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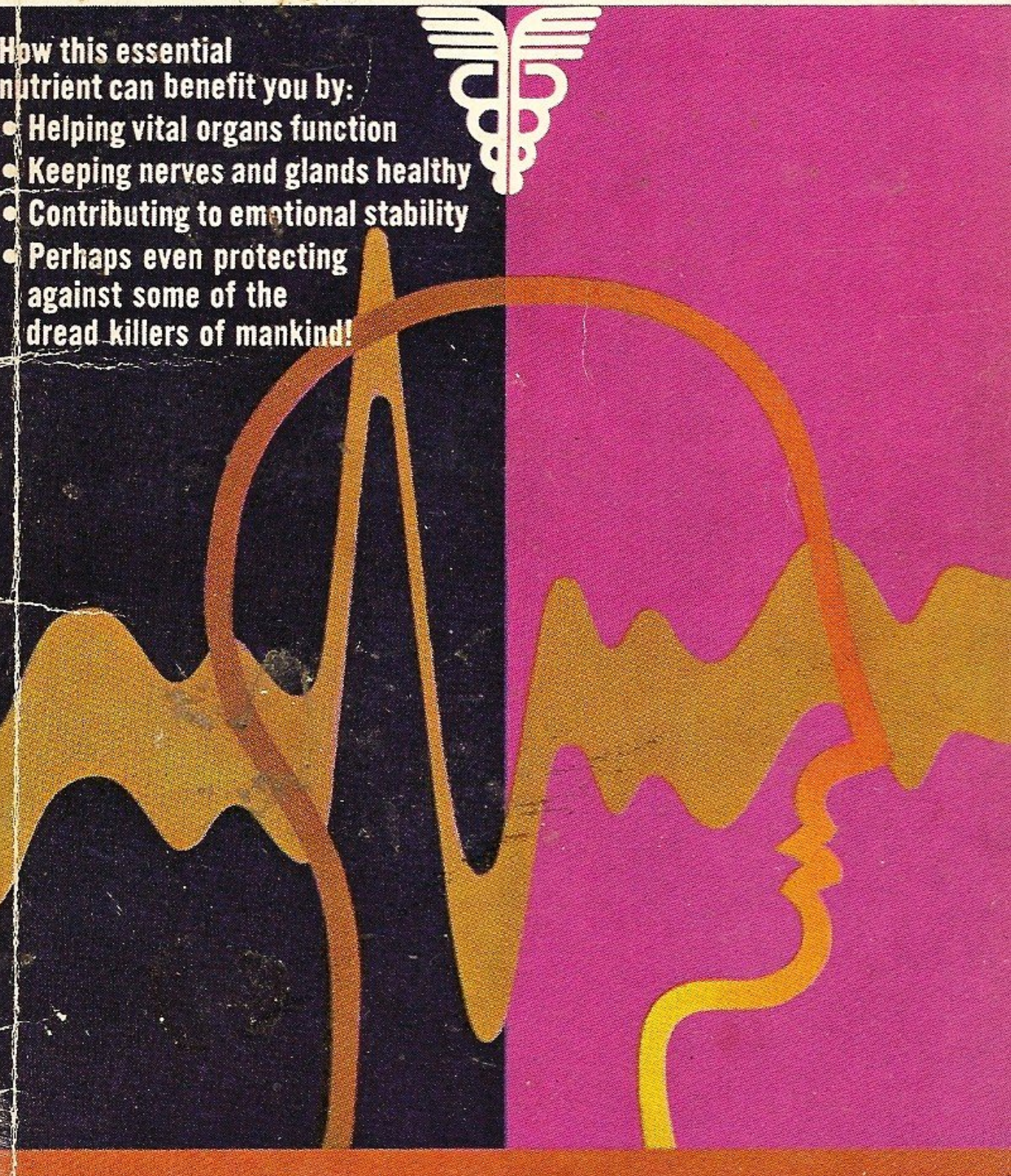
MUST READING IF YOU VALUE GOOD HEALTH!

magnesium, the nutrient that could change your life

How this essential nutrient can benefit you by:

- Helping vital organs function
- Keeping nerves and glands healthy
- Contributing to emotional stability
- Perhaps even protecting against some of the dread killers of mankind!



J. I. Rodale With Harald J. Taub

MAGNESIUM

THE NUTRIENT THAT COULD CHANGE YOUR LIFE

J. I. RODALE
with
HARALD J. TAUB

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MAGNESIUM, THE NUTRIENT THAT COULD CHANGE YOUR LIFE

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Introduction

It is only recently that scientists have definitely established the existence of magnesium deficiency in man. For years medical reports stated that a person could obtain enough magnesium from food to keep his bones and cells healthy. Yet the more researchers learned about this mineral, the more they have come to realize that much ill health is due to existing magnesium deficiencies. Furthermore, they now know that since most people never eat enough of the magnesium-rich foods (nuts, seed foods, and green vegetables), the deficiency may well be universal.

Without magnesium the actions of nerves and muscles are impaired. Convulsions, dizziness, muscular weakness, weak teeth and bones, and nervous irritability have all been cited as features of magnesium deficiency. There are other conditions where magnesium deficiency may also be present yet difficult to detect because the overt symptoms are missing or masked.

The editor and staff of *Prevention* magazine have long been aware of the importance of magnesium in human nutrition. They have been greatly concerned because the public was serenely confident that it was getting enough of this valuable mineral. Time and time again they have called attention to the fact that this is not so. Now that the essentiality of this

mineral and its widespread deficiency are both recognized, the time has come to put before the public the many vital metabolic roles of this one mineral and how to make certain you benefit by them.

If you want to understand the essential metabolic function of magnesium, to learn how a lack of this mineral nutrient affects the vital organs, and, most important of all, to learn how to prevent a deficiency in your own body, read on! The authors have drawn on voluminous research and years of study about this vital mineral to prepare this book for you. Their hope is that after reading it you will understand the relation of magnesium to physical and mental health, be aware of the symptoms of a magnesium deficiency and, first and foremost, be able to ensure an adequate supply of this essential mineral to your own body.

1. The Miracle Mineral

Our initial interest in magnesium as an aid to bodily health was aroused in 1939 by the work of Dr. P. Schrumpf-Pierron in the field of cancer research. The researches of Professor P. Schrumpf-Pierron are written up in the *Bulletin de L'Institut D'Egypte* (Vol. XIV, February 15, 1932) and others. He talks about the rarity of cancer in Egypt where the rate of malignant cases is only about one-tenth that of Europe. What is the cause? After exhaustive studies and research the doctor came to the conclusion that it was due to too much potassium and too little magnesium in the foods of Europeans. On the other hand, in the soils of Egypt the conditions are reversed; that is, more magnesium in relation to the potassium.

There seems to be a definite relationship between magnesium and potash wherever it is found, whether in the soils, rocks, or other places. Where there is an oversupply of potash, there is always an undersupply of magnesium and vice versa. Schrumpf-Pierron studied the cancer statistics for France in relation to the rock structure underlying its soils. It worked most uncannily. Wherever he found an excess of potash, there he discovered less magnesium and more human cancer cases. Wherever he observed a minimum of potash, he found a maximum of magnesium and less cancer cases. This means that people who eat food raised in certain soils that obtain their nutriments from the rocks that underlie them get certain elements into their foods because of this. Such a condition would apply more to France than to the United States, because in a country like France there would be more of a tendency to consume food near the point at which it is raised. But in the United States, with our more advanced industrial condition, where even the poorer people are able to buy winter vegetables raised in California, Florida, and elsewhere, a great deal of citrus foods, etc., and meats that are shipped long distances, local deficiencies and unbalancings of nutritional elements may tend to be corrected to a certain extent.

When Schrumpf-Pierron found that an excess of potassium in the rocks of a region tied in with an excess of cancer cases in that section, we should note that excess of potassium means excess of carbohydrates in plants grown there and, therefore, reduced protein in the foods. Farmers should know that it is best, therefore, to use dolomitic limestone when they apply lime, because it is rich in magnesium and acts as a safety factor in relation to the potash in the soil.

In an article, "The Importance of Magnesium in Human Nutrition," by S. Marcovitch, Ph.D., printed in *The Science Counselor* (December, 1954, Duquesne University Press), appears the following: "It is now generally known that the liberal use of potassium fertilizers tends to cause deficiency of magnesium in plants, and even lowers the calcium and soda content. Cattle fed on such high potassium forage develop grass tetany."

The evidence of a dietary need for much magnesium is mountainous-our files are bulging with scientific papers on the subject.

At this point you may be saying, "Am I getting enough magnesium?" So may we tell you that if you eat sunflower and pumpkin seeds, if you take at least four bone meal tablets of standard size a day, if you eat wheat germ, peanuts, peas, beans, soybeans, and plenty of meat, you are assured of getting enough magnesium.

At this time we would like to discuss our bête noire--milk drinking. Dr. S. Marcovitch, quoted above, says in the same article: "Milk with a low magnesium ratio, while an excellent food for the young, may be detrimental for adults."

Here is another reference: "Some component of milk interferes with the utilization of magnesium. R. H. Smith [in the *BioClinical Journal*, 67, 472, 19571 ... recently undertook the elucidation of this phenomenon," *Nutrition Reviews* (June, 1958).

In the March 31, 1958, issue of *Newsweek*, we were thrilled when we read of a discovery to help heart patients made by the famous Dr. Hans Selye of McGill University at Montreal. Selye took groups of albino rats and, by making them undergo certain stresses that damaged their heart muscles, caused them to die. But when he gave them injections of magnesium and potassium, they always continued to live.

We are sorry that we have to disagree with Dr. Selye, but we are of the opinion that he would have gotten the same results with the magnesium alone, and without the potassium, and there is much medical work that backs us up! In *The Journal of the American Medical Association* (October 19, 1963), Charles Fisch, M.D., stated that medical science may have been wrong in prescribing potassium for patients with coronary disease. Research shows that potassium may make digitalis intoxication worse, "even to the point of cardio active standstill." He says that "potassium has been too enthusiastically received, and some say too enthusiastically given. Recent observations, though, have pointed out to contraindications, and certain cardiologists have suggested caution in the use of potassium." Charles Fisch is chief of the cardiovascular division at Indiana University School of Medicine. He gives a lot of evidence to prove his point.

In our own files we find several proofs that good results in coronary cases can be obtained by the use of magnesium without potassium. Here is S. E. Browne, M.D., writing to *The Lancet* (London, December, 1961), who says that for the past nine months he has injected a magnesium sulfate solution into patients with severe angina or a history of coronary thrombosis with excellent results on five patients with really severe angina.

Another piece of evidence is in an article in *The Lancet* (November 1, 1958) which says, "Recent work has suggested that magnesium may be related to atherosclerosis and ischaemic heart disease. It has been claimed that magnesium sulphate is of therapeutic value in myocardial infarction, while a high magnesium diet has prevented the development of atherosclerosis in rats." Not a word about potassium.

In *The British Medical Journal* (January 23, 1960), an item contains the following: "Over 100 patients suffering from coronary heart disease . . . were treated with intramuscular [injected] magnesium sulphate with only one death, compared to their findings in the previous year when, of 196 cases admitted and treated with routine anticoagulants, 60 died."

In the *American Heart Journal* (February, 1959) cases are described of damage to the heart by certain medication. Then in the summary appears the following: "The damage to the heart and the blood vessels, caused by the bacterial polysaccharide, was considered as a common phenomenon induced by some of the high molecular substances . . . Such damage was reduced effectively by the concurrent oral administration of magnesium chloride."

Another in *The South African Medical Journal* (December 20, 1958): . . . "The value of parenteral [not oral] magnesium-sulphate therapy in acute and chronic heart disease has once again been affirmed. M cases of angina have been treated by 5 workers with 66 per cent remission of pain. 64 cases of acute coronary thrombosis or acute coronary insufficiency have been treated. Of these only one died in an acute attack. The great importance of early parenteral magnesium sulphate therapy in these cases has been stressed . . . It is suggested that in cases who have recovered from an attack of coronary thrombosis, life expectancy can be improved by combined heparin and magnesium- sulphate by long-term therapy."

Finally, here is an interesting item from *The South African Medical Journal* (October 18, 1958):

> "In a personal communication to us Dr. Parsons writes as follows:
>
> " 'We have completed 50 cases of patients treated with magnesium sulphate and have reported our findings in a paper to the British Medical Journal. We feel that this form of treatment has surpassed other forms especially in cases suffering from angina. Medicine is a progressive science and in its multiple branches new forms of therapy are constantly appearing.
>
> " 'To physicians who are students not alone of the manifestations of disease, but also of the working of human nature, there are few chapters in the field of therapeutics more interesting than those which record the response of medical men to the Supposed advances in the treatment of disease. This can roughly be divided into 4 stages:
>
> " 'The first reaction is that of scepticism and outright rejection by the few whose verdict matters most. This is understandable in the light of past experience. Many medical men have announced their cure of disease, provided remedies to relieve symptoms, and invented methods of treatment that seemed to put off the inevitable tendency to dissolution. Yet few of these inventions and discoveries have maintained their early reputation. Another initial difficulty is that our views about a new and unorthodox method of treatment are already prejudiced by various influences, both emotional and intellectual, and particularly by theories which pervade our own thought, sometimes without our being aware of them. To be ruthlessly critical of another man's theories is one of the easiest tasks to accomplish. The 2nd stage in the life history of a new drug is one of unbridled enthusiasm and acceptance by the many. Wild and exaggerated claims are made in support of a new drug, impossible hopes are entertained or the drug may be used in the wrong dose and in the wrong way. This inevitably brings a useful remedy into disrepute (3rd stage) and it may take years

before the 4th stage is reached and the drug makes its final reappearance in the field of therapeutics. The history of tuberculin is a glaring example of this."

So . . . we'll stake our money on magnesium without potassium.

2. MAGNESIUM AND CANCER

Under the date of MAY 19, 1931, Dr. P. Schrumpf-Pierron presented a paper entitled "On the Cause Of the Rarity of Cancer in Egypt," which was printed in the *Bulletin of the Academy of Medicine*, and the *Bulletin of the French Association for the Study of Cancer* in July, 1931. The following is a digested and simplified version of it:

During the year 1931 I presented to the Academy of Medicine in Paris several papers on the rarity of cancer in Egypt, which came to the following conclusions:

(1) Cancer for Egypt is about one-tenth that of Europe and America.

(2) In Egypt, cancer is less frequent in country fellahin than in the Egyptians who live in the towns and who have adopted Europeanized dietary habits.

(3) The degree of malignancy of Egyptian cancers is less than that of European cancers. They develop less quickly, and have less of a tendency to invade neighboring tissues.

(4) The type of cancer which is the most frequent in all the countries rich in cancer is cancer of the digestive, tract, which represents 40 to 50 percent of all cancers. In the case of Egyptians, this type of cancer is remarkably rare; in the country fellahin, practically nonexistent.

My predecessors at l'École de Médecine, Fergusson, Madden, Day, Dolbey, as well as the eminent English cancer specialist, Roger Williams, have arrived at the same conclusions. Engel Bey wrote in 1908. "From these data it appears that the reputation of Egypt for comparative immunity from cancer is well founded."

What are the causes of the rarity of cancer in Egypt? After having eliminated racial and climatic factors for reasons which can be found in my preceding papers, I said to myself that it must be looked for in an element contained in the food. It is this which led me to do research on the food of the fellah, and I found that that which characterizes the diet of the fellah is its richness in salts of magnesium. The fellah consumes in his food, in the water which he drinks, and in the crude salt which he uses from 2.5 to 3 grams of magnesium per day, against 4 to 5 grams of potash.

What is, by comparison, the mineralization of the average diet of the inhabitant of the towns of Europe and America? Let us look at the following:

Bread--for the populace, bread furnishes 40 percent of the calorie total; in the well-to-do classes only 20 Percent. And it is always a question of bread which is relatively rich in potash, poor in minerals in general. Thus the principal contribution of magnesium is lacking.

Meat--the amount of minerals in meat is practically negligible.

Potatoes--the 'industrial' varieties of potatoes with a large yield and with voluminous tubercles all show an excessive wealth of potash and are poor in magnesium. Thus, the consumption of large quantities of potatoes, such, for example, in, Germany, represents an important contribution in potash.

Doughs, rices, macaronis, etc. have the same composition as the flours from which they have been made. (Thus .5 percent of ashes at the maximum). Husked and polished rice is also poor in mineral elements.

Vegetables--spinach, carrots, beets, celery, cabbage, peas, all are rich in potash. (0.5 Percent). Except for spinach, they are poor in magnesium, but contain at times as much calcium as potash. Salads have as an average 0.38 percent of potash, 0.08 percent of, calcium, and 0.04 percent of magnesium.

But, according to the analyses of M. Villain, the greater part of vegetables today are, compared to those of Wolff's time (1870), too poor in magnesium and relatively too rich in potash.

Fruits--only the skins and rinds of fruits contain minerals and in particular magnesium.

Dairy products--milk is relatively rich in potash (0.17 percent), in calcium (0.16 percent), poor in magnesium (0.02 percent).

It can thus be seen that whole cereals, especially corn, are the foodstuffs in which there is enough magnesium. It is because of the processing and refining of foods that the world is being robbed of magnesium. Whereas the Egyptian fellah's ratio is 2.5 to 3 grams of magnesium against 4 to 5 grams of potash a day, in Europe and America it is only 0.5 gram of magnesium against 2 to 4 grams of potash per day.

An intoxication of potash--an excess of potash poisons--can "kill" the soil where the food is grown. It poisons the plants, then man. Besides, several other authorities have already accused potash of producing cancer. Theis and Benedikt, as well as Menetrier, have already stated that the higher amount of potash in cancerous tissue, which is a radioactive body, would cause the multiplication of cancerous cells.

P. Rosenstein and H. Kohler (from Berlin), who have just published the results of their researches on the causes of cancer, come to the same conclusions:

"If our opinion is correct, that is to say that potassium plays a preponderant role in the genesis of cancer, we will be better able to understand why the number of cancer cases has increased to such a degree: because *the generalisation of the use of modern chemical fertilizers today brings to the organism of men and animals much more potash than was formerly true."*

It is *absence of magnesium* that permits potash to become toxic and cancerogenic. Potash is useful and indispensable to the plant as to man, but only if it is in a favorable ratio with magnesium and calcium. Magnesium acts as a "brake for cancer" (Delbet), as much as an antitoxic of potash. This is why "the predisposition to cancer accompanies the deficit of magnesium reserves" (Dubar and Voisenet). The older the individual is, the easier the intoxication by potash, because the organism grows older and becomes poorer in magnesium

than the young organism; this loss in magnesium decreases vitality, resistance, the power of regeneration of cells (Delbet), "provoking a sort of cellular anarchy which favors the evolution of cancerous processes" (L. Randoin). Thus one must conceive the role of magnesium as twofold: first as an antitoxin for potash and second as an anti-senility element.

But why, it will be objected, are there in Europe agricultural districts where the inhabitants eat principally products of their own land, many vegetables, little meat, brown bread, etc., and where, however, we find regular nests of cancer, villages where the cancer mortality reaches enormous proportions? Because it is a question of districts where the earth has become so poor in magnesium, or where an excessive amount of chemical fertilizing made it so rich in potash, that the ratio of magnesium, potash, and calcium has become unfavorable to such a point that it leads particularly quickly to cancer. It is a question then in some way of *a surmineralization by minerals the balance of which is unfavorable*. It is thus that one can often explain the failure, and at times the clearly harmful effect, of the classic milk-vegetarian diet, of which there have been so many practitioners again these past years. The magnesium content is too low.

The practical conclusions which result from our thesis are the following:

To prevent cancer and progressively diminish its frequency, two conditions should be fulfilled:

First, agriculture should tend to produce new healthy plants, with "normal" mineralization. This can be obtained, as proved by M. Villain, by a regeneration of the earth with the aid of appropriate fertilizers, under a systematic control of the mineralization of cultivated vegetables. It is a question of a new science, which must be inspired with the fundamental principle *that abnormal mineralization of an alimentary plant logically has its repercussion on the mineral balance of animals and men who feed themselves on it*; that besides, the more the mineralization is "normal," the more the alimentary quality, if not the yield of the plant, is raised; that finally, in agriculture, quality must never be sacrificed to quantity.

Second, the principles of modem alimentary hygiene must be greatly modified and above all detached from the too-narrow concept of "caloric worth" of an aliment as the only measure of its "nutritive worth." The overly civilized world feeds itself poorly. Without being obliged to return to the quasi animal diet of the fellahin, it should relearn to mineralize itself normally. Thus, it is above all a bread reform that should be imposed; that is, certain varieties of wheat grown that are richer in magnesium than others. But the safest cereal is corn (maize) in which the proportion of magnesium is quite high. Corn is the magnesium aliment par excellence.

Even when it grows on less favorable soil, less rich, in magnesium than Egyptian soil, corn still always contains a relatively large amount of magnesium, little potash and calcium, and a lot of phosphoric acid.

In the southern countries, where corn is the base of the diet of the people, cancer is relatively rare. It is very rare where the corn is consumed integrally, as is done by the fellahin in Egypt. If colored people in the United States show less cases of cancer than whites, it is not because the dark race is refractory, as has been said, but very probably because the American Negroes have retained the African habit of eating corn.

One can state that the problem of cancer and many other illnesses depends mainly on the bread in the diet. There must be a reorganization of agricultural methods, especially with

regard to the kind of fertilizers used, and a change of concept in the food factories and bakeries. It is urgent that we act, because cancer is terribly on the increase.

With regard to fertilizers, the organic method, using no chemical fertilizer but only composts made from animal manures and vegetable matter, ensures against the over application of potash to the soil. Read our magazine *Organic Gardening*. Dolomite limestone, rich in magnesium should be used.

Here are some figures:

In 1961 the cancer death rate per 100,000 population was 178.3 for the New England states, compared to 128.2 for the South Atlantic states. The Middle Atlantic states (New York, New Jersey, Pennsylvania) had a rate of 180.5, compared to 127.7 in the East South Central states. The highest rate for the continental United States was in New York (186.5) and the lowest in New Mexico (78.8).

More corroboration. In 1958, the last year for which a figure is available, the Egyptian rate was 28.5 and the United States rate, 146.9.

Eat plenty of corn.

3. HEART ACTION IS AIDED

That the human heart is an unbelievably efficient type of pump, able to push incredible quantities of fluid and to work continuously, day and night, without ever resting, is a phenomenon that has long been recognized. Not so long known and far from universally recognized is the fact that the mineral nutrient, calcium, is indispensable to the ability of the heart to keep working. Failure to recognize this might be compared to understanding that a gasoline explosion turns the drive shaft of a car but not knowing that the gasoline will not explode unless it has a spark plug to ignite it.

Dr. Winifred Nayler of the Baker Medical Research Institute describes the process in *Heart Journal* (March, 1967) as an electrochemical process that takes places within each cell of the heart. On the outer surface of each heart tissue cell, there is a thin filament known as actin. The actin reaches with a kind of magnetic attraction toward the center of the cell shortening its length. The result of many cells shortening at one time is contraction of the muscle. And it is calcium, fed to the actin by the bloodstream, that provides both the stimulus and the means by which the actin does its work. A shortage of calcium must inevitably result in a weakened heartbeat, which can be speeded up by drug stimulants but cannot be strengthened, as long as the calcium is deficient. Even this simple explanation, we believe, points out the folly of treating a weak heartbeat with drugs, at least until the ability to absorb calcium and the quantity of calcium in the diet have been checked and corrected.

