

# FRONTIERS IN NUTRITION

The vast, unexplored land of nutrition offers new research trails to be blazed. How much thiamine is needed by human? How does the human body use carbohydrates? Is rapid growth desirable? Is obesity only a matter of ratio of intake to output?

FREQUENTLY one hears the statement that frontiers have disappeared and that we must settle down to a life in which venturesome young men can find little opportunity for rapid advancement. So far as nutrition research is concerned we are still on the frontier, the amount of new land to be explored is tremendous, and there are many opportunities for young scientists to become famous, even if they can't acquire much money in the process. At least they can still explore; there are new trails still to be blazed.

A simple method to demonstrate the need for knowledge is to consider briefly a nutrient which is familiar to chemists, the vitamin thiamine. We know that it should be present in the meals eaten by humans if they are to be healthy. How much thiamine is needed by humans? Asking that question is a good way to start an argument. Most text books on nutrition will assure us with definiteness of the number of milligrams of thiamine that are needed a day. It is curious that the figure given in books published in the United States is quite different from that quoted by the British [McLester, J. S., and Darby, W. J., "Nutrition and Diet in Health and Disease," 6th ed., W. B. Saunders Co., Philadelphia, Pa., (1952)]. I have been told that even in the United States there are some heretics who express doubts about thiamine requirements. My opinion is that we know so little about human re-

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quirements for thiamine that an argument on that subject is futile.

What purpose does thiamine serve in the body? That question can be answered with glib assurance: thiamine phosphate is the coenzyme of the carboxylase enzyme. What do those words mean? We can say that carboxylase is necessary in one stage of carbohydrate metabolism. Have we any information available, except interesting hypotheses, about the utilization of carbohydrate in the human body? I hope you will pardon me if I feel doubtful about our

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knowledge as to what thiamine does in the human body. Even less information is available regarding other vitamins.

Similar observations could be made about the requirement of any other nutrient. There has been considerable controversy over nutrient requirements. To cite an example: most nutritionists in Canada and in Britain think that the average requirement of ascorbic acid for adults is about 30 milligrams per day. The recommendation of the U. S. Food and Nutrition Board is for 70 to 75 milligrams a day for adults. If we realize how little is known about quantitative requirements for ascorbic acid, we can appreciate the futility of controversy about precise figures. Recommended allowances are used frequently to assess the adequacy of observed intakes. Suppose we find that a subject named Jones is using food which supplies 35 milligrams of ascorbic acid a day. He is getting sufficient of this vitamin on the basis of Canadian and British ideas. Evaluated by the recommended allowances of the U. S. Food and Nutrition Board, Jones is only receiving half as much ascorbic acid as he needs. If it were found that 40% of adults in Canada or in the United States had intakes similar to that of our friend Jones we would have a statement which could be used to advance a government welfare program to supply free oranges to all citizens or to enrich a food by the addition of ascorbic acid. No one but an obstreperous scientist would be worried that both programs were based on most inadequate evidence.

# RESEARCH

These statements on nutritional requirements could be interpreted as advocacy for extensive research on this aspect. The statements are not so intended and I offer the unorthodox opinion that much research on nutritional requirements is a waste of time and money. It is difficult to obtain human subjects for nutritional studies and most of the studies on quantitative requirements have been done on handfuls of subjects. I can recall an investigation of the calcium needs of children in which two children were employed. Is it proper to extrapolate results from six, or even 60, subjects to 160 million people? It would be most surprising if great variation between individuals did not exist. It is likely that most nutrients are needed in terms of either body weight or calorie expenditures. Environmental temperature, age, sex, the activity of endocrine glands, may all influence quantitative needs. To obtain any reliable information on the ascorbic acid requirements of the population of a country we would have to do a thorough study on a sample group which was suitable in size and in various characteristics to be statistically representative of the population. It could be predicted that such a study would be impossible.

There is another aspect to nutrition requirements which is often forgotten. In 1944 H. H. Mitchell published a valuable paper on nutritional adaptation [Mitchell, H. H., *J. Am. Dietet. Assoc.*, 20, 511 (1944)]. Unfortunately, that paper appears to have been little read. What Mitchell seemed to have in mind was that humans possess great adaptability to changes in intakes of nutrients. He cited calcium as an example and pointed out that people lived reasonably well on intakes much less than currently recommended allowances. The records of human experience amply substantiate the truth of Mitchell's statements. Without that ability to adapt to changing nutritional circumstances, deaths in many parts of the world would be much greater. It has been said that adaptation to a low intake means

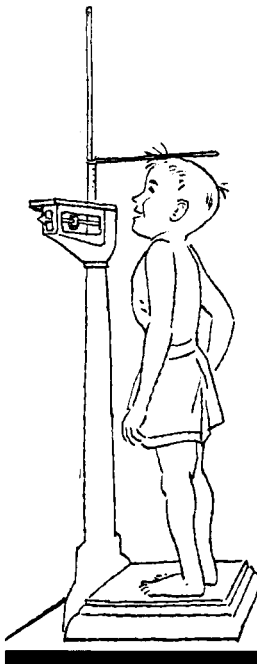
an impairment of health. Perhaps it does. I wish we could be sure what we mean by health.

