

# Orthomolecular Approach to the Treatment of Learning Disabilities

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Learning in the formal sense is markedly impaired in all children afflicted with the psychoses of childhood or with brain injury. Their behavior is most often bizarre and marked by intense hyperactivity and ritualism. The most common treatment has been psychotherapy based on psychoanalytic or related theories. Judging from studies of the relevant literature, Rimland<sup>1</sup> finds that the children who did best are those fortunate enough and initially well enough to be placed by their parents into a structured, disciplined school environment.

Drugs have been widely used in the treatment of this group of children and have been of some benefit in controlling the hyperactivity. However, their use does not constitute a definitive treatment since they alter the illness only by sedating or tranquillizing the child. They do nothing to attack the basic cause or causes of the illness.

Between 1966 and the present, I have treated 500 children with the Orthomolecular approach and have reported that this treatment regime shows greater promise than any other which has been tried.<sup>2</sup> The psychiatric literature shows few cases of dramatic response by disturbed children treated with drugs.

My results are being duplicated by many

physicians and clinics, by the Institute for Child Behavior Research and the New York Institute for Child Development. Two reports of negative results in the treatment of disturbed children with megavitamins have recently been reported.

One account describes a study reported to the Ontario Psychiatric Association. The other was reported in a letter to the editor of the J.A.M.A. The latter was a report of a study conducted at a school for disturbed children in New Jersey. In both studies negative results should have been anticipated since the only vitamin used was niacinamide.

In those cases in which positive results have been obtained, treatment included niacinamide or niacin, ascorbic acid, Pyridoxine and calcium pantothenate used in massive doses. Many parents and physicians have reported significant changes when only Pyridoxine was used in massive doses.

In August, 1970, Dr. L. E. Rosenberg<sup>3</sup> of Yale University Department of Genetic Research reported that of the dozen known disorders involving genetic vitamin dependency, B<sub>6</sub> is involved in five. In this group of newly discovered diseases, the body is unable to use normal levels of vitamins

properly and some can be treated successfully by massive doses of vitamins. Up to 1000 times the usual vitamin requirements are needed to prevent the disease from expressing itself.

After experiencing success in the treatment of schizophrenic adults with vitamins B<sub>3</sub>, B<sub>6</sub>, C, E and others in massive doses, I applied the treatment to children suffering from childhood schizophrenia and autism and found the improvement in many of these children to be more dramatic than in adults.

In the treatment of children, I had until three years ago used the megavitamin treatment almost exclusively in the treatment of the psychoses of childhood—primarily childhood schizophrenia and autism. The majority of those children whose parents persisted in the proper administration of the medications achieved significant improvement in many areas of functioning.

Most significant was the decreased hyperactivity and the improvement in concentration and attention span, which led to improved capacities for learning. In those children who had been unable to learn at all, a desire to learn became apparent. Trials were then begun with the megavitamin treatment in the child exhibiting learning disabilities

Until these above studies were begun, most remedial specialists stressed the more peripheral aspects of a handicapped child's performance, ignoring the biochemical basis of his disturbed behavior. Improvement under the megavitamin treatment directs attention of the scientific community to the central processes.

It is time for close scrutiny of the neurological and biochemical processes of the disturbed child and the learning-disabled child. Experience in my practice in the treatment of the learning-disabled child has in the two and a half years past been extremely encouraging.

A research project has been started at the New York Institute for Child Development designed to produce important data bearing upon the effectiveness of remediation in these two areas with megavitamin treatment added to perceptual-motor training.

Remedial efforts should be directed toward both brain function and body chemistry. In addition to the employment of perceptual-motor techniques, an attempt should be made to improve the child's biochemical balance through the use of Orthomolecular techniques.

Dr. Linus Pauling, the noted Nobel laureate in biochemistry, has suggested that megavitamin treatment could be better described as "Orthomolecular therapy." This may be defined as the treatment of mental illness by the provision of the optimum molecular composition of the brain, especially the optimum concentration of substances normally present in the human body.

