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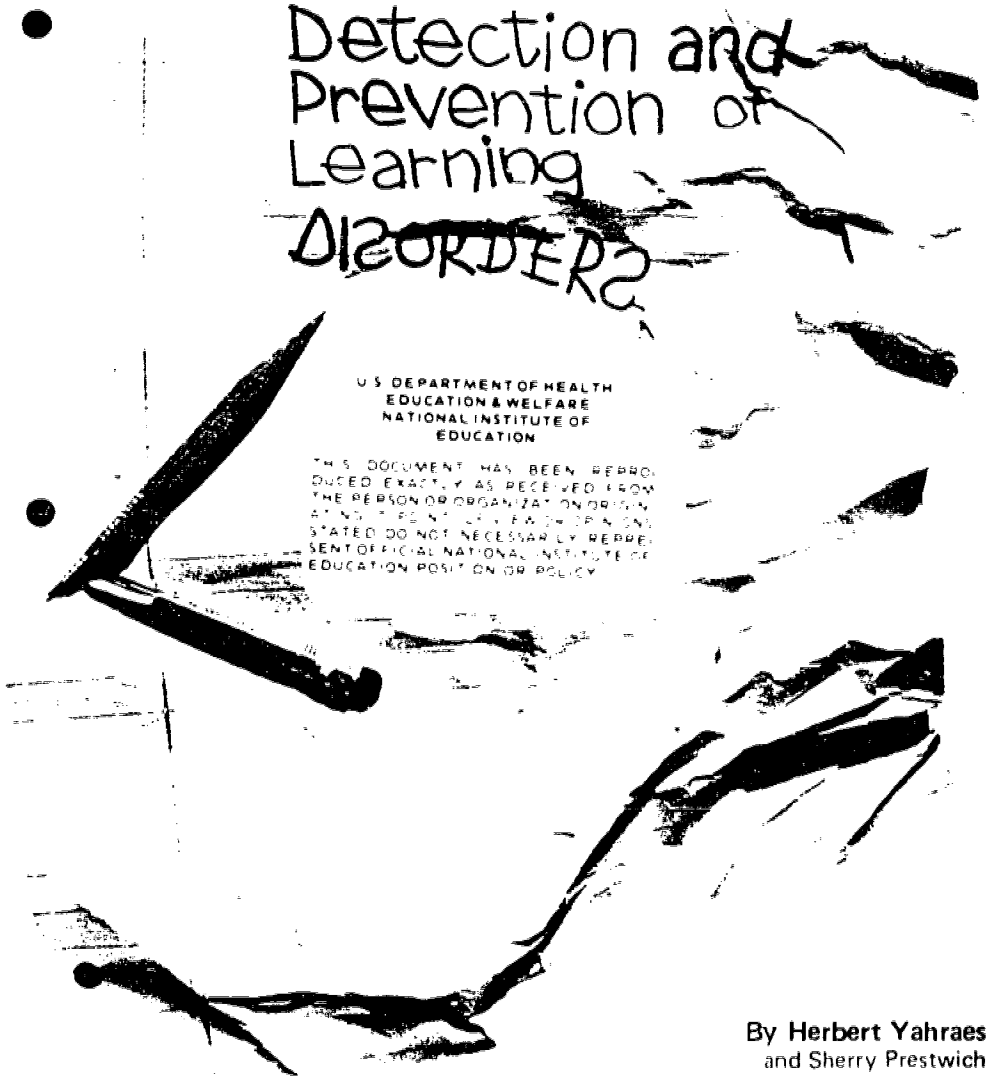
ABSTRACT

The document provides an overview of learning disabilities and described are various approaches to the detection and prevention of these handicapping conditions. Discussed in the introduction are definitions of learning disorders, the multiple nature of the handicap, and maturational lag as a cause. A section on clinical approaches covers research in such areas as cerebral dominance, the role of the brain's hemispheres, signs of neurological deficits, results of intervention, and scanning tests. An experimental approach is discussed in another section which reviews tests, their predictive value, and some results of intervention. Basic causes of learning disability are noted in a final section including hereditary and environmental factors, and complications of pregnancy and birth. (IM)

Detection and Prevention of Learning Disorders



By Herbert Yahraes
and Sherry Prestwich

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foreword

Learning disability is one of the most prevalent afflictions of childhood. Unless it is detected and prevented, or successfully treated, the outcome may be disastrous for the child, parents, and ultimately, for society-at-large. Among children referred to psychiatric clinics because of disturbed or disturbing behavior, a learning problem is one of the commonest signs. It is the greatest single reason children drop out of school—700,000 of them each year—and it characterizes 75 percent of the children who find themselves in juvenile detention centers.

Studies of the relationship between learning disorders and mental health shed light on both fields and highlight the kinds of day-to-day problems of living encountered by children and their parents that are a prime concern of the National Institute of Mental Health. Moreover, the study of learning disorders encompasses a large sampling of the scientific disciplines represented in the mental health field—from psychology and related behavioral sciences to biological disciplines such as neuroanatomy and pharmacology. The critical act of learning involves all that is human—perception, cognition, motivation, and emotional functioning.

This report describes in some detail the work of investigators devoted to research on the complex problem of learning disorders, including studies of causes as well as prevention. It was produced by the NIMH Division of Scientific and Public Information, directed by Dr. Julius Segal, as one of a continuing series designed to communicate the outcome of especially significant Institute efforts. It is intended that the report will be of use not only to mental health researchers, clinicians, and educators, but also to the general public, the ultimate consumer of the fruits of the Institute's endeavors.

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detection and prevention of learning disorders

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INTRODUCTION

One of the most pervasive of all mental health problems has been given a variety of names—including learning disability or disorder, specific reading disability, congenital word blindness, strephosymbolia ("twisted symbols"), and dyslexia (literally, "difficulty with words" but commonly used to mean "reading impairment"). By whatever label, it is a significant cause of emotional distress and behavior disorders among children and adolescents, and an important source of family dissension.

The National Advisory Committee on Dyslexia and Related fare, concluded in 1969 that such disorders affect about 15 percent Reading Disorders, Department of Health, Education, and Wel- of otherwise able schoolchildren. The trouble was described as "of sufficient severity to impair seriously the overall learning experience of these students and their ultimate usefulness and adaptability to modern society."

All the terms cited—learning disability, dyslexia, and so on—are used to describe the condition of those children who are severely retarded in reading but are of average or above average intelligence, are free of gross handicaps—sensory, neurological, and psychological—and have had the usual educational opportunities. For no obvious reason, they fail to read adequately, and because of this failure are subjected to years of frustration, humiliation, self-depreciation, and torment. Some, judged retarded because they cannot read, are tragically assigned to classes—and even institutions—for mentally retarded children.

Within the group of severely disabled readers is a subgroup described as "true" or "pure" dyslexics, or as afflicted with "specific" dyslexia. These have at least average intelligence, show no classical neurological signs, and come from middle-class or upper-class families—evidence that they have been culturally advantaged. They are estimated to comprise from 2 to 10 percent of the total.

Reading failure is most prevalent among children who have been culturally disadvantaged. Out of several hundred New York

City pupils studied by one team of investigators, for example, 33 percent had failed to learn to read by the end of the second grade. Among those who failed, 69 percent of the children were from families low on the socioeconomic scale. However, as evidence that reading failure occurs at every level, 30 percent of the children from "comfortable" backgrounds were also among the failures; as were 33 percent of the bright children measured by IQ tests.[1]

For lack of long-term followup studies, which several investigators have now begun, the eventual fate of most such children is unknown in any detail. It is known, however, that many of them become shy and troubled adolescents who turn away from the world and fight themselves. Others turn away from themselves and fight society.

"No single pattern of psychopathology is characteristic," reports Dr. Leon Eisenberg, a child psychiatrist who is associated with Harvard Medical School and the Children's Hospital Medical Center, Boston. "Among the more common patterns are anxiety states that preclude attention to academic tasks, preoccupation with fantasy such that the child is psychologically absent from class, passive-aggressive syndromes in which resistance to parental coercion is subtly executed by a hapless failure to learn, low self-esteem based upon identification with an inadequate parent, and schizophrenic thought pathology in which letters and words become invested with idiosyncratic meanings. Reading failure is a final common pathway for the expression of a multiplicity of antecedent disruptions in learning.

