy children. Healthy and optimal lives.

Reading and Reading Disorders

Reading is an important skill for communication, education, and most types of work. Reading disorders interfere with people's ability to read and affect how they learn to read. NICHD conducts and supports a variety of research aimed at understanding the process of reading, the mechanisms of reading disorders, and the best ways to help people who struggle with reading.

About Reading and Reading Disorders

Reading is the process by which a person gets information from written symbols such as letters, characters, and words. A person can read using sight or touch, such as when a vision-impaired person reads braille. Reading disorders occur when a person has trouble reading words or understanding what they read.

How does reading work?

Reading is a complex, multipart process.[1,2,3,4,5] View a slideshow (/newsroom/resources/spotlight/082015-reading-slideshow) that explains the process.

Phonemic Awareness

Figure 1: Phonemes and Speech

Spoken words are made up of smaller pieces of sound—called **phonemes**.

The English language has about 40 phonemes. When someone says a word, the sound comes out as one continuous stream (Figure 1). The brain must be able to separate the sound into pieces. For example, the word "bag" has three phonemes—*/b/*, */æ/*, and */g/*.

Understanding that words are made up of individual sounds is a key part of learning to read. An important skill that helps readers is called **phonemic awareness,** which refers to the ability to identify and manipulate (or work with) the individual sounds that make up a spoken word.

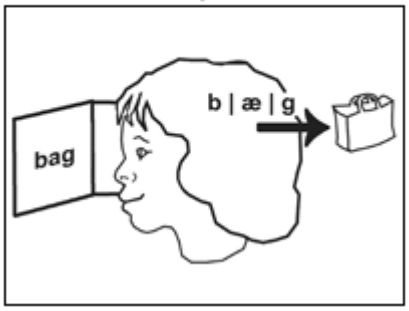
Phonemes make up spoken words, and words only make sense when these phonemes are combined in a particular order. Phonemic awareness can be taught and learned using activities such as rhyming games.

Another way to teach and learn this awareness is to work with single phonemes in spoken words, such as identifying the first sound in *cat* as */k/*. Part of this learning is also realizing that a change to a single sound or phoneme can change the meaning of the word. For example, changing the */g/* in *bag* to a */t/* gives us the word *bat*, which has a different meaning from *bag*.

The Alphabetic Principle and Phonics

In alphabetic languages such as English, another part of learning to read is understanding that letters of the alphabet stand for sounds or phonemes. A phoneme can correspond to one letter or a group of letters. This knowledge is called the **alphabetic principle** (Figure 2).

Figure 2: The Alphabetic Principle



When students use the letter-sound pairings to sound out printed words, it is called **phonics**. This requires learning to pair their knowledge of the sounds in words (phonemic awareness) with their skill at recognizing letters.

To better understand phonics, think about how you read a made-up word like “blit” or “fratchet.” Even though you don’t know the made-up word or what it means, you can read it by figuring out what sounds the letters make. Then you can sound it out and pronounce it.

Phonemic awareness and phonics skills help readers sound out new words.

Vocabulary

Knowing that a word has meaning is an important part of learning to read. The words we know are called our **vocabulary**.

Learning vocabulary starts very early in life. Infants and toddlers look at what you are talking about and say their first words to get what they need or want. As toddlers grow, they learn more and more words. By the time they start to sound out words to read, most children can recognize many of the words they are sounding out. They know they have heard those words before, and they know what the words mean. This is why having a good vocabulary is so important to reading.

Fluency

As a reader continues to develop phonics skills, a specific reading skill called **fluency** also improves. Fluency goes beyond just pronouncing or knowing words. It includes many parts:

- Being able to read quickly
- Reading words accurately
- Saying words and sentences with feeling
- Stressing the right word or phrase so a sentence sounds natural and conveys the correct meaning

Comprehension

Understanding the information that words and sentences communicate is another important part of reading. This is called **comprehension**. Comprehension is the main goal of learning to read. There are many ways to improve comprehension:

- **Building vocabulary.** Readers with a bigger vocabulary can recognize more words and better understand the overall meaning of the text.
- **Understanding the structure and organization of text.** Readers who know what to expect can better comprehend what they are reading.
- **Understanding different types of texts.** Teachers can give students strategies or guidelines for understanding a newspaper, a fiction book, a textbook, or a menu.