I suggest that quantitative nutritional requirements need some critical thinking and I also suggest that it might be profitable to postpone further research in favor of emphasis on more helpful topics.

### **Is Rapid Growth Desirable?**

We have all seen, and perhaps made, statements about the increased height of present-day children. Generally, it is said, as a consequence, that children are healthier. There is little doubt that scurvy and rickets occur much less frequently than they did 50 years ago. Killing infectious diseases are now well controlled, at least in the United States and in Canada. There is a great deal of evidence that the average height of children at a given age is greater than it was 25 years ago. I have been interested in the heights of children in Toronto. Average heights between the ages of 5 and 14 are definitely greater than was the case 25 years ago. In Toronto, at least, average heights after 14 have altered very little. These figures could be interpreted as indicating that growth between 5 and 14 has been accelerated but that the final result is not much changed. A great deal more information is needed before this interpretation can be considered to be correct. If it is established, we shall be faced with the question as to whether an acceleration of growth is desirable from the long-term viewpoint.

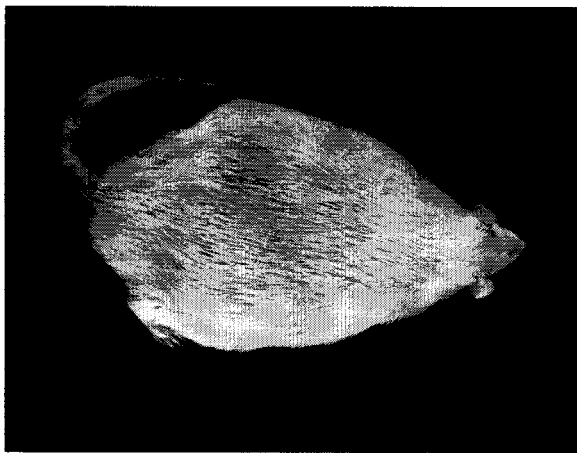
Emphasis on rapid growth of children is now so well entrenched that it is difficult to raise a question regarding its desirability. It is known that acceleration of growth of animals tends to shorten



life. Is it desirable to hasten the growth of children?

One of the consequences of the plentiful supply of food available in Canada and in the United States and of the general level of prosperity is that a considerable number of people are overweight. It has been estimated that one sixth of adults in both countries weigh more than they should. The principle theme of the last annual meeting of the American Public Health Association was obesity; life insurance companies are conducting vigorous campaigns about overweight. The reason for this interest has been explained frequently. Insurance records show that overweight persons are more prone to degenerative diseases and have a lessened life expectancy. It has been said that overweight is at present the most harmful and the most prevalent kind of malnutrition in Canada and probably this statement would be applicable to the United States.

A great many research studies have been carried out to determine if there are causes of obesity other than the simple ratio of intake to output. So far, no valid evidence has been secured for any other explanation. Yet I wonder if this is true. In animals it is readily possible, by dietary means, to alter the efficiency of energy production from absorbed food. If the efficiency, or the yield, of energy production is increased, there can develop a surplus which is used to increase weight. An ample supply of the B vitamins gives efficient energy production and the yield of energy can be impaired by a deficiency of any of the B vitamins. This has been demonstrated in many laboratories. It is simple to have two animals with the same food intake but with a definite difference in body weight because a deprivation of a B vitamin in one animal has impaired energy production. I do not think that this aspect of differences in body weight has been explored adequately in humans. Moreover, we have little information about the physiological factors which affect appetite. These



An example of the degree of obesity which can be produced in an animal by control of diet

questions about the cause of overweight do not invalidate the common teaching that the best method for reducing weight is to lessen food intake and that a person who wishes to remain slim should not eat too much.

While the evidence that overweight shortens life is clear and satisfactory, I have yet to see any valid observations to prove that a man of 50, who has been overweight for 10 years, can increase his length of life by weight reduction. This is a point which needs investigation. Has the damage been done and can it be undone? It seems to me that available information carries one proved moral—keep slim.