"At the same time, it must be recognized that the reading difficulty is in itself a potent source of emotional distress. Embarrassed by fumbling recitations before his peers, cajoled, implored, or bullied by his parents and his teachers to do what he cannot, the retarded reader is first disturbed and finally despondent about himself."[2]

Bad outcomes, though, are not preordained. The child who is strongly motivated to learn in spite of his handicap can succeed, particularly if he has the encouragement and understanding of parents and teachers and access to tutoring or special classes.* One investigator followed 56 boys, 12 of whom were considered to be severely dyslexic and 8 moderately so. As adults, these 20 still had trouble in reading and spelling, but they were doing at least as well in the world as the others. All had attended an upper-class school.[3] Nelson A. Rockefeller has achieved eminence, even though he has had to struggle since childhood to spell correctly and to read—and to remember that he perceives numbers in the wrong order, so that what he sees as 78, for example, is really 87.[4]

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* With financial aid from the Office of Education (OE), approximately 30 model demonstration centers for children with learning disabilities were being operated in as many States at the start of 1976. The OE's Bureau of Education for the Handicapped expected a number of additional projects to be approved for funding.

A Multiple Handicap

As in Rockefeller's case, dyslexia is usually accompanied by some other deficiency—in writing and spelling, speech, or arithmetic. Occasionally one of these may be more handicapping than the deficit in reading ability; but they are all apparently variants of the same basic trouble.

"The affected children," says the National Advisory Committee on Handicapped Children of the Office of Education, Department of Health, Education, and Welfare, "exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage."

Dyslexic children may also be hyperactive and poorly coordinated, have trouble balancing, and show awkwardness in play. If so, they are the despair both of parents who work for their children's academic success and of those who try to build athletic skills. By one estimate, children with such characteristics comprise about 10 percent of the total number affected.

Signs of trouble, based in part on a list published by the Association for Children with Learning Disabilities,[3] include:

- Failure in reading, spelling, writing, or arithmetic, particularly if the teacher says the child could do the work if he would only try.
- Poor coordination.
- Difficulty in telling right from left (which suggests that the child when reading may have trouble keeping letters and words in order).
- Impulsiveness or overactivity; ease of distraction.
- Confusion in language or speech; failure to understand what is said.
- Frequent display of anxiety or anger because of inability to cope with school or social situations.

Another indication, often, is slowness in learning to talk, though this can be misleading. For example, one son of a prominent researcher on learning disability did not talk until he was 3—a year later than most children. Yet, he readily made his way through school and, with an IQ of 198, was graduated from a leading university summa cum laude. On the other hand, another slow-to-talk youngster, also from a professional family, was labeled a borderline mental defective at 3 and for years had difficulty, first with his speech and then with reading and writing. Speech therapy helped, and at 18, with an IQ of 111, he was ready to enter col-

lege. Had the multiple nature of his handicap been recognized earlier and treated, presumably he would have done even better.[6]

Boys are more likely than girls to have learning disorders. The ratios of affected boys to affected girls range—depending on the study—from 1.3 to 1 at the lower end to 15 to 1 at the upper. Boys are also at greater risk than girls to hyperactivity, behavioral disturbances, autism, and schizophrenia. In the case of learning disorders, this may well be at least partly because the nervous system in boys tends to develop more slowly. Other proffered explanations[7] include:

- The typical girl has more opportunities and incentives for reading.
- Verbal abilities begin earlier in girls.
- Teachers are likely to rate girls higher than boys.
- Girls have a different attitude toward school and learning.
- Reading textbooks in common use carry more material of primary interest to girls.

Maturational Lag as a Cause

Whether the affected child is simply having a terrible time in school or is also a bumbler on the playground, it is essential to remember that the trouble is no fault of his. Researchers have reported a variety of causes—among them, genetic defects, prenatal and perinatal complications, postnatal brain trauma and infection, inadequate teaching, sensory defects, emotional problems, and the complexities of English orthography.[8] Some of these, such as genetic defects, are clearly basic and will be discussed later; others are more likely to be secondary.

Whatever the underlying trouble, there is some tendency to agree that learning disability can be ascribed in general to "maturational lag." This is a delay in the development of certain neurological functions or skills that children must have in order to learn to read.

For any function there is a sequence in maturation. A 3-year-old, for example, can generally draw a circle, when shown one; a 5-year-old, a square; a 6-year-old, a triangle. Also, by the time the child is 6, he generally does fairly well on a test known as finger-localization. In this test, he puts his hands on the table, palms down, and shuts his eyes. The investigator lightly touches one or more fingers, which the child then tries to identify. A 6-year-old generally knows when the two little fingers have been touched, or the two thumbs. But when, for instance, the touched fingers are the second on one hand and the third on another, he cannot point to them; the brain's representation of the fingers, when the eyes are closed, is still immature.

The ability to copy a triangle or to identify the two little fingers when they have been touched has nothing to do with reading skill, in itself. But the investigators have found that the lack of such ability in a school-age child indicates a lag or deficit in the devel-

opment of certain neurological functions. The inability to copy a triangle may be caused by a deficit in the ability to clearly recognize shapes, or by a deficit in visual-motor function—in the ability, that is, to control the fine movements essential for imitating a pattern. In the case of unusually poor finger-localization, the child cannot correctly orient, or visualize the location of, parts of his body; hence, he may have general trouble in recognizing and remembering the orientation of shapes.

As one authority points out, "The complex and interrelated functions required for the normal development of reading and spelling may be disturbed in a wide variety of ways. Children who have difficulties in recognizing shapes, patterns, and sequences of patterns are likely to have troubles when they are asked to identify letters in different sequences." [3]

There may well be complicating factors—for example, the attitude of the parents or the quality of the teaching. One study found that 23 percent of the children in classes taught by adequate teachers (as rated by their principals) failed in reading. Of the children in classes taught by poor teachers, 49 percent failed.[4]

The idea of a maturational lag was advanced as early as the 1920's by the late Dr. Samuel T. Orton, a neurologist who pioneered in the field of learning disorders. He noted that children with such disorders had trouble in orientation (for example, *b* might be perceived as *d* or *p*, and *6* might appear to be *9)*; in sequencing, so that letters—and words, too—might be transposed (*split*, for instance, might be perceived as *spilt*); and in recognizing or in copying shapes (with the result that, in reading, letters might not be recognized, and, in writing, might be grotesquely formed). Additional evidence of something askew in the central processing system was noted by Orton and later investigators. Included were mirror writing, the perception of letters as disjointed (so that *B*, for example, is seen as *13)*, and curious mistakes in the use of words, such as saying "soft" or "cold" when the intent is "hard" or "hot." Only fairly recently, however, have methods been perfected to assess the state of development of essential prereading functions.

There are now a number of test batteries intended for the early detection of learning disability. Some of them have been based on adequate research and have met standards set by the American Educational Research Association and the National Council of Measurement in Education. Others have not.

This report describes in some detail the work of two teams of investigators who have recently developed predictive tests. One team has developed and is continuing to improve a scanning battery that will enable teachers, toward the end of the kindergarten year, not only to predict which children will fail to read at the end of first grade but also to determine what type of intervention each vulnerable child needs. These researchers have also developed a training program for vulnerable children.

The second team has developed a test battery that foretells with considerable accuracy at the very start of kindergarten those children who will fail in reading. Thus, intervention can begin in kindergarten. There are indications that children at risk to learning disorder can be identified even earlier. The developers of another group of tests[1] claim it can appropriately be given to children as young as 2½-years.

Of the research teams whose work is described in this report, one is headed by Archie A. Silver, M.D., clinical professor of psychiatry at New York University Medical School and director of the Learning Disorders Unit of NYU-Bellevue Medical Center, and Rosa A. Hagin, Ph.D., research associate professor of psychology in the same school, and co-director of the Learning Disorders Unit. The other team is headed by Paul Satz, Ph.D., professor of psychology and clinical psychology and director of the Neuropsychology Laboratory, University of Florida.

After describing the work of these investigators, the report discusses research on basic causes of learning disorders.

A CLINICAL APPROACH TO DETECTION AND PREVENTION

Dr. Silver's interest in learning disability began some 25 years ago, soon after he had organized—in the basement of Bellevue Psychiatric Hospital, New York—a psychiatric clinic for children.[1] He thought he understood the children referred to him, until the day Lennie arrived.