The implications for much needed research in the more universal application of Orthomolecular treatment are clear. There is rapidly accumulating evidence that learning disabilities can be helped by massive doses of certain vitamins.

With the vitamin treatment, results are frequently quick in starting and dramatic in nature but in most instances three to six months is the usual time in which significant changes are seen. The child begins to understand and obey commands, exhibiting a willingness to cooperate with his parents and teachers. Gaze aversion ceases—the hyperactivity which is one of the cardinal symptoms of the childhood psychoses, subsides slowly.

The children I see have been exposed to every form of treatment and every known tranquilizer and sedative with little or no success, even in controlling the hyperactivity. The children who are nonverbal begin to make definite vocal efforts. Many parents report that the child begins

to babble and becomes "noisy."

Children who are verbal make greater efforts to communicate through speech and often will begin to use phrases and short sentences to express wants and observations. They show a slow but steady improvement in speech.

In their general behavior, they show a greater appreciation for the people in their environment. They become more loving and not only permit cuddling and hugging, but seek it. Bizarre food choices change slowly to include a larger variety of foods.

Those children who remain in treatment for the longest time make the greatest progress. My statistics show that those children whose treatment begins early in life—ages two or three to seven or eight—respond faster and frequently better than those further advanced in age. Those in the age group 11 or 12 and older often have the dimmest prognosis.

The treatment of disturbed children or of children with learning disabilities consists of the following vitamins taken orally—either in pill, capsule form or liquid—in the following doses:

Niacin or niacinamide — 1 to 2 gm. daily,  
depending upon body weight.

Ascorbic acid — 1 to 2 gm. daily.

Pyridoxine - 200 to 400 mg.

Calcium pantothenate — 400 to 600 mg. These are starting doses for children weighing 35 pounds or more. If a child is under 35 pounds, I generally use one-half the dose of B<sub>3</sub> and C and increase it at the end of a two week period, if the child shows no signs of intolerance. In a child weighing 45 pounds or more, I try to reach an optimum daily maintenance level of approximately 3 gm. of B<sub>3</sub> and 3 gm. of C.

There are no negative effects and any side effects are dose related and generally stem from the vitamin B<sub>3</sub>. Niacin, for the first five or six doses, produces a flushing of the skin which lasts about one or one and one-half hours each

time it occurs. But generally after the fifth or sixth dose, it no longer occurs. Niacinamide may, at times, produce nausea.

In my experience, extending over these many years, no serious side effects have resulted from any of the substances used. Frequently riboflavin, thiamine, vitamin E, folic acid, Deaneer and glutamic acid are used.

In the U.S.S.R. the use of pangamic acid (vitamin B<sub>15</sub>) in retardation is reported to show promising results in clinical trials. B<sub>15</sub> aids in the respiration of brain tissue.<sup>4</sup> Dr. Himwich has shown that proper brain function requires adequate tissue respiration.<sup>5</sup>

Dr. Warburg, Nobel laureate in biochemistry, described the importance of vitamins B<sub>3</sub> and C in the respiration of all body tissues in the maintenance of health.

Many skeptical physicians and researchers, in the absence of double-blind studies, are quick to judge reports of improvement by the use of the megavitamins to "placebo effect," but in this instance placebo effect has no bearing on the favorable results (Rimland).

This is proven beyond doubt whenever the medication has been interrupted by intercurrent illness. The children relapsed into their former symptoms of illness. Hyperactivity, withdrawal, regression of speech, screeching, self-mutilation, etc., return and parents comment that disturbed behavior they had not seen for months was again present. Within two or five days after resuming the medication, the former level of improvements was usually attained.

In brain-injured children, convulsions respond to megavitamin treatment. The parents of one patient reported that 11 days after starting their brain-injured child of vitamin B<sub>6</sub> he had his first seizure-free day in three years. During those three years he was taking Dilantin and pheno-barbital daily and the seizure activity was not controlled.



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Another patient who had multiple daily seizures for two years became seizure-free 72 hours after megavitamin treatment was started. He continues seizure-free four years later.