To continue our analogy, however, when you understand that it takes a spark plug to ignite your gasoline, that isn't the end of the story. It also takes ignition points to direct electrical energy to the right spark- plug at the right time. And as Dr. Nayler tells us, while calcium is

fundamentally necessary to the heartbeat, the calcium will not do what it is supposed to do unless it is controlled in its turn by a sufficient quantity of magnesium in the system.

The reason for this, Dr. Nayler tells us, is that it is necessary for the actin alternately to absorb and release calcium. If it could not do both, the heart would either contract and stay contracted or else refuse to contract at all. For the heart to keep contracting and relaxing alternately requires that it be a very busy living chemical laboratory. And it is magnesium that seems to be the key element that actually regulates the heartbeat. How does it do it? By providing the tiny positive electrical charge that repels calcium, pushing it to the opposite side of the individual cell and reversing the contraction that has just taken place. Throughout the body, magnesium seems to be the mineral of basic importance in controlling the manner in which electrical charges are utilized to induce the passage of materials in and out of cells.

Nor is the heart the only portion of the circulatory system that is affected and, in effect, controlled by whether we obtain enough magnesium in our diets.

Blood Vessels Improved

Throughout our systems, all muscular tissues are designed to be able both to contract and to relax, and if either function fails, there is trouble. Hypertension, or high blood pressure, is caused by an excessive contraction of or inability to relax the muscles surrounding the walls of arteries. It was reported fix the *Journal of the American Medical Association* (February 22, 1965) by Dr. B. H. Seller that magnesium salts induced these muscles to relax and had therefore been found effective as a treatment for high blood pressure.

Similarly, in experimenting on the cellular metabolism with possible treatments for arteriosclerosis (hardening of the arteries), Dr. T. Shimamoto reported in the *American Heart Journal* in 1959 that he was able to reduce swelling and consequent constriction of arterial walls with magnesium salts. According to Dr. Mildred Seelig (*American Journal of Clinical Nutrition*, June, 1964), there is a direct relationship between the amount of magnesium in the diet and ability to avoid high blood pressure. Dr. Seelig regards the difference in magnesium consumption as an important reason why there are far fewer heart attacks among Orientals than there are in the Western countries.

The study of magnesium and its many roles in human metabolism is only in its infancy. Until very recent years, this was the forgotten mineral. It was known to be essential, but nobody had any idea what it really does within the system nor did anyone seem to care much.

Today it is a different matter. As the new science of biochemistry gets under way, scientists have come to realize how important is the long-known fact that our bodies are constantly generating tiny electrical impulses and discharging them. These minute electrical charges have long been regarded as a curiosity of no great significance, but it has been discovered that they are an essential part of the processes of life. Every movement, external or internal, is triggered by such impulses transmitted along nerves. Without our electrical systems, there could be no life whatsoever. And so, today, we are compelled to recognize that if magnesium is the primary regulator of the electrical activity within our bodies, then magnesium is obviously of far greater importance to health and life itself than anybody had guessed even 10 years ago. This being so, what chance is there that you are getting enough magnesium in your regular diet?

Dr. Mildred Seelig, previously cited, calculated that the average American falls short by 200 milligrams a day or more of the optimal amount of magnesium one should consume for good health. Present in many foods, magnesium is unfortunately extremely sensitive to heat and easily lost during the processing of foods. People who eat raw and unprocessed foods probably get enough. How many in America do? How many in America even find it possible?

Therein, perhaps, lies the answer to the riddle of why so many Americans have heart attacks, high blood pressure, and strokes, and why these diseases are on the increase in western Europe. Nor is the circulatory system the only group of organs you will be giving a health boost if you are careful to add more magnesium to your diet. Even among essential nutrients, this one seems just a bit more essential.

4. THE BLOOD

In this chapter we will show how magnesium increases the efficiency of the white blood cells. For this we will turn to the celebrated work of Pierre Delbet, called *Politique Préventive du Cancer.*

There is, on the average, only one of these cells for each 150 of the red blood cells. These white corpuscles have a unique power. When the bloodstream is invaded by harmful bacteria or any other foreign matter, these white cells are somehow attracted to the source of the invasion, such as a wound, and go to work actually swallowing, and digesting the foreign matter and thus rendering it harmless. They do the same with any foreign bodies that infiltrate the bloodstream. They are the body's first and most important defense against all types of infection.

But to increase the number of such cells circulating in the bloodstream would be a very dangerous thing. Leukemia, cancer of the blood, is marked by precisely such an increase. The destructive capacity of these cells is so great that their numbers must be kept at normal proportions for fear of the damage they might do our own systems if they got out of hand.

But on the other hand, think what it could mean if we could induce the white cells in our blood to double their protective activity without any increase in numbers. It would reduce sharply the possibility that invaders of the bloodstream could get by these defenders and do consequent damage to our systems. It would mean that the need for drugs to fight bacterial invasions would be just about eliminated. It would mean bringing the protective ability of everybody's blood up to the level that is now possessed by the superbly healthy individual.

And that is just what Pierre Delbet claims that magnesium can do for us. He describes this in a paper he submitted in collaboration with Dr. Karalanopoulo to the French Academy of Science, September 6, 1915, titled *Cytophylaxis,* which means work done by the white cells or phagocytes in destroying invaders of the bloodstream.

The paper summarized a study Delbet made of the effect on body cells of various known solutions Used to dress wounds, in order to find a better solution. He mixed in test tubes white corpuscles, microbes, and the solution to be tested, then studied the destruction of foreign

bodies by the white cells after a lapse of 20 minutes. He used 16,000 white blood cells and 19,716 microbes.

Of the solutions studied, potassium permanganate and Labarraque's solution destroyed the red and white corpuscles to such an extent that it was impossible to recognize anything in the preparations. A similar effect was noted with Formalin.

Other solutions were less destructive. These included hydrogen peroxide, phenolic acid, Gram's solution, and cyanide of mercury. Sodium chloride was somewhat better.

Tests showed that, as antiseptics, these solutions were inadequate. The problem was to kill the microbes without killing the blood cells.

Since table salt (sodium chloride) showed up best in all these tests, various solutions of this type were tested but did not compare with the effectiveness of magnesium chloride. Delbet says, "A solution of magnesium chloride at 12.1 parts per 1,000 gave extraordinary results. It increased the proportion of phagocytosis [killing microbes] by 75 per cent as compared with the solution of sodium chloride at 8 parts per 1,000 which itself gave 63 per cent more than the Locke-Ringer's solution. The increase is based on the number of polynucleates [white cells] as well as the phagocytic [germ-destroying] power of each of them.

> "These experiments prove that a solution of desiccated chloride of magnesium at 12.1 parts per 1,000 has a special effect on the white corpuscles, which is not the case with either physiological serum [a solution of chloride of sodium at seven parts per 1,000] or seawater, or the solution of Locke-Ringer which was considered best for maintaining the activity of cells.
>
> "Consequently, a solution of chloride of magnesium was better than all the solutions previously used in the washing and dressing of wounds."

In another communication to the French Academy of Medicine (September 7, 1915), Dr. Delbet describes researches that proved the effectiveness of magnesium within the body. He injected 150 cc. of a solution of magnesium chloride into the vein of a dog, taking a blood sample before the injection and a second one 35 minutes afterward. Then the white corpuscles were presented with microbes from the same culture to see their effect on or power to destroy them.

Five hundred white cells in the first sample destroyed 245 microbes. Five hundred white cells from the second destroyed 681. This increase in microbe-killing under the influence of magnesium chloride was 180 percent over the other solutions.

More experiments were performed; in one there was an increase to 129 percent, in another, 333 percent.

Thus not only is the action of chloride of magnesium effective outside of the body but also inside. And the magnesium solution is not toxic.

Delbet says,

> "Used in dressings and in subcutaneous injections, the solution of chloride of magnesium, in my opinion, seemed to be effective. I think it enabled me to avoid

amputating the thigh of a soldier which I decided to amputate for an arthritis of the knee with the crushing of the knee-cap and of the external condyle of the femur.

"These experiments have enlarged to a remarkable extent the role of cytophylaxis. From a mere technique in dressing wounds it has become a general method which not only increases the resistance of the body against infection, but also against vitamin deficiency, against anaphylaxis, senile decay and cancer.

"I first used chloride of magnesium alone. At the beginning of 1928, after becoming acquainted with the famous works of Grignard on the synthetic power of the organo-magnesic compounds, I added to chloride small quantities of other halogenous salts of this metal. After some tentative efforts, I arrived in collaboration with Dr. Chapelle at the formula which I have described on page 15. [of this book]. It has been named 'delbiase.' Since March, 1928, all my experimental and clinical researches have been carried out with delbiase."

Regarding what Delbet means by delbiase, the following is a quote from his book above mentioned:

"The fine work of Grignard on the possibility of synthesizing organic compounds of magnesium led me to add to magnesium chloride small quantities of other halogenated salts of this metal: bromide, iodide, fluoride. I made compounds of which the formula is the following:

Magnesium chloride	0.592
Magnesium bromide	0.020
Magnesium iodide	0.0001
Magnesium fluoride	0.0009

"In the anhydrous salts, those supposedly desiccated by crystallization, this is the result:

Magnesium chloride anhydrous	0.379
Magnesium bromide	0.013
Magnesium iodide	0.000072
Magnesium fluoride	0.00009

"These compounds are named delbiase."

5. A TREATMENT FOR POLIO

There is fascinating material on the treatment of polio in a booklet by Dr. Neveu, published by Librairie le François, Paris, which is so sensational that we are amazed that American doctors don't use it. The booklet is entitled *Therapeutic Treatment of Infectious Diseases by Magnesium Chloride--Poliomyelitis.*

Both Dr. Neveu and Joseph Favier (the prostate man) obtained their magnesium indoctrination from Dr. Pierre Delbet.

Dr. Neveu's idea is that every household should have on hand a mixture of a certain amount of magnesium chloride in water . . . the mixture being 20 grams of desiccated magnesium chloride to one liter (about a quart) of water, and at the first appearance of a sore throat and a stiff feeling in the back of the neck, or even as late as the first appearance of paralysis, the taking of the magnesium mixture will put the patient out of danger within two days, with an eventual total cure, he claims.

Dr. Neveu says that all sore throats do not predict polio, but when a sore throat is accompanied by a stiffness of the vertebral column, then treatment should begin as soon as possible, under the care of a qualified physician.

Dr. Neveu says that the virus of Poliomyelitis destroys the nerve substance of the anterior horns of the marrow, and that this destruction leaves in its wake sclerotic scars that escape all medical or surgical intervention. The destruction of the nervous substance occurs in a period of time more or less long, and the magnesium arrests the process. In my opinion, wherever the nerves are involved, I would add massive doses of the whole vitamin B complex.

Case 1

Dr. Neveu's first case occurred in September, 1943 . . . a four-year-old boy, Jean-Claude, who suddenly contracted polio. He couldn't stand on his left leg. He cried and at noon would not eat. Dr. Neveu was called in and prepared the following solution:

Desiccated magnesium chloride 5 grams

Water 250 cc.

The first dose of 80 cc. was given the child at 1 p.m. The doctor came again at 4 p.m. The paralysis of the left leg was complete. The child was then given the second dose, and was scheduled to be given another three hours later, that is, at 7 p.m. The next morning the fever and the paralysis had disappeared. Jean-Claude was cured! There has been no return of symptoms.

Case 2

Let Dr. Neveu describe his second case of polio two years later. "Yves A, age 11 years, after having suffered some time previously with lumbar pains, is suddenly stricken on Thursday morning, September 1, 1949, with frontal and temporal headache and with painful distress in the neck and the back. He suffered from an inflamed throat, and swallowed his saliva with difficulty. His face was flushed, his eyes bright and moist. He was unable to stand up. He said he had no feeling in his legs, that they were legs of wool. He also felt pains in his upper arms. He could not stand the light . . . Rectal temperature 102º.

Dr. Neveu gave this patient the same magnesium chloride treatment. In this case:

Desiccated magnesium chloride 20 grams

Ordinary water 1 liter

In our terminology it is 0.7 ounce of magnesium chloride and slightly over a quart of water.

The treatment was started Thursday, September 1, at 2:30 p.m. . . . 125 cc. of the solution every six hours.

Thursday night: temperature 103 degrees.

Friday, September 2: Temperatures, morning, 100.1, evening, 101. All previous symptoms are gradually disappearing. The little patient slept well last night, and on waking was able to stand up. At night he asked for food.

Saturday, September 3: Temperatures, morning, 99.3, evening, 99.8. The patient said his head felt heavy, but his condition was definitely improved. The magnesium treatment is given at the rate of 125 cc. every eight hours.

Sunday, September 4: The patient seems definitely cured. Still slightly sensitive to light. I prescribe continuation of magnesium chloride solution, 125 cc. every, eight hours.

Monday, September 5: Recovery confirmed by the satisfactory condition of the young patient. Temperatures, morning, 99, evening, 100. Discontinuance of treatment.

Tuesday, September 6: Temperatures, morning, 98.6, evening, 99.4.

Case 3

The third case was that of Marcelle B., 47 years old whose sickness was a little more resistant to the magnesium treatment. She was completely paralyzed in the right lower leg and in the lumbar region. But after 12 days of the magnesium therapy, there resulted a complete cure.

Case 4

This case is so dramatic that we will give all of it, in Dr. Neveu's own words:

> "Fernand V., age 13 years, took a sea bath Sunday, August 14, 1955. He stayed in the water a quarter of an hour. On leaving he got a chill and started shivering. Monday, August 15, he complained about his head and stayed in bed. Temperature: evening, 40C [37 degrees Centigrade is equal to 98.6 Fahrenheit, which is normal]. A doctor, when called, prescribed cryogen sulfonamide tablets.
>
> "Tuesday, August 16: Temperature: morning, 38.8°C. The child's condition became aggravated during the night. He could not tolerate the tablets prescribed and vomited. The headache became very painful and the patient began to suffer in the neck and back. He could no longer stand the light. "The light hurts my eyes," he said. Temperature: 40.4 C. The physician, when summoned, told the mother: I suspect poliomyelitis: He said he would return Thursday morning, if called.
>
> "Wednesday, August 17: Temperature: morning, 38.5 C. The child was no better. The preceding night had been very bad and this morning the headache and the pains in the neck and the back had become insufferable. The child was highly agitated. He cried. His mother, literally quite beside herself, believed him doomed.
>
> "Just then someone brought her a newspaper which had just published a story about the treatment of poliomyelitis with magnesium chloride, a treatment that I had been studying since 1936 in the case of dogs and since 1943 with people as my subjects, and with which I was just beginning to have very satisfactory experience.
>
> "The poor mother came to my house to see me. She arrived breathless and begged me to come to see her son, to heal him. She was highly excited. She would pay, she said, whatever the cost would be. I just read, she said, that you can cure poliomyelitis; come and cure my son.
>
> "I asked her to come into my consultation room an made her sit down. She calmed down. I questioned her and she related to me the preceding events.
>
> "It was evidently an acute case of swiftly progressing poliomyelitis, but it was of recent beginning, which permitted me to tell this mother that her little one would be out of danger in 48 hours. I told her to wait for me, and she waited with complete trust.
>
> "I prepared the following solution:
>
> Desiccated magnesium chloride 20 grams
>
> Ordinary water 1 liter
>
> "To begin, the patient was to take 125 cc. Every six hours. The treatment began at noon. In the evening a slight improvement. Temperature: 39.6 C. The next morning, Thursday, August 18, the pains in the head, the neck and the back subside. Temperatures: morning, 37.1 C.; evening, 37.8 C. The child believes him self cured, raises himself and begins to divert himself in the afternoon in the garden.

"Saturday, August 20: He takes no more than two doses of the solution during the day. In the evening he complains of his head. Temperature: 38.2 C. Was this slight return of a temperature and of the headache of which the child complained, due to his playing yesterday afternoon or to some other reason? It matters little. The doctor treating him, when called, was told of the treatment which I had prescribed. He himself then prescribed tablets to soothe the head pains, and without hesitation advised continuation of the magnesium chloride.

"Sunday, August 21: The child took three doses the of magnesium chloride solution during the day. Temperatures: morning, 38.6 C.; evening, 38.1 C.

"Monday, August 22: Everything was back to normal. Discontinuance of the magnesium treatment. Temperatures; morning, 37.2 C.; evening, 37 C. The child was definitely cured.

"I saw this child Wednesday, September 7, in good health, but he had grown thin and taller during his illness, his mother told me.

"The first doses prescribed--125 cc. of the solution every six hours--had reduced to 100 cc. then increased again to 125 cc. Thereafter the child tolerated them perfectly.

"The mother came every day to keep me posted on her son's condition. When she understood, on Friday morning, August 19, that her little Fernand was out of danger and when she saw him play in the garden in the afternoon, this woman, who had progressed in 48 hours from the most frenzied anguish to the greatest joy, was seized with a vociferous frenzy when she came to my office to see me.

"The cytophylactic method of Professor Pierre Delbet by means of magnesium chloride, which I had been practicing in the treatment of infectious diseases with unexpected results, had just saved little Fernand."

I wish there was space here to cover fully all of the 15 cases of complete cures of polio, but I will just have to touch upon them.

Case 5

Bernard L., age 9. Right lower leg became paralyzed. The regular doctor prescribed Sanclomycine, only to raise the boy's temperature. Cured with magnesium therapy by Dr. Neveu in a week.

Case 6

Françoise B., age 13. Stiffness of the dorsal vertebral column. Two doctors called. Lower limbs agitated by nervous trembling. Neveu called. The therapeutic effect of the magnesium chloride was rapid. The next day all symptoms began to regress . . . but her parents stopped the treatment too soon . . . Dr. Neveu continued it. There was a cure, but in this case there is still a paralysis of the extensor muscle of the big toe in the left foot.

Case 7

Yvette R., age 20, suffered a persistent headache which progressed to vomiting and stiffness of the neck and dorsal vertebral column. Family physician suspected polio, prescribed optalidon suppositories. Pain became unbearable and patient threatened suicide. Treatment with 125 cc. of magnesium chloride solution was, begun by Dr. Neveu. An hour after the first glassful, pain began to abate and the patient was able to sleep. Treatment began on May 24, and by June 5, Yvette R. was completely cured.

Case 8

Brigitte M., age three, was hospitalized for polio and returned home paralyzed in both legs. Magnesium chloride treatment was only begun 25 days after onset of the disease. In two weeks there were striking results, with much leg mobility restored. Physical rehabilitation has been excellent. She walks with a slight limp.

Case 9

Remy T., a farmer of 20, was paralyzed in both lower legs and the right arm. Magnesium chloride treatment was begun 32 days after the attack. There was noticeable improvement. After four months of treatment, he was once more able to walk with the aid of crutches. Two years later, he could discard the crutches and walk with a cane.

Case 10

Mariette B., age 19, was brought to Dr. Neveu four months after a polio attack. Her left leg was paralyzed, and had already begun to atrophy. She was treated with 125 cc. of magnesium chloride solution every six hours, then every eight hours after 15 days. There was marked improvement of the paralyzed leg though it could never be returned to normal. She can ride a bicycle and walk with a limp.

Case 11

Marie-Madeleine M., a child of 26 months, received Dr. Neveu's treatment after a delay of 17 days. She was unable to stand or move her right arm. He prescribed 60 cc of magnesium chloride solution every four hours. Her legs recovered perfectly. Her right shoulder remains paralyzed.

Case 12

Frances B., age four, was paralyzed in the right arm and leg. Ten days after the attack began, she started magnesium chloride treatment She recovered 100 percent of her arm function and 60 to 75 percent of its strength. In the paralyzed leg, there was a 75 percent recovery of function and 50 to 60 percent of its strength.

Case 13

Christopher C., age two-and-a-half, was brought to Dr. Neveu 10 days after a comparatively mild attack of polio with a good prognosis. In two days he showed definite improvement of his abdominal paralysis. In two-and-a-half months he had made a complete recovery.

Case 14

Jean-Yves M., 20 months, was attacked by polio which was not diagnosed until a spinal tap and analysis was made 12 days later. His left foot was completely paralyzed. Magnesium chloride treatment brought improvement. After five months he was nearly normal, but required orthopedic shoes.

Case 15

Jocelyn C., age 12, was brought immediately to Dr. Neveu as soon as she complained of a sore throat and stiff neck. That day, even after commencement of magnesium chloride treatment, neck stiffness increased and spread down the spine. Treatment was continued. Stiffness disappeared the, next morning. The following day the sore throat was gone. She was cured except for needing time to convalesce and regain weight that had been lost.

Here is another confirming bit of evidence, in a letter (February 4, 1958) to Neveu from D. Jean Desoutter, member of the Academy of Agriculture of France, a biologist like Pierre Delbet:

> "Permit me to offer you my best wishes for the year now beginning, with the hope that the ideas which you defend will finally be disseminated among the public, despite an ostracism which, if not incomprehensible, is at least indefensible.
>
> "For my, part and to the limit of my means I spread and practice magnesium chloride therapy, and as I believe you too have said, it has given excellent results in the case of an infant attacked by poliomyelitis. This child was the daughter of a friend and was attacked by the disease twenty-five days ago.
>
> "My friend did not hesitate to have magnesium chloride administered to his child for a long period, and of all the children attacked at the same time as she, it is she who made the best recovery, and her parents hope to see her become normal again, despite the too tardy intervention of the chloride. In any case, the father has recently confirmed to

> me his conviction that the magnesium chloride has had the best result in the case of his child."

In spite of this evidence, Dr. Pierre Lepine, chief of the virus service at the Pasteur Institute, writing in *The Republic of the Center*, said:

> "In my laboratory we have tested the so-called treatment of Dr. Neveu, as we test without exception all treatments that have been proposed for the prevention or the treatment of poliomyelitis. I affirm from my 30 years of uninterrupted experience in researches on this subject that the treatment of Dr. Neveu is totally without efficacy in poliomyelitis. To set oneself up as the apostle of a method resting on inconsistent theories and defeated by established fact, is to make oneself an accomplice in a veritable moral swindle with respect to one's kinsmen.
>
> "There are the facts, which do not prevent us from being in a Republic."

Doctors who do not wish to give up the current accepted treatment for polio could add magnesium chloride therapy to it!

In closing, how many people are going, about today crippled because of polio, who could have been whole of limb had they been given the magnesium chloride treatment?

6. THE HEALTH OF THE NERVES

Think of all the jobs the nervous system must perform. Every activity of life, from the respiration of a single cell, to a gross motor function such as piloting an aircraft, is controlled by the nerves.