As Silver and Hagin have recounted: "Lennie was 10½-years-old then, a chubby, well-developed boy who kept looking about the examining room with frightened eyes. His mother complained that he could not read and that he would not do his school work. His grades were terrible; he had no friends; and he fought with his younger brother. It was the vogue then to explain learning failure as being due to emotional problems, and Lennie had them. . . . But Lennie revealed other interesting problems. His IQ on the Stanford-Binet was 106; his classical neurological examination was normal; his visual and his auditory acuity had no defect."

But he gave an odd performance on the Bender Gestalt and other tests that require the subject to copy a number of geometric figures. For instance, his diamond figures "were distorted in a peculiar dog-eared way, as though he could not decide on the direction to take when he had to draw an angle." Silver and Hagin describe this as "a curious performance, the cause of which we were impelled to understand."

They soon found that Lennie was not an isolated case. In fact 80 percent of the children referred to the clinic because of emotional and behavior problems were reading at a level at least 1 year lower than would have been expected on the basis of their intelligence and schooling. And many of them drew dog-eared diamonds and other distorted figures—evidence either that they were not perceiving the original drawings correctly or, for lack of fine motor

coordination, could not transfer to paper what they saw. There was something wrong with their visual-motor function.

As a group, these 8-to-11-year-olds showed other deficits. For example, they had trouble in "visual figure-ground perception"; that is, they could not pick out a given design when it was embedded in a background design. They had difficulty with the "temporal sequencing of auditory stimuli," meaning the spacing of sounds. Their body image was immature, as shown by their inability to distinguish between right and left and by their poor performance on the finger-localization test, described earlier.

The skills those children lacked, the investigators point out, are those essential to word identification. Before a child can learn to read, he must be able—among other things—to recognize likenesses and differences in complicated forms and to note and remember how one part of a form is oriented with respect to other parts. These problems call for skills in visual perception and for a well-developed memory.

Auditory skills are essential, too, among them the ability to discriminate among sounds and to arrange sounds in accurate sequence—so that one says "necessarily" for instance, instead of "necesserlery," as did one bright 10-year-old known to the investigators.

The beginning reader must also be able to perceive left from right and to be able, if he is to read words in context, to recognize designs that are set into a background.

By 1960, Silver and Hagin had studied 150 children with reading disability. Of these, 100 had been seen at the Bellevue Hospital Mental Hygiene Clinic and 50 in private psychiatric practice. All had been referred primarily for behavior disorder. Their ages when first seen ranged from 8½ to 14 years; their IQ's, from 81 to 123.

Thirty of the children with reading disability were compared with the same number of matched controls. In general, the dyslexic children were found to have perceptual deficits, while the children in the control group did not. A particularly sharp difference was noted in respect to right-left discrimination. Ninety-two percent of the children with reading disability—but no child in the control group—were defective in that skill.

The Question of Cerebral Dominance

Silver and Hagin hypothesize, as did Orton in 1925, that a major difficulty in dyslexia is lack of clear-cut cerebral dominance, particularly for language. In something more than 90 percent of people—those who are naturally right handed, and even a sizable proportion of those who are left handed—verbal information is processed by the brain's left hemisphere, the so-called dominant hemisphere.

The nondominant hemisphere processes important nonverbal information, including the orientation of objects in space, the re-

cognition of complex forms and of the relation between them, and musical memory. Consequently, damage to a certain part of the left hemisphere would wipe out the words of a song; damage to a certain part of the right hemisphere, its melody.[12]

Investigators have found that when individuals with evidence of brain impairment are given an IQ test—specifically, the Wechsler Intelligence Scale for Children—those whose impairment seems to be in the left hemisphere do better on the performance part of the test than on the verbal. Those whose impairment seems to be in the right hemisphere, do better with verbal skills.[13]

To determine cerebral dominance, Silver and Hagin used the so-called arm-extension test, in which the subject extends his arms straight out, with fingers spread. Individuals over 6 years old usually hold one arm slightly higher than the other. The investigators suggest the elevated arm is responding to the forces of the brain's dominant hemisphere. For example, if the right arm is held higher, they see this as a sign that the left hemisphere is dominant, as it is in most people. In that case, the child should be using his right hand for writing. Elevation of the left arm suggests that the right hemisphere is dominant and that the child is naturally left handed. Not all investigators, however, accept this test as valid.

Of the children with reading disability in the Silver-Hagin study, 74 percent showed a discrepancy between the elevated arm and the hand used for writing. Another 18 percent showed no elevation of either hand. Among the children in the control group, no such instances were found. Similar results were obtained in a study of 100 children attending the third and fourth grades of a suburban New Jersey public school.

When a child shows an abnormality on the extension test, the investigators report, the chances are overwhelming—better than 90 out of 100—that he has a reading problem; and if a child has a reading problem, the chances are almost as great that he will show an abnormality on the extension test.

Most of the dyslexic children tested held their left arms higher but were right handed in writing. Silver and Hagin believe, then, that the retarded reader is generally also the child who has not yet achieved clear-cut cerebral dominance for language.

The Question of Handedness

Some authorities in the area of learning disorders believe that trouble can arise when a natural left-hander is trained to use his right hand. This may occasionally be true, but most authorities agree that, in general, a child's learning disability has not been caused by his handedness.

Role of the Brain's Hemispheres

The basic trouble in learning disorders, Silver and Hagin suggest, may be either a functional defect in the hemisphere that is

concerned with the recognition and orientation of patterns, which in most people is the right one, or a functional imbalance between the two hemispheres. In about 9 cases out of 10, they think there has been no actual damage to brain tissue. They object to the diagnosis, "minimal brain dysfunction" (MBD), sometimes applied to learning-disabled children, because they believe it leads parents and teachers to infer that the brain has been damaged and that the outlook, therefore, is less hopeful than it really is. Satz, too, finds the term misleading and invidious. "The question is not whether a child has minimal brain dysfunction," he says, "or whether he shows hyperactivity, or whether he has dyslexia. The question should be: Is he having a language disturbance? If so, we should start there. The question then arises, do some of those having a learning difficulty also have minor neurological problems? We know that they do. But the trouble should not be called MBD. It should be called by its primary name: It's a learning problem."

Dr. Richard L. Masland, chairman of the department of neurology at the Neurological Institute of Columbia University's College of Physicians and Surgeons, has offered a more detailed explanation of the possible role of the brain's hemispheres in dyslexia. "By the time a child enters school," Masland says, "the analysis and use of auditory language are probably centered largely in the left hemisphere.[14] At some point, an association must be established between, on the one hand, the meaning and sound of letters, which are analyzed in the left hemisphere, and, on the other hand, the visual pattern of letters, which presumably is analyzed most effectively in the right hemisphere. In many cases a complex cooperative effort must be required between left and right hemisphere—which may heretofore have been barely communicating with each other."[15]

In children with learning disorders, the implication is that the brain may be having trouble integrating the information processed by one hemisphere with the complementary information processed by the other.

Signs of Neurological Deficits

Among the first group of children studied by Silver and Hagin —Lennie and 40 other children with both emotional problems and learning disabilities—the investigators identified a subgroup with neurological signs. Some of these were "soft," or minimal. They included eccentric pupils, poor ocular convergence, erratic breathing while talking, either hyper- or hypoactivity, and difficulty in sustaining attention. Other signs were "harder," or a firmer indication of organic trouble. Among these were problems with muscle tone, strength, and synergy, meaning the ability of the muscles to carry out a joint operation.* Other signs were of mild

* One test is to try to simultaneously rotate both hands, held in cupped position, from the wrist. A person who lacks synergy, as do some children with learning disorders, cannot do this.

facial paralysis; abnormal responses of deep reflexes, such as those of the knee and the sole of the foot; and "cogwheel-type rigidities," such as bringing the arm down, not smoothly but in a series of ratchetlike movements.

Over the years, these investigators have found that children with neurological signs constitute about 25 percent of those with learning disorders. And in those children, they have found that perceptual defects are more pervasive and more resistant to treatment than in children who have learning problems but no such signs.

Training-Out Deficits

To bolster the usual psychotherapeutic treatment, Silver and Hagin enrolled Lennie and 40 other psychiatric clinic patients in a remedial reading program. On the followup, some 10 years later, the great majority of the former patients, who by that time were young adults, seemed reasonably well adjusted emotionally, socially, and vocationally. But close to 40 percent were still reading at a level far below their general intelligence, and all of them still showed some evidence of perceptual deficits found earlier. Lennie had full-time work in a factory and part-time work in a bar; he was excellent in arithmetic but only at the ninth-grade level in reading.

