

Aluminum Toxicity as Indicated by Hair Analysis

Elizabeth Lodge Rees, M.D. ¹

My first observation on aluminum was made in the early spring of 1977 when a hyperactive boy, age 8^{1/2}, was brought to my office for consultation. Hair analysis had been done at Mineralab and his prior physician had ordered several minerals, including aluminum, in addition to the routine panel of 14 minerals and toxic metals. This boy had elevated copper, often seen in hyperactives, but also, aluminum of 4.2 mg percent (normal 0 -1.0 mg percent).

While thinking about this boy I remembered that some years before an acquaintance, male age 62, remarked that his physician ordered him to discard all his very expensive aluminum cooking utensils because whenever he ate food cooked in aluminum he had severe abdominal pain. The Complete Book of Minerals, Rodale Press (1976) lists the symptoms of aluminum poisoning to include colic—similar to painter's colic—heartburn and throbbing headache with constipation. Betts also described this in 1949.

Private practice of Orthomolecular medicine and pediatrics at 5311 Greenridge Road Castro Valley, California 94546, U.S.A. Medical director of Mineralab, 22455 Maple Ct, Hayward, California 94541, U.S.A.

In the spring of 1977 Mineralab converted from atomic analyzers to the argon plasma torch so that aluminum was included in our regular analysis. April of that year the hair of 10 severely delinquent, psychotic, or pre-psychotic boys age 12-18 and one counselor was tested. They live in Marin County, California, at a \$400,000 institution and cost the state \$1,750 monthly apiece. To my surprise nine of the boys had aluminum values from 2.9 to 8.7 mg percent with six of them above 5.2 mg percent. The counselor was 2.9 mg percent. The 10th boy who lived and ate with another counselor, not in the main building, had 1.6 mg percent. Normal values are considered by Mineralab to be 0-1.0 mg percent. Underwood (p. 430, 1971) gives the normal range for aluminum in human hair as 1.2ppm to 9.2ppm (0.12-0.92 mg percent). My interest was aroused so I quickly reviewed several laboratory runs of hundreds of tests. About 12 percent had aluminum values over 2.0 mg percent. Something strange was occurring in these disturbed delinquent boys who had a 90 percent incidence of elevated aluminum in their hair. Was the aluminum affecting their brains and consequently their behavior?

Pfeiffer (1975, 1978) summarized the reports of aluminum in the brains of patients dying with Alzheimer's premature senility and the reports of psychoses, often followed by death, due to kidney dialysis during which large oral doses of aluminum hydroxide were given to lower the phosphorus. The first such observations were made in 1970, and because of repeated reports the routine use of oral aluminum hydroxide during kidney dialysis has been stopped.

To complicate the problem of high aluminum in the hair of the nine boys the hair testing showed one boy had lead of 6.5 mg percent and five had lead from 2.1-3.0 mg percent. Normal is 0.0-2.5 mg percent. However, many children have similar lead elevations and are neither delinquent nor psychotic, though some are learning problems and/or hyperactive. To further complicate the problem, eight of the boys had iron elevated from 6.1-25 mg percent (normal 2.0-5.0 mg percent). Elevated iron was previously seen in a group of institutionalized disturbed boys, but aluminum was not tested. This group of boys were all of similar body type and facial appearance. Their consulting physician did not follow up this problem any further. The role of aluminum to iron needs further study. This will be a very complicated biochemical problem. Luckey (1975) points out that aluminum interferes with enzyme systems by uniting with the active S-H group, but he does not discuss the problems when aluminum and iron are both elevated.

In September, 1977, a mother brought her 28-month-old son to me with two complaints. He had severe temper tantrums, and he had a chronic cough which she could not clear up for the past six weeks. Eight weeks previously the family had moved into University of California student housing in Albany, California, which is adjacent to and upwind northeast from the Alcan Metal Powders Division of Alcan Aluminum Corporation. While trying to undress her son he had a temper tantrum such as I had never seen before in 37 years of pediatric practice. He screamed, fought, bit me, and then breaking away from his mother, dashed into

the patio adjacent to the examining room and tore at the bushes. Finally he dashed back and attacked me with teeth and nails just like a mad dog. I held him to the floor until he started to quiet. When his mother picked him up he started sobbing. She reported that her neighbors said her son was no different in behavior than their children and that frequently a child developed asthma after moving into the housing project. Aluminum powder was visible on the ground and foliage throughout the housing project, so she said, and this was emphasized by the powder clearly visible on six colored clothespins which had been on her veranda and which she brought to me. Physically her son was attractive, normally formed, and the only abnormal findings were a moderately red throat with one plus tonsillar lymph nodes and scattered squeaks and medium rales throughout both lungs.