Yet nutrition as it applies to the nerves is a sadly neglected affair. Any schoolchild knows he needs plenty of protein for muscle, vitamin C for healthy gums, and calcium for strong bones. But ask him what foods are good for his nerves and chances are he doesn't know. Fortunately, the fats, proteins, and vitamins that are needed for healthy nerve tissue are fairly abundant in the diet. However, one nutrient that recent research has found to be lacking in the diets of most people, and which lack may be the cause, of so much nervous illness, is magnesium. Information on, the essentiality of magnesium to the nerves was published by Penn and Loewenstein of Columbia University in *Science* (January, 1966), and will be discussed in a later chapter. Taking advantage of new advances in electronic measuring techniques, the scientists studied the electrical conduction of currents by the nerves. Their most important finding was that while calcium is the prime conductor of these minute electrical currents, it is magnesium that maintains normal levels of calcium in the system.

How does magnesium regulate calcium levels? Inside the body, these two minerals are positively charged. When they come into contact with negatively charged particles, an electrical current is formed. It is believed that fatty acids comprising the major portion of nerve tissue are negatively charged. It is for this reason, then, that calcium and magnesium

supplies must be constantly renewed; without them, the flow of current by the nerves cannot be maintained.

In, like fashion, a storage battery "works" only when a positive and a negative electrode are present to maintain an electrical current. When the positive plates become exhausted, the battery is no longer any good. By this same mechanism, small amounts of electrical currents flow from the calcium ion to the negatively charged nerve lipids. When magnesium levels are low, the calcium supply becomes exhausted, and in the absence of adequate calcium, the nerve cells cease to function.

Calms the Nerves

Magnesium works in other ways to preserve the health of the nervous system. By the twentieth century, doctors had learned that magnesium injections exert a depressant effect upon the nerves. In fact, one of the early uses of the mineral was to induce sleep. It is significant that hibernating animals have very high magnesium levels. Magnesium has also been shown effective in controlling convulsions, in pregnant women, epileptic seizures, and "the shakes" in alcoholics.

Yet one of the paradoxical effects of the mineral upon the nerves is that a magnesium-deficient person who takes magnesium feels more energetic than before, even though the mineral is a depressant and not a stimulant. Actually, magnesium relieves the nervous irritability and excessive energy that give rise to fatigue in the first place.

It should not be surprising, then, that when a person's magnesium level is subnormal, the nerves are unable to control such functions as muscle movement, respiration, and mental processes. Twitching, irregular heartbeat, irritability, and nervous fatigue are symptoms of what is frequently found to be magnesium depletion.

Most often, deficiency is simply a result of failure to obtain adequate magnesium from such dietary sources as wheat germ, cocoa, desiccated liver, eggs, green vegetables, soybeans, and almonds. In some instances, however, absorption of nutrients can be impaired by coexisting illness, such as an intestinal infection. In such an event, much of the ingested magnesium may be lost from the body.

A Host of Disorders

A case history presented in the *Archives of Neurology* (June, 1965) by Dr. Robert Fishman of New York illustrates just how "inadequate dietary intake coupled with excess gastrointestinal loss" can lead to a host of nervous disorders.

A 29-year-old man suffering from intestinal trouble for six years finally had large portions of the large and small colon removed. Six months later, he was readmitted to the hospital for a broken vertebra resulting from a "generalized convulsion" he had experienced during sleep. Dr. Fishman writes: "During the week prior to admission, he was noted by his family to be increasingly irritable and mildly confused, and to have twitching of the muscles of the face, hands, and feet."

The patient, described as "agitated" and "anxious," soon suffered a second convulsion. His pulse was 140 beats per minute (70 is average). After injections of magnesium sulfate were administered, his restlessness and neuromuscular difficulty disappeared. As bowel function improved, his need for magnesium gradually diminished.

Animals, too, can develop neurological damage when their diet is deficient in magnesium. Grass tetany results when cattle cannot obtain magnesium in ample amounts from chlorophyll, the green coloring matter in grass. Muscle spasms, frothing at the mouth, hypersensitivity, increased pulse rate, and fatal convulsions may occur in prolonged depletion.

Sometimes magnesium deficiency can cause disorders so severe that massive doses of magnesium by injection are required. High doses of injected magnesium, however, can cause profound depression of the entire nervous system and, ultimately, respiratory paralysis. The possibility of this danger is increased when a pregnant woman develops preeclampsia.

This condition, which affects about one in 500 pregnant women, may consist of convulsions, nausea, dizziness, and headache. It is believed that defective chemical substances in the blood or products derived from the placenta are unable to be excreted properly and may cause harm to the fetus. It has become almost routine for hospitals to inject the mother with magnesium to control eclamptic convulsions and to facilitate kidney function.

The uses of magnesium for nerve health still require further research, but even from the results of the few studies already made, we can be certain that unless our bodies are adequately fortified with this mineral, the nervous system can degenerate seriously.

A good supply of dolomite, meat, eggs, fruits, nuts, and vegetables can help to lessen the chances of developing nervous conditions that stem from a magnesium imbalance.

During 1966, there were published in *The Lancet* an article and successive letters dealing with a degenerative nervous disease that was observed among patients in Nigeria, one of the larger African countries. The original article by a Nigerian doctor, Professor Monekosso, described the disease carefully and, in effect, appealed for help in treating it. The disease was characterized by "mental apathy and depression; ataxia [loss of coordination]; decreased motor power, bulk, and tone; foot drop and wrist drop; calk tenderness, and limbs cold to the touch." The senses of touch and hearing were also impaired.

The symptoms were clearly suggestive of a form of beriberi, the thiamine (vitamin B_1) deficiency disease, and sure enough, on investigation it turned out that the thiamine intake of these patients was inadequate. However, administration of either thiamine alone or vitamin B complex did not cure them.

One of the later letters commenting on this article was written by Dr. Joan Caddell of the George Washington School of Medicine in Washington, D.C. It was published in the October 1, 1966, issue of *The Lancet.* It was the opinion of Dr. Caddell that magnesium deficiency was probably involved because of the essential role of magnesium in the biosynthesis and activation of thiamine pyrophosphate. . . . What she was really saying was that sometimes a thiamine deficiency is caused by a deficiency of magnesium and therefore it will not be cured by the administration of thiamine alone. Quoting her own experience in Nigeria, she stated:

> "Malnourished young Nigerian children from the same cultural group as the above [Monekosso] patients developed a similar syndrome, often with more acute features.

> The children had had severe, prolonged gastroenteritis and had received a diet of cornstarch and cassava. Vitamin-B enriched protein-milk therapy aggravated the syndrome, sometimes with the development of staring, nystagmus, ataxia, tremors, or convulsions. Magnesium deficiency was biochemically established by analysis of skeletal muscle and plasma. The symptoms were reversed after addition of magnesium to the therapy."

The exchange provides an excellent illustration of how much medicine has yet to learn about the many roles of magnesium in human metabolism and its indispensability to general health. The fact is that, as new studies are published and new discoveries made, it is becoming clearer and clearer that magnesium is one of the basic nutrients needed for a healthy nervous system and therefore almost any affliction in any part of the body might turn out to be actually an illness of the nerves that are involved because they are deficient in magnesium.

Epilepsy is one good example of this. As far back as recorded history goes, the "falling disease" has been one of the great mysteries of medicine. While dozens and hundreds of other illnesses responded to investigation, epilepsy remained unexplained and untreatable by any known method. It is only within the past year that there has been published work revealing that epilepsy is accompanied by a lower than normal level of magnesium in the spinal fluid, and that administration of magnesium can be expected to bring about quick improvement. It is a field that still requires much investigation, but present indications are that deficient magnesium in the spine, and the subsequent effect on major nerves of the spine running to and from the brain, may be the actual cause of epilepsy. Later in this book we will see that this work emerging from the Hereford Clinic and Deaf Smith Research Foundation in Hereford, Texas, under the direction of Lewis B. Barnett, M.D., further establishes wide-range effects that magnesium nutrition has on the nervous system.

Deficiency Caused Convulsions

Most recently, there was published in *The Lancet* (April 1, 1967), a case history of a newborn infant who developed convulsions because a metabolic abnormality did not permit the child to utilize its magnesium intake properly. "On three occasions withdrawing or decreasing magnesium supplements led to a fall in both plasma-magnesium and plasma-calcium levels and to recurrence of the convulsions." This is more evidence that if the nervous system is deprived of adequate magnesium the entire person will suffer for it.

If additional evidence were needed that healthy nerves require magnesium, it would certainly be supplied by the recent investigational studies entering into the development of "memory pills" at the Abbott Laboratories in Chicago. Memory, of course, is one of the primary and most important functions of the human nervous system. And the stimulant to memory and other mental function that is being developed at Abbott has magnesium as its basis.

In other recent studies we have learned that the motor nerves--those that carry messages by electrical impulse from the brain to the muscles--are dependent on magnesium for the ability to conduct these minute electrical messages properly. Now we are learning that magnesium is equally important to the central nervous system (spinal cord), and to the brain itself. Add to this the essentiality of the same mineral for hard healthy bones and teeth and for the functioning of many of our enzyme systems, and we believe it becomes perfectly clear that a

person would have to be a fool to take any chance on not getting enough magnesium for even a single day.

7. EPILEPSY

Wayne was only four years old, but he had been suffering epileptic seizures for 3 1/2 years. Though the seizures were particularly severe during stress periods, he was never completely free of them.

Anticonvulsant drugs were used, but none was successful. The boy's parents were resigned to the probability that he would have a life plagued with severe epilepsy.

At that time Dr. Lewis B. Barnett, head of the Hereford Clinic and Deaf Smith Research Foundation in Hereford, Texas, began a series of experiments. The boy became a subject. He was given, in addition to a normal diet, 450 mg. of magnesium gluconate and a thyroid extract. Within two weeks all signs of epilepsy vanished, and within the past three years there have been no signs of the illness.

Is It Magnesium Deficiency?

In 28 more cases, the same story has been repeated. Children of all ages, stricken with epilepsy failed to respond or responded only slightly to modern drugs and therapy. Placed on high oral doses of magnesium, they experienced stunning improvement.

Barnett did not start out to investigate a relationship between magnesium and epilepsy. He says, "My original work was directed toward the role of magnesium in bone apatite, and while investigating that field, it became obvious that magnesium might play a vital role in the physiology of the central nervous system." He studied the relatively few reports in medical literature concerned with the mineral, and found one by Martin, Meke, and Wertman. These researchers reported that in a state of epilepsy there is a deficiency of magnesium in the blood.

Children who definitely suffered from epilepsy were used in the Hereford study. First, their blood magnesium levels were established. In all cases, the levels were below normal, supporting the findings of Martin, Meke, and Wertman. Next Barnett decided to correct the deficiency by giving oral magnesium preparations. "It was hoped that the magnesium supplement would control the seizures," he told us in an interview.

Within a matter of weeks the blood magnesium level returned to normal, and in every case, except one there was definite clinical improvement.

"After reviewing most of the literature," Mr. Barnett says, "not very extensive according to references, it became obvious to me that very little work had been done in this most important and extremely active mineral--especially in its relation to the physiology of the central nervous system."

In his experiments, Barnett used magnesium gluconate, a form of magnesium which is easily absorbed by the system. 'Taken orally in this form, magnesium is harmless in almost any quantity," he reports. "The worst that can occur is that some individuals will become drowsy."

This tendency toward causing drowsiness is one of the key properties of the mineral.

Spine Concentrates Magnesium

It has been known for many years that magnesium is an analgesic. It is found both in the blood and in the spinal fluid, and is the only electrolyte found in higher concentration in the spinal fluid than in the blood. This is an important fact for two reasons:

First, testing for a deficiency of magnesium in the spinal fluid is easily done by taking a blood test and deciding what the magnesium level in the blood is. Scientists have found that the lower the blood level, the lower the spinal fluid level.

Second, the reason for the high magnesium content in the spinal fluid is that the mineral is necessary for balancing the stimulant effect of body hormones. The purpose of thyroid, gonadal, adrenal and other hormones is to charge up or excite the body. Magnesium and some other substances tend to slow down and relax the system, thus regulating the hormones and achieving a happy medium.

When magnesium deficiencies occur--and there are a number of reasons why this can happen--there is no regulation. Among the dangerous results of this state listed in medical literature are heart damage, osteoporosis, periodontal disease, and epilepsy. Another is hyperirritability. "A great many people have a magnesium deficiency manifesting itself in hyperirritability," Barnett said. These people may often have a metabolic rate 125 percent higher than normal, he says.

Their bodies and minds are greatly overactive, and they are constantly irritated. This is undoubtedly a partial explanation for the high rate of juvenile delinquency, divorce, and emotional instability rampant in modem society.

Pituitary Gland Important

A magnesium deficiency, according to Barnett, is a prime cause of the three million clinical and 10 to 15 million subclinical epilepsy cases now in this country. Deficiency may occur not from a lack of magnesium in the diet but because of malfunctioning of the pituitary gland. As far back as 1952, researchers observed that people suffering a magnesium deficiency had reactions similar to those in people who had had the Pituitary gland removed. The reason for this is not hard to understand.

The pituitary gland, located at the base of the brain, is believed, to regulate the functions of all the other glands of the body. It is the gland through which magnesium works as a prime component of pituitary secretions to regulate the functioning of the other glands. If magnesium is not available or the pituitary is not functioning properly, the body will suffer symptoms of a magnesium deficiency or a pituitary malfunction, depending on how you look

at it. (It must also be pointed out that fluoride bonds with magnesium in the blood, into the insoluble magnesium fluoride. This means that the magnesium cannot be assimilated by the pituitary, with the consequent failure of the pituitary to function properly that leads to the symptoms of magnesium deficiency.)

Milk Depletes Magnesium

The first step in treating the symptoms of magnesium depletion, especially among children, is to eliminate milk from the diet, according to Dr. Barnett. He reports that nine out of ten childhood epileptics drink milk. Calciferol (synthetic vitamin D), like fluorine, tends to bind the magnesium, he says. Milk is loaded with this substance and therefore enhances the problem. The synthetic form of the vitamin is 10 times more active than the natural form--which means it is 10 times more potent in binding magnesium. For this reason the natural vitamin, as found in fish liver oils, will not cause magnesium depletion, but milk can and does.

The second step, though new to medicine, is "old hat' to ranchers. Green grass tetany, the cattle equivalent of human hyperirritability, costs ranchers about a half billion dollars a year. This problem can be effectively treated only by adding magnesium to the animal's diet, but this must be done before the disease reaches serious proportions.

According to Barnett, this same therapy is often effective in humans. He considers dolomitic limestone an excellent form of the mineral.

Although compared to the early days of Barnett's research there have recently been many studies done on magnesium, its relation to epilepsy treatment has been largely ignored. Barnett hopes that now his studies will lead to other clinical experiments, and that eventually doctors will be able to control many cases of epilepsy without using depressant drugs. "By balancing their physiological state, with special emphasis on intracellular chemistry, an easier and finer control of these unfortunate individuals may be possible," he said.

8. THE MINERAL OF LIFE

Recent studies are throwing more and more light on the metabolic role of magnesium. Because progress in learning about this trace mineral has been painfully slow, however, we often see what magnesium does without understanding how it does it. We know, for instance, that magnesium bonds calcium and phosphate to teeth, thus strengthening resistance to decay, without understanding the mechanism involved. But now with the availability of the radioactive isotope magnesium 28, scientists have been learning more about how this mineral is absorbed, transported, and utilized in the body.

A comprehensive review of the subject appears in a book called *The Role of Magnesium in Biologic Processes* (Thomas publishers, 1963) and a 1965 supplement by J. K. Aikawa, M.D., associate professor of medicine at the University of Colorado. His supplement informs us that

magnesium plays important roles in bone metabolism, energy-giving processes, and in formation of nucleic acids that control the behavior and properties of living cells.

To understand how magnesium functions, we must consider its activity as an electrolyte, which is an element whose atoms contain an electric charge that is either positive or negative. The balance of these charged particles in our bodies is actually slightly more positive than negative. The magnesium cation with its positive charge is an active electrolyte that is constantly moving back and forth across cell membranes to maintain the proper balance. Scientists are still unsure of the mechanism that transports magnesium across membranes, but they have some theories.

Proper Amount Absorbed

Absorption into the gastrointestinal tract, for example seems to depend upon the load presented to the mucous membranes of the intestine. A study by L. Graham, J. Caesar, and A. Burger was reported in Metabolism (Vol. 9, 1960). Radioactive magnesium was used to trace the activities of the mineral. This radioactive form used for study purposes is not the type obtained from our diet.

In man, it was observed that, on a diet with an average amount of magnesium, 44 percent of the ingested radioactivity was absorbed; on a low-magnesium diet, 76 percent was absorbed; and on a high- magnesium diet, only 24 percent was absorbed.

These results indicate that there is no need ever to fear an overload of magnesium in the diet. Any excess will be excreted harmlessly, whereas a deficiency could have serious results.

How does absorption occur in the small intestine? The presence of calcium is an influencing factor. Magnesium and calcium have a natural affinity for each other. Scientists have learned that if either of the minerals is consumed greatly in excess, it will be carried out of the system with the aid of the other element. However, these minerals are absorbed more easily when they are both present than when either is present alone. Thus, a deficiency of either element can cause a deficiency of the other as well, particularly in tissues where they are needed.

A study published in *Clinical Science* (Vol. 22, 1962) by N. Alcock and I. MacIntyre demonstrates this concept. It was observed that absorption of both magnesium and calcium was impaired in magnesium-deficient rats. Additional dietary calcium aggravated magnesium deficiency, but the absence of calcium enhanced magnesium absorption. Dr. Aikawa remarks: "These results suggest the existence of a common mechanism for transporting calcium and magnesium across the intestinal wall."

Bone structures, which contain about 60 percent of the body's magnesium store, are also related to mineral transport. Dr. Aikawa observes two ways in which magnesium becomes a part of bone: living bone cells draw the element into the structure; or the mineral may simply adhere to the bone surface through a process called passive adsorption.

In laboratory tests, bone cortex and serum albumin both compete for the absorption of magnesium. Dr. Aikawa states: "Such a mechanism might play a role in the in vivo [in a living organism] balance between storage of bone and maintenance of the extracellular concentration of magnesium."

Enzyme Activator

Magnesium regulates the functions of cells other than bone. Certain small bodies within normal cells called mitochondria are considered the cells chief source of energy because they contain the enzymes that burn glucose to release energy. This burning of glucose, however, does not take place unless the enzymes are activated by an auxiliary substance. Magnesium, recognized to be an activator for many enzymes, plays an important role in this regard.

The mitochondria transport certain electrolytes and can take up or force out water, but to perform these activities, energy is again required. The studies of H. Baltscheffsky suggest that magnesium is specifically involved in regulating mitochondrial respiration, a process in which oxygen is taken in and carbon dioxide is given off.

One of his experiments, published in *Biochim. Biophys. Acta* (Vol. 20, 1965), revealed that when mitochondria were placed in a magnesium-free medium, the rate of respiration increased spontaneously. Baltscheffsky suggested that the swelling and structural disintegration of mitochondria were responsible for this increased rate, since it appears that magnesium is linked to mitochondria by a bond; if this bond breaks, respiratory rate is affected.

Magnesium is also "an absolute requirement for the binding of phosphate," according to Dr. Aikawa. There are two kinds of binding--active and passive. He sums up this complex but vital transport function: "Since mitochondrion is probably a model for cell membranes generally, coupled translocation of [the magnesium ion] and phosphate in the mitochondrion provides the first intimate glimpse into the active transport which goes on in a living system."

The structure of RNA (ribonucleic acid), the genetic substance that synthesizes protein, is built upon magnesium. RNA is believed to control thought and memory and the structure of all organs. The mineral has been observed to preserve the integrity of ribosomes, which contain tiny particles of nucleic acid molecules. Dr. Aikawa underlines the importance of this added responsibility: "The ribosomes from adult frog liver are subunits of RNA protein held together by magnesium. Removal of magnesium from frog liver or whole tadpoles by versene breaks the normal aggregation of 80 to 100 S particles into two to four S pieces."

Undoubtedly, many more functions of magnesium will be discovered in the coming years.

As Dr. Aikawa notes: "In the final analysis, the ultimate explanation of the fact that magnesium alone is operative in such diverse but fundamental cellular processes must be based on the unique atomic structure of this element. Just how it is unique remains to be ascertained." To us it means that, while the emerging biochemical information may be complicated and difficult to understand, its underlying meaning is simple and basic. It has been learned and established that magnesium is a key element in indispensable life processes. Without enough magnesium in the system, life itself is threatened. And since we cannot harm ourselves with an excess, it is better to take too much than too little.

How magnesium, along with calcium, helps the body to sustain a healthy nervous system is new information, that has recently been unveiled in a report from Columbia University. It is signed by Richard D. Penn and Werner R. Loewenstein and appeared in Volume 151 of

Science (January, 1966) the organ of the American Association for the Advancement of Science.

Electrical Impulses

The new knowledge the report brings forth relates to the electrical nature of nerve impulses, which is probably why it has taken so long for laboratory science to learn these essential facts. Until the development of very new instruments capable of measuring the microcurrents of electricity that pass along the nerves, all such studies were doomed to failure.

But the instruments now exist, and with their aid Penn and Loewenstein were able to measure what happens to the electrical currents conducted along a chain of nerve cells under various circumstances.

Free Calcium Conductor

It was found that the nerve cells, as might have been expected, transmit minute electrical currents from one to another at the point where the cells join. It was also found, however, that the calcium existing in a free state in the fluid outside the cell acts as a conductor. And as, little by little, the calcium in this fluid bath was decreased, the amount of current that one cell was able to transmit to another also decreased. "At a certain level of calcium withdrawal from the cell system, junctional conductance reaches a critical low point at which the cells become functionally disconnected: the nerve impulses which are normally discharged in synchrony by the cells become asynchronous. These effects of calcium on junctional connections are irreversible . . ."

What this means, more specifically, is that Penn and Loewenstein have found that when there is insufficient free calcium in the serum, the individual nerve cells seal themselves off and actually increase their resistance to the transmission of electrical nerve impulses. There is thus a double action, the assistance of calcium as a conductor being also lost. As a consequence, an insufficiency of calcium leads to an inability of the nerves to conduct commands to the various organs of the body properly. Moreover, once this insufficiency has become established, it cannot be reversed. No amount of calcium in the diet will restore the health of nerves already damaged by a deficiency of this precious mineral.

Magnesium As Good

According to Penn and Loewenstein, the only protection we have against the ill effects of such a calcium deficiency would seem to be the maintenance of a high serum magnesium level. "Magnesium seems to substitute for calcium in maintaining intercellular communication." They go on to show that the nerve cells did not uncouple (sever their points of contact) as long as there was a good supply of magnesium in the serum, even without calcium.

In other words, a sensible person desiring to maintain a healthy nervous system, which in turn is vital to general health, will make certain that the level of free calcium and magnesium in his blood serum is always a high one. Don't think you can get along without these minerals for a few months and then catch up later. Damage will be done, and once done, it cannot be repaired.

Even though there are many good food sources of both these minerals, to maintain a really high serum level we must face the problem not only of eating them but also of absorbing what we eat. And it is for purposes of absorption that we recommend that everyone take supplements of both bone meal and dolomite. These mineral supplements provide a complex of mineral nutrients in the proportions that best promote complete absorption and use by the human metabolism. If you take them daily, you can feel confident that you will never suffer from a calcium or magnesium deficiency.