At this point the investigators decided not only that traditional remedial reading methods were insufficient but also that it was dangerous simply to wait for perceptual and neurological maturation to occur spontaneously. That might never occur, and at best might occur too late—"after the wave of educational failure has already engulfed the child." So they began developing and testing a method that would directly attack the deficits and attempt to train them out. In schools, the teaching of reading starts with the recognition and comprehension of words. But in many cases, Silver and Hagin were convinced, it was necessary first of all to build visual and auditory perception, left-to-right progression, and related skills. Instead of teaching the child to read, they aimed to develop the skills essential to reading.

These efforts continued for a dozen years. Their results were first tested during the late 1960's in a study involving two groups of boys. The boys ranged in age from 7 to 13 years and had IQ's running from 80 to 132. All had been referred to the psychiatric clinic for emotional disorders or behavioral problems, or both. "In them," the investigators report, "the inevitable school failure had already established fixed resistances to learning and had contributed in a great degree to their emotional and behavioral decompensation."

Each child had two training sessions a week, lasting about 45 minutes each and continuing for 50 weeks. During the first 50 sessions, the members of Group I received individual perceptual training built around each boy's particular deficits. For example, if

a boy could not easily recognize and copy geometric forms and other patterns, and, therefore, had trouble discriminating letters and recognizing words, he was drilled in the recognition and copying of designs—simple ones first and then more complex. A boy with normal hearing acuity but an inability to remember a series of sounds in proper order or to discriminate between words that sounded much alike was drilled in auditory sequencing and in the aural recognition of words. During the next 50 sessions, members of this group were tutored in reading through the use of conventional teaching methods. For members of Group II, the order of tutoring was reversed. Each child could thus serve as his own control, and the two groups could be compared.

Some of the defects, particularly in visual memory, proved difficult to correct. More than half of the students required more than 10 hours—several, more than 25—to learn to recognize and copy even quite simple geometric figures.

Of the 58 children involved, 74 percent improved significantly on the perceptual tests. And those who improved on the perceptual tests also improved significantly on tests of oral reading and reading comprehension. No improvement, on either perceptual or reading tests, was associated with the tutoring in reading.

Silver and Hagin now decided that they should try to reach such children before they ended up in a psychiatric clinic. Accordingly, and with the cooperation of parents, teachers, and administrators, they opened a preventive program in the first grade of a public school in the Kips Bay area of Manhattan. This is a mixed area, on the East Side, peopled largely by lower-class families but with sizable blocs of families higher on the socioeconomic scale.

First on the program was an epidemiological survey, accomplished by giving each of 86 children a psychiatric, neurologic, perceptual, psychological, educational, and social evaluation. This resulted in a profile both of each individual, on which to base preventive work if necessary, and of the entire first grade. The latter showed that:

- One-third of all of the first graders in 1969–70 had evidence of perceptual immaturity sufficient to require specific training if they were not to become reading failures.
- The children needing special help to prevent reading disability had IQ's ranging from 70 to 140 and came from all socioeconomic levels. However, those from the lowest three levels were overrepresented in the group needing intervention; those from the highest four levels, underrepresented.
- Twelve percent of all the children in the grade had symptoms of emotional disturbance considered severe enough to warrant treatment. Two-thirds of all the children had mild or moderate symptoms indicating emotional stress. The others, about one-fourth of the total, were considered well adjusted. Of the children selected for special training to

prevent learning disability, about 9 out of 10 had some degree of psychiatric impairment.

Examples of Children With Psychiatric Problems

The statistics reported above show that 75 percent of the first graders studied were considered to have psychiatric symptoms. This is a strikingly high proportion. To demonstrate what they mean by *mild*, *moderate*, and *severe* symptoms, Silver and Hagin have published their criteria and given examples of the children in each group. They have also pointed out that many of the symptoms on which their ratings were based may prove to be transitory.

The examples follow:

"*Mild impairment:* Daniel, 6 years 5 months, IQ 67. Pale child, normal in size. Friendly and interested, but hypokinetic in posture, becoming more rigid as his family and home are discussed, occasional outbursts of aggression at father, fear of fires, rats, and roaches, feels that his building might collapse and that he or his parents will be in accidents. Thinking coherent and relevant, complains of 'stomachaches.' Family situation chaotic.

"*Moderate impairment:* Mark, 6 years 10 months, IQ 109. Depressed and anxious, restless, suspicious. Fear of houses falling and of flying, describes dreams of a submarine crashing into him and cutting his belly open; feels he is being watched and that the teachers and his classmates do not like him; feels he is a bad person and will be punished; suffers from asthma.

"*Severe impairment:* Jorge, 6 years 2 months, IQ 96. Marked anxiety, with fears of separating from mother and later from teacher, becomes clinging and infantile, perseverative, negativistic, hyperkinetic. Attention span very short. He is evasive, with disconnected fragments about cars hitting him, his hitting cars. He bites and tears at his shirt sleeve and wrist. Parents report sleep disturbance, constipation, Spanish-speaking home."

Results of Intervention

For the children with neuroperceptual difficulties—most of whom had a psychiatric impairment, too—a "resource room" was established in the school. Each child went there 20 minutes a day for perceptual training by a regular teacher who had been trained by a supervising teacher from the Learning Disorders Unit of the NYU-Bellevue Medical Center.

When the training began, in the fall of 1969, the reading scores of these children clustered in the lowest segment of the total first grade scores. The following spring, the distribution of scores resembled in a general way that of the total group. A year later, toward the end of second grade, the resemblance was closer, with the scores in both cases ranging from lower than grade 1 level to higher than grade 5. The median for the entire

grade was 2.8. In contrast, the median for the preceding year's second graders, with whom the investigators had had no contact, had been 2.3.

Beyond this, the children in the intervention group whose emotional problems had been considered either mild or moderate needed no psychiatric help. "Success in learning," the investigators conclude, "provided a strong point around which the developing personality could rally."

By grade 5, mental health had improved markedly. In the first grade, none of the children in the 1969–70 group selected for training because of vulnerability to learning disorder was considered to be without psychiatric disability. Four years later—years during which these children received training in prereading skills—the proportion without disability had risen from 0 to 28 percent.

During the same time, the percentage of those with only mild impairment rose from 33 to 44.

The proportion of those with moderate impairment fell from 44 to 23 percent.

Those rated as severely impaired dropped from 23 percent in first grade to 5 percent in fifth.

Children with IQ's around 70 were functioning at higher levels —in the 80's or 90's.

Similar changes occurred in the 1970–71 group.

The investigators are certain that the improvement, at least in most cases, did not occur spontaneously but resulted from the special training.

Scanning Tests

Silver and Hagin have checked yearly on the Kips Bay classes, but have not yet analyzed their data except as reported above (concerning the improvement in mental health). They have also helped institute a similar program in four other New York public schools, in a nursery school for children from 3 to 5 years old, and in several schools of a rural county in North Carolina.

While developing their program of intervention, the investigators also worked to develop a battery of scanning tests and make them applicable to children toward the end of the kindergarten year. Originally they had used 17 tests, plus psychiatric and neurological examinations, so that the whole evaluative procedure took several hours for each child. By mid-1975, they had streamlined the process, limiting it to 10 tests, had tested and standardized these with 534 children from six kindergarten grades of four Manhattan schools, and published a preliminary edition of a manual for their use.

Silver and Hagin say that the 10 tests, comprising a scanning battery they call *Search*, can be given in about 20 minutes and that two trained teachers could test every child in a kindergarten class in two school days. The tests measure visual, auditory, and

intermodal perception and appraise other aspects of neurological development.

In one test, for example, the child is shown an asymmetric figure—it looks like a lamb chop—and is asked to point to the same figure among a number of others. To respond correctly, he has to be able to understand and remember how the figure is oriented, or placed—as to the left and right and horizontally and vertically. Another test, of visual-motor skill, measures ability to copy designs. The skills required for this include visual discrimination, memory, attention, and fine motor control.

A measure called *rote sequencing* is concerned with the child's ability to arrange elements within commonly heard sequences. The subject may be asked, for instance, to say what number comes after eight, or what day was yesterday, or what will next month be. In a test of auditory discrimination, the examiner pronounces pairs of words or syllables that are either the same or vary by one sound; the child responds "same" or "different." An *intermodal dictation* test assesses the child's ability to recognize the names of other kindergarten children when spoken and to pick out these names from a written list. To succeed on this measure, the child has to be able to take information received through one sense, aural, and apply it to a situation involving another sense, visual, as he does in learning to read.