Such strategies teach students to ask and answer questions about what they are reading, summarize paragraphs and stories, and draw conclusions from the information.

These skills are the foundation for understanding science, history, social studies, math, and the many other subjects students will study throughout their education.

Citations

1. Berninger, V. W., Abbott, R. D., Vermeulen, K., & Fulton, C.M. (2006). Paths to reading comprehension in at-risk second-grade readers. *Journal of Learning Disabilities*, 39(4), 334–351. doi:10.1177/00222194060390040701
2. Foorman, B. R., Breier, J. I., & Fletcher, J. M. (2003). Interventions aimed at improving reading success: An evidence-based approach. *Developmental Neuropsychology*, 24(2-3), 613–639. doi:10.1080/87565641.2003.9651913
3. Richards, T. L., & Berninger, V. W. (2008). Abnormal fMRI connectivity in children with dyslexia during a phoneme task: Before but not after treatment. *Journal of Neurolinguistics*, 21(4), 294–304. doi:10.1016/j.jneuroling.2007.07.002
4. Lyon, G. R., & Moats, L. C. (1997). Critical conceptual and methodological considerations in reading intervention research. *Journal of Learning Disabilities*, 30(6), 578–588. doi:10.1177/002221949703000601
5. *Eunice Kennedy Shriver* National Institute of Child Health and Human Development. (2019). *National reading panel publications*. Retrieved September 16, 2019, from https://www.nichd.nih.gov/about/org/der/branches/cdbb/nationalreadingpanelpubs

What is the best way to teach children to read?

The NICHD-led National Reading Panel, formed by Congress in the late 1990s, reviewed decades of research about reading and reading instruction to determine the most effective teaching methods. The panel found that specific instruction in the major parts of reading (phonemic awareness, phonics, fluency, vocabulary, and comprehension) is the best approach to teaching most children to read. Instruction should also be systematic (well-planned and consistent) and clear. These findings on reading instruction are still relevant today.

Watch our video and learn what NICHD research is teaching us (https://www.youtube.com/watch?v=aCRmWQ_Gf1Y) (/external-disclaimer) about reading and the brain, and what works when teaching young learners with dyslexia how to read.

Dyslexia Research at NICHD: A Get To Know NICHD Video
https://www.youtube.com/embed/aCRmWQ_Gf1Y

Text Alternative (/about/profiles/KnowNICHD/miller/VTA)

There are multiple ways to teach and learn reading. Some methods work better than others, and some readers learn better from one method than they do from another. Reading aloud is considered the best way for caregivers to prepare a child to learn to read.[1]

The panel's analysis showed that the best approaches to reading instruction have the following elements:[2]

- Explicit instruction in phonemic awareness
- Systematic phonics instruction
- Methods to improve fluency
- Ways to enhance comprehension

Since the panel's report, NICHD-supported researchers have built on the panel's findings. For example, new discoveries shed light on how learning changes the brain and how to teach most effectively. Learn more about these and other research findings in NICHD Looks Back on 50 Years of Learning Disabilities Research (/newsroom/news/071719-learning-disabilities).

Additional findings are listed in NICHD's news items related to reading and reading disorders (/newsroom/news?topic=reading&year=all).

Browse NICHD publications about teaching children to read (/publications/list/collection?g=7&col=18&cat=all).

Citations

1. Handler, S. M., & Fierson, W. M. (2011). Learning disabilities, dyslexia, and vision. *Pediatrics*, 127(3), e818–e856.
2. National Reading Panel. (2000). Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction. NIH Pub. No. 00-4769. Retrieved August 19, 2019, from https://www.nichd.nih.gov/publications/pubs/nrp/smallbook

What are reading disorders?