I have seen very few cases of childhood schizophrenia, autism or brain injury in whom seizure activity did not respond to the megavitamins.

Recognition that dependency on vitamin B<sub>6</sub> results in convulsive phenomena both in experimental animals and human subjects prompted studies at the University of Texas to inquire into the role of this vitamin in the problem of infantile convulsions.

The remarkable response of many infants with frequent convulsions to the administration of vitamin B<sub>6</sub> in large doses in addition to that received in a mixed diet led to the conclusion that infantile seizures appeared in many cases to be due to an aberration in the metabolism of vitamin B<sub>6</sub> and not to a simple dietary deficiency.<sup>6</sup>

Two research projects now under way at the New York Institute for Child Development will produce important data bearing upon the effectiveness of the megavitamins as an aid in the remediation of brain function and body chemistry in children suffering minimal brain dysfunction and in learning-disabled children.

The term "minimal brain dysfunction" is meant

to refer to children of near or above average intelligence, with certain learning or behavioral disabilities, ranging from mild to severe, which are associated with deviations of function of the central nervous system.<sup>7</sup>

Today there is a growing recognition that the hyperactive "problem child," the child with a learning disability, may indeed have a biochemical disorder. Although vast strides are being made to identify and understand this disorder, much has yet to be learned. The characteristic sign most often observed is hyperactivity, the one symptom common to all emotional disorders of childhood. Other symptoms include perceptual-motor impairments, emotional lability, general coordination deficits, disorders of attention, impulsivity, disorders of memory and thinking, learning disabilities and disorders of speech and hearing.

Many children diagnosed "minimal brain dysfunction" seem normal or near-normal until they enter a classroom. Then, in spite of having average or above average intelligence, they will have difficulty in one or more areas of learning. Reading disabilities are the most common, although motor problems are frequent. The resulting academic and emotional difficulties easily lead to misdiagnoses of retardation or of primary psychiatric problems.

Dr. William Windle, Director of Research of New York University Institute of Rehabilitation Medicine, states that the real cause seems to be malfunctioning of one area or another of the brain.<sup>7</sup> In many cases the malfunction is caused by physical damage to the brain, although such damage is difficult or impossible to prove. Because the damage is subtle, states Dr. Windle, no EEG abnormalities are found in about half the cases.

In experiments with rhesus monkeys in 1968 in which asphyxia was deliberately induced in 130 subjects during or after birth, development of this group was then

compared with that of uninjured controls. In the early years the differences were obvious. The asphyxiated monkeys had marked ataxia, extreme difficulty in carrying out simple motor tasks and noticeable sensory problems.

By the fourth year of life the monkeys seemed to have made a normal adjustment although a lack of manual dexterity and a low level of spontaneous activity were visible signs of neurological deficit. In most cases the EEGs were normal but autopsies showed that the brain injury induced by asphyxia had not been repaired. There was widespread nerve cell damage in several parts of the brain.

In humans, brain damage due to trauma at birth or early in life is believed to be responsible for many cases. The following compilation highlights the many aspects of the problem as they are perceived and endured by the teacher and the family. In speaking to the parents of these children, I find them generally to be intelligent and perceptive, yet puzzled by their own children. They all relate variations of the following story:

*"Even when he was an infant, he was different from other children and developed differently from his siblings. He was irritable and cried a great deal. He slept poorly. Nothing seemed to satisfy him. I had him checked by our pediatrician who told me that he was a perfectly normal child and that I was an overly anxious mother. Later when he became hyperactive and began banging his head in the crib, I was told that this was a phase of development he would outgrow. It seemed like he was in such a frenzy that he didn't take time to crawl or creep like my other children did. He just got up and began walking.*

*"Our child's troubles really began when he started to attend school. The teacher blamed his hyperactive, disruptive behavior on immaturity and lack of self-control. No one could give us specific help on how to help him, so we tried to*

*encourage him to develop self-control by punishing him. Soon we all realized that he wasn't learning to read like other children.*