Other tests on the list, the investigators believe, indicate the extent to which the child has matured with respect to body image, which they relate to the establishment of cerebral dominance. Body image is the mental representation an individual has of his body. One aspect of it is spatial orientation, or the ability to tell right from left. Another aspect is "finger gnosis," or finger knowledge, which can be assessed by the finger-localization test.

The investigators arrived at a simple means of scoring the battery. Because they had found in class after class that one-third of the children were vulnerable to learning disorders, they set a cutoff score for each of the 10 tests at the point below which one-third of the children scored. A child falling below that point in a particular test was scored 0 for that test; a child falling above it, 1. The score for the *Search* battery, then, was the sum of the scores on the 10 individual tests. It could range from 0 to 10.

Of 171 kindergarten children who were tested and then given psychiatric and neurological examinations, the lowest one-third scored 5 or less. These were the children considered to need treatment if educational failure was to be avoided.

The intensive clinical analysis found that 80 percent of those scoring from 0 to 3 had "hard," or classical, neurological signs. The examiners suspected that these children had a structural abnormality in the central nervous system. Silver, always putting quotation marks around the word, refers to them as the "or-

ganic" group. They have the same perceptual defects as Silver and Hagin have found in all children with learning disabilities.

These "organic" children comprised slightly more than one-tenth of the entire group. The other 20 percent of the children scoring 0–3, those who did not have "hard" neurological signs, were diagnosed as chronically ill or generally retarded.

The NYU-Bellevue team concludes that children who score from 0 to 3 on this battery of tests should be studied neurologically.

Of the children scoring 4 and 5, two-thirds had learning problems, frequently coupled with "soft" neurological signs. They were diagnosed as having "a developmental language disability," meaning that maturation of the perceptual skills necessary for learning to read seemed to be lagging. With such children, the investigators find that training in prereading skills may be started immediately "with confidence that it will meet the child's needs." In the Silver-Hagin group, such children were 13 percent of the total.

Of the children scoring 6 or 7, significant emotional problems —but no neurological or developmental deficits—were found in 50 percent. These comprised one-tenth of the entire group. For children with such a score, the investigators suggest "exploration of intrapsychic and family dynamics."

Children scoring 8, 9, or 10 were on the whole those who were doing well in reading and other language work.

For direct evidence that the scanning battery actually was picking out the children vulnerable to learning disorders, the tests were given to kindergartners in a control school, where there had been no intervention. Between the battery score at the end of kindergarten and the oral reading score 1 year later, the correlation was .62, which is moderately high. Nobody with a score of 5 or less placed above the median in oral reading; 38 percent of the children with scores of 6 or 7 placed above the median; 87 percent of those with scores of 8 to 10 placed above the median. The correlation between the battery score and the oral reading score 2 years later was .71.

At the end of the fourth grade, the intervention group had only a few members scoring very low in oral reading and in reading comprehension; the control group had 26 percent. On the average and for both abilities, the intervention group was a year ahead of the controls.

After a quarter-century of clinical research and service, then, Silver and Hagin report that their scanning battery, *Search*, will not only predict at the end of kindergarten which children will soon become casualties of the learning process as managed in today's schools, but will also help pick out which among these children are, in addition, at neurological or psychiatric risk. And they believe that their intervention program, called *Teach*, will head off in most cases the threatening learning problems. They

now hope to develop a scanning battery that will accurately predict learning problems, unless intervention occurs, 2 full years earlier, when the child is 3.

Silver and Hagin report that the scanning battery picks out both the children who will have severe reading problems (those scoring in the bottom range) and the children who will have no learning problems (those in the top range) with better than 95 percent accuracy. Some investigators who are impressed with this work believe that more extensive data on the precision of the battery as a whole and the reliability of its components are needed. These investigators would also like to see additional data on the battery's success rate in identifying high-risk children and in avoiding a misidentification of children who are not at risk for learning disabilities.

AN EXPERIMENTAL APPROACH TO PREDICTION AND PREVENTION

Dr. Silver, as has been noted, began research on learning disorders because of his interest in treating disturbed children. Another prominent investigator, Dr. Paul Satz, of the University of Florida, entered the field through quite a different route. As a research psychologist, he was originally interested in the effects of damage to certain areas in one or the other of the brain's hemispheres. He studied adults. Then he began to wonder what might happen if these same areas, instead of suffering damage, simply failed to mature, or matured more slowly than in most children. At the urging of one of his students, Dr. Sarah Sparrow, he planned a program of research to find out.[16]

Along with earlier investigators, Sparrow and Satz hypothesized that children with reading disorders had one or more impairments in brain function. These impairments were caused not by damage but by delay in development. By means of fairly simple tests, it should be possible to detect the trouble early enough to do something about it.

The Florida investigators resolved to put this hypothesis to its first large-scale test with a fairly homogenous population. Their main question was: Could they single out, early in kindergarten, those children destined to encounter severe problems in reading?

Their first sample comprised all the white boys—approximately 500—in the 1970 kindergarten classes of Alachua County, Florida. This county includes Gainesville, seat of the University, and has 20 elementary schools. The study was limited to boys because, as noted earlier, they are much more likely than girls to have learning disorders. And it was limited to whites in order to minimize the effects of sociocultural handicaps, known to be far more common among blacks. In other words, the investigator wanted as pure a population as he could get, so that the results would be uncontaminated by differences of sex or race.

The following year the investigators tested a second group—the 200 white boys in each of the kindergarten classes in five of the county's largest schools.

Battery of Eight Tests

In their efforts to predict which of the children would prove to have reading troubles, the investigators first used 20 measures, which assessed a wide variety of cognitive and developmental skills. Administration took 2½ hours. Analysis of the results showed that virtually the same findings could have been obtained by using less than half of the original battery. The essential measures, which can be given in 30 minutes, were found to be these:

1. The finger-localization test, described earlier.
2. Alphabet recitation, considered to be a test of memory.
3. A recognition-discrimination test, in which the child is shown a geometric design and asked to pick the same design from a group of four figures, all resembling one another.
4. The Beery Developmental Test, which measures the integration of visual and motor abilities. In this test the child is shown a variety of geometric figures and asked to copy them.
5. The Peabody Picture Vocabulary Test. Here the child is shown several pictures at a time and asked to pick out the one illustrating a given object or activity.
6. An auditory-discrimination test, which requires the child to recognize whether pairs of spoken words are the same or different. Some of the pairs consist of the same word; others, of two different but similar sounding words.
7. The Dichotic Listening Test, in which the child puts on stereophonic earphones, hears rapid sequences of digits—a different digit arriving in each ear at the same time—and calls out all the numbers he has heard. Most right-handers report significantly more of the numbers that have been fed into the right ear. Satz believes that this is because what is heard, in the right ear reaches the speech area of the brain's left hemisphere faster than what is heard in the left ear. The investigator hoped that the results of the test would tell him something about the development of cerebral dominance for speech and language but found no clear-cut answer—probably, he thinks, because children of kindergarten age have not yet established complete cerebral dominance for speech. He also expected that the results would be related to verbal fluency, as measured by another test in the original battery. Instead, they proved to be related to the child's ability to hold and retrieve information; that is, they were related to his memory. The Dichotic Listening Test has been retained because it may eventually indicate at what age children develop right-ear superiority and complete cere-

bral dominance for speech, and whether or not failure to do so by a certain age is related to the development of language problems.

8. The socioeconomic status of the child's family as rated by the teacher—either "low" or "average or above."

The first three of these measures were found to be by far the most important. Taken together, they are considered to assess certain abilities—sensory, perceptual, motor, and mnemonic—that are essential to the development of language skills and that are maturing most rapidly during preschool years.

Predictive Value

The original battery of tests given to the first group of kindergarten boys correctly designated 100 percent of the children who were found, almost 2 years later, at the end of first grade, to have severe reading disability. There were 18 such cases. The tests also correctly predicted 71 percent of the 55 boys found to have a mild disability, 84 percent of the average readers, and 95 percent of the superior readers.