9. HOW TO EAT ENOUGH MAGNESIUM

There are a few food supplements that are very rich in magnesium. Bone meal is one of them. More than 60 percent of the magnesium in the body of man or animal is in the bones and teeth. So, we must take bone meal (which is pulverized young beef bone) not only for its calcium and phosphorus, but also because of the magnesium and the amount of valuable trace minerals it contains.

Wheat germ is extremely rich in magnesium, so take a lot of it. So is kelp and brewer's yeast, sunflower and pumpkin seeds. If you would take a fair amount of the six above-mentioned items everyday, you have fairly well taken care of your magnesium requirement. If you are a user of sea salt, you might wish to know that this product is also very rich in magnesium.

Now, in addition to the above, you should know which foods are richest in magnesium. I would divide all foods into groups. The richest are the seeds, so to speak. Nature puts potent nutrients into them because they have to produce life, and magnesium is a life-giving element. That is why we recommend sunflower and pumpkin seeds. Sesame seeds are a good source, too.

The U. S. Department of Agriculture's handbook No. 8, called *Composition of Foods*, revised to December, 1963, includes hundreds of foods, detailed as to their various vitamin and mineral elements, including magnesium. We have combed through this book and first set up a list of all the seed foods that are richest in magnesium. This lists the amount of magnesium in milligrams in the edible portion of one pound of the food as purchased.

Almonds, dried:		
	In shell	615
	Shelled	1,225
Beans, common, mature seeds, dry:		
	White-raw	771

	Canned, baked	168
	Red, raw	739
	(notice the loss of magnesium when the beans are baked)	
Beans, lima:		
	Mature seeds, dry, raw	816
Brazil nuts:		
	In shell	490
	Shelled	1,021
Buckwheat:		
	Whole grain	1,039
	Flour, light	218
Cashew nuts		1,211
Cornmeal:		
	Whole-ground,bolted dry form	481
Cowpeas,including black-eyed peas		249
Filberts (hazelnuts):		
	In shell	384
	Shelled	835
Hickory nuts:		
	In shell	254
	Shelled	726
Lentils, mature seeds, dry		363
Millet, proso, whole grain		735
Peanut butter		785
Peanuts:		
	Raw:	
	In shell	682
	Shelled	934
	Roasted:	
	In shell	532
	Shelled	794
Peas, mature seeds, dry		816
Pecans:		
	In shell	341

	Shelled	644
Pigeon peas, mature seeds, dry		549
Pistachio nuts:		
	In Shell	358
	Shelled	717
Rice, brown, raw		399
Sesame seeds, whole, raw		821
Soybeans, mature seeds, dry		1,202
Walnuts:		
	Black:	
	In shell	190
	Shelled	862
	Persian or English:	
	In shell	267
	Shelled	594
Wild rice, raw		585

The application of heat drives out a large amount of the magnesium, depending on the amount of heat. For example, the roasting of peanuts is not as bad as the boiling of rice. But if you want magnesium from nuts and other seeds, stick to those that you can eat raw, such as almonds, brazils, cashews, filberts, hickorys, peanuts pecans, pistachios, and walnuts.

If you want to know how rich they are in magnesium, compare with the following:

Apples, raw	33
Apricots, raw	51
Cured bacon	51
Blueberries, raw	25
Cranberries	9
Grapes	37
Lamb	57

Of course, we don't choose all of our food for its magnesium. We need other minerals, and vitamins, too. We must eat eggs which are not high in magnesium, and meats which are also in this same class.

Green leafy vegetables are rich in magnesium:

Beet greens, common, raw	269
Brussels sprouts, raw	121

Chard, Swiss, raw	271
Kale, raw, leaves without midribs	107
Kohlrabi, raw	123
Parsley, raw	186
Spinach, raw	399
Turnip greens	221

And here are some miscellaneous items, all raw:

Apricots	281
Blackberries	129
Curry powder	1,288
Dates	229
Figs	91
Garlic cloves	144
Malt extract, dried	635
Molasses, blackstrap	1,170
Okra	145
Peaches	218
Prunes	154
Raisins, seedless	159

Of course there is a difference in magnesium content of foods, based on the region and soil in which they grow, but the above figures are an average. In Chapter 20, we will show that eggs produced by the organic method on our farm had twice the amount of magnesium as eggs from chickens who were fed a regular commercial mash. And on our farm we are using magnesium-rich dolomite as a soil amendment. Readers would do well to raise their own vegetables organically, using dolomite as one of the fertilizers.

In France, the bottled waters of Chatel-Guyon, rich in magnesium, are available to the public. Joseph Favier in *Equilibre Minéral et Santé* (Mineral Equilibrium and Health, 1951 . . . and out of print) says, "Already in 1926, C. Billard, professor at Clermont-Ferrand, wrote that the waters of Chatel-Guyon, rich in magnesium chloride, had the power of neutralizing snake venom (C. R. *Soc. de Bro.*, May 7, 1926)."

Quoting from Favier's book:

> "In the volume of *Journees therapeutiques de Paris*, 1947, we find on pages 284 and 285 a résumé, by professor Ch. Debray, of C. Billard's experiences:
>
> "It is C. Billard, professor at Clermont-Ferrand, who earns the merit of having proven the extraordinary power of protection of certain Mineral waters against various poisons. This power, which he has named the prophylactic power, exists in a high

> degree in chloride of magnesium waters. These waters have a specific action against the tetany toxin, and under certain conditions, a surprising power of protection against snake venom."

He describes three separate experiments with guinea pigs which were injected with lethal doses of snake venom, diluted in five cc. of Chatel-Guyon water, all of whom survived. Also a rabbit bitten by a snake did not die when he was injected with 10 cc. of Chatel-Guyon water.

Recently we came across a source of magnesium that is important and that should be considered. It is mineral water. from Saratoga Springs, New York, owned by the State of New York. The address is: Saratoga Springs Commission, Saratoga Springs, New York.

The State of New York bottles three different brands of mineral water containing magnesium. Their Hathorn brand contains 2,354 parts per million of magnesium, which is very high. Their circular reads: "Hathorn is a natural Saline laxative water containing significant amounts of certain magnesium compounds. Taken before breakfast, at room temperature, it is an effective aid to constipation."

The Coesa brand has 1,698 parts per million of magnesium, and the circular says regarding it. "Coesa is a milder laxative water. Like Hathorn water, its laxative action arises largely from the presence of magnesium compounds. Saratoga Coesa stimulates bile drainage. Many people also use Coesa as an occasional, mild laxative."

It is the third brand that we are interested in, called Saratoga Geyser water, bottled for the public under the seal of the State of New York. It contains only 600 parts per million of magnesium, or only about one-fourth that contained in the Hathorn brand. Regarding Saratoga Geyser the circular says that it is "bottled exactly as it flows from the deep mineral springs at the Saratoga Spa. Nothing is added . . . nothing is removed. Drinking bottled Geyser water at home is just like drinking at the Spa itself."

The circular says, "A Wealth of Health in Every Glass" And that probably is true, but even with the milder Geyser brand, one couldn't continue to take it if it kept the bowels too loose. That is a matter for each individual to check and experiment with.

I will now give you the complete contents of the Saratoga Geyser circular:

The Mineral Springs of Saratoga Now Flow in Your Home

"At the Saratoga Springs, nature has made one of those grand gestures with which she often puts to shame the best works of man.

"Nature leaves her riches in different places, in various ways. But, at the Saratoga Spa, Mother Nature outdid herself. Here in the form of a geyser, she spouts her riches into the air, bringing forth from hidden caverns beneath the Earth's surface, health giving mineral waters, compounded over many centuries.

"During the prehistoric "glacial" era, underground streams were created deep beneath the rock of the Earth's surface. These streams absorbed the many minerals until, saturated by them, the, natural gasses forced the water to burst upward through natural filters of sand and gravel, through the Earth's surface itself, to become the famous Saratoga Geysers.

"The remarkable qualities of Saratoga Geyser sparkling water were first discovered and enjoyed by the American Indians many years before the first settlers came to this country. But, it remained for latter day settlers to develop their maximum benefit.

"For over 170 years Saratoga Springs has enjoyed world-wide fame from millions of people who have enjoyed its marvelous waters.

These Rare Qualities Protected by the State

"In 1909, when their values had become widely recognized, the State of New York, acquired the principal springs at the Saratoga Spa in order to protect these rare waters from exploitation, and to preserve them for the benefit of future generations.

Geyser Water Is Delicious

"Saratoga Geyser Water is a wonderful tasting sparkling water. It is absolutely natural--naturally carbonated . . . naturally mineralized . . . naturally delicious. Geyser served as a table water adds "sparkle" to every meal.

Geyser Water Is Naturally Carbonated

"The "natural" effervescence of Saratoga Geyser Water has never been even closely duplicated by artificial means. Here is light, bubbling, thirst quenching naturalness.

"Many people serve Saratoga Geyser Water as a highball mixer or as a

chaser. Geyser tastes great, and it helps prevent that "morning after feeling" too.

Geyser Water Is Alkaline

"The high ratio of alkalinity in Saratoga Geyser Water makes it an excellent aid to digestion. It helps relieve the discomfort often caused by excessive eating or drinking . . . lets you eat the foods you like, that don't like you.

Geyser Water Is 15 Important Minerals

"Saratoga Geyser Water is "nature" endowed with fifteen minerals including iron and calcium.

Bottling the Water

"At the bottling plant, a highly perfected process is followed using specially designed equipment so that the delicate balance of gas and minerals will not be disturbed. The waters to be bottled are kept under several atmospheres of pressure, never exposed to air. (Even the air in the bottle is removed before filling.)

"The bottling operation is performed in a modern plant that is as sanitary as a hospital. For the State of New York requires that the Saratoga Spa be conducted in accordance with the soundest medical and scientific standards ... from the safeguarding of the wells . . . to the bottling . . . even to the statements made regarding the use of the waters."

The one undesirable feature of Saratoga Geyser is the sodium bicarbonate content--3,487 parts per million. The *Merck Index* says regarding it, "Human Toxicity: Average doses by any route in presence of renal (kidney] insufficiency, or large doses by any route in patients with normal renal functions, may cause alkalosis (irritability, restlessness, neuromuscular hyperexcitability, tetany). Antidote: Ammonium chloride." Saratoga Geyser Water contains 35 parts per million of ammonium chloride.

However, there is much evidence that magnesium is a protector of the kidneys, and therefore the magnesium in this water might possibly protect the drinker from any ill effects coming from the sodium bicarbonate, usually referred to as bicarbonate of soda. Besides, if a person began to drink the water and soon became more irritable and restless than usual, it would be a sign to stop. But the fact that millions of people have been drinking this water over the years should be reassuring.

The same thing applies to the sodium chloride (table salt) content of this Geyser Water. It is 1,506 parts per million. You must know what you're drinking. Then it is up to you.

Coming back to foods that contain magnesium, one of the reasons why the American people are magnesium deficient, on the average, is that they cook so much of their food. Even if

people eat whole wheat, bread, the act of baking it under high heat kills a great deal of the magnesium in the wheat germ. Therefore, take wheat germ as a separate food supplement.

And regarding vegetables, cooking them and throwing away the water is an act of murder against the magnesium they contain. Delbet, in his *Politique Préventif du Cancer* says that the magnesium salts in plants are so soluble that not only cooking with high heat, but also merely blanching them will demineralize them.

An experiment is described in which cabbage, sorrel, and spinach were cooked. It was found that they did not lose much of the calcium, but the amounts of magnesium that went out in the cooking water were as follows:

Cabbage	more than 99 percent
Sorrel	94 percent
Spinach	about one-half

Delbet says it is best either to stew the vegetables, or to consume the cooking water as a bouillon.

He found that in cooking beef over 99.9 percent of the magnesium is lost. So when a person orders a hamburger on a white roll, he gets practically no magnesium. The same applies to hot dogs. Dairy foods also contain very little magnesium.

For extra magnesium, go heavy on nuts and the greens, both to be consumed raw. When junior fought against cooked spinach, he was on a better track than his parents.

My opinion is that if magnesium pills were given to people, it could do much good, but we recommend the magnesium carbonate form, obtained from dolomite limestone. It is available in tablets made from a ground dolomite rock which has been treated to eliminate any impurities it may contain. It is not merely magnesium carbonate; it contains other valuable minerals.

10. MAGNESIUM FOR STRONG TEETH

When you ask the dentist how you can help to prevent cavities, chances are he gives you a new toothbrush or special toothpicks, and warns you to brush after every meal, and to avoid too many sweets. If he is like most other dentists, he may recommend plenty of milk so that you get enough calcium, long known for its supposed tooth-hardening properties.

Undoubtedly, your dentist is doing what he can to help you take preventive measures, at least to the best of his knowledge. He is aware that bacteria from unremoved food particles and sugar by-products produce lactic acid, which dissolves calcium in the protective enamel layer.

He also knows the pain involved when decay spreads to the sensitive pulp tissue. Yet he ignores the fact that milk is recognized to be a greater producer of lactic acid than any other known food.

Indeed, the "best of his knowledge" may not be enough. One thing he probably does not know is that a number of studies have now established that it is magnesium, not calcium, that forms the kind of hard enamel that resists decay. And no matter how much calcium you take, without magnesium only soft enamel can be formed. If too soft the enamel will lack sufficient resistance to the acids of decay.

For years it was believed that high intakes of calcium and phosphorus inhibited decay by strengthening the enamel. Recent evidence, however, indicates that an increase in these two elements is useless unless we increase our magnesium intake at the same time. It has even been observed that dental structures beneath the surface can dissolve when additional amounts of calcium and phosphorus diffuse through the enamel at different rates. Thus milk, poor in magnesium, but high in the other two elements, not only interferes with magnesium metabolism, but also antagonizes the mineral responsible for decay prevention.

An article in *Nature* (April 29, 1961) reports that when 200 patients given an alkaline phosphate for three years showed a significant reduction in dental caries, scientists at the University of Otago in New Zealand discovered that magnesium was the beneficial factor. The report concluded that "an important role can possibly be assigned to magnesium [phosphate] in the stabilization of chemical, physical and electro kinetic states of the surface enamel calcium."

An earlier paper presented to the orthopedic section of the annual Texas Medical Association meeting in Dallas (May 6, 1952) tells a most encouraging story about magnesium. Lewis B. Barnett, a well-known orthopedic (bone) surgeon, noticed that people in Deaf Smith County, Texas, had much lower incidences of tooth decay and faster healing of broken bones than residents elsewhere. In his paper, the doctor offers the explanation that "water and foods have a very high magnesium and iodine content and recently we have proven that all of the trace minerals known to be essential are present in the water and foods grown in that area."

Dr. Barnett found that the magnesium bone content of a Deaf Smith County resident was often five times as high as in a Dallas County resident. Plenty of protein and vitamin C were also included in the diets of Deaf Smith County people.

A strong piece of evidence comes from a publication called *The Announcer*, issued monthly by the College of Agriculture, University of Missouri. It was published in the August, 1958, issue, and it would be best that we quote the whole item, as follows:

Mineral Studies May Mean Stronger Teeth, Healthier Bodies

"Recent work done on this research project points up the importance of magnesium in bone and tooth development and for the prevention of mineral deposits in the soft tissues of the body.

"The observations were made on guinea pigs but they have important implications for man. This is particularly true when related to dental caries in children and calcified joints in older people.

"Guinea pigs have a higher requirement for magnesium than many animals but there are wide variations in the nutritional requirements of all animals including man. Consequently, one individual may suffer from lack of magnesium although his diet is entirely adequate for the average person.

"When guinea pigs are fed a diet deficient in magnesium they grow slowly and, if they survive for a few months, they develop deposits of calcium phosphate in such organs as the kidneys, muscles, liver, stomach, and heart.

"At the same time, teeth fail to calcify normally. The incisors frequently become discolored, eroded, and finally break off at the gum line.

"A high calcium level in the diet increases the magnesium requirement of guinea pigs just as has been observed by others who have studied the magnesium requirement of the rat. The most significant contribution of the Missouri work to the science of nutrition, however, is the observation that a high phosphorus level in the diet aggravates the symptoms of a magnesium deficiency to as great, if not greater, extent than does calcium.

"This effect has been observed in the rat as well as in the guinea pig. The magnesium requirement of the latter was increased as much as four- to five-fold when high levels of phosphorus were present.

"The effect of high dietary phosphorus on the magnesium requirement has important implications in animal nutrition as well as in man. The horse, although no longer important in agriculture in this country, is particularly subject to bony overgrowths and abnormal calcification.

"This is particularly true when the ration is high in concentrates which are rich in phosphorus and low in high-quality forage. In this country, man tends to consume a high phosphorus diet and may exclude leafy vegetables, such as spinach and kale, which are rich in magnesium."

The most significant part of this article is the statement that a high calcium level in the diet increases the magnesium requirement, and this not only with guinea pigs, but "has been observed by others who have studied the magnesium requirement of the rat."

Unknowingly, *Dental Abstracts* for May, 1964, reported the same observation in publishing an abstract of an article from the *Journal of the Southern California Dental Association* (December, 1963). This article purports to show that an increase of refined food in the diets of rats increases the incidence of caries. But the only change that was made in the diet involved comparing the effects of whole wheat flour and refined white flour.

Whole wheat flour contains 113 mg. of magnesium per 100 grams. White flour has only 25. So in substituting white flour for whole wheat, the researchers were actually depriving the rats of large amounts of magnesium--and finding that more caries developed. There were 3.64 carious lesions per rat on the white flour diet, which also contained the high calcium foods

cottage cheese and milk, that created a magnesium deficiency. On the same diet, but using high magnesium whole wheat flour, there were only 1.16 carious lesions.

This research was conducted at Loma Linda University in California by Steinman Saunders, Gilliland, Holub, and Tague.

Since there is usually a deficiency of magnesium in the population, the belief that we must have lots of calcium to prevent cavities could result in just the opposite effect. Drinking large quantities of milk, therefore, could be one of the causes of dental caries.

Up to this point we have been dealing with experiments on guinea pigs and rats. Has the same effect ever been proved with people? It has! Three years later, in the April 29, 1961, issue of *Nature,* published in London, an article previously mentioned appeared, describing some work that took place at the University of Otago in New Zealand.

The discovery was accidental, as so often happens in medical research. An alkaline phosphate was administered to a group of 200 patients, ranging from five to 56 years old, during a period of three years, and it was noticed as a side effect that it reduced the number of cavities on the surface enamel of the teeth. Further investigation revealed that it was the magnesium in the phosphate compound that was the responsible factor.

The following are details of seven extracted teeth of persons who received the magnesium compound, all of which had a great reduction in the incidence of caries. In these cases the teeth were extracted and then tested for their calcium and magnesium content, as follows:

	Calcium	Magnesium
	4.73	0.22
	4.33	0.13
	3.65	0.42
	4.19	0.49
	4.35	0.30
	4.31	0.10
	3.50	0.30
	--------	--------
Average	4.15	0.28

The following are the figures for the teeth of persons who did not get the magnesium compound and who had more caries.

	Calcium	Magnesium
	4.75	0.03
	4.60	0.05
	4.75	0.19
	4.70	0.27

	4.42	0.08
	4.13	0.28
	4.60	0.14
	4.50	0.12
	--------	--------
Average	4.55	0.14

In this case there were only half the amounts of magnesium in the teeth. We can deduce several things from these figures: First, the magnesium from the magnesium compound taken by Group I showed up to a certain extent in the teeth and it is believed by the researchers that this gave the teeth a resistance to caries.

Second, it appears, according to this project, as in the Missouri research, that, calcium does not play a part in preventing caries, as is popularly supposed. In fact the article in *Nature* states: "Preliminary chemical analyses, carried out in the chemistry department of the University of Otago, have indicated that an important role can possibly be assigned to magnesium [phosphate] in the stabilization of chemical, physical and electro kinetic states of the surface calcium." In other words, the calcium requires stabilization, and magnesium does just that. Here possibly is a situation where, in the absence of magnesium, calcium can be a troublemaker rather than a help in preventing caries.

Another proof that calcium does not prevent cavities is the fact that although the consumption of milk in the U.S. is high, so is the general rate of dental caries. Milk is a food low in magnesium. Bone meal, however, which we know is a cavities preventer, is very high in magnesium, because three-quarters of the body's store of this mineral is in the bone structure.

Incidentally, the New Zealand researchers, who were aware of the worldwide fluoride controversy, went to the trouble of including a statement in their paper to the effect that the magnesium compound they used was fluoride-free.

Only seven examples were given of the teeth of persons in this experiment who had received the magnesium compound because these were the only ones of the 200 cases that had had teeth extracted.

As we said, this fallacy about calcium as a caries preventer will die hard. When Dr. Ritchie, the Otago University researcher, saw in what direction his work was going, he knew that the vested medical opinion might not accept his findings, so he protected his position, as will be seen in the following letter, written to our librarian, by W. C. H. Edwards of the Royal University of Malta:

> "DEAR MRS. LOMAKO,
>
> "Thank you for your letter of 8th May about my collaboration with Dr. D. B. Ritchie.
>
> "I am afraid I cannot help you further in this matter. I assisted Dr. Ritchie for two main reasons. One was that local medical opinion was very suspicious of his claims that enhancing the magnesium content of the diet could reduce incidence of caries, and it was essential that an independent collaborator should be involved in the Project. I, therefore, prepared the necessary solution of enamel samples, and Dr. Ritchie carried

out the estimations under my guidance, but he was in ignorance of the origin of the solutions with which I supplied him. In this way he could be exonerated from allegations that he had in any way been influenced in reaching the final results. Not until the end of the series did we compare notes, relating the magnesium content to the source of the sample.

"The second reason for my collaboration was the need to have an experienced analyst oversee the actual work of analysis. The method used could (and actually did in some instances) differ in its results from the straightforward literature descriptions of E. D. T. A. estimations, and we thought it might be necessary to make modifications to suit the particular problem.

"I presume that you have been in touch with Dr. Ritchie. I have had no contact with him since 1960.

"All good wishes,

"Yours sincerely,
W. G. H. EDWARDS
Professor of Chemistry."

A letter received in 1961 from G. S. Jones, a doctor of veterinary medicine, first called our attention to a paper presented by John A. Meyers, M.D., to the New York Academy of Dentistry on February 13, 1958. This paper is entitled "The Role of Some Nutritional Elements in the Health of the Teeth and Their Supporting Structures" (printed in *Annals of Dentistry*, Vol. XVLI, No. 2, June, 1958).

Dr. Meyers gives high praise to Dr. L. B. Barnett's investigations in Hereford and Dallas, Texas, in bone development. Dr. Barnett makes mention of the fact that people in older years frequently have fracture of the cervical neck of the femur and these are very difficult to heal in many localities. However, he noted that this fracture rarely occurs in Deaf Smith County, whereas it was common in Dallas County, Texas, where he also practiced. When a fracture did occur in Deaf Smith, healing was easy and rapid even in people 80 to 100 years old. In contrast, fractures in Dallas were common and very difficult to heal, if not impossible. One of his investigations of the mineral content of the ash of young males of Deaf Smith County and Dallas County showed the calcium and phosphorus to be about the same in both places--42 percent calcium and 15 percent phosphorus. However, there is five times as much magnesium in Deaf Smith subjects as in the Dallas ones, 2 percent and 0.4 percent respectively.

