What we know About Neuro-Pathways and Dyslexia: Average-Gifted Intelligence

I. The brain formation of people with dyslexia is different than the norm.

a. Speech is processed and produced preferentially by the left hemisphere. Phonological perception and production is primarily specialized in the left hemisphere (Gazzaniga; Ojemann and Mateer). In most people, the left planum temporale (the portion of the brain implicated in language processing) is not symmetrical. It is symmetrical in dyslexics (Galaburda). Highly significant correlations were found between the extent of hemispheric asymmetry and degree of auditory temporal processing deficits (Tallal, Sainburg and Jerigan).

b. A portion of the frontal cortex contains ectopias (unusual bulges). Damage to this area has been known to lead to aphasia. Studies have indicated a different pattern of learning when the ectopias are present. Ectopias depress performance on discrimination learning. Learners make fewer correct choices and take longer to respond. The people with ectopias are very capable of learning. It just takes them longer (Galaburda, et al).

c. Damage to the left cerebral hemisphere disrupts the rapidly changing acoustic spectra regardless of whether stimuli are verbal or nonverbal. Slowly changing information processing remains intact, regardless of whether it is verbal or nonverbal (Kimura and Archibald, Ojemann and Mateer).

d. Processing of information presented over longer durations such as environmental noises, scene analysis or coordination of gross motor movements is not expected to be impaired (Liberman and Shankweiler).

e. Dysfunction of higher level speech processing, necessary for normal language development may result from difficulties in the rapid processing of basic sensory information entering the nervous system in rapid succession. This deficit affects multisensory modalities and motor output. These deficits cause a cascade of deficits.

i. Disruption of effective and efficient phonological system

ii. Time available for acoustic processing is important for sequential memory processing (Tallal).

iii. Primary temporal processing deficit may result in a form of auditory deprivation that alters neuronal mapping and connections across the auditory system

iv. Retards development of complex acoustic processes

v. Causes deficits in perception of rapid and sequential changes within speech leads to more global delayed development of receptive language (Tallal)

f. The vast majority of children identified in preschool as developmentally language impaired exhibit inordinate difficulty learning to read when they reach elementary school (Tallal, Curtis and Kaplan)

g. Both dyslexic and language impaired children show deficits at various levels of temporal integration of basic sensory information

i. Both groups are plagued by deficits in rapid sequential, fine motor performance (Wolff, Katz, Curtis and Tallal)

ii. Both groups have a deficit in nonverbal auditory temporal processing and reading of nonsense words (decoding skills) (Tallal)

h. Individuals with Dyslexia with normal oral language scores

i. Do NOT have phonological decoding deficits

ii. Do NOT have temporal processing deficits in any sensory modality

iii. Do have difficulties with higher level analysis (Galaburda and Livingston)

II. Differences in the structure of thalamocortical magnocellular systems are found in dyslexics – in the VISUAL system and/or the AUDITORY system. (Magnocellular systems respond most strongly to rapid, changing or moving peripheral stimuli) No difference is found in parvocellular systems. Parvocellular systems respond strongly to detailed static stimuli presented centrally.

a. In a study of visual processing speed, dyslexic 10 year old processed at the speed of "normal"8 year olds (Chase and Tallal).

b. Not all dyslexics have visual processing difficulties. Those who do are among the most severely impaired readers. Visual deficits disrupt the quality of all subsequent linguistic analysis. It becomes difficult for those with visual and auditory processing difficulties to develop a compensatory sight vocabulary (Leffly and Pennington).