The work of Ancel Keys has indicated a parallel between fat intake and incidence of heart disease. This is of interest from points of view of both nutrition and sociology, as there is also evidence, from Cathcart's findings, that the share of total calories in the diet varies directly with economic status [Cathcart, E. P., and Murray, A. M. T., Medical Research Council (Great Britain) Special Report 151 (1931)].

There is good information available regarding the minimal needs of humans for protein. We have no data about similar needs for carbohydrates and for fats. You will recall that the physiologist Starling stated that the human gastrointestinal tract was designed to handle meals in which fat contributed one fourth of the total calories. In general, nutritionists have felt that at least this much fat was desirable to reduce the bulk size of meals, to furnish fat-soluble vitamins and to ensure a supply of essential fatty acids. If a liberal use of fat is proved to be the cause of cardiovascular damage, our concepts regarding fat will need revision. I am quite sure that the next few years will see a considerable amount of urgently needed research on the role of fats in nutrition.

The goal of public health has been a reduction in the death-rate, especially in the younger age groups and there has

been marked success. There is now an increasing proportion of older people in the population and life expectancy has been lengthened. In recent years attention has been advised repeatedly to the need for studies on the health of old people. It seems to me that senility is the most baneful and the least understood enemy of happiness for older persons. Putting the matter bluntly, I can see little reason for efforts to prolong life unless we can develop methods to postpone the onset of senility. There is little information to suggest that nutrition may be involved. Claims have been made that deprivation of B vitamins, particularly of niacin, accelerate senile changes. I would like to quote a sentence from the last edition of McLester and Darby's book, "Nutrition and Diet in Health and Disease." The sentence is: "Undernutrition may not hasten senility, but to a grievous extent it lessens the aged person's vigor and sense of well-being." The relation of nutrition to mental and physical health in the aged needs exploration.

#### Getting Information To the Public

So far I have mentioned several nutritional problems which are closely related to public health and which need exploration. Continuing this general theme, I shall turn to a problem which most people would consider unsuitable for consideration by scientific people. Our scientific knowledge of nutrition is incomplete and fragmentary but, even so, it is greatly in advance of information possessed by the general public. Valid data have been available for 15 years to prove that the deficiency disease, rickets, can occur in children to at least age 14. It is known with certainty that rickets can be prevented if children have sufficient vitamin D. In a recent study in two elementary schools in Toronto we found that three fourths of the children were not being given vitamin D. This last winter a second study showed that two-thirds of 4700 sixth-grade pupils, aged 10 and 11 years, were not getting vitamin D. The reason for this failure is not economic, but the situation is due to a combination of indifference and ignorance. It is not right to blame the general public for being ignorant about this particular aspect of nutrition. The principal of one of the two schools mentioned said that he knew that babies needed vitamin D but he did not know that school children required this vitamin. Many physicians in the Toronto area likewise do not know that vitamin D is needed so long as growth is taking place. One reason for this lack of knowledge is that text books, currently used by medical students in the University of Toronto, state that rickets is a disease of infancy which hardly ever occurs after the second year of life.

This state of affairs about vitamin D is only one instance, and perhaps a minor one, of general ignorance about nutrition. Every food intake study in Canada and in the United States during the past 10 years has shown that a considerable portion of the population eats meals which are not conducive to health. Wide-spread pseudosocialism has caused the blame to be placed on economic conditions and has been responsible for remedies of doing things for people instead of helping them to do things for themselves. The prevalence of dietary fads and of oldwives' tales about particular foods are substantial evidence of ignorance.

#### Handicaps

In overcoming ignorance about food use we are handicapped by at least two factors. I have heard repeatedly the statement that it is undignified and unethical for the scientists who possess factual information to try to communicate it to the public. Where else could the public hope to get reliable information?

The other handicap is that we do not know effective means of interesting people in obtaining reliable information. True it is that there are many procedures in current use. Whenever nutritionists become members of a committee to educate the public, they decide to prepare and distribute a pamphlet. Do people generally read pamphlets and, if so, does the reading cause a change in firmly entrenched food habits? Another pet trick is to have someone speak at a parent-teachers meeting. The people who attend the meeting are the ones who are already interested and who don't need what the speaker says. What do we do about the two thirds of the community who don't attend meetings?

You will, perhaps, find it strange that I should say that a pressing problem in the field of nutrition is how to effectively furnish to the public the basic information that we do possess. It would be fine if we could help people to keep from believing current rubbish. How can we convince a segment of the population that the cooking of food in aluminum utensils won't cause cancer? Or how can we encourage people to eat more cheese when they are sure that cheese is constipating? Perhaps it is too much to hope that the public can be educated about food use. I don't think it is hopeless but I do suggest that we need to give thought as to means which are really effective.