Reading disorders occur when a person has trouble reading words or understanding what they read. Dyslexia is one type of reading disorder. It generally refers to difficulties reading individual words and can lead to problems understanding text.

Most reading disorders result from specific differences in the way the brain processes written words and text.[1] Usually, these differences are present from a young age. But a person can develop a reading problem from an injury to the brain at any age.

People with reading disorders often have problems recognizing words they already know and understanding text they read. They also may be poor spellers. Not everyone with a reading disorder has every symptom.

Reading disorders are not a type of intellectual or developmental disorder (/health/topics/idds), and they are not a sign of lower intelligence (/newsroom/releases/110311-dyslexia-IQ) or unwillingness to learn.

People with reading disorders may have other learning disabilities, too, including problems with writing (/health/topics/learning/conditioninfo/signs#dysgraphia) or numbers (/health/topics/learning/conditioninfo/signs#dyscalculia). Visit our topic on learning disabilities (/health/topics/learningdisabilities) for more information about these problems.

Types of Reading Disorders

Dyslexia is the most well-known reading disorder. It specifically impairs a person's ability to read. Individuals with dyslexia have normal intelligence, but they read at levels significantly lower than expected. Although the disorder varies from person to person, there are common characteristics: People with dyslexia often have a hard time sounding out words, understanding written words, and naming objects quickly.[1]

Most reading problems are present from the time a child learns to read. But some people lose the ability to read after a stroke (/health/topics/stroke) or an injury to the area of the brain involved with reading (/health/topics/tbi).[2] This kind of reading disorder is called **alexia**.

Hyperlexia is a disorder where people have advanced reading skills but may have problems understanding what is read or spoken aloud. They may also have cognitive or social problems.[3,4]

Other people may have normal reading skills but have problems understanding written words.[5]

Reading disorders can also involve problems with specific skills:

- **Word decoding.** People who have difficulty sounding out written words struggle to match letters to their proper sounds.
- **Fluency.** People who lack fluency have difficulty reading quickly, accurately, and with proper expression (if reading aloud).
- **Poor reading comprehension.** People with poor reading comprehension have trouble understanding what they read.

Citations

1. Hulme, C., & Snowling, M. J. (2016). Reading disorders and dyslexia. *Current Opinion in Pediatrics*, *28*(6), 731–735. Retrieved August 19, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293161/
2. Cherney, L. R. (2004). Aphasia, alexia, and oral reading. *Topics in Stroke Rehabilitation*, 11(1), 22–36. Retrieved February 21, 2020, from https://www.ncbi.nlm.nih.gov/pubmed/?term=14872397
3. Ostrolenk, A., Forgeot d'Arc, B., Jelenic, P., Samson, F., & Mottron, L. (2017). Hyperlexia: Systematic review, neurocognitive modelling, and outcome. *Neuroscience and Biobehavioral Reviews*, 79, 134–149. Retrieved August 19, 2019, from https://www.ncbi.nlm.nih.gov/pubmed/28478182
4. American Speech-Language-Hearing Association. (n.d.). *Disorders of reading and writing*. Retrieved August 19, 2019, from https://www.asha.org/Practice-Portal/Clinical-Topics/Written-Language-Disorders/Disorders-of-Reading-and-Writing/
5. Landi, N., & Ryherd, K. (2017). Understanding specific reading comprehension deficit: A review. *Language and Linguistics Compass*, 11(2), e12234. Retrieved August 19, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6051548/

What are the symptoms of reading disorders?

People with reading disorders often have different combinations of symptoms.

Symptoms can include:[1,2,3]

- Problems sounding out words
- Difficulty recognizing sounds and the letters that make up those sounds
- Poor spelling
- Slow reading
- Problems reading out loud with correct expression
- Problems understanding what was just read

Citations

1. International Dyslexia Association. (n.d.). *Definition of dyslexia*. Retrieved August 2, 2019, from https://dyslexiaida.org/definition-of-dyslexia/
2. International Dyslexia Association. (n.d.). *Frequently asked questions*. Retrieved August 13, 2019, from https://dyslexiaida.org/frequently-asked-questions-2/
3. Hulme, C., & Snowling, M. J. (2016). Reading disorders and dyslexia. *Current Opinion in Pediatrics*, *28*(6), 731–735. Retrieved August 21, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293161/

How are reading disorders diagnosed?

