

## **The Cerebellum and Autism**

Written by Stephen M. Edelson, Ph.D.

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The cerebellum is a relatively large portion of the brain and is located near the brainstem. It is primarily responsible for motor movements, and damage to this area during the birth process can cause cerebral palsy, a disorder characterized by uncontrollable motor movements. There is also some recent evidence that the cerebellum is partially responsible for speech, learning, emotions, and attention.

In the late 1980's, Dr. Eric Courchesne used magnetic resonance imaging (MRI) to examine whether autistic individuals have any structural brain abnormalities. He found that two areas of the cerebellum, lobules VI and VII, were significantly smaller in autistic individuals than in the non-autistic population. This abnormality is called 'hypoplasia' and seems to hold for all ages. Those who were more impaired tended to have much smaller lobules. Interestingly, there was a small group of autistic individuals whose lobules VI and VII were much larger than normal; this condition is called 'hyperplasia.'

Dr. Courchesne has conducted research on the relationship between attention and each these two lobules. He has concluded that they may be responsible for shifting attention. An inability to shift attention in a timely manner is one of the primary problems in autism, according to Dr. Courchesne. For most people, it takes a short period of time, less than a second or two, to redirect attention from one stimulus to another in the environment. In contrast, autistic individuals continue to attend to a stimulus even when prompted for redirection, and they may take three to five seconds or longer to shift their attention. Dr. Courchesne feels that young autistic children have difficulty directing their attention to changes in their surroundings; and by the time they do shift their attention, they lose information regarding context and content. For example, if an autistic child is attending to a toy and a parent starts talking to him/her, it may take a few seconds before he/she can attend to and listen to the parent. As a result, the child has difficulty understanding the parent because he/she did not attend to the first few sentences.

It is thought that the reduction in size in lobules VI and VII are a result of lack of development in utero rather than due to atrophy or damage postnatally. In addition, it is not known what causes this problem. However, researchers speculate it may be due to oxygen deprivation, infection, toxic exposure, and/or may be genetically transmitted.

It should also be mentioned that autopsies of autistic individuals have not revealed any evidence of smaller lobules VI and VII. This discrepancy with Dr. Courchesne's findings needs to be further examined. However, autopsy studies have shown a dramatic reduction in Purkinje cells in the cerebellum. These cells are rich in the neurotransmitter serotonin (a and are responsible for inhibition. Interestingly abnormal levels of serotonin are well-documented in individuals with autism and may be linked to faulty arousal and problems in mood regulation.

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