On most of the tests of development, the boys who would show either mild or severe reading problems 2 years later lagged behind those who would demonstrate either average or superior reading ability. On the test of visual-motor integration, for example, the boys who would become poor readers had an average performance age of 54.4 months—almost 1 year behind their chronological age of 65.8 months. In contrast, the performance age of the other boys was almost identical with their chronological age.

By the end of the second grade, when more objective reading measures were available, the incidence of reading disability, both mild and severe, had risen from 15 percent to 34 percent. The test battery was found to have predicted 91 percent of the severely handicapped readers and 97 percent of the superior readers. Overall, it was accurate in 76 percent of the cases. This was the third-year followup.

A year later, at the end of the third grade, the findings were almost the same. The incidence of reading disability had not declined, even though many of the reading-handicapped children—all of those judged on the basis of the tests to be severely vulnerable and some of those judged to be mildly vulnerable—had been receiving remedial instruction. Similar results were found during the fifth-year followup, at the end of grade 4.

It should be noted that the results of the tests were not given either to parents or teachers. In the natural course of events, however, the teachers spotted the poorest readers and some of the others and arranged for special treatment.

Satz points out that the measures taken when the children were 5½ years old must have been assessing very stable traits and characteristics; otherwise, their predictive value would have been

sharply reduced by all the changes, including growth and remedial reading instruction, taking place in the child's life during the next 5 years.

"Of particular importance," the investigators report, "is the fact that the tests continued to show greater accuracy for those children destined to extremes of the reading distribution in later years. It is these children that educators must identify, hopefully during primary grades, in order to institute more effective programs for future growth and development."

The tests proved to be much more accurate than the teachers. At the end of the kindergarten year, the latter had been asked to make long-term predictions. They correctly chose most of the children who would prove to be superior readers, but missed most of those who would prove to have severe disability.

In order to validate the findings, the investigators, as noted earlier, tested a second group of boys a year after the first one. At the end of the second grade, the incidence of reading disability in this group was somewhat higher—40 percent—than in the first one, but the percentage of severe cases was the same. The accuracy of the test battery was less striking with the new, and smaller group, but the tests did correctly predict 74 percent of the outcomes, and performed substantially better than that with both the superior and the severely retarded cases. As is customary in validation studies, the predictions were based on the weights derived from the original standardization group. When the weights were derived from the smaller sample, instead, the percentage of correct outcomes increased to 84.

At the beginning of school in 1974, still another cross-validation group was tested—an entire kindergarten class, including girls, as well as boys, and blacks, as well as whites—and predictions were made and reviewed. The results were substantially the same as with the earlier groups.

Some Evidence of Outcome

Satz and his associates view learning disability "as a disorder in central processing, the nature of which varies with the age and developmental status of the child." To check this hypothesis, they tested pairs of younger children (7–8 years) and pairs of older children (11–12 years). In each pair, one of the children was reading-disabled and the other was normal. The younger children with a reading disability were found to score lower than their controls on certain tests of skills that develop earlier in life. On these same tests, however, there was no difference between the older children with a disability and their controls. But on tests to measure cognitive and linguistic skills that develop later, the older reading-handicapped did show themselves at a disadvantage.

In another study, Sparrow and Satz tested a group of disabled and normal readers, all aged 9–11, on a wide range of tasks. In

general, the poor readers did as well as the others on the simpler tasks but not on those that were more complex. Studies by other investigators have shown similar results. There is a suggestion that the younger child with a reading disability eventually develops the same basic skills as other young children; by the time he has caught up, however, he may lag in certain basic linguistic skills that develop later.

The central nervous system (CNS) usually stops growing at about puberty, but there are marked differences among individuals. Studies now indicate that in some persons the CNS keeps developing until the age of 18 or 19. Satz theorizes that if a person is still lagging at that time, he may face long-term difficulties. What these are can only be determined by long-term investigation.

Another investigator has reported that children who became schizophrenic as adults had severe reading problems as children. Whether coincidental or not, only time will tell, but Satz has found in his group of children that those destined to have severe reading problems also had IQ's from 12 to 14 points lower than their matched controls.

In what is believed to be the first study of its kind, the Florida researchers have also determined the proportion of "pure" dyslexics—those with an IQ of at least 90, of middle-upper socioeconomic background, and without evidence of gross neurological or sensory handicap—among their white male populations. It is approximately 5 percent.

When those dyslexics were compared with other reading-disabled boys at the time of the fifth-year followup, an interesting difference emerged: significantly more of the "pure" dyslexics had improved in reading.

Despite that change, the proportion of severe reading casualties in the project remained approximately the same, about 13 percent, during the third, fourth, and fifth years. "This is disturbing," Satz reports, "when one considers the costly school intervention programs underway for these children."

Satz and his fellow workers want to know where reading disability fits into the broad category of developmental disturbances and disturbances of adolescence. They suspect that reading disability may be due to disturbances in processes which underlie many functional behaviors, not just reading. The causes may well vary both in number and nature.

The work with predictive tests has been in preparation for the development of an intervention program starting in kindergarten. Most of the intervention programs now in use began with children who are in second or third grade or even further along. "Why not begin working with them," Satz asks, "when the brain is more plastic, when they have the high-risk signs but have not had the experience of repeated academic failure, and when they don't regard themselves as different or damaged?" Like Silver and Hagin, Satz believes that the child with learning disability

can be trained to overcome the effects of the lag in his neurological and psychological development. This investigator and his associates are now working to determine what form an intervention program should take to be most effective.

In spite of the impressive results through 1975, Satz felt that his work was still in the experimental stage and must be replicated. One large-scale replication got underway that year in Australia, at governmental request.

BASIC CAUSES OF LEARNING DISABILITY

The underlying reason why a child of normal intelligence cannot learn to read and write well—or has extreme difficulty doing so—when taught by the usual educational methods is still a mystery. There is good evidence to support the theory of a lag in the development of the neurological structures that make possible the skills needed in reading. But why—if the brain has not been damaged—the lag? Findings of research concerned with some possible causes are presented in the following sections.

Heredity as a Factor

Beginning with two studies in 1905, numerous investigations have found evidence that learning disorders run in families and apparently can be inherited. The most comprehensive study was conducted by Dr. Bertil Hallgren, at the Psychiatric Clinic in Karolinska Institutet, Stockholm, during the years 1947 and 1950.[17]

Hallgren investigated 112 children with "specific" dyslexia—meaning dyslexia that could not be explained by sickness, neglect, problem families, and the like—and found that 88 percent of them had relatives who were affected. He concluded that the disability probably followed a dominant mode of inheritance. In other words, if one parent carried the gene leading to the development of dyslexia, the odds that a given child would be affected would be about one in two; if both parents carried the gene, one in one. In 17 percent of Hallgren's cases, though, neither of the parents had been affected.

More recent, though less exhaustive, studies found a considerably lower proportion of dyslexics with a family history of reading or other learning problems. A New Jersey investigator, studying 556 children who were or had been enrolled in a special program for children with learning disabilities, found a strong familial pattern in from 30 to 40 percent of them. It was 40 percent in the group for which the most information was available.[18] An Edinburgh, Scotland, study came up with similar percentages: 25 percent in one diagnostic group, 40 percent in another.

However, a 1975 study by the Satz group at the University of Florida arrived at a figure similar to Hallgren's for one group of reading-disabled children. In a sample of 28 families with a "pure" dyslexic child, close to 80 percent were found to have at least one parent who was handicapped in reading. Parents were

considered handicapped if they read at a level at least 2 years below their level of schooling. In contrast, the control group of families had close to 80 percent *without* a reading-handicapped parent. The difference was significant at the .001 level, meaning that the likelihood of its having occurred by chance was only 1 in 1000.

Families of children who had a severe reading disability but did not qualify as "pure" dyslexics had a much lower proportion —about 40 percent—of reading-handicapped parents. Approximately this same proportion of reading-handicapped parents was found among the families of children without a reading disability.