*"He is a constant irritant to his teacher and he is destroying our family. We have had such conflicting advice as to discipline him more severely or to stop all discipline, to help him with his school work or to stop helping him and let him suffer the consequences.*

*"We haven't done anything different in raising him, yet our other children are fine but he is an exasperating child to have around. We can't believe that he is mentally retarded or emotionally disturbed because he frequently does such bright things when he is not in school. At other times something comes over him and makes living with him impossible."*

Education of the parents is of the utmost importance. Since most parents who have sought professional help have been exposed to the psychodynamic orientation, they have been given an added burden of guilt by being blamed for their child's illness. Clarification of the condition helps the parents to realize that they are not to blame and enables them to manage the child with greater consistency and less over-protectiveness.

With the understanding of the biochemical nature of the disorder, parents are given hope of improvement in their child's condition by the use of chemotherapy. Massive doses of certain vitamins have in clinical trials to date proven to be a most valuable adjunct to the total treatment regimen of these children.

In obtaining detailed case histories of schizophrenic patients whose illness developed during their adolescent years, I found a high percentage who exhibited hyperactivity and learning disabilities early

in life. This is suggestive that hyperactivity may in the genetically predisposed child be an early symptom of schizophrenia.

The importance of diet in the creation of an optimum molecular environment for the brain is being investigated widely. In a report presented to the National Academy of Sciences on April 28, 1971, Roger J. Williams of the Clayton Foundation Biochemical Institute, the University of Texas at Austin, stated that our total environment includes not only the air we breathe and the water we drink but also the food we consume.

These external environmental factors derive their importance from the fact that they do not remain external; they are the materials which enter into the internal environments of our body cells and tissues. Greater concern must be shown for the quality of the internal environments in which our cells and tissues function because as in the entire biological world these environments can vary through the full spectrum from those which barely keep cells alive, up through hundreds of gradations to levels supporting something like optimal performance.

In a forthcoming well-documented book, Dr. Williams has made a reasonable case for the proposition that, aside from infections, the poor internal environments we commonly furnish our cells and tissues is the major cause of disease.<sup>8</sup>

At a recent meeting (April 19, 1968) of the Federation of American Societies for Experimental Biology, Drs. Joseph Vitale and Hernan Velez reported on the population of Heliconia, a village of 5,000 in Columbia. Here they found that the babies are born with normal intelligence but by the time they become teen age, 95% are mentally retarded, principally because they have never had a proper diet.

They were tested for malnutrition by measuring the levels of the essential amino acids in the blood. They point out that the body must obtain essential

amino acids from food in order to manufacture the rest. The mainstays of the diet in Heliconia are manioc, potatoes and rice—all carbohydrates of the rapidly absorbed variety. They also eat panela, a syrup byproduct of sugar cane.

Besides being intellectually stunted, the villagers are physically stunted as well, the average adult achieving a height of five feet three inches. Twenty-four percent of the population are dwarfs who never grow bigger than the typical six year old.

Dr. F. Curtis Dohan<sup>9</sup> of the University of Pennsylvania has declared that some hereditary diseases are made manifest by ordinarily harmless food substances, e.g., celiac disease by wheat gluten and its analogues in other cereal. Celiac disease and schizophrenia (both probably polygenic) apparently occur in the same person more often than chance and have many common features.

At a recent (December 1970) conference on Genetic Disease Control, Dr. Sutton of the University of Texas and Dr. Neil of the University of Michigan stated that some human beings are able to convert harmless substances to harmful ones (e.g., wheat in celiacs).

All men admitted to a locked psychiatric ward (Veterans Administration Hospital, Coatesville, Pennsylvania) were randomized to either a milk-and-cereal-free diet (CF) or a somewhat high-cereal diet (HC) but were otherwise routinely treated. Antischizophrenic medication did not differ between the two diet groups.

Of the 47 CF relapsed schizophrenics, 62% were released from the ward to "full privileges" before the end of the "median day" compared to 36% of the HC schizophrenics ( $P < 0.01$ ). Diet had no effect on nonschizophrenics. The ward staff denied knowing the diet of individuals. Nevertheless, wheat gluten was secretly added to

the CF diet and the difference in release rates of schizophrenics disappeared.