Dr. Barnett gives much credit to the water of Deaf Smith in furnishing the extra magnesium. Here is a portion of the analysis quoted (in parts per million):

Element	*Deaf Smith County*	*Dallas County*
Fluorine	**1.3**	
Iodine	**0.16**	**0.023**
Calcium	**23.0**	**4.0**

Magnesium	**16.0**	**8.0**

Dolomite For Teeth

We interviewed Dr. Barnett in September of 1966. He told us that supplementing the diet with magnesium would be a much better method than fluorides for decay prevention. Dr. Barnett also said he would like to see the water supplies and soils treated with magnesium, in view of the fact that the Hereford Clinic and Deaf Smith Research Foundation found 60 percent of 5,000 people to be magnesium deficient.

Dr. Meyers in his paper gives much credit to the "iodine" in bone development and uses magnesium iodide and zinc iodide extensively in his practice to treat infected teeth and to tighten loose teeth in their sockets as well as to prevent tooth decay. Of course he prescribes vitamins and even proteins when he thinks necessary.

The Archives of Oral Biology (Vol. 11, 1966) contains a study conducted by A. Stralfors at the University of Umea in Sweden. This experiment found that defatted cocoa had a strong caries-inhibiting effect, whereas cocoa butter, the fat element 'n cocoa, actually increased caries in hamsters. The report concluded: "They clearly point to the conception that the defatted cocoa powder contains the substance or substances capable of inhibiting caries."

Such findings, however, are no signal for us to start buying chocolate candies by the carload. The chocolate we see in stores has been emulsified with fats and sweetened with sugars to such an extent that it can only be the culprit responsible for the fantastic number of cavities plaguing our nation, especially the children. Early theories implicating sugar are still up held today.

Avoid Carbohydrates

The May, 1966, issue of *Dental Abstracts* presents a valuable opinion by Dr. Samuel Dreizen of Northwestern University. The summary states, "Caries in susceptible persons exists in direct proportion to the quantity of fermentable carbohydrates in the diet. Diets completely devoid of such carbohydrates are incapable of producing caries . . . An excessive consumption of sugar and concentrated sweets is the most prominent dietary feature associated with a high caries prevalence."

If you are concerned about your teeth, substitute a magnesium-rich nutrient for those slow-dissolving, acid-forming chewing gums and hard sucking candies. Soft carbohydrates are much harder to brush away than crunchy vegetables and good meat. Dolomite and bone meal can give you the minerals you need. Avoid milk which more and more seems to be a prime cause of the soft teeth with which many of today's youngsters are afflicted.

The dentist of tomorrow, hopefully, will know enough about magnesium to recommend it to us as a decay-preventive measure. As Dr. Barnett told us: "Magnesium has for far too long a time been the mystery mineral. This is a real tragedy, because of the mineral's great importance to the human physiology. The trend is now beginning to change, and last year

[1965] there were 250 research reports published on magnesium. This is only a beginning. There is a great deal more to learn about this important mineral."

So we say to all dentists and doctors who are chasing the fluoride rainbow--get hep about magnesium! Start a national campaign on the subject! Find out the truth! Is it calcium or is it magnesium . . . or is it fluoride? Or what is it?

11. BONE MEAL AND DOLOMITE

Phosphorus, the practically forgotten mineral, can make the difference between healthy and decaying teeth, it was recently reported to a meeting of the American Institute of Oral Biology by Dr. Robert S. Harris, the brilliant nutritionist of the Massachusetts Institute of Technology. It has long been known, of course, that phosphorus is one of the dietary essentials, required in substantial amounts in everyone's food consumption. But it has also long been taken for granted that everybody gets enough phosphorus in his daily diet. Consequently there has been little investigation of the metabolic roles of this mineral and even less is known about how much of it is required for optimal intake.

It came as something of a bombshell among the oral biologists, therefore, when Dr. Harris Pointed out that on the basis of extensive studies he has made to date, the phosphorus content of the average diet would have to be doubled to achieve the maximum beneficial effect of this mineral on the teeth. "This is really not excessive," he pointed out, "for one would have to triple the phosphorus content of white flour and white rice to raise the phosphorus to whole cereal levels."

Grains Stripped of Minerals

This is no more than a restatement and confirmation from a top scientist of something that *Prevention* has been telling its readers for 15 years. With regard to the refining of grain, we have concentrated more on the loss of vitamin E than the depletion of minerals, simply because vitamin E is so hard to obtain from other sources. But we have frequently taken care to point out that such essential minerals as phosphorus, and magnesium as well, are stripped away from grains when flour and cereals are made, leaving the foods empty of everything but carbohydrate calories without the minerals and vitamins needed to metabolize them properly. What was new and extremely important about Dr. Harris' paper was that it gave us additional information reinforcing our growing belief that phosphorus plays its chief role in relation to other minerals, and that without enough phosphorus in the system, none of the other important minerals will be efficiently utilized.

Dr. Harris pointed out that, as far as he could determine, phosphorus reduces caries by an initial demineralizing and a subsequent remineralizing of the tooth, in the course of which its mineral structure is altered, becoming far stronger and more resistant to the causes of decay. As such studies emerge, it becomes more and more likely they will reveal that much of our health depends on the ability of phosphorus to attract other minerals and bond itself to them into compounds known as phosphates. It has long been known that calcium phosphate is

readily absorbed into the system, while calcium alone is not. That is why we have long encouraged the use of bone meal, in which calcium and phosphorus occur as a phosphated compound in the exact proportions in which bone can best use them, in preference to any other dietary or pharmaceutical source of calcium. But now it seems evident that phosphorus is related not only to the proper utilization of calcium, but also to the utilization of every mineral that is important to the health of our bodies.

We recently received a letter from Charles B. Branson, D.D.S., a dental investigator in Greeley, Colorado, discussing the great need for all of us to have more phosphorus. Among many data that his letter presents, Dr. Branson points out that as early as the 11th edition of the *Encyclopedia Britannica*, which dates back to the 1920's, it was already known that phosphorus deficiency is found in rickets, in nervous ailments, in impotency, in paralysis agitans, locomotor ataxia, chronic eczema, diabetes, acne indurata and lymphadenoma. This does not mean that all these afflictions are caused directly by a phosphorus deficiency. But it may very well mean that they are caused by a deficiency in one or more other minerals or nutrients that cannot be properly used by the human system when the phosphorus supply is inadequate.

Fundamental Phosphates

According to Dr. Branson's letter:

> "Phosphorus not only plays a most fundamental role in the building of both bones and teeth, but in the construction, nourishment and the constant regeneration of the brain, the nerves, the arteries, all organs, and even every individual cell of the body. Furthermore, phosphorus plays a vital role in the metabolism of all proteins, fats and all carbohydrates. It appears to activate the vitamin and enzyme activity, even forming co-enzymes in such metabolism. Phosphorus is a chemical regulator of the bodily energy, storing energy and releasing energy similar to an electric battery. Furthermore, phosphorus serves as a transport in carrying nourishment to every cell, through the phosphates existing in the blood-stream.
>
> "Thus phosphorus appears to be the life essence in all seeds and all sperm of plant and animal life respectively, as well as all metabolism. When there is a serious deficiency of either phosphorus or calcium, it is evident that not only may the system draw upon the stored reserves within the bones for supplying other more urgent needs elsewhere, but it may draw calcium from the teeth as in caries; phosphorus from the arteries as in hardening of the arteries; from the nerves to thus result in nervous tensions and other nervous ailments; and may lead to mental disturbances when the brain fails to obtain a large proportion of phosphorus.
>
> "It thus appears that where there is an adequate level of such phosphorus available with a calcium balance, regeneration of all cells and all tissues proceed normally; but in absence of such an adequate level, faulty metabolism and degeneration may then tend to occur in humans as well as in plant and animal life as disclosed by agricultural scientists."

Dr. Branson is undoubtedly right so far as his information goes. We believe, however, that he may be oversimplifying in limiting the various states of health or degeneration that he has

specified to the condition of the calcium-phosphorus balance. This particular balance is enormously important, as we have been telling the world for 15 years. It is not, however, the sum total of our mineral needs.

Magnesium

With regard to the teeth, there are many studies that show the importance of minerals other than phosphorus for the strength and caries resistance of teeth. The study of Dr. Robert Harris, quoted above, indicated as much when he pointed out that phosphorus has its beneficial effect by modifying the mineral structure of the tooth. It is quite conceivable that the phosphorus itself is not even of basic importance in the tooth structure and that its true role is entirely connected with its faculty of bonding itself to other minerals and thus encouraging their incorporation in body structures that otherwise would reject them. There is very good reason to believe that the most important single mineral directly concerned with the strength of the tooth structure is magnesium. We have already described a report of some dental investigations made in New Zealand at the University of Otago and reported in *Nature* (April 29, 1961).

In the study cited, it was shown that a group of caries resistant teeth contained on the average twice as much magnesium as those in a comparable group that were caries-prone. There can be little doubt that it was actually the magnesium that strengthened the teeth, yet the magnesium could not have gotten into the teeth to strengthen them if it had not been transported by being bonded to the alkaline phosphate.

Calcium, which is the primary mineral in teeth, is also dependent on phosphorus. When there is a phosphorus deficiency, the teeth tend to decalcify. Additional replacement calcium can be carried into the teeth, but only when bonded to phosphorus.

Thus we see that for the best possible tooth health, we must consider a number of trace minerals and also the primary mineral triad, calcium-magnesium-phosphorus. These minerals are so interdependent on one another that a copious supply of any one of them will automatically create a deficiency in the other two, unless the other two are equally well supplied in the diet.

And yet, as complex as this nutrition problem may sound, it is really a simple one. By taking supplements of bone meal, we can get a rich supply of every single mineral that our health requires, although not quite enough magnesium. When we add dolomite tablets to the bone meal, we are gaining still more calcium but a calcium that this time is extremely rich in magnesium. In this simple way we can assure ourselves of an ample supply of every mineral required in our diets, in the proper proportions and able to undergo the proper complexing operations, for the health of our teeth, our bones, and all of our soft tissues as well. What could be easier, or bring greater rewards?

12. CHOLESTEROL

In the first chapter showing the effect of magnesium in preventing heart attacks, the work of several physicians was mentioned. In one case, referring to an item from *The Lancet*, it was stated that recent work has suggested that magnesium may be related to atherosclerosis . . . a high magnesium diet has prevented the development of atherosclerosis in rats. Atherosclerosis is considered to be caused mainly by too high levels of cholesterol in the blood!

We quote from an article that appeared in the May 18, 1957, issue of *The Lancet:* "In a recent publication from this institute, *Medical Proceedings* (1956, 2, 455, I. Bersohn and P. J. Oelsfse), it was shown that in many cases of coronary heart disease a dramatic clinical improvement followed parenteral [by injection] administration of magnesium sulphate [Epsom salts]."

One of the things that occurred was that abnormal cholesterol patterns rapidly reverted to normal in many of the cases studied.

The authors state that coronary thrombosis (blood clots) is reported to be uncommon in Africans. In Johannesburg the disease is very rare among the Bantu. In one series of 352 postmortems of Bantus over 40, only one death was found to be caused by a coronary thrombosis.

In another study, of 523 postmortems of non Europeans, there was an incidence of 1.66 percent of coronary thrombosis in the 41-60 age group. This contrasts with a figure of 12.8 percent at the Massachusetts General Hospital.

The authors state: "Serum cholesterol levels are lower in the African native than in the European." But the cholesterol level in the newborn Bantu is the same as in European babies. Something happens after birth to give the Bantu the advantage, as far as cholesterol is concerned. It probably is the diet and the active physical life led by the natives.

In a study of 70 healthy South African Europeans, the cholesterol level was 215. In the Bantus, of similar age and sex, it was only 174.

"In view of our striking results with magnesium sulphate therapy in coronary thrombosis, and the low cholesterol levels and low incidence of coronary occlusion in the Bantu, we decided to investigate the serum magnesium level in European and Bantu groups, and to find out Whether it was correlated as was the serum-cholesterol level . . . Serum-magnesium levels were determined on 47 normal Europeans and 53 normal Bantu (all 25-75 years)." The results were 1.92 for the Europeans and 2.11 for the Bantus. According to the investigators, this .19 advantage of the Bantus' magnesium is highly significant.

More magnesium serum studies were made and the authors summarized. "These results show (1) that the magnesium level is significantly higher in the non-European than in the European, and (2) that a definite correlation exists between serum-magnesium and the serum-cholesterol levels. Where the serum-cholesterol content is low the magnesium content is significantly increased . . . These findings suggest that the part played by magnesium in diet and nutrition requires further study. The possible role of this element in cholesterol metabolism, and indirectly perhaps in atherosclerosis [hardening of the arteries], has not been fully appreciated, studied or recognized."

A few years later, the work just cited was questioned, and an item on it which appeared in *The British Medical Journal* (January 13, 1960) is herewith given in its entirety because of its importance.

> "Magnesium Sulphate in Coronary Thrombosis--Drs. B. Malkiel-Shapiro and I. Bersohn (South African Institute for Medical Research, Johannesburg) write: In reply to a query by one of your readers (*Any Ques*tions? February 8, 1957, p. 353) as to whether our observations on the efficacy of parenteral magnesium sulphate in coronary thrombosis had been confirmed, you reply that 'no confirmatory study appears to have been published since,' and 'in the absence of confirmation of this work it is not possible to define the indications for magnesium sulphate therapy.' We have refrained from writing before, since we were awaiting possible confirmation of our original observations from other sources. Recently, Parsons, Butler, and Sellars, from the Royal Hobart Hospital, Tasmania, have published a paper on 'The Sulphate.' Their conclusions on the biochemical results of patients suffering from coronary artery disease after taking magnesium sulphate were, among others, as follows: (1) a significant reduction in the serum cholesterol levels; (2) a great improvement in the lecithin: cholesterol ratio; (3) a marked increase in serum magnesium levels; (4) a reduction in nearly all cases of the degree of inhibition of plasmin; (5) a marked reduction in the beta-lipoprotein content. On the clinical side, they report that 'over 100 patients suffering from coronary heart disease (of which at least one-third had acute myocardial infarctions) were treated with intramuscular magnesium sulphate with only one death, compared to their findings in the previous year when of 196 cases admitted and treated with routine anticoagulants, 60 died. They conclude as follows: 'It is evident that the work of Malkiel-Shapiro and Bersohn has been confirmed.' Confirmation on the clinical efficacy of magnesium therapy in coronary thrombosis has also been published by Agranat, Marais, and Teeger. We feel now, as we did when we published our preliminary communication, that although the clinical case is not yet definitely proved, there seems to be a growing mass of evidence, in experimental animals as well as in man, to indicate that magnesium sulphate may well have an important therapeutic action in this field.
>
> "Our Expert replies: I agree that there now seems to be a growing quantity of evidence suggesting that magnesium sulphate may be of therapeutic value in arterial disease. Whether this is due to lipid changes, as suggested by your correspondent, or to a 'protective' action against steroids, as suggested by Selye, or again to a purely anticoagulant action, as suggested by Lehmann et al., is still under experimental investigation. Further clinical laboratory trials are in progress and. their results are awaited with interest. A letter from Dr. Parsons and his colleagues is printed on P. 276 of this Journal."

Another piece of evidence is an article called "Effect of a French Mineral Water on Serum, Cholesterol," by Korenyi, Harkavy, and Whittier, all M.D.'s, connected with the Creedmoor Institute for Psychobiologic Studies, Creedmoor State Hospital, Queens Village, New York. It appeared in *Current Therapeutic Research* (March, 1961).

The authors screened 143 patients at Creedmoor and selected 34 whose serum cholesterol levels were above 250 mg. percent (that is, mg. per 100 milliliters of blood). These 34 patients were not receiving any other type of treatment known to have any effect on serum cholesterol.

A volume of 30 1/2 fluid ounces of mineral water was given daily in three divided doses for 30 days. The mineral content of this water was as follows: calcium carbonate, 3.5 mg. per 100 cc; -calcium sulphate, 156.5 mg. per 100 cc; magnesium bicarbonate, 3.5 mg. per 100 cc; and magnesium sulphate, 19.0 mg. per 100 CC."

There was no other change in their treatment.

At the end of two weeks, there was an average decrease in serum cholesterol of 9.9 mg. %. After four weeks, at the conclusion of the study, the mean decrease had become 23.8 mg. %

In discussing their results, the authors state:

> "The recent report by Schroeder ("Relation Between Mortality from Cardiovascular Disease and Treated Water Supplies", JAMA, 172, 1960) demonstrated a highly significant negative correlation of total death rates and mortality from coronary heart disease with total water hardness . . .
>
> "Since there are many prior reports indicating a relation between magnesium metabolism and atherosclerosis and magnesium is required for the activation of most of the enzymes concerned with the transfer and removal of phosphate in biological systems, it is possible that the hypercholesterolemic and perhaps atheroprophylactic effect of mineral water is related to its content of this substance . . ."

For control of the serum cholesterol, therefore, one should exercise actively every day, eat a very low fat diet, make sure that the diet is rich in niacin, linoleic acid, pectin and vitamins C, A, D, and E, and take a magnesium supplement. Dr. Pierre Delbet, who has made contributions on the subject of magnesium to the French Academy of Medicine said, *"Je répète que le magnésium doit etre considéré comme un aliment et non comme un médicament* ... I repeat that magnesium should be considered as a food and not as a drug."

13. THE PROSTATE

In the December, 1963, issue of *Prevention*, as part of a series of articles on the prostate, we wrote a chapter on magnesium and prostate trouble, part of which we will reprint here as follows.

There is a remarkable book published in French, called *Êquilibre Minéral et Santé* (Mineral Equilibrium and Health), by Dr. Joseph Favier (Librairie le François, Paris), and . . . the title indicates that it deals with the mineral magnesium . . . the miracle mineral. The book shows how valuable magnesium as a medicament is for many diseases, but its chapter on magnesium's effect on the prostate should be discussed. Unfortunately for those who would like to read it, it is out of print.

Dr. Favier gives a Dr. Stora credit for being the first to discover magnesium chloride as an effective agent in treating urinary troubles of prostate origin. He informed the Medical Academy of France of it, on March 18, 1930. Eight days later, Dr. Pierre Delbet submitted a report showing the same results with magnesium chloride.

When Dr. Stora spoke about his results to Favier, the author of the book we are discussing, Favier began to make inquiries among his physician friends ... He found that they were all taking magnesium chloride. To his surprise he found that four out of five of them had been disturbed by difficulties in urinating, especially at night. And all of them, after taking the magnesium tablets, found that their nocturnal urinating troubles diminished or disappeared.

Another doctor--Chevassu--gave him other interesting data about 12 prostatic cases whom he treated with magnesium tablets. Ten of them were cured. One disappeared, and he does not know what the result was with him. The one that was not cured was left with nothing more than nightly urinations. The interesting thing is that the general physical condition of all these patients improved. Evidently, there is something about magnesium that is healthful for the body.

Dr. Chevassu speaks of his Case No. 4, a 77-year-old prostatic patient who suffered a crisis of complete retention of urine. He had to be probed in order to urinate. His prostate was very much enlarged. Probes were carried on three times a day up to November 24, and hot clysters (enemas) were administered. The first spontaneous urination took place on November 25; the probes were cut off on December 7. On December 10, the patient urinated five times a night and he had a big residue.

The magnesium treatment started on December 14, the dosage being four tablets (2 g. 40), and went on until February 21, 1930. The nightly urinations fell from five to three, and the residue dropped to 20 grams.

The patient, having recovered his strength and feeling very well, believing he was cured, discontinued the treatment. The frequency of urinations increased, and three days later, on February 24, the residue had gone up to 126 grams. The magnesium treatment was resumed, the frequency of urinations curtailed, and on March 21, the patient informed the doctor that he urinates only two to three times a night.

Regarding patient 13, who had been a case of complete retention of urine: he was sent to the hospital in order to have an operation of the prostate performed; that is, to have his prostate removed. But Dr. Chevassu felt that the operation in his case would be too dangerous. He was therefore given the magnesium chloride tablets. Spontaneous urination occurred, and the patient left the hospital without the operation. From then on he had no difficulty or pain with his urinations. Thereafter the patient used to come to the hospital regularly merely as a friendly visitor to show his gratitude to the doctor. He was, of course, taking magnesium tablets after he left the hospital.

Dr. Favier ends the chapter by saying that among the men who have been taking magnesium chloride tablets for many years, none to his knowledge has suffered from prostatic trouble.

In connection with some of these cases and their cure, Dr. Pierre Delbet in *Academy of Medicine* (Paris), session of March 25, 1930, says, in regard to how magnesium acts on the body:

> "As magnesium adds to the contractibility of smooth muscle fibers, one may wonder if the treatment doesn't act uniquely on the bladder, inasmuch as there isn't any parallel between reduction in size of the adenoma [a tumor of glandular origin] and functional improvement. But if, in certain cases, this improvement is considerable, when

reduction in size is slight, which is favorable to the hypothesis, in other cases, it's quite the contrary, the reduction is quite more marked than functional improvement.

"In an earlier communication, M. Bretau and I have shown that age is accompanied by a reduction in magnesium in the most active organs and that the absorption of halogenated salts permits a struggle against certain manifestations of senility.

"Hypertrophy of the prostate is a complaint of waning life and perhaps the one which strikes most terribly. The facts communicated by M. Stora, which I have just reported and which belong to M. Chevassu, show that it is one illness which can be modified by halogenated magnesium salts.

"The preceding observations show that halogenated magnesium salts sometimes have an extraordinary action in very advanced cases. The sick man in observation XIII, who had complete retention, comes to see me regularly at Cochin to express his gratitude. He came right at the time of my retirement, that is to say during 16 months. He continued to take the treatment and urinated without difficulty.

"Since that time, a number of prostate sufferers, whom I don't know, have expressed their gratitude to me for the services that delbiase [a magnesium compound] rendered them.

"Its mode of action is completely obscure to me. What is striking is that the effects stop from the moment that the treatment is stopped. The subject of observation IV is an example. His nocturnal urinations were reduced to three and the residue, which had been considerable, fell to 20 grams. He stopped the treatment and in three days, the frequency of his urinations increased and the residue rose to 125 grams.

"One of my former pupils, a distinguished surgeon, has communicated his own observation to me. It appears to be very interesting. He had nocturnal urinations whose frequency increases all the time. He put himself on the delbiase regimen. His urination became less frequent. "My life," he said, "was completely untroubled. I could only complain that drinks were a little more frequent and a little more demanding than I should have liked." At the beginning of the war, he was mobilized and sent to be a surgeon at the front where he couldn't get any delbiase. His urinations became more frequent and assumed painful proportions. His general health was affected. Two and a half months after the treatment was stopped, it was noted that he had a residue of 220 grams.

"In sum, the effect of halogenated salts of magnesium isn't lasting. They improve or even suppress functional difficulties; they don't heal the lesions. They cause them to retrocede in a certain number of cases, but they don't cure them. As soon as the treatment is stopped, the development begins anew. Doesn't that prove in a peremptory manner that an insufficiency of magnesium in the organism is the cause, or at least one of the causes, of these lesions?'