Shaver and Riddell (Shaver and Riddell, 1947; Shaver, 1948) did x-ray and pathological lung examinations on men working in the manufacturing of alumina abrasives. Dyspnea with sudden attacks of extreme breathlessness and chronic cough with white frothy sputum were the presenting symptoms when the men sought medical care. Weakness, fatigue, and sleeplessness occurred with advanced dyspnea. Thirty-five active cases were found in 344 men, but it was later learned that others developed lung pathology years after cessation of exposure. X-rays showed radiographic shadows in the lungs. Postmortem examinations of four patients showed patchy areas of pleural thickening and interstitial lung fibrosis, non-nodular in type, along with emphysematous changes.

The brief stay of this family in the contaminated area could not have produced such lung changes, so no x-rays were done. Hair testing, however, was done even though little was expected since it takes time for the body to excrete metals into the hair. The boy was 1.9 mg percent, father 0.73 mg percent, and mother 0.04 mg percent. The father never felt well when he was home on weekends—felt better when away attending classes. The mother was quite up-

ALUMINUM IN HAIR ANALYSIS

set about the entire situation. This could have been situational, due to aluminum poisoning as shown in her blood, or from both. Blood tests were done. Normal is up to 13 meg per ml. Father was 25 meg per ml, mother 31 meg per ml, and the son 40 meg per ml. The apartment was tested with fresh, clean tissue wiped across the inside furniture and showed 32 ppm. That wiped on the balcony had 610ppm compared to the control tissue of 16ppm.

I wrote a letter to the University of California student housing giving the above history and data and requesting that the family be moved to a housing project distant from this aluminum contamination. This was done, and they moved to Richmond. The students who remained started a campaign to get Alcan to control the aluminum powder drift into their housing area. January 24, 1978, at 7:15 p.m. there was an explosion in the Alcan plant, reported by the newspaper as cause unknown, but later reported as probably touched off by compressed aluminum dust. The explosion was heard and seen throughout the San Francisco Bay Area.

The next and most startling case was a man, F. J., age 32 who appeared to be Mexican, but later revealed that he was Spanish, Portuguese, Dutch, English, and Guamanian. He seemed quite paranoid, in fact had a Hoffer-Osmond Diagnostic Test of 87 (normal is 2-15), with a paranoid score of 19 and a perceptual score of 29. His chief and constant complaints were that his hair was falling out, was dry and brittle, and that he did not look as he should. Over several visits the story unfolded. As an adolescent he had used a great deal of commercial deodorants which undoubtedly contained either alum or aluminum chloride. Was this use of deodorants because of profuse sweating, or did he have olfactory dysperception at this time? We will never know. From ages 26-29 he had worked as an aluminum spray painter in a closed shop with no ventilation. For the three years prior to seeking medical help he had been completely incapacitated physically and mentally. Physically he looked quite depressed with an expressionless face. He was dark brunette, had a receding hair line, and very

dry brittle *dark brown hair. His hair test showed 13 mg percent of aluminum. Was this a laboratory error? No, a repeat test of freshly cut hair confirmed the excessive amount.

Treatment was started with Veg 12 Concentrate, made by Pickrell Enterprises, three tablets three times daily, and continued for seven months without obvious results. This preparation contains alfalfa, turnip leaves, beet leaves, watercress, parsley leaves, rhubarb root, carrot leaves, horse radish, kale, dulse, and cayenne. It had been effective in dropping the hair aluminum levels of 4-6 mg percent to less than 1 mg percent in three hyperactive, but not psychotic, children. Recently from another source he obtained homeopathic remedies based upon a saliva test and is continuing to take these in addition to the Veg 12 concentrate. Slowly he has gotten a bit better, but still has dry brittle hair.

In reviewing my office cases since the laboratory has been doing aluminum routinely, April, 1977-April, 1978, 595 tests were done (Table 1). Of these 74 or 12.4 percent had aluminum over 2.0 mg percent. 2 mg percent was taken instead of 1 mg percent as the figure for elevation of aluminum since other testing laboratories use a higher figure as the upper limit. This may be an average since Underwood (1971) uses .92 mg percent.

