SCIENCE

VOL. LXV JUNE 10, 1927 No. 1693

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 8, 1879.

PRESENTATION OF THE MEDAL OF THE AMERICAN INSTITUTE OF CHEMISTS[1]

THE MEDALIST

LAFAYETTE B. MENDEL first saw the light of day in the village of Delhi, New York, on February 5, 1872. A boyhood composition prepared at school and entitled "Our Village," which once fell into my hands, tells us that Delhi was a very beautiful village, and also we learn that it had a railway station. Mendel entered Yale at the age of fifteen as the youngest member of his class and graduated in due course. I remember distinctly the punctilious politeness with which he, as graduate student of twenty-one, took off his hat when in the streets of New Haven he passed me, a professor of the age of twenty-six. I mention this merely to indicate that we have been friends for thirty-five years. I would also remark that in the course of years this attitude has been reversed and that to-night I take off my hat to him.

Mendel, like many who have become broadminded and influential men, had an early and thorough grounding in the classics, and his knowledge of Latin has remained with him throughout his life. Such training gives an intellectual background which represents a continuity of education from its beginnings in the ancient world. It has always contributed to the power of those possessing it. A generation ago there was scarcely a member of the British Parliament who could not, like our friend of this evening, quote Horace to his purpose.

As has been said, Mendel's early life was spent at Delhi and to this home he has ever since returned for his summer vacations. The local physicians have been his friends and councilors. With them he has taken many a long drive in the old-fashioned buggy and made calls upon the sick and learned medicine as the country doctor knew it. The doctor of the old school, who would drive a horse twenty miles of an afternoon to see a sick man living far away, perhaps in a desolate habitation, was one from whom lessons, not only of medicine, but also of conduct, could be learned. Inspiration came even as the fresh air which entered the lungs during the long drive. Some one has pointed out that the modern doctor in his Ford can no longer ruminate upon the

[1] Rumford Hall, Chemists' Club, New York City, May 11, 1927.

case he may have attended in a house as he passes it, but rather upon a narrow escape from a collision which had happened to him there a few months before. Nor will the Ford bring the tired doctor home without giving a thought, as Dobbin would bring the buggy home.

There is no doubt that much of the harmony in the life of Lafayette Mendel is derived from the love of the serenity of his native village of Delhi, and of the scenes and friends of his boyhood.

It is known to all that Mendel is the most illustrious of Chittenden's pupils. He received his doctorate of philosophy from the hands of Chittenden in 1893. He studied with Heidenhain at Breslau and with Baumann at Freiburg in 1895 and 1896. From the time of his graduation he was closely associated with Chittenden in teaching and research at the Sheffield Scientific School, and when Chittenden became director of the Scientific School in 1898 the direction of the laboratory became increasingly Mendel's personal responsibility.

In these early days of the beginnings of scientific medicine in the United States there was one dominant group of alert and able scientific men associated together, that at the Johns Hopkins University under the presidency of Gilman. This represented an atmosphere of scientific stimulation unequaled anywhere at that period. The Chittenden-Mendel School was a sporadic manifestation, an offshoot of the school of Samuel Johnson, the pioneer agricultural chemist. It originated and was maintained in a miserable building utterly devoid of the trappings found in our stately modern laboratories. The mechanical toys which are our present-day delight were not the meat on which this our Caesar fed. But life in squalor does not subdue the things of the spirit, and things of the spirit were in that old building. A merchant may see his shop and goods destroyed by fire and the next day arrange for carrying on the business, of which he alone is master and which he alone can inspire. And so, too, in science. Great buildings, much to be desired as they are, may become tawdry non-essentials unless the human spirit can soar above their comforts and luxuries.

The work of a man's life is equal to the sum of all the influences which he has brought to bear upon the world in which he lives. It does not depend on contests for priority, but on the discovery of truth and its promulgation. In Mendel the great influences have been those of a teacher and investigator. As a matter of routine throughout his life he has spent two afternoons and evenings reading scientific literature in the Yale University Library. This has given knowledge of what other men in his own and in other lands are thinking. In a weekly journal club held with his graduate students, who now number twenty, this life-long habit of knowledge comes to aid beginners in the art. No one can be well balanced mentally who seeks only the latest fad, and so we find that Mendel and his school have always emphasized the influence of the older classical writers. Many brief historical reviews have been published from his laboratory as memoirs concerning the older men of science.