Pregnancy and Birth Complications

Time and again, investigators who have searched the backgrounds of children in an attempt to throw light on the causes of learning disability, and of other disorders, have found an increased incidence of complications of pregnancy and birth. For instance, one research team looked at the relationship of prematurity and complications of pregnancy to seven conditions—cerebral palsy, epilepsy, mental deficiency, behavior disorder, reading disability, childhood tics, and speech disorder. "All but the last," they reported, "were found to be significantly associated with prematurity and complications, the association being strongest with cerebral palsy and descending as the degree of disability decreased."[19]

Some investigators have reported that children who were born prematurely do poorly in reading tests when compared with full-term children of equal intelligence. Others have pointed out that prematurity is commonest among mothers at the lowest socioeconomic levels, and that children of these mothers are much more prone than other children to develop learning disabilities. A study in the United Kingdom—where every child born within a 7-day period was reexamined at the age of 7—found that birth complications and socioeconomic deprivation had debilitating effects on early school achievement. It also found that the rate of prematurity among those children who were failing in reading, writing, and spelling at the age of 7 had been disproportionately high.[8] A longitudinal study in New Orleans indicated that normality or abnormality in developmental competence at the age of 7 could be predicted from prenatal, perinatal, and postnatal information.[8]

All in all, there has seemed good reason to suppose that complications of pregnancy and birth were often a causative factor. But this supposition has now been questioned by several investigators.

One of these is Dr. Larry B. Silver, of the department of psychiatry, Rutgers Medical School, whose findings on the familial incidence of learning disabilities were reported in the preceding section. Silver found that prematurity, pregnancy complications, or respiratory distress at birth had indeed been experienced by

a number of children who had a family history of learning disability. In almost every case, however, these children had brothers or sisters who had not been subjected to such difficulties but, who, nonetheless, had learning handicaps.[19]

This investigator made another intriguing finding. Studying a random sample of 80 of the children, he discovered that the proportion of adopted children among them was several times greater than in the general population. (The expected number of adopted children in a random sample of 80 children would have been 3 on the basis of national figures and 2 on the basis of New Jersey figures; the actual number was 10.)

What is the significance of such a finding? As Silver asks: "Do mothers who place their children for adoption receive less than adequate prenatal care, have a less than adequate diet, deliver their children in community rather than private facilities, or have a physician-in-training deliver their child rather than a fully trained obstetrician? What was the academic ability or success of the mother, the father?"

A study of the preadoption background of the natural parents would have thrown light on the role of such factors, but it could not be carried out. "Although the need for privacy for both the natural and adopting parents is understood," Silver reports, "the refusal to release necessary information, in confidence, for use in a study of this type inhibits further progress in studying the high-adoption rate and the possibility of an inherited familial pattern for these handicapped children." He points out that another research team had studied a similar population, found similar results, and, like him, could not obtain the information necessary to draw conclusions.

Dr. Arnold J. Sameroff, professor of psychology and pediatrics, University of Rochester, has reviewed much of the research dealing with a possible relationship between constitutional factors—such as those resulting from complications of pregnancy and birth—and various disturbances in development and behavior. He emphasizes the difference between retrospective research, which seeks to find out how people get to be as they are by looking backward at what happened to a sample of them, and prospective research, which has the same aim but starts with infants or children and looks forward, noting what happens to them as development proceeds.

Sameroff concludes: "There has yet to be demonstrated a causal connection between a constitutional variable and any personality or intellectual developmental outcome. Whenever retrospective research has pointed to a variable which was thought to be causal to some adverse behavioral outcome, prospective research has shown that individuals with exactly the same characteristics or experiences have not [illegible] the adverse outcome."[20]

This investigator, who is not dealing specifically with learning disability, believes that poor outcomes, in general, have to be

attributed neither to the complications nor the environment but to the transaction the child enters into with his environment.

The Effect of Environment

Silver and Hagin found learning disabilities most prevalent among underprivileged children. Satz noticed that as he moved from urban schools to rural schools, which served a higher proportion of children from low-socioeconomic levels, the proportion of affected children increased. Eisenberg found that in one county 12 percent of the white children were 2 or more years retarded in reading, as compared with 36 percent of the black, and that 7 percent of the white families were in the lowest social class, as compared with 60 percent of the black.[2] Other research projects have reported the same findings: Reading failure or learning disability occurs more often among culturally and economically disadvantaged children than among others.

Why? Presumably one reason is that their mothers, lacking good medical care and other safeguards, are at greater risks to the complications of pregnancy and birth, including prematurity. It may well be true that the results of such complications have no direct bearing on whether a given child does or does not develop a learning disability. (It is certainly true that many children with a history of such complications do not develop a learning disability and, conversely, that many children without such a history do develop a disability.) But could the results in some cases trigger off an inherited disposition to developmental lag? Or could they in some cases make for a type of interaction between the child and his environment—meaning in particular his parents—that hinders fully normal development?

Another answer may be malnutrition among impoverished mothers and their children. A recent study estimated that the brains of more than one million infants and young children had either been adversely affected by malnutrition or were in danger of being so. The finding implies, the report says, "that a corresponding proportion of the difficulties children experience in school and later in their career development may be due to undernutrition affecting their brain growth *in utero* and during early life, thus interfering in the most serious way with the quality of their lives, and placing an unmeasured but probably significant burden on the rest of United States society."[21]

Dr. Merrill S. Read, director of the Growth and Development Branch, National Institute of Child Health and Human Development, points out that hunger itself, let alone malnutrition, may powerfully influence learning. "Hunger," he says, "is part of the constellation of poverty. As such, it may signify personal inadequacy to the child to the point that his motivation to achieve is reduced. In turn, this might interfere with his relations with his peers and his teachers. Similarly, the inability of parents to pro-

vide necessities, such as food for their children, may have deleterious effects on their own self-image, their attitudes toward their environment, their concepts of achievement, and their relationship with their children. These factors, too, will influence learning performance by the child in school."[22]

Even more pervasive than lack of food among children of disadvantaged families is lack of perceptual and intellectual stimulation. Numerous studies have documented that many children from the poorest neighborhoods arrive at school age unable to benefit from the usual school program simply because they have not been played with, talked and read to, and otherwise stimulated to the extent customary in other homes.

As Eisenberg has put it: "We know that if a child does not hear language, he will not speak. We tend to overlook the corollary proposition that if he is exposed to a less differentiated language experience, he will speak and understand less well. The slum child, on the average, has had less training in listening to sustained and grammatically complex speech, has had less exposure to the extensive vocabulary of our language, and has had less reinforcement for his own verbal efforts. He exhibits defects in auditory attention and perception, performs less well on vocabulary tests (especially when challenged by abstract words), and is less responsive to verbal instruction in the classroom."[2]

Eisenberg also says: "When parents fail to reinforce a child for good school performance or to chastise him for academic misbehavior, when they convey a belief that school success bears little relationship to ultimate occupational attainment, and when they share with a child a view of school authorities as repressive agents employed by a society hostile to their values, they provide little support for the development of achievement motivation."

The beliefs to which such behaviors give rise, this authority continues, far from being myths, are constructed from the social reality of the slum dweller. . . . The Negro high school graduate is more often unemployed and, when employed, earns less, than the white graduate. The examples of success that sustained previous generations of immigrants from abroad have been replaced by the examples, in homes and on street corners, of failure. And all but the hardiest of today's domestic immigrants from farm and mine are discouraged. The solution for this problem will not lie in the schools but in the creation of job opportunities to which all have equal access."

The attitudes of teachers "may serve to consolidate a conviction of the hopelessness of it all. Educators are satisfied with less from the lower-class child because they expect less; their expectations form part of the social field that molds the child and determines, in part, what he does."

Eisenberg refers to a study of elementary schoolchildren who had been referred for placement in classes for "slow learners"

because of academic failure. The study found that 78 percent had performance IQ's that were average or better than average. Only 7 percent of the parents, however, recognized their children's potential. "Need it surprise us that 86 percent of the children rated themselves as dull or defective? With such a self-image, affirmed at school and at home, what shall it profit a child to try?"

SUMMING UP

Learning disability is one of the most prevalent afflictions of childhood. Unless it is detected and prevented, or successfully treated, it may have a disastrous outcome for the child, and probably for society as well.

No one clear cause has been discovered, except in the case of disadvantaged children who have received inadequate verbal and perceptual stimulation from infancy onward.

There appears to be a substantial hereditary influence.

There is probably no actual damage to the brain except in a minority—perhaps 10 percent—of the cases. There does appear to be a delay in the development or maturation of parts of the brain controlling certain skills that a child must acquire before he can learn to read well. The delay may be caused by genetic, organic, or environmental factors. Whatever the nature of the insult, as Archie Silver suggests, the language function is presumably the most vulnerable because in the history of the species it was the most recently acquired.

Strong evidence has been found that the lack of essential prereading skills can be readily detected at the age of kindergarten, and probably well before. There is promising evidence that training programs can be instituted to coordinate eye, hand, and brain, and thus prevent development of actual learning disability.