TABLE 1

595 Hair Tests for Aluminum					
April, 1977-April, 1978					
Aluminum	Number	Percent of total	Male	Female	Ages
2.0-2.9mg%	32	5.4%	16	16	2-60
3.0-3.9mg%	11	1.8%	5	6	1-60
4.0-4.9mg%	5	0.8%	4-	1	6-11
5.0-5.9mg%	11	1.8%	8	3	7-71
6.&6.9mg%	2	0.4%	2	0	8-62-
7.0 and over	13 74	2.2% 12.4%	11 46	2 28	6-52

Therefore, 12.4% of 595 hair tests showed aluminum over 2.0mg%. Despite the fact that my practice has at least as many females as males there is almost a 2:1 ratio of males to females. Ages are too scattered to evaluate.

Comparison is made to 636 cases of four total Mineralab runs which represent cases from many health professionals throughout the nation and consequently must have been taken from a very wide variety of patients as to age, sex, race and complaints (Table 2).

TABLE 2

636 Cases of 4 Total Runs at Mineralab

Aluminum	Number	Percent	of total
2.0-2.9mg%	52	8.2%	
3.0-3.9mg%	20	3.1%	
4.04.9mg%	6	0.9%	
5.0-5.9mg%	4	0.6%	
6.0-6.9mg%	1	0.2%	
7.0 and over	8	1.3%	
	91	14.3%	

My 13 cases with aluminum over 7.0 mg percent include three of the boys at the Marin County institution, and F. J. discussed above. A Black family of three children age 5-11 and mother was first seen in 1975. Complaints were that their hair was falling out, and the mother brought large amounts of same for me to see. In addition the mother had had periods of depression with several hospitalizations. In 1975 I was unaware of the implications of falling hair and depression as major symptoms of aluminum poisoning so no tests for aluminum were ordered. When in 1977 they were tested, despite the very high values and detoxification by Veg 12 which was ordered, they did not return.

Two children, R. L. male, and M. B. male, sent in hair preceding their visits and then cancelled the appointments. They were both over 7.0HTig percent.

A. B. male age five was an autistic child to the extent that he could not use language meaningfully most of the time. He had been very successfully treated by removal of the offending allergic foods from his diet and supplementing with pure powdered mega-vitamins. He is now doing well in regular classes at school. At age six his hair showed 7.5 mg percent of aluminum, and he was given Veg 12 Concentrate one tablet t.i.d. The next observation is very interesting.

Several months later a check arrived for this medication with a payment for the next bottle and the comment that when the mother ran out of it, his hair had lost its sheen. Thus she continued for seven to eight weeks more of therapy. He lives several hundred miles north, and since he is doing well, has not returned for another check. But again, hair's appearance may serve as a clue to aluminum toxicity.

The remaining three patients with aluminum elevated above 7.0 mg percent are adults. W. H. age 22 was depressed, had displayed learning problems from age five, had been withdrawing into his own world by age 12, and had a history of respiratory illnesses. His aluminum was 11 mg percent and the iron 8.8 mg percent (normal 2.0-5.0). Once he had blacked out, but this was undoubtedly due to hypoglycemia. Glucose-tolerance testing was not done as it can be dangerous to a borderline psychotic unless hospitalized. He is improving with Veg 12 Concentrate, a hypoglycemic diet, and chromium. This case again brings up the problem of a possible interrelation between aluminum toxicity and excessive iron.

G. B. age 52, a self-employed gardener, had been ill for two years. His symptoms were severe insomnia, soreness in the testicles which had been followed by prostate trouble for which surgical drilling had been done. This surgery had not alleviated the pain in his testicles when he sat down, and burning of urination. Urologists had found nothing more treatable. Aluminum was 12.4 mg percent, iron 6.8 percent, and lead 7.1 mg percent. Treatment has been Detox to remove lead, Veg 12 Concentrate three tablets t.i.d. to try to mobilize the aluminum and zinc and calcium supplementation because of low values in the hair. Diet was altered to remove "junk foods" and all refined carbohydrates. He is improving.

H. W. female age 84 complained of constant fatigue, hypertension, and came to the office for hair testing and nutritional advice only. She had medical care elsewhere. Despite her complaints she ran the household for self and husband. Aluminum was 12.0 mg percent and lead 4.4 mg percent.