Senility

Here are some of Delbet's ideas on senility. He says that all organs and tissues do not age at the same speed. The muscular system generally lasts the shortest period, the nervous system the longest. "The role of magnesium in organic synthesis leads one to think that it must

diminish with age. Weiske's work shows that magnesium is less abundant in the bones of old rabbits than it is in those of young ones." In the human testicles a decline in magnesium was demonstrated as a person ages, but in old age calcium is more abundant than magnesium-three times more abundant. But here is something extremely interesting. As Dr. Delbet puts it, calcium is considered as a "framework" mineral, but magnesium is an "action" mineral. Calcium is static, magnesium is dynamic.

He says, "Added calcium and reduced magnesium are the characteristics of the senile testicle. In the brain and in the testicle, the relationship with age of are the same degree, but it appears certain to us that at the time that life is waning, magnesium diminishes while calcium rises. Now, everything that is known about the chemical magnesium, about its action in the synthesis of chlorophyll, justifies one in thinking that its reduction plays a role in senility, **or** at least in certain phenomena of senility.

Now, if magnesium in the body becomes less abundant as we grow old, and since medical researchers prove that deficiencies of magnesium lead to many diseases, isn't it common sense to take magnesium as a food supplement on a permanent basis?

14. ALCOHOLISM

After going through many medical articles on the subject, one comes to the definite opinion that a deficiency of magnesium is one of the principal causes of alcoholism. In *Nutrition Reviews* (July, 1960), "Magnesium Balance in Alcoholics," appears the following (p. 200): "Chronic alcoholics as a group possess a wide spectrum of nutritional deficiencies because they obtain their caloric needs mainly from drinks which are deficient in most nutritional substances except alcohol, water and carbohydrate." Another article in *The American Journal of Clinical Nutrition* (June, 1963), comprising a study of three experiments with various numbers of people at the Veterans Administration Hospital, at Minneapolis, Minnesota, gives the following: "The serum magnesium content in patients with nutritional cirrhosis is also frequently low. This has been attributed to inadequate dietary intake ... magnesium depletion contributes significantly to the tremor, twitching and tetany, as well as the psychiatric disturbances occurring in chronic alcoholism." It states also: "Magnesium excretion induced by alcohol ingestion as well as poor dietary intake probably contributes to magnesium deficiency in chronic alcoholism ... Following alcohol ingestion under varying dietary conditions, the urinary excretion of magnesium increased strikingly in six of the twelve subjects."

We found a corroboration of this in several other medical papers. In other words it would seem that alcohol is quite a disturbing element when it enters the body. We know that every drink of alcohol removes some of the body's store of vitamin B. Now we see that it also removes some of the magnesium. The question is, what effect does it have on other important vitamins and minerals?

In a paper published in *The New England Journal of Medicine* (February 20, 1964), "Metabolic Effects of Alcohol on the Liver," there is a separate discussion on magnesium metabolism in which it is confirmed that in chronic alcoholism the level of magnesium in the blood is low. But the following is important: "The evidence relating some manifestations of

chronic alcoholism to magnesium depletion includes the favorable response to magnesium administration and the positive magnesium balance during the recovery phase of chronic alcoholism." It also mentions the fact that very low levels of magnesium in the blood can lead to hallucinations and delirium tremens. It states further that the authors as well as three other groups of investigators have found that there is a serious loss of magnesium in alcoholism. But the important thing about their work is the favorable effect the taking of magnesium has on the alcoholic.

The final statement in this section of the article is, "The current evidence suggests, therefore, that in addition to poor dietary intake, the hypo-magnesemia [low magnesium] of the alcoholic patient may be due to increased urinary magnesium excretion." In other words, alcoholism probably begins in a diet very low in magnesium, and this can happen easily on a diet of white bread and other refined food products.

An article on magnesium in *Annals of Internal Medicine* (47:956, 1957), in which alcoholism and magnesium are discussed, contains the following summary: "A clinical syndrome characterized by muscle tremor, twitching and more bizarre movements, occasionally by convulsions and often by delirium, has been described and is considered to be a manifestation of magnesium deficiency. The evidence for this concept is the many similarities to experimental animal magnesium deficiency, the occurrence of low mean serum magnesium concentrations for a group of patients, a positive magnesium balance during treatment, and, finally, the frequently gratifying and sometimes dramatic response to therapy with magnesium salts."

In conclusion, here is a quote from a newspaper column, by Dr. H. L. Herschensohn, in the Arizona Republic, sometime in 1958: "For years Epsom salts was given to persons suffering from acute alcoholism. The good effect was partially due to its cathartic action, but it was also due to the fact that Epsom salts, being magnesium sulphate, makes up for the deficiency of magnesium characteristic of alcoholism.

> "In animal experiments, when the magnesium in the blood is decreased, tremors occur similar to delirium tremens ... magnesium is an important part of every cell in the body. It is possible that its deficiency, even in non-alcoholics, may account for some ailments which are difficult to diagnose."

15. MAGNESIUM FIGHTS OSTEOPOROSIS

For many years osteoporosis has been a mystery disease, striking most frequently in old age, often crippling and always bringing pain. When it strikes, bones gradually lose density and become more porous. They break easier, and are proportionately harder to mend. Osteoporosis attacks 20 to 30 percent of post-menopausal women, and between 5 to 10 percent of men more than 50 years old.

For a long time nothing was known of its cause. It was considered an unavoidable part of aging. Researchers now know that the bones of the body are continually "shedding" cells and being rebuilt. Osteoporosis results when the shedding or breaking down and resorbing of the bone occurs faster than the building-up process.

Here are several theories for-why this takes place. One is that the building blocks of the bone-calcium, vitamin D, etc.-are lacking. Sometimes, dietary supplements of these elements can reestablish a normal balance so that the bone is replaced as quickly as it is resorbed.

Studies have also shown that prolonged lack of exercise can cause deterioration of the bone. In these cases, a simple exercise program along with adequate dietary therapy can block the disease's progress.

A more recent finding is that osteoporosis can be caused by overproduction of adrenal steroids and large doses of corticosteroids. At the same time, certain other hormones (estrogens) appear to combat osteoporosis.

All of the facts have been jangling around in the files of medical researchers for months and years- making no sense to many of them, and leaving osteoporosis as much a mystery disease as ever. Now Dr. Lewis B. Barnett, a retired orthopedic (bone) surgeon living in Center, Colorado, whose work we have cited in previous chapters, has advanced a theory that takes into account and explains all these random facts. What's more, Barnett has successfully tested his theory.

In a personal interview at his Colorado home, Meadow Ranch, Dr. Barnett told us, "One of the most important aspects of the disease osteoporosis has been almost totally overlooked. That aspect is the role played by magnesium."

Health from Minerals in Water

Dr. Barnett first became interested in the role of magnesium in bones and osteoporosis in 1950. At that time he began a series of investigations in Hereford and Dallas, Texas. One purpose of the study was to find out why people in later years frequently have fractures of the cervical neck of the femur, and why in certain areas these heal with great difficulty. These fractures rarely occurred in the Hereford area but were common in Dallas.

When the fractures did occur in the Hereford area, at an average age of 82.5, the healing time was eight weeks. In Dallas, the fractures occurred at the average of age 63, and, if they healed at all, took in the vicinity of 6.3 months.

Barnett analyzed the soil and water content of the two areas, and concluded the major factor in bone health was the mineral content of the water supply. Analysis of the water showed that calcium alone could not be the element responsible for combating osteoporosis. The Hereford water contained only four parts per million of calcium while the Dallas water contained 23 p.p.m. There were only slight differences in the fluorine, iodine, and phosphorus content of the water. Barnett considered these differences statistically insignificant.

The one really outstanding difference was in the magnesium content of the two water supplies. The Dallas supply contained eight p.p.m. of the mineral, while the Hereford water contained 16 p.p.m.

Although the medical literature then contained very little on the virtues of magnesium, Barnett did locate some reports on the subject. In the publication, *Vital Facts About Foods,* by Otto Carque (1933) is the statement. "Bones average about 1 per cent phosphate of

magnesium and teeth about 1% per cent phosphate of magnesium. Elephant tusks contain 2 per cent of phosphate of magnesium and billiard balls made from these are almost indestructible. The teeth of carnivorous animals contain nearly 5 per cent phosphate of magnesium and thus they are able to crush and grind the bones of their prey without difficulty."

Barnett decided to analyze the bone content of people in Dallas and Hereford. He chose for his study 500 women, average age 55. All were his patients, undergoing lumbar and cervical vertebrae surgery. Except for slipped disks and related problems, they considered themselves healthy individuals.

More Magnesium, Stronger Bone

The findings bore out the results of the previous studies: the major difference was in the magnesium content of the bone. In the Dallas area where bone weakness was evident because of the high number of cases of osteoporosis, the magnesium content of bone was .05 percent; in Hereford, 1.76 percent.

Still Barnett was not satisfied. He decided on another study. He examined the bone content of healthy people and compared it with the content of people suffering from severe osteoporosis. Again he found there was little difference among the calcium, phosphorus, and fluoride content of the bones of the individuals. The magnesium content of the healthy people, however, was 1.26 percent. That of the osteoporosis victims was .62 percent.

'The mechanism whereby magnesium functions to strengthen bone and combat osteoporosis is, like many functions of the body, quite complex," Dr. Barnett explained. "Our studies, however, have convinced us that the mineral is important-perhaps the most important single element-in bone health."

The theory behind it is that magnesium is needed, by the pituitary gland**.** This gland regulates all the other glands of the body, and to do this regulating it uses magnesium. This mineral acts as a sedative, counteracting the stimulant effect of the adrenal glands. These glands must be restrained in their production, or else their secretions will speed up the breaking down and resorption of bone tissue.

Another function of magnesium is to act as an enzyme or catalyst. In effect, it acts as the glue that binds calcium and fluorine to build bone. Thus, even though calcium and fluorine may be abundant in the diet, they cannot be used and are flushed out of the system unless the binding element, magnesium, is also present.

Deficiency Widespread

"A test we conducted on 5,000 people found about 60 percent of them deficient in magnesium," Barnett told us.

"Perhaps it wouldn't be a bad idea, since they are adding things to the water supply anyway, if they considered magnesium." At any rate, Barnett does not consider osteoporosis a necessary

accompaniment of old age. A diet high in magnesium, calcium, phosphorus, and fluorine is definitely an important preventive measure.

There is no official recommendation on how much magnesium one should get in his daily diet. Not only is magnesium the mystery mineral, but it is also, to a large degree, the ignored one. However, Dr. Barnett advocates that 600 mg. a day will provide a safety margin and will not be wasted.

16. KIDNEY STONES

One of the most excruciating pains to bedevil mankind and the medical profession ever since the dawn of history is caused by kidney stones. The torture of passing a kidney stone was aptly described by one victim as "passing broken bottles, old razor blades, molten lead and sulphuric acid garnished with bits of rusty barbed wire." Stones have been found in the kidneys of Egyptian mummies, and it is apparent that man has suffered with this affliction at least 4,000 years, while doctors have been able to be of little or no help.

We will now discuss the effect of magnesium on kidney stones. We will first quote from *Health Bulletin* (June 13, 1964) published by the Rodale Press: "Magnesium oxide 'looks very promising' as a preventive of kidney stones," Dr. H. E. Sauberlich of the Army's Fitzsimons General Hospital in Denver told *Health Bulletin* this week. He said that results he has been getting with a 250 milligram tablet made from the same material used to manufacture fire bricks could spark a revaluation of the present methods of treating kidney stones.

> "The new therapy is simply taking one capsule daily. Assisted by three researchers from the University of Colorado Medical School, Dr. Sauberlich prescribed this capsule for a group of volunteer patients who had histories of passing kidney stones. After only a very short time on these pills, he pointed out, the patients had no more stones. That happened with each of the patients he has followed up for as long as two years, Sauberlich added. No side effects have been encountered.
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> "The odd part about the new therapy, which is strictly experimental and not conclusive, is that none of the researchers understands why or how magnesium prevents kidney stone formation. The only clue they have to go on is that a patient with this disorder 'for some unknown reason requires more magnesium than normal amounts.' Tracking down the reason and devising a test to discover those individuals who have this unusual requirement is the next step, Sauberlich said.
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> "A possible hint to the way the Denver researchers will attack the problem came when Dr. Sauberlich was asked whether a dietary deficiency was implicated in the kidney disorder. Although he stated that at present no such association exists, he was quick to point out that 'magnesium as a dietary requirement has not been adequately studied.'"

Further information on the above research was given in *The Medical Tribune* (June 3, 1964), which said, regarding Dr. Sauberlich's work:

"'Therapy consisted of a single tablet of 420 mg. of magnesium oxide, which provided 250 mg. of magnesium, daily. Longest period of treatment to date is two years, and none of the 14 have passed urinary tract calculi while undergoing treatment,' Dr. Sauberlich said.

"He detailed two phases of the magnesium therapy after other methods had failed. A 34-year-old man had passed a calculus about every other week for 11 years, but passed none while receiving therapy for six months. When the therapy was temporarily withdrawn, he began passing calculi within two weeks. Since returning to therapy he has been asymptomatic [without symptoms] for a year.

"A 38-year-old man had a 10-year history of weekly kidney stones. Magnesium therapy stopped this for 12 months, at the end of which the patient decided on his own to discontinue treatment. Calculi recurred within two weeks, and Dr. Sauberlich observed that he gladly resumed therapy, also on his own. He has been asymptomatic again for three months.

"Co investigators were G. E. Bunce, Ph.D., and Drs. C. A. Moore and 0. G. Stonington of Fitzsimons and the University of Colorado Medical School."

There was a recent medical article on the subject of oxalic acid present in many foods, in which appeared the statement that approximately two-thirds of the kidney stones in English people contain calcium oxalate. In another medical article, we now find that kidney stones come usually where there is a deficiency of magnesium. In the first-mentioned article, it was also stated that vitamin B_6 (pyridoxine) could reduce the oxalic acid in the body.

Vitamin B_6 will be found in brewer's yeast tablets, wheat germ, and desiccated liver tablets. Therefore, if a person observes care in his diet to see that the oxalate-containing foods are low, and that he is getting enough magnesium and vitamin B_6, the chances are he can forget all about kidney stones.

Let us look into the second-mentioned article which appeared in *Nutrition Reviews* (October, 1961). It says that as far back as 1931 it was known that kidney stones could result if there were a deficiency of magnesium. In *The Lancet* (2, 174, 1932), W. Cramer found kidney stones in rats that were on a low magnesium diet. These rats were normal except for the kidneys.

G. Hammarsten (Lunds Universitets *Arrskrit,* N. F. 32, 12, 1937) produced kidney stones in rats fed a diet low in magnesium. Then when there was an addition of magnesium to their diet, it prevented the occurrence of kidney stones. These researchers also found that "high levels of magnesium appear to have a sparing effect for very low levels of vitamin B_6," which means that magnesium acts as a protector of the vitamin B_6 supply in the body.

Finally, there is news of a new study which shows that kidney stones are most likely a deficiency disease that can be corrected with proper diet. Nutritional correction is the means that has been found, at last, to brighten the outlook of the victims of this agonizing disease, from which no race or geographic area has ever been entirely free.

In the study conducted at the Department of Nutrition, Harvard School of Public Health, reported by Stanley N. Gershoff and Edwin L. Prien (*American Journal of Clinical Nutrition,* May, 1967), patients suffering recurring kidney stones have been relieved of this condition

without resorting to surgery when maintained on oral supplements of both magnesium and vitamin B_6.

This latest news of cures achieved by the team of researchers from the Harvard School of Public Health throws the spotlight on vitamin B_6 as perhaps the "unknown factor" which, when in short supply, increases the body's needs for magnesium.

Because a B_6 deficiency in laboratory rats resulted in a marked increase in urinary oxalate, the precursor to kidney stones, Harvard researchers Stanley N. Gershoff and Edwin L. Prien undertook an investigation of the effects of daily oral administration of both magnesium and B_6 on patients with histories of recurring kidney stones. Their results can only be described as remarkable.

Male and female adult patients who had had two or more kidney stones in the two years prior to the study were used for this investigation reported in *The American journal of Clinical Nutrition.* Patients were asked to take two tablets, each containing 100 mg. of pyridoxine, daily. This treatment did not produce looseness of the bowels except in an occasional patient. All patients were told to avoid milk as a beverage but were allowed the use of milk or cream in all other foods. Intakes of cheese and other high calcium foods were restricted. They were asked to drink two quarts of water per day.

Fabulous Results

Thirty-six patients have been maintained in this study for at least five years. There was no recurrence of kidney stones in nine. Two patients produced one stone each in their fourth year in the program. Another passed several over the Christmas holiday in his first year when he stopped taking the pill, one in the second year, and one in the fourth. This patient had passed 11 in the year before therapy and over 300 in the 14 years prior to entering the program. A fourth patient, a very busy executive, passed one or two small stones every year for three years, none since. A fifth patient, with two existing small stones when the treatment was started, showed no increase in their size for 2 1/2 years, failed to come in for checkups after this period, and stopped taking the drugs six months later. A year and a half later, one of the stones had grown considerably and caused symptoms requiring surgery. Only one patient showed no improvement and continued to make stones.

While researchers Gershoff and Prien recognize that a much larger series of cases over a long period of time will be necessary to determine the efficacy of this regimen, they are encouraged by the results obtained so far. Of 36 patients maintained on the program for five years or more, 30 have shown no recurrence or decreased recurrence of stone formation.

This study, it seems to us, has deep significance for everyone--not only for those who are suffering the agonies of kidney stones, but also for those who would avoid them.

If you are not careful about your nutrition, are not getting natural supplements, and have been trying to slim down by following one of the popular reducing diets, you could be shortchanging your body of that vitally essential catalyst, vitamin B_6.

This vitamin is essential for the synthesis of proteins. It serves as a key link in the metabolism of amino acids and fatty acids. Lack of B_6 has been shown to cause a variety of metabolic

difficulties because of inability to use proteins properly. One of these metabolic disturbances results in a marked increase in urinary oxalate, the precursor to kidney stones. Vitamin B_6 deficiency can also lead to weakness, irritability, nervousness, skin and hair problems, muscle malfunction, and abdominal pain. Prolonged deficiency in the rhesus monkey produces arteriosclerosis, anemia, cirrhosis of the liver, and dental caries. Cancer tissue has a very low level of vitamin B_6 and uses amino acids differently from normal tissues.

"The Pill" a Threat?

Women who take oral contraceptives are apparently being robbed of B_6**,** according to a recent study reported in a weekly journal of science published in England. Oral contraceptive tablets contain synthetic estrogen and progesterone, and their action is very similar to that of hormone secretions during a natural pregnancy. They create a false pregnancy in which ovulation is prevented. Recently it has been learned that one of their effects is to inhibit the activity of enzymes containing B_6. Dr. David P. Rose of Sheffield, England, expresses his concern in *Nature* (April 9, 1966) that oral contraceptives might have the same effect as pregnancy on enzymes containing pyridoxine, thus exposing another large group of women to B_6 deficiency. It is already known that pregnancy often leads to deficiency of this vitamin. A study reported at the Fifth International Congress on Nutrition reported in *Obstetric Research* advised greatly increased consumption of B_6 for pregnant women. The average pregnant woman now gets about 0.5 to 1.5 mg. daily instead of the 15 to 20 mg. she needs. It would seem from Dr. Rose's study that women on "The Pill" would have the same requirements.

Because B_6 is sadly lacking in processed foods and is destroyed by heat, it is easy to incur a deficiency. Pyridoxine does not exist in natural form apart from the other B vitamins, all of which play an important role in your body's remarkable assembly line. Any preparation, therefore, that is sold just as pyridoxine would have to be synthetic. Get your pyridoxine along with other B vitamins in fresh raw fruits and vegetables (not cooked), and from liver, heart, wheat germ, peanuts, egg yolk, legumes, and especially brewer's yeast which is your richest source of pyridoxine. While B_6 is not lost in quick cooking to any great extent, much of it may dissolve and be thrown away in the water in which foods are slowly cooked. Roasting or stewing of meat can result in great losses. Decreases in vitamin B_6 in sterilized liquid milk products not only occur during pasteurization but continue at a rapid rate for as long as seven days.

So, if you have been on a reducing diet, guard against any B_6 deficiency you may have induced by increasing your intake either through natural foods or supplements of yeast and desiccated liver--another rich source of all the B vitamins.

Magnesium, the vital mineral in this partnership that is proving so effective in preventing the formation of kidney stones, is indispensable for a proper regulation of calcium metabolism. When animals deficient in vitamin B_6 were given high levels of magnesium, they continued to show oxalic acid in the urine but they no longer converted this acid into kidney stones. Magnesium, then, by improving the body's utilization of calcium, has the effect of a solvent-preventing the caking and crusting, like lime in your teakettle, of unassimilated calcium.

Good dietary sources of magnesium are wheat germ, desiccated liver, eggs, green vegetables, soybeans, almonds and dolomite.

Gallstones

In addition to the prevention of kidney stones there is evidence that magnesium can prevent gallstones. Our medical dictionary says that the gallstone is a concretion formed in the bladder or the biliary ducts, composed, in varying amounts, of cholesterol, bilirubin, and other elements found in bile. The biliary ducts are in the liver. In this case also, magnesium is a specific preventive factor in the formation of gall- or liver stones. For one thing, in a previous chapter, we showed that magnesium has the effect of reducing the amount of cholesterol in the bloodstream.

The matter is mentioned in a communication to the French Academy of Medicine (June 23, 1931) by Pierre Delbet, M.D., reproduced in his book *Politique Préventif du Cancer*. He says that when the diet is rich in magnesium it immediately shows up in the bile. In this manner the quantity of the magnesium in the bile can be actually doubled. This was confirmed by Bretau. Dr. Delbet also mentions clinical work by Drs. Godard and Palios, which showed that such increase in magnesium can have a favorable influence on gallstones.

Dr. Delbet studied human bile in the laboratory and found that the addition of magnesium drove out practically all the cholesterol, and he noted that the addition of magnesium added a pigmentation to the bile, gave it a deeper coloring. Its effect on the bile was to make the cholesterol in it more soluble.

Dr. Delbet then adds that, "It is a clear result of experiments ... on the action of magnesium chloride on the elements that make up calculi [stones] that the addition of a food ration of magnesium in the form of halogenated salts has the power to reduce chance of biliary calculus formation.

"This conclusion is confirmed by facts. I know a great number of people who take delbiase regularly. None of them has vesicular trouble. That's probably not very convincing. You can't prove that those who take delbiase would have had biliary calculus if they bad not taken it. On the other hand, quite a few patients have biliary calculus without being magnesium deficient." In other words, there are other causes of gallstones than a magnesium deficiency.

However, says Delbet, "cases of the gall bladder being healed by the regular use of halogenated magnesium salts are numerous."

