



Neurobiological Factors and Learning Disabilities

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It is important for parents and educators to carefully think about how they conceptualize learning disabilities (LDs). Many of us have had the concept of constitutional factors engrained into our consciousness when we evaluate students with LDs. More recent neurobiological research suggests that these conceptualizations need to be altered, particularly if the goal is to change the special education system into one oriented towards results, and not just process. Thus, all good instruction is brain-based and response to instruction must drive the search for constitutional factors that contribute to LDs.

As we reviewed in our book on LDs (Fletcher, Lyon, Fuchs, & Barnes, 2007), recent investigations of learning disabilities question the presumption that LDs are simply and directly caused by neurobiological factors. In fact, the interactions between neurobiological and environmental factors that occur in the development of students identified with LDs are necessary to assess in order to predict a student's response to intervention. Together with the neurobiological research, such studies suggest that LDs are not direct products of constitutional factors, but reflect the interplay of genes, brains, and experience. Neurobiological factors lead to risk for LDs. However, the neural systems observed to be impaired in students with reading disabilities are malleable and plastic if the environment is altered in a way that is intense enough to impact these areas of the brain.

The interaction between neurobiology and constitution is most apparent in recent functional neuroimaging studies of students with reading disabilities that use functional magnetic resonance imaging to measure the metabolic or neurophysiological changes that take place when a person engages in cognitive activity. Multiple studies have imaged the brain before and after reading intervention. These studies have found that effective instruction changes brain function and that the changes are predominantly associated with normalization of brain function as opposed to compensatory patterns representing mediation by areas of the brain not usually involved in reading. Thus, instruction leads to the development of the neural networks that must be in place to mediate reading.

These findings are consistent with studies of the genetics of reading disability. Different studies have shown that while half or more the variability in reading performance can be accounted for by heritable factors, environmental factors also account for a significant amount of this variability. These environmental factors involve the language/ literacy and instructional environments in which a student develops. Although the association of economic disadvantage and achievement is well-known, it is also apparent that families in which the parents have reading problems often do not engage in literacy activities that promote the development of literacy and language skills. Instruction is another example of an environmental variable associated with reading difficulties.

Many studies have found that when intervention is provided for students at-risk early in their development, more students become average readers. Many students who begin remedial programs at older ages also make progress if the intervention is sufficiently intense. However, these students commonly lag in their development of fluency even as they improve in word recognition and fluency. As fluency is a skill that develops with practice and repetition, such deficits may be partly experiential, reflecting beginning reading problems that limit the student's access to print.

These findings are important in the context of current efforts to revitalize the construct of LD through response to instruction models, reflected in the most recent reauthorization of IDEA. Many students eventually identified with LDs may master academic skills if instruction is matched to their learning needs early in their development. The most important inclusionary criterion for determining the presence of LDs may involve ensuring that the student has received quality instruction. If a student receives quality instruction in the general education classroom and, if needed, supplemental interventions that extend the amount and intensity of instruction, LDs would represent those who are difficult to teach. Such intractability is not predicted by an IQ-achievement discrepancy. Rather, students who are difficult to teach can only be identified through efforts to instruct the child with careful monitoring of progress. This is the basis for the opportunities in the reauthorization that permit states to drop IQ tests from the identification of LDs and to move towards response to instruction approaches. The opportunities in the reauthorization are not mandates or requirements, but opportunities for each state to reauthorize

the construct of LDs into one that is meaningfully related to instruction. These opportunities are consistent with what is known about neurobiological factors that make students with LD s difficult to teach, not unable to learn.

References

Fletcher, J.M, Lyon, G.R, Fuchs, L., & Barnes, M.A. (2007). Learning disabilities: From identification to intervention. New York: Guilford Press