Neurobiology

It is true that dyslexia can be described as an unexpected difficulty with reading and writing *not* related to emotional problems, vision or hearing impairment, lack of school attendance or low IQ, but more useful definitions will now also mention "a phonological deficit leading to decoding weakness". In other words they reflect what we now know about cause and the real possibility of remediation.

Popular wisdom said that dyslexics did "mirror" writing (reversing letters), had poor visual memory and were mainly male and left-handed.

The empirical knowledge that began to give an understanding of the causes of reading difficulties through comparing selected groups of children and providing specific teaching interventions began to accumulate in the 1970's (*see Educational Research*) .
There is also an important biological line of enquiry. *(For a detailed review of the history see Chapter 6 of "Overcoming Dyslexia" by Sally Shaywitz, M.D.)*

In the 1950's Norman Geschwind had studied actual brain gyri in post mortem research, and he found differences for individuals with histories of reading difficulties mainly in their left hemisphere language processing structures. His findings and theories were corroborated twenty years later in more post mortem work sponsored by the Orton Dyslexia Society in the USA. The neurobiological origins of dyslexia then became an important focus of study.

Nowadays it is possible to see brain activity while a person reads by means of brain imaging (fMRI - functional Magnetic Resonance Imaging). The printed word registers as a visual icon and then must be transformed into the important sounds (phonemes) of language. *Once more remember that phonemes are not written letters : print representing the sounds in speech has to turn back into speech sounds.* Then links with meaning are activated.
Crucially this technology shows that different activation patterns occur for dyslexic readers compared to good readers, and also there are different patterns over time for good readers compared to dyslexic readers.

Therefore we know that dyslexics have a core difference within their brain's language processing system. Usually, this deficit is genetic and remains hidden until the individual is learning to read and write. We all have a complex mechanism for discriminating sounds that make up the infinite possibilities of our spoken language and we develop the ability to speak and understand spoken language "naturally." In reading, however, we must link abstract, man-made symbols (the alphabetic code) with phonemes. This is where the problem occurs for someone who's dyslexic. Though widely distributed neural systems are also involved, studies have shown that dyslexics strive slowly and laboriously to use two important brain regions (parieto-temporal to occipito-temporal) that work smoothly for others.