Providers usually use a series of tests to diagnose a reading disorder. They assess a person's memory, spelling abilities, visual perception, and reading skills. Family history, a child's history of response to instruction, and other assessments might also be involved.[1]

Although NICHD studies reading and reading disorders, the institute is not involved with setting definitions or guidelines for diagnosing reading disorders.

The U.S. Department of Education offers services and assistance for people with reading disorders through its Office of Special Education Programs (OSEP) (https://www2.ed.gov/parents/needs/speced/resources.html).

OSEP also supports the Center for Parent Information & Resources (https://www.parentcenterhub.org/) (/external-disclaimer), which can help parents learn about their children's reading or other learning disorders. The center helps parents find professionals to assist with children's treatment and education. It also provides information about the laws and policies related to education for a child with a reading disorder or learning disability. Each state has a Parent Training and Information Center. Find a center near you (https://www.parentcenterhub.org/find-your-center/) (/external-disclaimer).

The organization Understood (https://www.understood.org/) (/external-disclaimer) provides resources to parents, families, and educators to understand and support children with reading or other learning challenges, including steps to take after a child is diagnosed with dyslexia (https://www.understood.org/en/learning-thinking-differences/signs-symptoms/could-your-child-have/im-concerned-my-child-might-have-dyslexia-now-what?_ul=1*1372qhz*domain_userid*YW1wLUsxc19rZ0szTWtuU3pNYlE5c01pc1E.) (/external-disclaimer).

Citations

1. Hamilton, S. S., & Glascoe, F. P. (2006). Evaluation of children with reading difficulties. *American Family Physician*, *74*(12), 2079-2086. Retrieved February 20, 2020, from http://www.aafp.org/afp/2006/1215/p2079.html

What causes reading disorders?

Reading disorders involve specific, brain-based difficulties in learning to recognize and decipher printed words. There is no single known cause at this time.[1]

Environmental factors—such as children's experiences in the classroom or whether they were read to often as preschoolers—can play a significant role in reading ability.

In addition, research suggests that difficulty with reading may be linked to a person's genes. This finding means that reading disorders can pass from one generation to the next. For example, some cases of reading disorders are associated with a change in genes that play a role in prenatal brain development.[1]

Citations

1. Hulme, C., & Snowling, M. J. (2016). Reading disorders and dyslexia. *Current Opinion in Pediatrics*, *28*(6), 731–735. Retrieved August 21, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293161/

What are common treatments for reading disorders?

The best treatment strategy for a reading disorder depends on the needs of the individual. In general, teachers with special training provide the most effective instruction. The instruction should be intensive. And the earlier children receive help, the better the results.

Reading disorders cannot be "cured." But with proper instruction, people with these disorders can overcome specific problems, learn to read, and improve fluency and comprehension.[1]

There is no single treatment for reading disorders. The following sources provide reliable information about the many treatment options available:

- U.S. Department of Education (ED), Institute of Education Sciences: What Works Clearinghouse (https://ies.ed.gov/ncee/wwc/FWW/Results?filters=,Literacy)
- ED, Office of Special Education and Rehabilitative Services (https://www2.ed.gov/about/offices/list/osers/osep/index.html)
- International Dyslexia Association: Dyslexia Handbook: What Every Family Should Know (https://dyslexiaida.org/ida-dyslexia-handbook/) (/external-disclaimer)

Read more about educational treatments for children with reading disorders and other types of learning disabilities at NICHD's Learning Disabilities (/health/topics/learning/conditioninfo/treatment) A to Z webpage.

Citations

1. Snowling, M. J., & Hulme, C. (2012). Interventions for children's language and literacy difficulties. *International Journal of Language & Communication Disorders*, *47*(1), 27–34. Retrieved August 21, 2019, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3429860/

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