Treatment was started. She has not returned.

The 18 patients with aluminum between 4.0 and 6.9 mg percent are grouped as follows: seven hyperactive children, three boys from the Marin County institution, the mother of the family which was losing its hair, three adults who were interested only in hair testing and nutritional analysis, and four diabetics. The diabetics represent my entire group of diabetics for the 12 months discussed. Is there a relationship of aluminum to pancreatic enzymes? It is known that aluminum is one of the metals which binds with enzymes (Lucky, 1975).

Review of the Literature

Campbell and Cass et al., (1957) in an excellent review article show that prior to World War II toxicity to aluminum was studied both in the U.S.A. and Europe. Then came the war with a rapid increase in the use of aluminum for wartime materials including airplanes and in the food manufacturing industry. Sorenson et al. (1974) again reviewed the literature in a 92-page article and summarized about 1,000 articles. The first page, set out with a black border, stresses that we are not getting enough aluminum to be harmful in any way. The last page notes that the research for this paper was paid for by grants from the United States Public Health Service and Reynolds Aluminum!

However, careful reading of the entire article gives various proofs of aluminum toxicity. Mice fed with large doses of aluminum showed no obvious defects, but their offspring followed for three generations had growth defects. We are now in a period of increasing congenital anomalies and a very real epidemic of learning disorders and hyperactivity in our children. Is there a relationship to the use of aluminum in food preparation and storage? I have many cases from families which show the children's aluminum in their hair to be above 1.0 mg percent and in the mother and often, too, the father less than 1.0 mg percent, thus implying aluminum transport through the human placenta. Secondly, if food is wrapped in aluminum foil it will keep longer than if wrapped in other types of

material—the reason being that the aluminum sets up a compound with the food which is-toxic to bacteria. Won't the food also be toxic to humans and animals since we are getting repeated small doses over many years? Third, cats injected with aluminum hydroxide are slower learners in simple conditioned avoidance tests. The dose was 12 meg/gram of cat which is the same amount as was found in the brains of Alzheimer's disease.

Crapper et al. (1973) and Kopeloff et al. (1942) showed that the application of trace amounts of aluminum to the surface of animal brains produced seizure activity.

Sources of Aluminum Poisoning

One main source of aluminum poisoning, as already revealed in two of the case studies presented, is industrial exposure. All types of production of aluminum compounds are a danger as is the use of aluminum abrasives or paints in industrial operations. The production of glass, paper, synthetic leather, porcelain and explosives involves exposure to aluminum, as well as pyrotechnical manufacturing sources which often use aluminum.

The most tragic thing about aluminum contamination at the industrial level is not only that it may be carried in the air to surrounding areas (often destroying foliage) and neighborhoods, but that if a workman's clothing is contaminated with aluminum powder he may carry it home with him in this manner and also contaminate his residence and family.

Medications such as antacids often contain aluminum. Domeboro powder used for burns, deodorants, and other skin preparations containing aluminum can produce skin irritation as well as absorption through the skin.

At the household level the consumer is bombarded with aluminum. Unless he is a very careful label-reader he may be contaminating himself through using buffered and children's aspirin, toothpastes, and free flowing salt. Aluminum content in water may vary widely in different parts of the country due to the fact that public health

or other standards for aluminum are virtually nonexistent. Water not only may contain fluoride which is a derivative of the aluminum industry, but aluminum gel is often used to flocculate out dirt and mud, especially after a rain. Pfeiffer notes that high aluminum content in the water of South Wales has been linked positively to congenital malformations of the central nervous system.

The American housewife may be saturated with sources of aluminum poisoning in her own kitchen and not even be aware of it. The list of "offenders" may include all aluminum cooking utensils, aluminum foil, and of course all foods pre-packaged in aluminum. Aluminum cooking utensils and tap water may combine together for a none-too-healthful effect if fluoride is present in the tap water, it increases the absorption of aluminum from the aluminum cooking utensils.

Also commonly found in the kitchen is baking powder. There is sodium aluminum sulfate in baking powder since it is cheaper than cream of tartar. Most commercial breads are now raised with baking powder instead of yeast.