Delbet gives an interesting account of a doctor who used magnesium in connection with difficulties he had with the bile:

> "The clinical facts have, for the most part, been observed by chance. My followers take much magnesium chloride. They are enthusiasts propagandizing for it. Others adopt it, partly, perhaps, because it often produces systemic excitation. Among those who take it for its tonic action, several are afflicted with various ailments which disappear, and they report from time to time successes I did not expect, acting on ailments that are out of my province. Thus I am led to discuss matters of which I do not know a great deal.
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> "About the preparation of the sick for operations, I have reported the action of magnesium chloride on the digestive tract.

"Laborde states that it has a strong action on the secretion of bile. I have no experience on this point, but I have confirmed with de Wades that, introduced into the duodenum, it leads to evacuation of the tube. By this mechanism it can render service in infections of the biliary duct. One of our associates has sent me his own observation which seems interesting to me, He had repeated attacks of inflammation of the gall bladder and the biliary ducts With fevers up to 39.6º, chronic intestinal troubles (diarrhea, distention, painful spasms after eating). In spite of a strict regime and treatment by physical agents on the liver and abdomen (diathermy and infra-red light), he showed no improvement. He put himself on delbiase in a dosage of 2 tablets (1 gr. 20) a day, stopping all other medication. Here are the results: it is he who has recounted them. "No more liver attacks, no more epigastric pains; intestinal troubles improved. After several weeks the stools became normal, as they had not been for five months. In two months, a weight gain of 10 kilograms. Transformation of the appearance, appetite normal, digestion easy, in spite of a return to hard work. The possibility, without the least sensation of fatigue, of taking up once more my habitual occupations."

So we pause and look back on what we have been reading. It sounds too good to be true--magnesium seems to be good for anything that ails you.

Therefore why don't we hear much about it? The newspapers sing the praises of the wonder drugs in headlines, but the action of this miracle mineral is ignored. One wonders about the honesty of medicine. There have been hundreds of researches on magnesium. Is there a specific reason why it is being ignored?

17. MAGNESIUM'S EFFECT ON BODY ODORS

In this book on magnesium we are more or less of a compiler, but we are proud of what we have compiled There is no value in a bunch of researches done in various parts of the world, and reported in dozens of medical journals, lying dormant, moldering in the archives so to speak, and not being used by practicing physicians. Our function is to find everything pertinent to magnesium and publish it in one place--in one book--so that doctors can see at one glance what a wonderful weapon they have in this mineral.

The foremost pioneer in this field was Pierre Delbet, M.D., who sent many communications on his experiences with magnesium to the French Academy of Medicine. One of them dealing with body odors was dated June 5, 1928. Here is a translation of a portion of it.

"The surgeon must endeavor to bring his patients to the operating table with the maximum resistance of which each is capable: resistance to the nervous upset of emotion, resistance to the toxicity of anesthetics, resistance to hemorrhage, resistance to infection. It is a gigantic program whose solution will demand the full play not only of what one knows about biology, but also of what one doesn't know about it.

"I have touched only two small points.

"I give my patients who are to be operated on some magnesium chloride while they receive the preoperative vaccination. Each day they take 100 grams of the liquid

solution of 12,10 gr per 1 liter . . . (containing thus 1200 mg. anhydrous magnesium chloride), a solution which I determined in 1915 acts on the white corpuscles (an action that I have called cytophylactic).

"During this period, thirteen years ago, I began to administer this solution, either by the digestive or subcutaneous route, to infected individuals.

"After a few days, they experienced a sensation of euphoria and energy which they called to my attention. At first, I wondered if it weren't a case of those illusions which are so frequent in sick persons who have been prescribed a new medication. Then, when the constancy of the effect had forced itself on my attention, I recalled the relative richness in magnesium of the grey matter of the brain in comparison with all organs of highly differentiated functions, and I wondered if humanity, a great consumer of an elevated order of energy, didn't have a magnesium deficiency. Then I took it myself as a chloride, and had several members of my entourage take it, and during thirteen years, I've made a great number of observations and experiments.

"Today, I will speak only of the preparation of sick persons for the operation.

"At a dose of I gram 20 mg. magnesium chloride can be considered only as a purgative, but it regularizes salts as a matter of course. Taken continuously, it brings them out in many persons who are chronically constipated, and reduces them in many who are diarrhetic. In a few days, if their diets contain nothing particularly toxic, it deodorizes them. It is a very striking phenomenon: their fecal matter loses all of its disagreeable odor. That can be due only to a modification of the intestinal flora, but I haven't succeeded in noting what the modification consists of. Even though it seems a little puerile to establish a relationship between fetidity and toxicity, we do it instinctively; so this deodorization seems advantageous, particularly in patients who won't evacuate stercoral matter for two or three days after the operation.

"Magnesium chloride stimulates the biliary system. Perhaps this is the mechanism by which it regularizes salts.

"The head of my clinic, M. de Vadder, who makes duodenal tubage in my service, has observed at my request that the injection of magnesium chloride into the duodenum brings out a wave of vesical bile."

A Personal Note by J. I. Rodale

In the first paragraph of this chapter, I admitted to being a compiler, but on the subject of magnesium's effect on body odor, I went a step further. I made myself a guinea pig. Here are some, of my experiences:

For eight or nine months I took magnesium in the form of dolomite tablets. I wanted to see its effects on me before I recommended it to others. Within a few clays, exactly as Delbet had said, I noticed that it deodorized my stool.

But may I say that this deodorization process began with me many years ago, after a few years of being on the *Prevention* system, cutting out bread, salt, sugar, and milk and taking

the many vitamins and minerals, exercising, etc. But with the addition of dolomite the process of deodorization was made almost complete--let us say 99.4 percent complete.

But when I started to take dolomite tablets, I was not prepared for another change it produced, something that took about six months. This was an almost complete disappearance of underarm odor! Unbelievable, you might say! But perhaps the unbelievable is about to come true. Wouldn't that be something--something as basic as the purification of the inner body, by a simple little tablet?

Delbet in the above quotation says that magnesium's effect on body odor is no doubt due to a modification of the intestinal flora, the beneficial intestinal bacteria that take part in the process of breaking down the food. I came to this conclusion independently owing to several experiences I had with magnesium.

Normally when I ate cooked beets, my stool would be red the next morning. There was not complete digestion, with reference especially to the red coloring matter. But when I ate raw beets, there was no red in the stool the next morning.

It is a known fact that ordinary cooking temperatures kill all the enzymes in foods. But when you eat raw beets, with all their enzymes available to aid in their complete digestion, everything is absorbed and used up in the body.

Now here is an astonishing fact: when I began to take dolomite tablets and would eat cooked beets, with their enzymes destroyed, my stool was not red the next morning. Evidently magnesium either has the property of acting in the place of enzymes, or increases the intestinal flora to such an extent that they could do the job of digestion completely by themselves. The ideal situation would be to eat raw beets and take dolomite tablets. I often eat raw beets in thin slices and find them very palatable.

I had a similar experience with asparagus. Many persons have found that when they eat asparagus, it gives their urine a characteristic odor. I always found this to be so when I ate cooked asparagus, but not when I ate raw asparagus. But after being on dolomite for a while, I could consume this vegetable cooked or raw with no odor resulting in the urine.

In the matter of the effect of magnesium on body odor, while the latter is important, the question of what is behind this, that is, what happens in the body that neutralizes odor-producing chemicals, is more important! And science should start experiments to learn exactly what goes on in the digestive process when magnesium is introduced.

In this book we have shown how effective magnesium is in curing certain diseases. Could this be because of the fact that magnesium increases the intestinal flora and enables the body to absorb more nutrients from the food, and thus improve the nutrition to a particular organ that is sick or in a process that is defective?

Magnesium in Chlorophyll

We found a clue next in a study that was subsequently made of chlorophyll as a deodorizer. For many years there have been conflicting reports about the "green blood" of plants, and

utterly contradictory laboratory results arising from tests of the deodorant properties of chlorophyll.

Yet there had been enough confirmation that chlorophyll *is a* deodorizer, so that we felt it deserved further investigation. We even found one research man, Dr. J. C. Munch, who headed a research laboratory in Mexico City, who found in relation to a study of the effect of water-soluble chlorophyll on Mexican boys and girls "direct application to the armpits has confirmed its properties as a deodorant." And many other doctors writing in various medical journals either confirmed or accepted as a matter of course the deodorant properties of chlorophyllin. Yet the highly respected Dr. F. C. Lu of the Food and Drug Laboratories of the Canadian Department of National Health and Welfare tested chlorophyllin on both dogs and human beings and found no appreciable change in odors. Moreover, there were other research scientists who felt the same as Dr. Lu.

Finally, by close reading of the research reports, we were able to isolate what we consider the significant difference. Chlorophyllin is defined by the Merck Index as sodium magnesium chlorophyllin. But the chlorophyllin used by Dr. Lu and others who got negative results was a special form in which the magnesium had been removed. This is done on the assumption, made by many, that any deodorizing effect of chlorophyll is due -to its tendency to absorb carbon dioxide and convert it to free oxygen. Such conversion is performed quite as well by chlorophyllin without magnesium as it is by chlorophyllin with magnesium. The researchers assumed that the commercially refined product would have just the same deodorant effect, if any, as the natural product.

But it did not have the same effect, and the difference, of course, was magnesium. This study left us convinced that chlorophyll is a good natural deodorizer, but only in the magnesium-containing form and only because of the magnesium. In other words, for the deodorizing effect you might as well use the magnesium without the sodium and the green pigment.

Lately we have gotten another clue. There is now much reason to believe that magnesium in large quantities is essential to the healthy functioning of the pituitary gland. This gland, in turn, regulates the functions of all the other glands. And, when there is a noticeable unpleasant odor about anyone's body that cannot be traced to a specific disease condition, it is most often a malfunction of a particular set of glands -the apocrine glands-that gets the blame.

Is it possible that, by regulating and improving the function of the pituitary, magnesium acts through the pituitary to regulate the apocrine glands so that they will no longer release enough of their secretions to form unpleasant odors?

We do not know yet, though we feel we are coming closer to the answer. What we do know is that, for reasons not yet established, magnesium consumed in sufficient quantity to avert any possible deficiency does definitely seem to reduce or altogether eliminate any tendency an otherwise healthy person might have to unpleasant body odors.

Thirty years ago, when I was not on any health system, I had my share of stool and underarm odor. At various times they were unusually offensive, if you will excuse me. But gradually as I stopped taking drugs and began following a good nutritional program, they became less offensive. Formerly on the average my stool was a very dark color, but gradually as I became healthier, it assumed a bland light brown appearance, which is as it should be.

There can be no question that what we eat can affect the odor of our stool and our bodies generally. The seven-month-old infant of a friend of mine, who was being breast fed, was placed on a bottle formula. Immediately his stool began to smell!

I have often read that Orientals claim that Westerners have an offensive smell. When I mentioned this to an artist friend, he confirmed it. Years ago, in Japan, he was married to a Japanese girl who claimed he smelled bad!

The odor of Westerners' might come from wheat (the Oriental eats rice); it might also come from dairy products. Until very recently the Orientals had no dairy industry. It may also come from toxic additives in Western food, and from patent medicines. Possibly, also, the Oriental's diet may contain more magnesium than ours.

You will recall from Delbet's quotation that he could not deodorize the body of a person with magnesium unless his diet did not contain anything that was toxic. I imagine that the stools of people who take certain medicines must smell badly, unless sledge hammered with deodorant products.

In this respect the taking of antibiotics is a sure way to start the "body-smell" process, because the antibiotic is a bacteria killer, killing indiscriminately, the good with the bad, seriously reducing the population of intestinal flora. In other words, the more antibiotics people take the more they will smell; that is, under the cloak of the chemical deodorant.

That magnesium acts to improve the digestion was discussed in *The Medical Tribune* of June 3, 1964. It was a case described by Dr. Maurice E. Shils of the Sloan-Kettering Institute for Cancer Research--a 74- year-old man who developed gastrointestinal symptoms after the fifty-third day of a magnesium-deficient diet. His symptoms cleared up in four days after magnesium was added to his diet.

Note that it took 53 days of getting very little magnesium to show an ill effect. This might be because it took that long to reduce the population of intestinal flora. I found this to be the case once when I purposely stopped taking the dolomite tablets. The advantages held for quite a while. But the buildup process, starting low, is much faster.

I did a little experimental work, eating certain forbidden foods to observe their effect on my stool, but the results were confusing because I did not stop taking dolomite. But when I ate some thin-walled chocolate Easter eggs that we brought from Italy, there was an odor the next morning. Evidently a certain chemical or emulsifier must have been used in the chocolate to enable the thin wall to withstand breakage. I noted that it took quite an effort to break it.

Science must launch a longtime study on the effects on the body odor of eating various kinds of foods and the taking of various kinds of drugs, exercise, etc. I am sure that many drugs are so toxic that they kill intestinal flora. Thus the doctor is substituting one form of illness for another, the remedy in many cases worse than the disease.

In my premagnesium era I discovered that, when I walked for two hours a day (at two sessions of one hour each), my foot odor vanished completely. But one hour of this exercise a day did not do it. Today without any walking at all (during the winter), my dolomite tablets keep my feet completely free of odor. How about athlete's foot? I don't know. I haven't had it for many years. I was cured of it about seven or eight years ago by the *Prevention* system. But perhaps the taking of dolomite might cure it.

As I have said, I take nine tablets of dolomite a day. At the beginning, I had a few days of light diarrhea, but soon everything set itself in the proper order. Delbet says the same thing in his communication to the French Academy of Medicine, July 10, 1928: "In persons who have normally active bowels, it brings on a diarrhea in the first days, but it does not last."

It would seem, therefore, that with dolomite, good nutrition, and sufficient exercise, and without certain organic disease conditions, most underarm, stool, and foot odor could be eliminated. I believe there is another factor, namely, the emotions, which must be considered. In emergencies and under tensions there might be a temporary return of b.o.

Delbet put himself on record on this subject in 1928, or 40 years ago, and his work has been completely ignored ever since. No regular medical checking tests a person's status in regard to blood magnesium. It is time this is changed.

It is not merely a matter of body odor, but if what is behind it means a better digestion, a better absorption of vitamins and minerals from our food, a better feeding of the glands and organs of the body, then it would be an important part of the process of preventing disease in general-from a toothache to cancer.

Here is a new field for medical research-a place where some of the government's three billion research dollars can be invested to great advantage. Medical science must be alerted! Breathtaking accomplishments might come of it! What medical organization will be the first to test Pierre Delbet's claims?

18. SOME LETTERS

Several of these, chapters appeared first as articles in *Prevention*. After a while, after considerable study and seeking technical advice, we began to recommend dolomite tablets, rich in magnesium. We knew that the taking of magnesium would help many people, and that after a while they would write of their experiences. Well, the letters have come in. We should like to reprint some here.

One of the most exciting aspects of taking magnesium is a reduction of body odor. In my own case it helped in this respect. Here are several letters that agree with me:

One is from Frank J. Jarnum of St. Paul, Minnesota (March 18, 1965):

> "About three weeks ago I purchased a supply of dolomite tablets and to this date I can honestly say it is better than any deodorant I had ever used--I'd say about 99.99%. effective."

Here is a letter from W. R. Smith, 838 Wood Street, Kansas City, Kansas:

> "Dear *Prevention*:
>
> "I would be an ingrate not to mention the benefits derived from reading a series of articles on magnesium. I had all the following complaints: high blood pressure; threats

of strokes; dizziness; bitter taste before arising; constipation; indigestion was prevalent;

"I became nauseated if I stood, especially if I looked upwards; appetite, at times, fickle; sometimes, while walking, I inclined to veer sharply to the right and there was a noticeable lack of energy.

"First, I took a teaspoon of Phillips' Milk of Magnesia in a cup of water before eating, then no more until next morning. After each meal or three times a day, I took one dolomite tablet. This regime has been in force about four weeks and I feel no effects of the above complaints.

"Starting the magnesium treatment may at first cause a mild case of diarrhea. The stool is less offensive, evacuation is facilitated, body odors are markedly decreased. The teeth are not so likely to gather plaque and tartar. There is a feeling of well-being generally."

This letter is from Roger A. Clark, North Shore Drive, Beulah Michigan (May 5, 1965):

"Dear Mr. Rodale:

"I have read your article on dolomite and have had extra good results. I had acidity and canker sores under my dental plates, had tear ducts that were running all the time. I'm OK on these three troubles now.

"Then for four years had a bad pair of knees sore as boils, couldn't seem to find a place for them at night. They are slowly getting better and my general health is better.

"I'm 73--retired and work at home taking care of three homes and three large buildings 30 x 70. So I'm not all in yet, but had these ailments that bothered me.

"I have recommended dolomite to at least 12 friends. They all feel better. One had cramps in his legs at night; " has stopped. He also feels better, not so tired.

"I have a daughter living at McKeesport, Pennsylvania.

"She and family are taking dolomite. The results are good."

The following letters will speak for themselves.

"Dear Editor:

"It is with great interest that I read your article on magnesium, the miracle mineral, especially as a means to control the actions of the intestinal tract.

"I decided to try dolomite tablets by taking three tablets a day with each meal. Much to my surprise, within a weeks time my hemorrhoids receded to about one-fourth their size. I also find that there is less strain and stress in my bowel movements which occur with positive regularity.

"Sincerely yours,
Carl A. Komm
181 Lakewood Avenue
Pittsburgh, Pennsylvania 15229"

"Dear Mr. Rodale:

"I am a reader of Prevention and I take vitamins A, B, C, D, E, besides bone meal, rutin and garlic.

"Since February I have been taking 3 dolomite tablets, one after each meal.

"It has made my heart quiet down and I sleep better, Also brought down my blood pressure. Last year it was over 200. Now it's O.K.

"My best wishes to all of you.

"Sincerely,
Nancy FRY
2 BOYD Avenue
Jersey City, New Jersey 07304"

"DEAR Sirs:

"I am a new subscriber to your magazine *Prevention*.

"My first interest was your part 12--on Magnesium and the Prostate. I have had prostate trouble for over 20 years. I had all the standard treatments, but none helped, except temporarily.

"Then on the first of March, 1964, 1 was operated on for an obstruction at the neck of the bladder and knots on prostate gland. It helped lots, to relieve the pressure on my bladder.

"I still had a high pus count in my urine, also in my prostate fluid. I went to the doctor every other week for a massage of the prostate to keep down the pus count.

"I still had bad lower back pain. I went to a chiropractor every day for two weeks, then three times a week for a month, still had backache.

"I had for two or three years taken some small pills that cost almost 50 cents each, four per day for pus.

"Then I received your magazine, read your part 12 on Magnesium and the Prostate and started to take dolomite tablets, nine per day. After about four weeks, "no massage," my pus count dropped from 40 per whatever part they use to 8 to same part. *I took no other drug.*

"To me that is worth crowing about and one of the best parts is my backache has gone. I don't get up at night any more. I am 55 years old.

"James L. Creekbaum
R. R. 18, Box 70
Indianapolis, Indiana 46234"

"Dear sir:

"I must write to you and tell you about magnesium. I was in the hospital December 15 till the 21. I had a heart attack they said. I got an infection in the bladder when I came home. I was sick 4 months. I passed bladder stones as large as a small pea. I passed blood. I asked the doctor what he could do for it; he said he wished he knew. I asked another doctor about it; he said why worry, you're passing them. I sent for an old doctor 87 years old. I told him about magnesium oxide. I let him read it in *Prevention.* He said I'll write you a prescription, just get a dozen, try them. They charged me $1.00. 1 took them. As soon as I took the first capsule, the stones disappeared. If I stopped one, I had them back. I went to the drug store and asked for 2 ounces of magnesium oxide and 100 capsules. I told him [the druggist] what they would do. He said, I know it will dissolve stones. I said why don't the doctors recommend it? He said he did not know. I make my own capsules, take one a day. I am fine. I told the doctor about it; he said they will wreck your kidneys. I asked my doctor; he said they would not. Dolomite did not dissolve them. I took the pure magnesium oxide. Thank you so much for your remedy that cleaned up my bladder trouble I've had for 40 years. God bless you. I am fine.

"Mrs. Hilda Richardson
1016 Center Street
Wilkinson 21, Pennsylvania"

(We prefer the dolomite form of magnesium. Magnesium oxide should be taken only under the supervision of a physician.)

"Dear Mr. Rodale:

"As one of your original first subscribers to your, *Prevention* about 18-20 years ago when I was living in New York City, I want to tell you that you have been the great eye-opener of those that read your articles, and also a pioneer in guiding your readers to help themselves and lead healthy lives. I was a creaking door then and now at 75 am still hanging around with less trouble than when I was 20 years younger.

"You have done a marvelous job in educational articles in your *Prevention* about magnesium, which no pharmacy or wholesale drug outfit cares to carry, but now with the Dolomite tablets you have succeeded in helping your readers. I have been using magnesium oxide in 5 grain capsules for many months and I feel wonderful. I had my magnesium from France where it has been used for many years.

"God bless you, Mr. Rodale.

"Martin G. Missir
Palm Beach, Florida"

A reader writes describing how he had been subject to delirium tremens, the uncontrollable hallucinations and shaking that develop after long-term excessive drinking. He goes on: "Recently I purchased some magnesium oxide, light. [See *Merck Index.]* I take a small amount which the end of a paring knife holds each day; I do not have the slightest desire for any kind of alcohol after taking this amount each day for about two months.

> "Many years ago I noticed that I did not have any desire for alcohol when I visited my parents near New Castle, Indiana. It might have been that either the water or the vegetables there contained an abundance of magnesium."

Magnesium Aids in Taking Vitamins

A letter from Mrs. Esther Mattin, Burlingame, California (November 10, 1964):

> "Dear Mr. Rodale"
>
> "I have just read the last *Prevention* and your article on magnesium. I am one of the people who can truly be grateful about the marvelous results of taking magnesium.
>
> "First you must know that I have been a faithful follower of the *Prevention* program for about 15 years. But about 5 years ago I got into the menopause and from then on I was unable to keep on taking vitamins E and A. I tried smaller doses but to no avail--always getting a very upset liver.
>
> "Well, about a week and a half ago I started on the magnesium tablets (3 a day) and all my troubles are over. Besides feeling wonderful I can take again those 2 precious vitamins. I hope it won't be long before everybody will give it a try. Thanks a million for all the information on this valuable discovery."

(Note: I take nine tablets of dolomite a day. I started with three and gradually upped it to nine. At first there was a little diarrhea due to the fact that the magnesium was doing a little housecleaning in the digestive system.)

Ocean Water and Magnesium

Mrs. E. Clarke Smith of San Antonio, Texas, writes:

> "Swimming in the ocean for several weeks has benefited me so much that I wonder if there could be some absorption of magnesium and other minerals we earth-bound creatures need."

There no doubt is, because seawater is very rich in magnesium. It represents about 13/100 of 1 percent of all the minerals in seawater. This is a large amount. Therefore, by all means, dunk yourself in seawater every chance you get. In fact, merely to be at the seashore and to breathe the magnesium-rich sea air should be invigorating and healthy.