Recently, at Ann Arbor, I had the pleasure of meeting a band of twenty graduate students who were pupils of Professor H. B. Lewis, of the University of Michigan. And Lewis, a pupil of Mendel, was following the same procedure as his master in unfolding the story of the world's work. After this fashion the influence of Mendel's teaching radiates throughout the country and even to remote Japan. Among his pupils may be enumerated the following who hold high academic positions and are engaged in actively teaching the doctrines which he has inculcated:

Robert E. Swain (Ph.D., 1904), Stanford University.
Harold C. Bradley (Ph.D., 1905), University of Wisconsin.
Tadasu Saiki (Ph.D., 1907), director, Nutrition Institute, Tokio.
Stanley R. Benedict (Ph.D., 1908), Cornell University Medical College, N. Y. C.
Mary Swartz Rose (Ph.D., 1909), Columbia University.
Victor C. Myers (Ph.D., 1909), Western Reserve University.
John F. Lyman (Ph.D., 1909), Ohio State University.
William C. Rose (Ph.D., 1911), University of Illinois.
Howard B. Lewis (Ph.D., 1913), University of Michigan.
Ruth Wheeler (Ph.D., 1913), Vassar College.
Amy L. Daniels (Ph.D., 1914), University of Iowa.
D. Wright Wilson (Ph.D., 1914), University of Pennsylvania.
Raymond L. Stehle (Ph.D., 1915), McGill University.

In this connection it should be recalled that E. V. McCollum took his degree under the chemist Treat B. Johnson at Yale in 1906 and that he spent the academic year 1906-7 in Mendel's laboratory.

As regards his research work, there are ten bound volumes of reprints which have come from Mendel's laboratory. At the beginning he was interested especially in the metabolism of the purins. He also participated in Chittenden's classical work upon low protein diet which appeared under the title of "Physiological Economy in Nutrition." He is best known for his analysis of the value of food constituents, as shown by their influence upon the growth curves of young rats. The method was established in a few experiments by Gowland Hopkins, and Mendel, the pioneer in this country, has developed it into a fine art. Osborne, the world's leading authority of the chemistry of vegetable proteins, had in his safe in New Haven a large variety of vegetable proteins in a state of absolute purity. From a study of the nature of these proteins the two men were led into discoveries in the vitamine field which were of great significance.

It is quite impossible to do justice to this work in a brief review. The white rat has been raised from the children's pet of our boyhood until the literature concerning it has reached heroic proportions and is worthy of an epic poem as yet unsung.

How can one tell what is a perfect food? Evidently it would be such a mixture of materials as would support normal life. The world is full of food faddists willing to advocate the most absurd propositions, but such contribute little to real knowledge. Osborne and Mendel took young rats just weaning and fed them with various mixtures to see whether they would grow as normal rats grow and later reproduce their kind. For example, the diet must contain protein for the building up of new muscle, salts for the construction of new bone, and it must have starch and fat for the fuel supply (calories) wherewith to maintain the living parts of the body.

But it is not quite so simple, and they thus expound the situation:

According to present day criteria a *balanced ration* must represent something more than an adequate quota of calories including no less than a certain minimal proportion of protein along with inorganic salts and perhaps "roughage." The protein must be suitable in quality, so as to furnish a sufficient yield of amino-acids —the building stones of tissue cells; the inorganic salts must be both quantitatively and qualitatively appropriate; and evidently certain vitamines (including vitamine A, soluble in some of the natural fats; *e.g.*, butter fat and cod liver oil, and also vitamine B, soluble in water, which appear to be widely distributed in the active cells of plants and animals) are needed, even if the absolute quantity requisite is small.

The quality of the protein in a dietary is of great importance. Body protein is built up of about 18 different chemical compounds. Now, just as it is impossible to spell the word *p-r-o-t-e-i-n* without the letters p and n, so, too, it is impossible to build up new protein in the body without the chemical substances *lysin* and *tryptophan,* which are among the broken fragments of digestion of meat. Osborne and Mendel have found that the principal protein of wheat, gliadin, when given to young rats as the only source of protein, will not cause growth. The animals remain stunted over a long period, but when lysin is added to the diet normal growth is rapidly attained. Gliadin contains only 1 per cent. of lysin and muscle a much larger percentage. So the amino-acid mixture derived from gliadin was inadequate to build up new body proteins. The furry coat of the animal was also in bad condition, but began to grow at once when lysin was added. A thoughtful pupil of Mendel advised him to take lysin to make the hair grow on the top of his head.

Mendel showed that if rats were given a dietary containing protein, carbohydrate, fat in the form of lard, together with salts and yeast to furnish the antineuritic vitamine B, the animals grew a little while, stopped growing, developed an eye disease and perished. He found that if butter fat or cod liver oil was substituted wholly or in part for the lard, the animals developed normally. Experimenting with a thousand rats, Mendel finds that this eye disease, first noted by him, is not contagious but is a true disease of dietary deficiency due to the lack of vitamine A.

Perhaps the hearer of this review, having reached this point, will come to the conclusion that the discussion of the effect of food on rats is merely a ludicrous performance of a secluded academic mind, of no value to the great outside world. And yet we read that in the siege of Kut-el-Amara in 1916 beri-beri broke out among the British troops while they were taking their normal ration of white wheaten flour and cleared up when they were obliged to share in the more coarsely milled grain of their fellow soldiers from India; and that the disturbance of the eyes, xerophthalmia, occurred during the war among Scandinavian children fed with cereals and skimmed (fat free) milk.