Commercially processed foods such as milk may use aluminum equipment during processing and storage. Many products have aluminum compounds directly added to them. Examples include aluminum sulfate added to pickles, sodium aluminum phosphate to American cheese, aluminum sulfate in maraschino cherries, and aluminum phosphide which is often used as a fumigant in processing foods. Potassium alum, an aluminum-containing compound, is a bleaching agent used to whiten flour. Aluminum compounds and aluminum-bearing ores such as betonite are used in the production of pesticides, wine, beer, cider (as clarifiers), animal feed, desiccants for food preservation, FD&C colors, vanilla powder, seasoning, and plant food.

We tested various brands of soft drinks and beer in the laboratory for aluminum and compared the results to the same products in glass bottles. Even after the cans had been left open at room temperature for three days there was no measurable level of aluminum in the contents. These cans are effectively lined to prevent the liquids which have a pH of 2.5 ± 0.5

from attacking the can. Only beer and root beer have a higher pH, namely 4.5 ± 0.5 . The homeopathic physicians have told me that we can still get the vibratory essence of aluminum from these beverages, but this cannot be tested with our present instruments.

Symptoms and Effects of Aluminum Poisoning

The effects of aluminum poisoning are varied and may manifest in different areas of the body, according to length of exposure and degree of aluminum contamination, and include weight loss accompanied by loss of appetite.

Deodorants often plug the sweat glands. Hair may become dry and brittle, and much may be lost.

Lung: dyspnea, asthma, Shaver's disease associated with cough, shortness of breath, and frothy sputum.

Gastrointestinal: Symptoms vary from heartburn to colic and gastroenteritis. Effects may be severe enough to cause a hemorrhagic condition, including ulceration of the duodenum and often of the stomach. Intestinal absorption and retention of fluoride is lowered by aluminum intake. This may have adverse effects related to dental decay and osteoporosis if the sole source of fluoride is from foods.

Muscles and Bones: These effects are most marked in the patients who have had kidney dialysis with oral aluminum hydroxide. Muscle aches and weakness associated with dissolution of the bones is due to phosphorus lack since the aluminum combines with it and prevents absorption.

Liver and Kidneys: Aluminum accumulates in the liver interfering with function. Effects on the kidney include nephritis and degeneration. Fatty infiltrates have been produced by animal experiments.

Brain: Alzheimer's premature senility and psychosis with death after kidney dialysis are thoroughly documented, as is brain damage in experimental animals (see references).

Treatment

The best treatment of aluminum poisoning is prevention which, though difficult in our present environment, can be accomplished, at least partially. Whenever I have a hair test reading over 1.0 mg percent of aluminum, I use it as a teaching tool to recommend removal of all aluminum from the kitchen and medicine chest—including deodorants. There are good herbal deodorants that can be used. Food can be stored in glass and cooked in stainless steel, high-grade enamel, or glass pans. The old-fashioned iron skillet is still the best, especially for women who have a tendency to iron deficiency anemia. If there is a family member with excess iron, of course this should not be used.

Oral chelation probably can be accomplished over a long period of time with the herbal Veg 12 Concentrate, magnesium ascorbate, and various types of oral chelators which are used for other heavy metal toxicities. Distilled or spring water should be substituted for most waters generally used, and if in doubt water should be tested. Despite the lack of aluminum found in beverages, it may be better to drink beer and soft drinks from glass bottles. Of course the best method of eating and drinking would be to buy only pure unprocessed meats, vegetables, fruits, etc. (see references).

Summary

Hair analyses were done on 595 patients. Seventy-four or 12.4 percent had aluminum elevated above 2.0 mg percent (normal 0.1-1.0 mg percent). Ten delinquent, psychotic, or prepsychotic boys age 12-18 had a 90 percent incidence of elevated aluminum.

A role of chronic aluminum poisoning to hyperactivity, psychosis, and congenital anomalies in the childhood population is suggested.

Questions are raised as to the relationships involved when elevated aluminum is associated with elevated iron.

Aluminum is not innocuous in our environment. The entire population is exposed to chronic aluminum poisoning because of the uses of aluminum in industry and food preparation and

storage.

Sources of aluminum are listed. Signs and symptoms of poisoning are listed.