Mrs. W. Lewita, Flushing 54, New York writes:

> "In your October issue I read an article about Calcium Oxalates that are quite a problem to our kidneys, and I wish to tell you of my own experience.
>
> "At age 17 1 had a terrible kidney attack, and the doctors found out I had three small calcium oxalate calculi [stones]. I was lucky enough that they did not decide on surgery, but gave me Magnesium Carbonate and large quantities of water. With this treatment in a very short time my calcium oxalate stones were dissolved. Since my urine tests show now and then calcium oxalates, the doctor advised me to take Magnesium Carbonate every two months for about two weeks, and this way I have kept free from kidney stones.
>
> "I am writing this to you, as there might be other people among your readers who could use this treatment. You can buy magnesium carbonate at the drug store without any prescription, as some people use it as an antacid.

In our opinion it might be all right to take magnesium carbonate in an emergency, but we would prefer dolomite tablets, which contain magnesium carbonate. In this case the magnesium is surrounded with many other minerals!

Migraine Headaches

Mrs. Roy Rea of Canon City, Colorado, writes:

> "I read with real interest your article on magnesium in the last issue [May] and its use in the treatment of polio. Some years ago my husband and I learned what magnesium carbonate would do to improve one's general health and in particular in the relief of migraine headaches which I had suffered for over fifty years. The elderly doctor who prescribed this for us said in his forty years of practice, he had not found anything as valuable as magnesium carbonate for his patients. He used it in the case of heart malfunction, asthma, headache, etc.
>
> "What seemed a heart condition, this doctor said, was nothing more than gas pressing against the heart. The magnesium corrected this condition."

As I have said before, I believe the dolomite form of magnesium is safer than the straight magnesium carbonate. But here is a view of a naturopathic physician on a different form of magnesium. He is Dr. A. W. Allen of Portland, Oregon:

> "I have followed your articles on magnesium closely as I have been using it for several years, since noticing in a drug catalogue that magnesium gluconate was suggested for pre-menstrual tension. I have found that it is effective for pre-menstrual tension, and since my special interest is in Psychotherapy I reasoned that if it were a tranquilizer in

one instance it should be in another, and have found that this is true. To date I have found no side effects or had any adverse reactions to it. True it is not as potent as some of the synthetic tranquilizers, but neither does it gently lay them down only to jump on them later as do the synthetics.

"You refer to looking for an acceptable form of magnesium and I have found the gluconate to be very acceptable, although not generally available and not even listed in *Merck Index.* Incidentally if you will refer to *Merck Index* you will find that practically all of the magnesium compounds that are used for humans are either antacids or laxatives, and that magnesium carbonate falls in this category also."

If you want to take magnesium, you'd better check first with your physician.

19. SUICIDE AND THE MAGNESIUM DEFICIT

WHAT is it that makes a person jump off a bridge, swallow an overdose of pills, turn on the gas jets, or put a gun to his temple? Whatever it is that triggers this kind of desperate action is at the root of the most widely misunderstood of our health and social problems. Suicide is the most irrational of all individual actions. Most of us realize this. Yet every 20 minutes in the United States someone takes his own life. Can anything be done to stem this tragedy of self-destruction which accounts for 22,000 deaths annually, which is the tenth leading cause of death in our nation, and which among college students is the second leading cause of death?

In this great big expanding world full of so many splendors, so many opportunities for growth, enrichment, so many exciting experiences to anticipate that one lifetime is hardly sufficient for all of them, why would anyone want to pull down the curtain before the show is over? Certainly it isn't that the trials and troubles are meted out more to the suicide-prone than to those with zest for life. Haven't you seen people with the troubles of a job manfully shouldering their packs with never a thought of ending it all? No, it isn't the troubles. We all have our share of those. Is it then a capacity for handling burdens--the emotional stability that, when troubles abound, whispers in your ear, "This too shall pass"?

And what is it that gives one this emotional stability? Is this quality in some way dependent upon your physical health which in turn is dependent upon your nutrition?

According to a French scientist, it definitely is--and particularly related to a mineral that has only recently been recognized as essential in human nutrition, but has been so neglected that the specific daily requirement has never been officially determined.

Would you believe that increasing lack in our diets of the mineral magnesium could in some way be linked to the increasing suicide rate in our country? Does this sound irrational, too pat, farfetched? Let's look at the evidence and you be the judge.

French scientist, M. L. Robinet, in a study of suicide statistics, discovered that "the comparison of geological maps and statistics establishes in a striking manner the influence of the magnesium content of the soil on the number of suicides. It is evident," M. Robinet points out, "that one doesn't commit suicide because the soil is poor in magnesium. But, those who regularly absorb a good amount of magnesium salts have a more stable equilibrium, they support adversity with more calm and do not renounce everything to avoid some sorrow.

"The use of magnesium permits one to support adversity with more serenity," M. Robinet concludes in the *Bulletin of the Academy of Medicine* published in France (1934).

Apparently M. Robinet's study has been largely overlooked in this country where the inability to "cope" is treated on the psychiatrist's couch and not generally by improving one's nutrition.

And yet there are many clues in the scientific literature that lead one to the conclusion that this mineral in plentiful supply is vital to mental health and the innate ability to see the silver lining behind the clouds.

Small Problems Loom Large

It would seem from experimental studies on animals that when one is low on magnesium, small problems loom large, even overpowering. Thus animals deprived of magnesium suffer from super excitability to such an extent that they become hysterical at the sound of small noises or the sight of shadows.

Symptoms of magnesium depletion in man as reported by Dr. L. M. Dalderup of the Netherlands Institute of Nutrition in the Swiss publication *Voeding* (August 15, 1960) are excitability and apprehensiveness, muscle twitchings, tremor, myoclonus--not responding to calcium administration-confusion, and disorientation. Indeed the blood of people suffering from extreme irritability has been found to be low in magnesium.

Recently much new knowledge has been gained about the role of magnesium in general metabolism. This mineral activates some 30 enzymes in the body, it takes an active role in the metabolism of protein, fat, and carbohydrate; it influences the action of some of the vitamins and hormones.

Magnesium, says Dr. Lewis B. Barnett, is needed by the pituitary gland. The pituitary, sometimes called the miracle gland, takes instructions from the hypothalamus in the brain to which it is connected by a thin stalk, then transmits them through the body in the form of chemical messengers known as hormones. These hormones not only exert a direct influence of their own, but also trigger the production of other vital hormones elsewhere in the body. When the pituitary is not getting the magnesium it needs, it fails in its function of exercising a sort of thermostatic control over the adrenals which are thus allowed to overproduce adrenaline. It is known that situations of danger incite the activity of the adrenal glands. Troubles or worry also incite the adrenal glands, which then pour hormones through the body that increase heartbeat, release sugar from the liver, and contribute to a host of problems not the least of which is hyperexcitability and an inability to "cope."

According to some startling new data presented at the meeting of the American Societies for Experimental Biology in May, 1966 the adrenal glands also contribute to the desire of a suicide to cut himself away from life.

Scientific evidence was presented at this conference that showed how, in the split instant of final decision to take his life, it is the glands rather than the psyche that give that last little push. New data indicated that "successful suicides probably had highly active adrenal glands just before their deaths. That discovery fits neatly into other observations that depressed

patients--those most likely to commit suicide--also have more adrenal hormone in their blood than do normal persons," says Earl Ubell, science editor of the *Herald Tribune* (May, 1966).

One investigation revealed that, just before attempting suicide, depressed patients experience a rapid rise of adrenal breakdown products in the urine. As reported in that study, a laboratory made measurements on one woman, found an extraordinarily high hormone level, and called her home to warn her family only to find she had already killed herself.

Bone Storage No Answer

Magnesium triggers and controls so many bodily reactions that without an ample supply one cannot possibly enjoy a zest for living. Without an ample supply, one courts many debilitating conditions, some of which possibly have not yet been identified. Why is it generally ignored by the medical profession? Because for many years it was believed that the magnesium in the bones was a storehouse that supplied the tissues when they were in want of it. But nutritionist Williard A. Krehl, M.D., says in *Nutrition Today* (September, 1967) that magnesium stored in the bones is not released in response to a deficit the way calcium is, and a wide variety of clinical circumstances exists in which magnesium deficiency may develop rapidly and profoundly. Dr. Krehl found many nervous disorders in patients suffering from magnesium deficiency. More than 78 percent of these patients suffered mental confusion, 83 percent were disoriented, all of them suffered hyperreflexia, the kind of exaggerated reflexes that make people jump when they hear an unexpected noise from behind.

We know that the psyche is influenced by the soma --that physical ailments trigger mental upsets. "The most general indications of impending suicide," says Dr. Matthew Ross of the Harvard Medical School, are emotional disorders that manifest themselves in some significant change in basic *biological* functions and behavior that cannot be determined by routine physical examinations."

These people who are potential suicides are aware of some disturbance in their bodies. Fifty percent of all suicides saw a physician during the last month of their lives, says Dr. Robert E. Litman of the Los Angeles Suicide Prevention Center.

Dr. Jerome A. Motto of the University of California found in a study of attempted and completed suicides in San Francisco that one out of every 25 cases saw a physician on the same day be chose self-destruction.

Ironically, although physicians should be in the best position to note warnings of an impending suicide threat and avert it, says Dr. Howard A. Rusk, medical columnist of *The New York Times* (January 21, 1968), the suicide rate among physicians is much higher than that of the general population.

A study by Dr. Daniel DeSole of the Veterans Administration Hospital in Albany showed that 26 percent of all deaths among physicians 25 to 39 years of age were suicides. This compares to a rate of 9 percent for white males in the same age group.

Doctors, with a few rare exceptions, tend to preach and practice the doctrine of "Eat a balanced diet and you will get all the nutrients you need."

In a recent 900-page book on clinical nutrition, written as a reference book for the practicing physician and as a textbook for medical students, the word magnesium is not mentioned or listed in the index. The assumption is that it is unimportant because it is generously supplied in our foods. But is it? Not only are meats, eggs, and dairy products, the staples of the high protein diet so many Americans are subscribing to, low in magnesium, but the more protein you consume, the more magnesium you need to metabolize this protein.

A study done by Menaker and Kleiner published in *Pro. Soc. Exp. Biol.* (81, 1952) of nitrogen balance in respect to magnesium content of adult animals indicated that a high protein diet enlarged the need for magnesium. A high protein diet could even induce acute magnesium deficiency symptoms, because magnesium is involved in important amino acid transformations.

With our country growing more affluent and people eating more meat, the magnesium deficiency seem to be increasing year by year. This may provide some explanation why people who seem to have so much to live for work themselves up into emotional states in which they kill themselves.

It should be noted that large amounts of calcium, too, aggravate magnesium deficiency. Milk has very little if any magnesium. People on weight-watching diets that emphasize proteins and skimmed milk should be careful to include plenty of magnesium. The best source of magnesium is fresh green vegetables, but much of this heat-sensitive mineral is lost in the cooking water. Raw wheat germ is an excellent source, but this nutrient is lost in the flour refining process. Nuts, especially almonds, are naturally rich in magnesium, but they lose some in the roasting process.

Dr. Barnett told *Prevention* that, in a test he conducted on 5,000 people, 60 percent proved to be deficient in magnesium.

How much magnesium should one get? On the basis of his findings, Dr. Barnett recommends 600 milligrams a day. How can you be sure of getting that much? Make sure your diet is rich in green leafy vegetables (uncooked), in raw nuts and seeds, and, to be on the safe side of the mineral balance, take a dolomite supplement. Dolomite limestone supplies a good balance, not only of calcium and magnesium, but also of many trace minerals which, in minute quantities, play an important and often overlooked role in human nutrition.

Last year a Center for Studies of Suicide Prevention was established within the National Institute of Mental Health. It is publishing a new periodical Bulletin *of Suicidology*. The center's program includes support of suicide prevention activities, follow-up studies, research and training grants, refinement of statistics on suicide, and training of personnel. We wonder if all of these sophisticated and high-priced procedures will lead ultimately to the *Nutrition to Discourage Suicide.*

We don't mean to imply that dolomite will succeed in solving the problems that weigh on the shoulders of every potential suicide. It won't pay gambling debts or solve your income tax underpayments or make your mother-in-law more appreciative of your virtues. But it might just be the element that helps put the rosy hue in your glasses. It might be that little extra something that transforms a problem too big to support into a challenge to be tackled with a sense of adventure, cheer, and a twinkle in the eye. It's worth trying.

20. THE NATIONAL MAGNESIUM DEFICIENCY

Under the date of June, 1964, the *American Journal of Clinical Nutrition* published a 50-page article by Mildred S. Seelig, M.D., entitled "The Requirement of Magnesium by the Normal Adult," which points up serious deficiencies of magnesium in the nutrition and the bodies of American people. We will skim through the article for you, our comments being in parentheses.

> "Magnesium has been accepted as an essential nutrient for the rat since 1932."

(In France it was known as an essential nutrient before 1910.)

> "A deficiency of magnesium is dangerous for the nervous system, heart and kidneys.
>
> "Haury and Hirschfelder correlated low plasma levels of magnesium with several clinical conditions in which hyper-irritability or convulsions are presenting signs, among which were epilepsy, eclampsia [convulsive seizures] and renal [kidney] insufficiency.... Grass staggers of cattle, and the convulsions of calves fed only whole milk, were similarly found to be associated with low blood magnesium levels, and to be preventable by feeding magnesium supplements.
>
> "Neuromuscular and mental symptoms, ranging from tremor, nervousness, and clouded sensorium through delirium, hallucinations and convulsions, were often most severe in patients with the lowest plasma magnesium levels . . .
>
> "Patients lose a great deal of magnesium after operations.
>
> "Hanna and MacIntyre have found mental depression and muscle weakness as a result of low magnesium in the body.
>
> "Contrary to the consensus, the customary diet in Occidental [Western] countries cannot be relied upon to provide sufficient magnesium to maintain equilibrium. Magnesium requirements should be reconsidered in the light of findings that indicate the likely development of negative balance on magnesium intakes below 6 mg. per kg. per day."

(Six milligram of magnesium per kilogram of body weight per day. This is approximately 385 milligrams of magnesium in the diet per day.)

> "Additional work should be carried out to ascertain, with more certainty, the optimal daily intake of magnesium . . . A prolonged dietary insufficiency of magnesium may contribute to the development of chronic disease.
>
> "On the basis of 105 balance periods in men and 146 in women, totaling 658 and 781 days respectively, it appears that negative balances are likely to develop in either sex on magnesium intakes under 4 milligrams per kilogram per day."

(This is 256 milligrams of magnesium per day.)

(A large number of pages are devoted to tables and to technical description of the processes leading to the measurements.)

> "At intakes of 10 mg. per kg. daily and above, markedly positive magnesium balances were found in both long-and-short-term studies leading to retention of as much as 444 milligrams of magnesium per day . . ."

(10 mg. per kg. per day is about 640 milligrams.)

(Data is then given to show that men excrete more magnesium than women, and that a too-high calcium intake can cause a magnesium deficiency.)

(Since taking nine dolomite tablets a day, I have reduced my bone meal intake from six to three a day. Dolomite tablets contain 100 milligrams of calcium to 46 of magnesium.)

(The following is something which we believe to be extremely important:)

> "Magnesium seems to be absorbed more poorly from diets which are rich in phytates, such as brown bread, brown rice or oatmeal, or from refined bread to which phytate has been added."

(The phytate is in the wheat germ portion of the wheat, and acts to prevent magnesium from being absorbed. I would not stop taking wheat germ, as it has great advantages, but I would compensate for the phytate by taking liberal quantities of dolomite.)

(In the concluding part of the article are a few interesting items).

> "Since the foods which constitute the major portion of the Occidental diet provide relatively little magnesium, it is not surprising that analyses of typical American and British dietaries . . . reveal that the customary diet often falls short of providing even 5 mg. per kg. per day. Finnish subjects on diets of similar caloric value ingested approximately 3 times as much magnesium as did the American subjects."

(Perhaps the food of the Finns is grown along more primitive lines, with less artificial fertilizers and poisonous insecticides, and more organic matter. I have recently concluded an experiment on our farm, with two groups of chickens, fed since they were a day old. One group was fed with organically produced food grown on our farm. The other was fed on purchased mash. Later on, some eggs laid by each group were analyzed by a reputable laboratory (La Wall and Harrison of Philadelphia), and it was found that the eggs laid by the organic group had 100 percent more magnesium than the other chickens. If all the farms in the U.S. were run on an organic basis, it probably would cure the national magnesium deficiency.)

> "In the East, where soybeans, vegetables and rice are the main dietary constituents, calcium intake is likely to be low, and fish plays a small but more important role than meat in the diet, the daily magnesium intake falls below 6 mg. per kg. only infrequently and may surpass 10 mg. per kg. Coullumbine and associates in their study of Ceylonese medical students on a control diet corresponding to their customary intake found that the daily magnesium intake ranged from 351 to 641 mg., or 5.7 to 11.5 mg. per kg. per day.
>
> "Indian men on their diets had a daily magnesium intake of from 6.1 to 10.6 mg. per kg. while in healthy young Chinese men and women from the upper classes it was from 6.5 to 10.6."

(In the U.S. the average is less than five mg per kg. per day.)

(Dr. Seelig, the author, tells about a patient described by Petersen, who had a persistently low plasma calcium level which rose on correction of the magnesium deficit, and showed improvement of previously intractable tetany.)

(The rest of this article is the summary by Dr. Seelig, and explains itself:)

> "The widespread assumption that the average daily intake of magnesium is sufficient to maintain equilibrium in the normal adult has been questioned. Analysis of published metabolic data indicates that the minimal daily requirement is not 220 to 300 mg. per day, as has been reiterated, or even 5 mg. per kg. per day as has also been suggested, but probably at least 6 mg per kg. per day.
>
> "The available clinical metabolic data provide evidence that at intakes below 6 mg. per kg. per day, negative magnesium balance is likely to develop, particularly in men. Women seem to retain more magnesium than men at low and marginal magnesium intakes. At intakes above 10 mg. per kg. per day, strong positive magnesium balances develop, which probably reflect repletion of suboptimal tissue stores. High protein, calcium and vitamin D intakes, and alcohol function to impede retention or to increase the requirement of magnesium, particularly in those on low magnesium intakes. On magnesium intakes above 6 mg. per kg. per day, little interference with magnesium retention by calcium, protein or vitamin D has been reported.
>
> "The diet in the Orient apparently provides 6 to 10 mg. per kg. per day. The Occidental diet, however, provides an average of 250 to 300 mg. of magnesium daily, or less than 5 mg. per kg. per day for most adults. Because the Western diet is often also rich in protein, calcium and vitamin D, and alcohol ingestion is common, it is suggested that the optimal daily intake of magnesium should be 7 to 10 mg. per kg. per day.
>
> "The existence of subacute or chronic magnesium deficiency is difficult to diagnose. Because the tissues damaged by magnesium depletion are those of the cardiovascular, renal and the neuromuscular systems, early damage is not readily detectable. It is postulated that long-term suboptimal intakes of magnesium may participate in the pathogenesis of chronic disease of these systems."

Yet it is only recently that some scientists have come to accept the existence of magnesium deficiency in man. For years, medical reports stated that a person could obtain enough magnesium from food to keep his bones and cells healthy. Yet the more researchers learned about this mineral, the more they have come to realize that much ill health is due to existing deficiencies. Furthermore, they now know that since most people never eat enough of the magnesium-rich foods (nuts, seed foods, and green vegetables), the deficiency may well be universal.

Without magnesium the actions of nerves and muscles are impaired. Convulsions, dizziness, muscular weakness, weak teeth and bones, and nervous irritability have all been cited as features of magnesium deficiency. There are other conditions where magnesium deficiency may also be present, yet difficult to detect because the overt symptoms are missing or masked. One such ailment is kwashiorkor, a protein-calorie deficiency disease.

Associated Diseases

A study by C. G. Linder and associates has been published in *Pediatrics* (Vol. 33, 1963). Linder found that children suffering from kwashiorkor also had severe magnesium depletion. Less than half the normal quantity of the mineral was present throughout the body. When the children were given curative diets, a positive balance of magnesium appeared.

Chronic alcoholics also tend to show low magnesium levels, particularly those patients with delirium tremens. Magnesium therapy often helps control delirium tremens, although there is still some question as to whether alcoholism actually causes magnesium deficiency or is perhaps partially caused by it. It is suggested by many researchers that it may well be the non nutritious diet of the alcoholic that leads to magnesium deficiency.

Low magnesium levels have been reported in cases of steatorrhea, an illness marked by intestinal disturbances and loose fatty stools. I. MacIntyre and his colleagues report in *Clinical Science* (Vol. 20, 1961) that as an accompaniment to this disease, muscle content and exchange levels of magnesium were reduced to two-thirds of the normal figure, although bone content was unchanged. This may mean that bone cells conserve magnesium at the expense of other tissues, or perhaps that magnesium-containing bone is so tough it cannot readily be broken down.

In steatorrhea, the magnesium deficiency is primarily due to fecal loss of the mineral. The researchers, however, also noted that a high calcium intake aggravated the deficiency. A number of other studies have also noted this effect of calcium. Magnesium and calcium have a great affinity for each other. If one is deficient, however, an excess of the other creates the danger that still more of the deficient element will be carried out of the body.

Additionally, when magnesium is absent from the diet, calcium is not absorbed, but instead forms deposits upon vital tissues, including, skeletal, heart, and stomach muscle, lungs, kidneys, and trachea. The obvious solution is to make certain you consume enough of both these essential minerals.

Antagonistic Drugs

Some hormones used as drugs can upset magnesium metabolism and produce a local deficiency. Cortisone, claimed to reduce inflammation caused by arthritis and allergies, has also been found to have the side effect of producing diabetes. And in some studies it has been shown to reduce magnesium concentrations in the blood.

In his well-documented book, *The Role of Magnesium in Biologic Processes*, J. K. Aikawa, M.D., of the University of Colorado, writes that cortisone also increases magnesium uptake by the appendix, heart, and muscle. He states: "These results suggest that cortisone produces subtle changes in the distribution of magnesium in the body, which cannot be attributed to its diabetogenic or anti-inflammatory effect."

Dr. Aikawa mentions that tetracycline, an antibiotic, also interferes with magnesium metabolism by disrupting the chain of events in which energy is released in mitochondria.

Testosterone, thyroxin and digitoxin suppress magnesium activity, but one of the more dangerous therapeutic tools seems to be the X-ray.

Suspecting that irradiation would destroy certain cellular processes, Dr. Aikawa subjected male rabbits to total X-ray exposure to note the effect on magnesium. He found that "the bone cortex, kidney, and heart-tissues previously considered radio resistant- are as radiosensitive as the appendix, stomach, and testis." After six days, he found a "significantly decreased turnover of stable magnesium."

Certainly, it is apparent that without magnesium the system can hardly be expected to carry on the processes that are necessary to good health. Currently, magnesium deficiency is suspected to be a factor in causing heart trouble, thyroid disorders, tooth decay, and eosinophilia, a condition in which there is an abnormal increase in the amount of microorganisms circulating in the blood.

We still need to dispel the fallacy that says we can get enough magnesium from ordinary food and that it is dangerous to take in too much magnesium. Both claims have now been disproved. Indeed, the American habits of eating such high amounts of refined and processed foods would make a sufficiency of magnesium extremely rare.

We can be sure that the sooner these widespread fallacies are eliminated, the sooner will the fantastically poor health level of our country be improved. Now that science has proved that magnesium deficiency is a reality, perhaps the goal of achieving better health will become a reality, too.