Scientists Find Hereditary Form of Dyslexia

Classroom teachers have known and reported for years that reading disability can run in families. When children without intellectual or emotional handicaps nevertheless have severe problems with reading and writing, educators have observed, such "dyslexia" tends to show up frequently in siblings and parents.

Beginning with this anecdotal evidence, scientists have in recent years been searching for clues to the genetic transmission of dyslexia, and last week a team of psychogeneticists reported preliminary evidence that reading disability is indeed passed from generation to generation. The suggested mode of inheritance, moreover, may lend support to an emerging theory linking learning disability, handedness, migraine headaches and immune dysfunction to the hormones controlling early neurological development.

Four researchers studied nine families with a three-generation history of dyslexia (as indicated by educational histories and performance on a battery of tests). They also analyzed the blood of the 84 subjects, looking for anything heritable—a particular blood type, for example—that might be consistently linked with the presence of dyslexia; any such consistent linkage to a trait for which the gene is known would indicate the location of the dyslexia gene on the chromosomal map.

As reported in the March 18 SCIENCE, the scientists did not find a specific genetic "marker" for reading disability, meaning that they cannot yet pinpoint the dyslexia gene. But they did find that in most families dyslexia was very strongly associated with a "polymorphism" — or biochemical variability—on chromosome 15. The chances of such a strong association are less than 1,000 to 1, the researchers say, indicating that the gene carrying dyslexia must be on chromosome 15; but it does not indicate just where on that chromosome the gene is located, nor does it reveal the body's chemical substance for which the gene codes.

One possibility is that the polymorphism they have identified reflects variability in the gene for beta(β)-2 microglobulin, a small protein whose genetic code is known to be carried on chromosome 15, says geneticist Shelley D. Smith of the Boys Town Institute for Communication Disorder. Emphasizing that such an interpretation is still purely speculative, Smith told SCIENCE NEWS that it is consistent with a recent theory, by Harvard University neurologist Norman Geschwind, that explains intellectual and bodily abnormalities in terms of hormonal influences on early brain development.

Geschwind agrees that the new findings may be strongly supportive of his theory. Beta-2 microglobulin, Geschwind explains, is known to play an essential role in many immune reactions; in addition, he notes, it has been suggested that this same protein is important to the formation of the testes. Testosterone, the male sex hormone, may slow the growth of the brain's left hemisphere *in utero*, Geschwind says, while at the same time suppressing the thymus gland and causing immune dysfunction.

As evidence for this theory, Geschwind and Peter Behan of Glasgow University in Scotland reported last August that they had found significantly higher rates of dyslexia (language resides mainly in the left hemisphere) and immune disease in left-handers than in right-handers (left-handedness is a function of right hemisphere dominance). They also studied patients with migraines and immune disease and found a higher frequency of left-handedness than in the general population. Since August, Geschwind told SCIENCE NEWS, he and Behan have found strong confirmation of these associations in a study of more than 1,000 subjects. Because the fetal testes of males secrete testosterone, Geschwind says, it is not surprising that males are more often dyslexic and more often left-handed. Smith and cohorts also found familial reading problems predominantly among male family members.

Both Smith and Geschwind stress that the role of β-2 microglobulin in dyslexia must remain theoretical until the precise gene is identified. Smith is planning a follow-up study, using recombinant DNA techniques, to probe the β-2 microglobulin gene of dyslexic subjects and test for chemical variation.

Participating in the study along with Smith were geneticist William J. Kimberling, also of Boys Town, psychologist Bruce F. Pennington of the University of Colorado and geneticist Herbert A. Lubs of the University of Miami. —*W. Herbert*

A shared chemistry for brain and body

An animal's reaction to its environment is controlled by both its body and its brain. A single chemical, acting on the body as a hormone or in the brain as a nerve signal transmitter, may trigger these two aspects of response, recent studies of behavior indicate.

The most dramatic parallel action of this sort, according to George F. Koob of the Salk Institute in San Diego, is provided by a chemical discovered only about a year ago (SN: 9/26/81, p. 200). Called corticotropin releasing factor (CRF), it is a 41-amino acid peptide that may "augment stressful effects of the environment," Koob said in New York at the Science Writers Seminar of the Society for Neuroscience.

As a hormone, CRF acts on the pituitary gland to release another hormone known to be part of the body's response to stress. In recent work Koob finds, in addition, that CRF injected directly into the brain causes a dramatic, stressful effect on rats. The treated rats put in an unfamiliar box "hung very close to the side walls and seldom ventured into the center," he reports. Koob says this hormone-neurotransmitter system "may have developed as a means for an organism to mobilize not only the pituitary adrenal system, but also the central nervous system in response to environmental challenge."

A second example of brain and body sharing a chemical signal is vasopressin, a hormone released from the pituitary gland during stress. Vasopressin causes the kidneys to retain water and produces increases in blood pressure. This hormone also prolongs memory in some learning tasks (SN: 2/14/81, p. 103). Koob now finds that when small amounts of vasopressin are injected into a rat's brain, there are no effects on water retention or blood pressure. So the vasopressin is not exerting its hormonal role in the body. But due to vasopressin's brain influence, memory is again improved on a learning task — a thirsty rat seeking its water bottle. Koob thus suggests that vasopressin is involved in two ways in a highly stressed animal's attempt to employ its memory.

An advance in mapping the pleasure centers of the brain was also described by Koob. He uses a rat trained to press a lever in order to receive a dose of heroin. He injects directly into the rat's brain a chemical antagonist, which competes with heroin for its receptors. The rat then presses the lever more often, in order to receive more heroin. Koob says that for locating responsive brain regions this method gives a clearer measure, a positive behavioral change, in response to a negative effect, interference with reward.

Koob also finds that an analog of one of the brain's intrinsic opiates, when injected into certain areas of the brain, increases the rat's level of general activity. "This activation of the animal might reflect a euphoric effect," Koob says. Now he wants to determine whether addictive opiate drugs act at the same sites, and whether these findings relate to the way people normally feel pleasure and avoid pain. He calls his work "a phrenology of neurotransmitter function." —*J.A. Miller*