Subsequent studies confirmed the apparently beneficial effect of the CF diet which was free of milk and cereal grain products. Relapsed readmitted schizophrenics assigned to the opposite diet to that on the initial admission to the ward were released when on the CF diet in half the time taken on the HC diet. Schizophrenics randomized to the CF diet were discharged from the hospital significantly sooner than the HC group.

*Thus preliminary results suggest that the ingestion of cereal grains and their products may be a factor in the production of symptoms in those with the schizophrenic genotype.*

Further investigations with strictly controlled diets are necessary to determine if this hypothesis is correct.

Growing evidence that nutrition may affect intellectual and behavioral, as well as physical growth has stimulated efforts to determine the extent of malnutrition in the United States and to assess its long-term impact.<sup>10</sup>

Malnutrition is not synonymous with hunger but may result from long periods of insufficient food. Hunger can be immediately relieved by food; malnutrition requires expert treatment and despite all efforts may leave lasting effects. Malnutrition should be defined as a condition in which one lacks one or more nutrients to the extent that specific symptoms of illness appear (anemia, goiter, rickets, vitamin deficiencies) or retardation in physical development occurs.

The National Nutrition Survey, begun in 1968 and being carried out by the Department of Health, Education and Welfare, is the first comprehensive effort to assess the nutritional status of the U. S. population.

The survey has found an unexpectedly high prevalence of symptoms associated with severe

malnutrition. Four to five percent of the 12,000 people of all ages randomly selected in poverty areas of two states exhibited symptoms associated with severe malnutrition.

One-third of the children under six years of age were found to have anemia; 17% showed abnormally low protein levels in their blood. Vitamin D, which is necessary for the absorption of calcium and the normal development of bones, was found to be lower than normal in the blood of 58 children under six years of age, and 18 cases of rickets were diagnosed.

The consequences of malnutrition depend upon the time in the life of the individual when nutritional defects occur, as well as on their severity and duration.<sup>11</sup> The brain may be damaged by various influences during the period of fastest growth, which in human beings occurs from about five months before to six months after birth.

At the end of the first year the brain has achieved approximately 70% of its adult weight and by the end of the second year it has practically completed its growth. The brain grows both by increase in the number of cells and by increase in the size of each cell.

Experiments with rats, made by Dr. Myron Winnick of the Cornell University Medical College in New York,<sup>11</sup> show that severe malnutrition during the period of cell division permanently reduces the total number of cells, despite subsequent nutritional rehabilitation. Severe food restriction later during the growth period may reduce cell size during the period of starvation but the cells retain the ability to enlarge with increased feedings.

Obviously, similar studies cannot be done with human infants. However, the brains of infants who died of marasmus (results from severe restriction of food intake—particularly of calories—from birth or shortly after) were found to have only

40% of the expected number of cells when compared with the brains of infants who died from accidents. Severe malnutrition in a pregnant woman probably affects the unborn child by reducing the nutrients available to it for normal cell growth.

Also, severe malnutrition during the first six months of the infant's life further reduces the number of brain cells the baby will develop. Although information from experiments with animals cannot be applied directly to humans, it can point the way to possible consequences for man.

Rats and pigs fed severely restricted diets during periods of fastest brain growth and then later fed good diets have shown changes in behavior as well as in size and composition of their brains. The animals cannot learn as fast as their normal litter mates, cannot unlearn a task they have finally mastered and tend to overact in an agitated and irritable way when exposed to unpleasant situations.

Pertinent recent studies have shown that social isolation may reduce the size and number of cells in rat brain much the same as malnutrition does.

A report in the July 1968 *Bulletin of the Foundation for Nutrition and Stress Research*<sup>12</sup> describes the results of a nutrition survey done at the Pennsylvania State College, from which the conclusion was reached that only one person in a thousand escapes malnutrition.