REFERENCES

- BENNETTE, R. M.: Influence of Soluble Aluminum Salts on Growth of Wheat Seedlings in Shives R3C3 Solution. N.J. Stat. Rpt: 255-53,1923.
- BETTS, C. T.: Does Aluminum Kitchen Ware Cause Cancer? Nature's Path, April, 1949.
- BERTRAND, G., and LEVY, G.: Content of Plants in Aluminum. Comp. Rend. Acad. Sci. Paris 192 No. 9:525-529,1931.
- CAMPBELL, I., and CASS, J., et al.. Aluminum in the Environment of Man. AMA Archives of Industrial Medicine 15: 359-448, May, 1957.
- CLEMENT, M.: Aluminum, A Menace to Health. Bh-True Publ. Co., Ruslington, Sussex. June, 1949.
- CRAPPER, D.R., KRISHMAN, S. S., and DALTON, A. S.: Brain Aluminum Distribution and Experimental Neurofibrillary Degeneration. Science, Vol. 180 pp. 511 -513, May 4,1973.
- FUCHS, C, and BRASCHE, M., et al.: Aluminum Determination in Serum by Flameless Atomic Absorption. Clinica Chimica Acta 52: 71-80,1974.
- KOPELOFF, L, BARRERA, S., and KOPELOFF, N.: Amer. J. Psychiat 98:881,1942.
- LUCKEY, T. D., VERMUGOPAL, B., and HUTCHINSON, D.: Heavy Metal Toxicity, Safety and Hormology. George Thieme Publishers, Stuttgart Academic Press, New York, S.F., London, 1975.
- MAYOR, G. H., and KEISER, J. A.: Aluminum Absorption and Distribution. Effect of Parathyroid Hormone. Science 197: 1187-89, September, 1977.
- PFEIFFER, C.: Mental and Elemental Nutrients. Keats Publ. Co., New Canaan, Conn., 1975.
- PFEIFFER, C: Zinc and Other Nutrients. Keats Publ. Co., New Canaan, Conn., 1978.
- Physicians Desk Reference, 1978.
- RODALE, J. I., and Staff: Complete Book of Minerals For Health. Rodale Books, Inc., Emmaus, PA, 1976.
- SHAYER, C. G., and RIDDELL, A. R.: Lung Changes Associated with the Manufacture of Alumina Abrasives. Jour. of Ind. Hygiene and Toxicology 29:3, pp. 145-157, May, 1947.
- SHAYER, C. G.: Further Observations of Lung Changes with the Manufacture of Alumina Abrasives. Radiology Vol. 50,160-69,1948.
- SORENSEN, J. R. J., CAMPBELL, I. R., TEPPER, L. B., and LENGG, R.D.: Aluminum in Environment and Human Health. Environment Health Perspectives 8:3-95,1974.
- UNDERWOOD, E. J.: Trace Elements in Human and Animal Nutrition. Academic Press, London, 1971.
- WILLIAMS, D.: Introduction to Bio-Inorganic Chemistry. Publ. Chas. Thomas, 1976.

BOOK REVIEWS

MALNUTRITION, BEHAVIOR AND SOCIAL ORGANIZATION

Ed. L. S. Greene Academic Press, Inc., New York 298 pages, \$19.50

Orthomolecular psychiatry deals with the effect of certain forms of malnutrition on behavior of individuals. But we seldom have an opportunity of studying a type of malnutrition much more common in underdeveloped countries, such as chronic protein calorie deficiency or starvation. In infants it takes the form of either marasmus or kwashiorkor, or a combination of both. In developed countries we see the effects of a recent and peculiar form of malnutrition generated by the massive consumption of processed foods which do not have the nutritional quality of the original foodstuff from which they are made. The new processed food is rich in food artifacts (fractions of original food separated out by chemical techniques) and in food additives which impart color, flavor and palatability while deteriorating the food. It is also depleted in a number of vitamins and minerals and in fiber.

Protein calorie malnutrition (PCM) threatens life much more directly, but the other form, or Orthomolecular malnutrition, more often threatens the quality of life more than life itself. This book

examines the relationship between PCM, behavior and social organization which is why-1 became interested in it. However, while it is a very informative volume, it deals very little with behavior on an individual level, but it does describe some of what is known about the effect of two forms of severe malnutrition on social organization, PCM and endemic goitre and cretinism. I am encouraged by this display of interest among nutritionists and anthropologists in the relationship of malnutrition and social behavior.