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The investment by NIMH in child mental health as its first priority springs from a natural concern with the well-being of the young, from a special sense of compassion for those in our society who suffer disability even before they have had a chance to master their environment, and who endure pain and suffering before they have begun to sample the fruits of their heritage as members of American society.

The Institute's effort in the area also stems from sound scientific strategy. In mental health, more so perhaps than in any other area of public health, the bases of adult well-being or illness are laid in childhood. A major key to adult adjustment and health lies in the psychological and biological events of childhood; indeed, the origins of some of the most severe mental and emotional illnesses may be tracked to the early physical and emotional experiences of the child's world. Thus, the concern of the Institute with the child bespeaks a concern, too, with the whole man, along the entire life cycle.

As one important developmental phenomenon, the ability to communicate, articulate, and organize through spoken and written language one's internal and external experiences has a profound impact on behavior. Thus, learning disorders theoretically can lay foundations of vulnerability for delinquent and criminal behavior, for severe mental illness, for emotional problems, and for social dysfunction.

It is in this light that we consider what you have just read to be an important contribution, for it points toward a not-too-distant future when learning disorders as a major challenge to psychosocial development may be identified, ameliorated, and prevented to a degree that is not possible today. Moreover, it is hoped that through its continued research efforts in other areas of child development, NIMH will play a key role in improving the mental health of all children.

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references

1. Jansky, J., and de Hirsch, K. *Preventing Reading Failure.* New York: Harper & Row, 1972.
2. Eisenberg, Leon. The epidemiology of reading retardation and a program for preventive intervention. In: Money, John, ed. *The Disabled Reader: Education of the Dyslexic Child.* Baltimore: The Johns Hopkins Press, 1966.
3. Rawson, M.B. Cited by Ingram, Thomas T.S. The nature of dyslexia. In: Young, Francis A., and Lindsley, Donald B., eds. *Early Experience and Visual Information Processing in Perceptual and Reading Disorders.* Washington, D.C.: National Academy of Sciences, 1970.
4. Young, Warren R. A strange disease that makes words play tricks. *Washington, D.C. Star,* Sept. 28, 1975.
5. Association for Children with Learning Disabilities, 5225 Grace Street, Pittsburgh, Pa. 15236.
6. Silver, Archie A., and Hagin, Rosa A. Developmental language disability simulating mental retardation. *Journal of the American Academy of Child Psychology,* 4:485-494, 1965.
7. Blom, Gaston E. Sex differences in reading disability. In: Calkins, Eloise O., ed. *Reading Forum: A Collection of Reference Papers Concerned with Reading Disability.* Washington, D.C.: U.S. Government Printing Office, DHEW Publication No. (NIH) 72-44.
8. *Research in the Service of Mental Health: Report of the Research Task Force of the National Institute of Mental Health.* Washington, D.C.: U.S. Government Printing Office, DHEW Publication No. (ADM) 75-236, 1975.
9. Ingram, Thomas T.S. The nature of dyslexia. In: Young, Francis A., and Lindsley, Donald B., ed. *Early Experience and Visual Information Processing in Perceptual and Reading Disorders.* Washington, D.C.: National Academy of Sciences, 1970.
10. Developmental Indicators for the Assessment of Learning, Box 911, Highland Park, Ill. 60035.
11. Silver, Archie A., et al. *In addition to interview material, this section draws upon the following papers:*

    Silver, Archie A., and Hagin, Rosa A. Fascinating journey: Paths to the prediction and prevention of reading disability. *Bulletin of the Orton Society,* in press.

    Silver, Archie A. Early signs of delay in learning. In: Irving N. Berlin, M.D., ed. *Basic Handbook of Child Psychiatry,* in press.

    Silver, Archie A.; Hagin, Rosa A.; DeVito, Estelle; Kreeger, Henrietta; and Scully, Elizabeth. A Search battery for scanning kindergarten children for potential learning disability. *Journal of Academy of Child Psychiatry,* in press.

    Silver, Archie A. The learning disorders unit: A review of progress. *New York University Medical Quarterly,* 30:2, 1974.

Hagin, Rosa A.; Silver, Archie A.; and Corwin, Carol G. Scanning school samples for vulnerable children. Presented at the annual convention of the American Psychological Association. 1974.

Silver, Archie A., and Hagin, Rosa A. Profile of a first grade: A basis for preventive psychiatry. *Journal of the American Academy of Child Psychiatry*, 11:4, 645-674. 1972.

———. Specific reading disability: Follow-up studies. *American Journal of Orthopsychiatry*, 34:1. 95-102, 1964.

———. Strategies of intervention in the spectrum of defects in specific reading disability. *Bulletin of the Orton Society*, 17:39-46, 1967.

———. Specific reading disability: Delineation of the syndrome and relationship to cerebral dominance. *Comprehensive Psychiatry*, 1,2:126-134, 1960.

12. Luce, Gay. The asymmetry of the human brain and implications for training. In: *Mental Health Program Reports—5*. Washington, D.C.: U.S. Government Printing Office, DHEW Publication No. (HMS) 72-9042, 1971.

13. Rudel, R.G., and Denckla, M.B. Relation of forward and backward digit repetitions to neurologic impairment in children with learning disabilities. Cited by Masland, Richard L., 1973. See reference 15.

14. Masland, Richard L. Implications for therapy. In: Jansky and de Hirsch, eds. *Preventing Reading Failure*. New York: Harper & Row, 1972.

15. Masland, Richard L. Medical aspects. In: *State of the Art: Where Are We in Learning Disabilities?* Second Western Regional Conference sponsored by the Association for Children With Learning Disabilities and the California Association for Neurologically Handicapped Children, Feb. 3, 1973. See reference 5.

16. Satz, Paul, et al. *In addition to interview material, this section draws upon the following papers:*

Satz, Paul, and Friel, Janette. The predictive validity of an abbreviated screening battery: A preliminary cross validation study. *Journal of Learning Disabilities*, in press.

Satz, Paul; Friel, Janette; and Rudegeair, Fran. Differential changes in the acquisition of developmental skills in children who later became dyslexic: A three-year followup. In: Stein, D., and Butters, N., eds. *Recovery of Function*. Washington, D.C.: Academic Press, 1974.

———. Some predictive antecedents of specific reading disability: A two-, three-, and four-year followup, for the Hyman Blumberg Symposium on Research in Early Childhood Education. Baltimore: Johns Hopkins University, 1974.

Satz, Paul, and Friel, Janette. Some predictive antecedents of specific learning disability: A preliminary one-year followup. In: Satz, P., and Ross, J., eds. *The Disabled Learner: Early Detection and Intervention*. Rotterdam (Netherlands): Rotterdam University Press, 1973.

Satz, Paul, and Van Nostrand, Gary K. Developmental dyslexia: An evaluation of a theory. In: Satz, P., and Ross, J., eds. *The Disabled Learner: Early Detection and Intervention*. Rotterdam (Netherlands): Rotterdam University Press, 1973.

Satz, Paul. Learning disorders and remediation of learning disorders. Unpublished paper for the Research Task Force of the National Institute of Mental Health, 1973.

17. Hallgren, Bertil. Specific dyslexia: A clinical and genetic study. *Acta Psychiatrica and Neurologic*, Suppl. 65:1-287, 1950.

18. Silver, Larry B. Familial patterns in children with neurologically-based learning disabilities. *Journal of Learning Disabilities*, Aug.-Sept. 1971.

19. Pasamanick, Benjamin, and Knobloch, Hilda. The epidemiology of reproductive casualty. In: Sapir, Selma G., and Nitzburg, Ann C., eds. *Children With Learning Problems*. New York: Brunner/Mazel, 1973.

20. Sameroff, Arnold J. Concepts of humanity in primary prevention. Paper prepared for The Vermont Conference on the Primary Prevention of Psychopathology. Burlington, Vermont, June 1975.

———. Early influences on development: Fact or fancy? *Merrill-Palmer Quarterly*, 21:4, 267-294, 1975.

21. Livingston, Robert B., et al. Report for the International Brain Research, Foundation, quoted in the *New York Times*, p. 38, November 2, 1975.

22. Read, Merrill S. The biological bases: Malnutrition and behavioral development. In: *Early Childhood Education*. 71st Yearbook of the National Society for the Study of Education, Chicago, 1972.