The survey took six years and covered 2,511 Pennsylvanians, both adult and children. Various nutrition tests revealed that the majority were deficient in several areas tested. Deficiencies in protein, calcium, phosphorus, vitamin D and other vitamins and minerals were revealed.

More than half of the people studied were below the desirable standard in hemoglobin, which was used as a criterion for evidence of lack of iron. Many were low in vitamin A ratings.

In all communities, regardless of economic status, the average diets of children and adults were far below the daily intake levels of proteins, vitamins and minerals recommended by the National Research Council. Most of the people in the study were not aware of any actual illness due to food deficiencies. I have found these so-called "borderline deficiencies" in a large percentage of schizophrenic adults and in the children I treat.

In the years 1965-1966, the U. S. Department of Agriculture conducted the most extensive survey into the quality of diets in the American household within the past 30 years. It covered a continuous 12-month period and included 7,500 households and 15,000 individuals in the spring of 1965 and 2,500 households in each of three succeeding seasons—summer and fall 1965 and winter 1966.

Weekly records of foods purchased were obtained and the amounts of protein, calcium, iron, vitamin A, vitamin B<sub>1</sub>, B<sub>2</sub> and ascorbic acid were calculated from food tables.

The results revealed that in 1965 less fruits and vegetables were consumed than in 1955. And there was a marked increase in the purchase of meat, snack foods (frozen milk desserts, coffee, soft drinks, punches) and convenience foods (e.g., frozen vegetables).

Only 50% of the households surveyed had diets that were rated "good" (compared to 60% in 1955). Twenty percent of the households had diets that were rated "poor" because they provided less than two thirds of the recommended allowance for one or more of the nutrients studied.

Ascorbic acid, vitamin A and calcium were the nutrients most lacking and were low in 25-30% of the household diets. The percentage of households actually having "poor diets" is certainly much higher than 20% if we take into account losses of nutrients due to storage, waste and method of preparing meals. Furthermore,

the *American Journal of Clinical Nutrition* has reported that food tables tend to give values that are too high.

The universal observations on the dietary habits of brain-injured children, hyperactive children, learning-disabled children and psychotic children have been that these children eat a diet which is high in cereals, in carbohydrate foods and those foods prepared with sugar.

My clinical research into the glucose tolerance of this group of patients reveals an abnormally high incidence of hypoglycemia and dysinsulinism. I have also found an abnormally high family history of diabetes in this group.

The glucose in the bloodstream is one of the most important nutrients for the proper functioning of the brain and the maintenance of a proper glucose level is essential in the creation of an optimum molecular environment for the mind.

One who suffers from hypoglycemia or dysinsulinism should eat those foods which are lowest in carbohydrate and must eliminate from their diets those foods which are prepared with sugar.

The role of the trace elements copper, zinc, magnesium, manganese, chromium, calcium, potassium, sodium and iron as nutrients necessary to the maintenance of proper brain functioning is being investigated in many centers of nutrition research.

In my clinical investigation of the biochemical disorders in the children I treat, I find a high percentage of hypoglycemia, dysinsulinism, disturbance of histamine levels and of trace mineral levels. In 26 out of 30 children whose hair was analyzed for trace minerals I found a lower than normal level of several minerals. Lead was found to be present in every sample tested.

An urgent need exists to relate the advances in the nutritional sciences to medicine, since neither medical education nor medical practice has kept abreast of them. Although the pace is slow,

research in the importance of the trace minerals as nutrients in the maintenance of health is gaining momentum.

Until the past decade it was stated with confidence that zinc was present in optimum amounts in foods and that there was no evidence of a deficiency in the human body. More recently there has been a reconsideration of the role of the whole grain cereals and edible seeds in blocking the absorption of zinc. At the molecular level, zinc serves as an essential metal for the structure or the function of a number of enzymes.

The interplay of chromium, zinc and magnesium upon insulin secretion is at the present time known, but completely undeveloped.<sup>13</sup> Dr. Myron Winick has shown that a magnesium deficient diet in rats produced death in utero, abnormally low hemoglobin and alteration in the size and shape of the red blood cells.<sup>11</sup>

The trace metals are known to compete with each other in biological systems so an excess of copper could block other more effective trace minerals from an active enzyme site.