Cottonseed meal is largely used as a cattle feed. Mendel and Osborne analyzed its value and showed that if it be fed with starch (which is free from water soluble vitamine) and lard (free from fat soluble vitamine) but with a proper mixture of salts, then normal growth is obtained. This means that cottonseed meal contains not only the proper protein for growth but also the water soluble vitamine B, because otherwise the rat could not have grown and would have developed the disease of beri-beri with the resulting paralysis of the limbs; and it shows that the cottonseed meal contains the fat soluble vitamine A, without which growth ceases and a redness of the eyes develops which no antiseptic treatment can benefit. Cottonseed meal is evidently a material which, if taken by a milch cow, will give the valuable fat soluble vitamine whose appearance in milk in the form of butter fat endows butter with its superiority over lard and over such vegetable oils as olive oil or cocoanut oil, from which much of the vegetable margarine is made.

A similar analysis shows that the soy-bean, which is largely used as a cattle feed in this country and as a food for human beings in Japan, contains proteins which are adequate for promoting normal growth, an adequate amount of water soluble vitamine, and some of the essential fat soluble vitamine.

A remarkably interesting statement reveals that spinach has more water soluble vitamine B in it than whole wheat, milk or potatoes, substances known to be rich in such vitamines, and that spinach contains almost as much fat soluble vitamine A as butter does. This brings sharply before one the relation between the green things of the field and the occurrence in butter fat of fat soluble vitamine, the idea of which was first suggested by Dr. McCollum. One sees, also, how instinct triumphs when man eats olive oil, which is free from fat soluble vitamine, with cabbage, lettuce and beet tops, which are full of it.

Osborne and Mendel report how they have succeeded when others have failed in rearing chickens in confinement by giving them grain and adding fat soluble vitamine in the form of butter instead of in green food, which is ordinarily taken when the young chick is free to roam. Good growth was obtained with such a diet. Roughage was furnished in the form of blotting paper, of which a full grown bird may eat daily a piece 2 feet square.

Why should an animal fail to grow when there is no water soluble vitamine B and his diet contains only purified protein, starch, salts and butter fat? If to such a diet milk or extracts of the embryos of seeds or certain animal tissues are added, they produce growth. Yeast also furnishes the water soluble vitamine B necessary for growth.

Again, why should an animal fail to grow when there is no fat soluble vitamine A in the diet, that is to say, when the diet is made up of purified protein, starch, salts, yeast and lard? If to such a diet butter fat, egg yolk fat, beef fat or cod liver oil supplant lard, then full development takes place. Is this all a matter of improved appetite on account of a better taste of the food or does it improve the condition of the animal and therefore affect the appetite? Does the animal grow because it eats or does it eat because it grows? Osborne and Mendel incline to believe in the second explanation; that is to say, given the condition for growth, the animal eats sufficient to gain in weight.

Mendel and Osborne call attention to the fact that their milk supply was 8 times less efficient as a source of water soluble vitamine than has been reported by Hopkins for English milk. They consider it probable that when milk is diluted for the nourishment of infants the water soluble vitamines become insufficient for normal growth. Hence, the early difficulties with bottle fed babies.

But what is the sense of all this? Has not man thriven and developed true to type throughout hundreds of centuries without giving a thought to his metabolism? The secret of this lies in the power of instinct. When the Italian laborer partakes of beet tops and olive oil, as he has done through the ages, he does not know that the beet tops contain fat soluble vitamine and salts similar to those of milk. When, however, food must be prescribed by a physician, such a one should know the value of it. Alas, he often does not. But when a choice of foods is offered to either man or animals the most suitable food will usually, but not always, be taken.

To demonstrate this Osborne and Mendel offered rats their choice of superior or inferior foods. For example, two rats were offered the choice of diets, one diet containing the water soluble vitamine and the other free from it. One rat took chiefly of the food containing the water soluble vitamine and grew normally. The other for 3 weeks took the food free from this vitamine and lost in weight. It then learned to prefer the other food and grew with compensatory rapidity in the next 3 weeks, attaining almost normal growth for its age within that period. In like manner, rats will prefer diets containing casein to the same diets which are free from protein, or prefer a diet which contains a superior quality of protein (lactalbumin) to those containing an inferior protein (zein of corn).

Recent work from Mendel's laboratory shows that a diet which contains only protein and fat as the fuel giving foods, that is, one which is practically free from carbohydrate, is sufficient for excellent growth of the rat. This explains, perhaps, the predilection of the rat for cheese. Not only this, but splendid growth occurred when the diet contained 90 per cent. of protein, to which was added 5 per cent. of salts, together with alfalfa to furnish vitamine A and yeast to furnish vitamine B. This shows that true fats are not essential for growth, which can be supported at the expense of protein alone.

Mendel's influence has been potent for human welfare in the largest sense. His advice has been widely sought and his judgment of men and of affairs is highly prized. He has the faculty of kindly criticism, which is of greatest value, for, as was said by Pflüger, "Criticism is the mainspring of every advance." He has been the inspiration of hundreds of students and he has left an imperishable mark upon his day and generation.

GRAHAM LUSK

CORNELL MEDICAL COLLEGE