Readers of this book will discover that enormous numbers of children in underdeveloped countries suffer from severe and moderate PCM which leaves a clear deficit on social and intellectual function of the unfortunate individual. This is mediated by means of the residual deficits of the central nervous system. A good example is deaf-mute cretinism arising from chronic hypothyroidism. PCM also decreases resistance to infection which in turn leads to more infection which aggravates malnutrition.

PCM in children leads to apathy, irritability, anorexia and withdrawal. The evidence that it also causes permanent mental deficiency is suggestive. This syndrome is rare in developed countries where we more often see hyperactivity and learning disorders.

The effect of chronic endemic cretinism was examined in an area in Ecuador where six percent of the population were deaf-mute cretins: in this population the population also contained many individuals with moderate neurological deficits who were considered to be normal. The presence of so many deaf-mute cretins created a concept of normality which excluded only the most severely affected. The deaf-mute cretin became a basic referent. As a result, anyone who was not deaf-mute was "normal." It also allowed the upper classes, mostly white, to consider the lower classes on inferior race; they did not recognize the condition was nutritionally induced. We have not recognized the danger of using average populations for determining health status. Thus hypoglycemia has become so frequent in our population that it is becoming incorporated into so-called norms. So many children are hyperactive that some pediatricians no longer consider it abnormal. We must be careful to maintain ideal health standards and not allow any abnormal conditions to debase our standards.

The only direct reference to psychiatry dealt with grand hysteria, a once common condition no longer seen, and arctic hysteria sometimes seen in Eskimos. It is suggested this was due to low blood calcium due to a shortage of sunshine and dairy products.

The type of malnutrition (PCM) described here is not yet of great concern in the USA and Canada. I would hope academics would become interested in Orthomolecular malnutrition for if and when PCM is finally brought under some control, it will surely be followed by Orthomolecular malnutrition unless developing countries learn our lessons and do not allow their food supply to be debased as we have ours.

CANCER AND ITS NUTRITIONAL THERAPIES

R. A. Passwater Keats Publishing, Inc., New Canaan, Conn., 1978.

Cancer, in common with other degenerative diseases, relentlessly resists the combined efforts of medical research to discover effective and practical treatment. Where there has been a decrease in incidence for some types of cancer the reasons are obscure. The public, which has been led to believe that a cure can be found, is not prepared to accept these negative conclusions. They do not believe that research has failed. Rather they believe it is a failure of the cancer medical establishment to do its research properly. They believe that the cancer research we all hear about has been too single-minded in pursuing the search for one cause and one miracle treatment. They believe that many other options should have been investigated. They will no longer accept the blanket indictment of alternative forms of treatment as quackery. The introduction of the right to use laetrile, against the most powerful establishment opposition, is proof of what the public thinks of the establishment cancer view. At any time the controversy could have been halted by a willingness to examine the claims of alternative treatment, no matter how bizarre they might appear to be.

In this book, Dr. R. A. Passwater outlines the main alternative treatment program. It is in fact an amalgam of the most effective orthodox treatment, surgery, chemotherapy, radiation, with the most modern Orthomolecular treatment, i.e., optimum nutrition and optimum doses of those nutrients which have been found to have an effect. The main vitamins used in large doses are Vitamin A, Vitamin C, Vitamin E, the B complex and the trace element selenium. This treatment is not a revolution against orthodox cancer treatment; it is an evolution to something less toxic and more effective. Laetrile is also discussed in a later section. The controversy over laetrile is one of the current medical

dramas being played in our time. There have been many others.

Passwater's book leads to the conclusion that the chances of getting cancer prevention are greatly enhanced if one avoids known cancer risk factors such as smoking, additives in food, pollutants in water, soil and air, and over exposure to radiation including sun. Prevention is also enhanced by striving for optimum health. This is achieved by super nutrition, i.e., by eating only food. All junk or processed foods containing substances which do not enhance nutritional quality are forbidden. The vitamins already listed are also used.

For treatment the same approach is used but now vitamins are used in much larger quantities. Laetrile may also be used in this total program. Passwater's review of the data shows that the evidence favoring laetrile is scientifically much stronger than the negative data.

Passwater is a rare author; a scientist well able to examine evidence critically and able to present it clearly and effectively. This book should join his two other books, **Supernutrition: Megavitamin Revolution**, and **Supernutrition for Healthy Hearts**, in the library of every person who believes he/she has some responsibility for his/her own health.

A. Hoffer, M.D., Ph.D.