Dr. Carl Pfeiffer has shown that the so-called well rounded diet does not provide sufficient amounts of zinc and manganese, the two trace elements he found to be most important in combatting excesses of copper and iron in the schizophrenias.<sup>13</sup>

Plants grown on a well fertilized soil should contain all the trace elements vital to life. However, the soils of all lands are not adequate, for many of them have been cultivated for a century with fertilizers containing only nitrate, phosphate, potash, calcium and magnesium. These fertilizers grow plants with inadequate levels of trace metals.

The use of organic fertilizers or compost provides more of the trace elements. The sandy soil of Florida lacks many of the trace elements necessary to grow an abundant citrus crop. At present, zinc, man-

ganese, cobalt, molybdenum, iron and copper salts are all added to the citrus groves.

Chelating agents used in processing frozen vegetables remove a large portion of the trace metals.<sup>14</sup> Deficiency or imbalance in trace minerals need not appear with readily related manifestations; it may take years to become evident.

The environmental pollutants are often heavy metals such as lead, mercury or cadmium. The pollution of our environment and particularly the cities with lead has already reached a disturbingly high level.

In 1967 in Manchester, England, a group of children were found to have lead levels of 30+ ug. per 100 ml. of blood. One in six children had levels of 50 ug. per 100 ml. of blood.

Professor D. Bryce Smith of the University of Reading wrote recently in the journal, *Chemistry in Britain*, that no other toxic chemical pollutant has accumulated in man to average levels so close to the threshold for overt clinical poisoning.

Whenever lead poisoning has been diagnosed it has always been possible to trace it to some definite source. In children, it may be chewing on old paint work or toys containing lead. There has been no known case of lead poisoning from the widespread general pollution to which everyone is exposed.

This is why the apparently alarming situation to which Professor Smith draws attention has caused little concern.

"Lead pollution does not seem to be doing any serious damage," the complacent argument runs, "so why worry about it."

However, this position begins to look more and more vulnerable in the face of mounting evidence that lead could have harmful effects at levels well below those which cause overt poisoning.

In 1964, Sir Alan Moncrieff<sup>13</sup> and others at the

Institute of Child Health in London

found that a group of mentally retarded children had distinctly more lead in their blood than a group of normal children. In fact, nearly half the retarded children had higher blood levels than the maximum level in the other group.

It does not of course follow that lead was responsible for the childrens' mental retardation. It could well have been their retardation which made them more prone to chew on substances with a lead content. Nevertheless, the possibility that lead at levels too low to cause obvious poisoning might result in mental retardation could not be ignored and acted as a spur to the search for some measurable effect of low levels of lead in the human body.

In 1970, Dr. Sven Hernberg and his associates found that lead affected the functioning of an enzyme, ALA Dehydratase, which is involved in haem synthesis. Furthermore, he showed that in the test tube *any* level of lead affected the activity of ALA Dehydratase to some degree.

In October, 1970, a research group at Glasgow University led by Professor Abraham Goldberg fed lead to baby rats and found that the activity of ALA Dehydratase was affected not only in their blood but in their brains as well.

They wrote in their report in *The Lan-cet*,<sup>16</sup> "The finding of decreased ALA Dehydratase activity in the blood of children with lead levels falling within the normal range and the possibility that similar biochemical changes are present in the brain also, emphasizes the danger of exposure to even very small amounts of lead during childhood and suggests that a downward revision of acceptable levels of blood lead in children is desirable."

In addition to lead discharged into the atmosphere in vehicle exhaust, one absorbs lead from foods and water.

It seems quite clear from the clinical reports of parents, teachers and others who have observed the children I've treated that

there is indeed a large number of disturbed children and children with learning disabilities who can be expected to benefit from orthomolecular treatment. controlled studies should be given the highest priority, for we are dealing with a patient population of 20 million children.

Investigation of this treatment modality by

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