FUTURE TOTAL SOLAR ECLIPSES IN THE UNITED STATES

AFTER the total solar eclipse of August 31, 1932, when will there be another visible in the United States? A number of advertising circulars and newspaper articles have appeared with the statement that "there will not be another total eclipse of the sun visible in this country until the year 2024." Others have set the date as 2017 or 1970. But as recently reported in *Science News*,[1] Dr. Robertson, of the Nautical Almanac Office, U. S. Naval Observatory, has pointed out that the total eclipse of July 20, 1963, will be favorably located for observation from certain points in Maine.

Perhaps it will do no harm to repeat that the next four total solar eclipses visible in the United States will occur on July 9, 1945, June 30, 1954, October 2, 1959, and July 20, 1963. The first three of these will be visible at or near sunrise in the United States and consequently will not be favorably located in the sky for professional observation. The fourth will be favorable for observation from certain points in Canada and Northern New England.

The information contained in the following paragraphs is based on computations made using the elements given in Oppolzer's "Canon der Finsternisse." This very valuable book (now out of print) contains elements for every eclipse, solar or lunar, occurring between 1207 B. C. and 2162 A. D., and in addition contains maps showing the approximate paths of the moon's shadow on the earth for each solar eclipse visible in the northern hemisphere and for a few others. It is the approximate character of these maps which is responsible for many of the erroneous statements about coming eclipses. For instance, an excellent book on astronomy which appeared in 1931 has a map showing the paths of total solar eclipses from 1918 to 2000 A. D. in which the path of the 1932 eclipse is shown as passing down between Labrador and Greenland and not crossing New England at all! The elements given by Oppolzer are somewhat more accurate than his maps. For a discussion of the accuracy of Oppolzer's elements and maps, one may refer to "A Test of the Accuracy of Oppolzer's Eclipse Predictions," by Mrs. Isabel M. Lewis.[2]

It may be of some interest to give approximate central lines of the paths of totality for the four eclipses mentioned above. For the eclipse of July 9, 1945, the moon's shadow will strike the earth at sunrise just north of Boise, Idaho. It will sweep across Manitoba passing near Winnipeg, across the northwestern section of Ontario, over Hudson Bay and across the northern part of Quebec. For a point just south of Hudson Strait, the duration of totality will be about a minute. The sun will be about 24° above the horizon there.

For the eclipse of June 30, 1954, the moon's shadow will strike the earth at sunrise in north central Nebraska. It will pass over Lake Superior, going near the southern end of James Bay and on out near the southern tip of Greenland. For a point in Northern Quebec, the duration of totality will be about two minutes. The sun will then be about 27° above the horizon. For the eclipse of October 2, 1959, the moon's shadow will strike the earth at sunrise in southern New England and will move at once out over the Atlantic Ocean.

For the eclipse of July 20, 1963, Oppolzer's elements indicate that the moon's shadow will come down out of the northwest, passing near the southwestern edge of Hudson Bay and James Bay, crossing Maine near Belfast. The accurate computations made at the Nautical Almanac Office were based on modern elements and consequently their determination of the path of totality of this eclipse will be much more accurate than this. It is interesting to note that, though the maximum duration of totality for the eclipse as given by Dr. Robertson is 100 seconds, the duration of totality for points in Maine will be in the neighborhood of 70 seconds. In this connection, it may be mentioned that for a point in Maine, Oppolzer's elements indicate a duration of totality of 113 seconds instead of 98 seconds as predicted on the basis of modern elements.

For points in Maine, totality in the 1963 eclipse will begin about 5:40 P. M., Daylight Saving Time, but because it will be near the middle of the summer, the sun will be almost as high above the horizon as it will be at Fryeburg, Maine, at this year's eclipse.

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OBITUARY

GRAHAM LUSK

GRAHAM LUSK died in New York on July 18, after a brief illness. He had just completed writing the obituary notice of his old friend, Max Rubner. These two great pupils of Carl Voit had extended the work of their former master and had placed on a strong foundation the modern science of nutrition. Dr. Lusk had not only made important additions to our knowledge by his own investigations but also had been the chief means of disseminating in this country

[1] SCIENCE, n. s., 75, 1956, viii.

[2] Publ. Amer. Astr. Soc., 7, 3, 92–93, February, 1932.

and Europe the contributions of Voit and Rubner. He had been our strongest connecting link with the old masters and had transmitted to us what was best in the scientific laboratories and academic circles of this and previous centuries. No one who came in touch with him can forget his force of character, his kindliness, his enthusiasm and his devotion to science.

It takes many generations to make a man like Graham Lusk. He came of an old and prominent family and his father, who had studied medicine in this country and Germany, had been one of the first American physiologists before he devoted himself to practice. Graham Lusk was born in Bridgeport, Connecticut, on February 15, 1866. He studied chemical engineering at the Columbia School of Mines in New York and graduated with the degree of Ph.B. in 1887. For the next few years he worked in Munich under Carl von Voit and received the degree of doctor of philosophy in 1891. At that time Voit was at the height of his fame and he was surrounded by a distinguished group of pupils. Among them were Dr. Lusk's lifelong friends, Prausnitz, Max Cremer, Otto Frank and Friedrich Müller.

On returning to this country he was appointed instructor in physiology at Yale and in 1895 made professor. Three years later he was called to the chair at New York University and Bellevue Medical College. In 1899 he married May W. Tiffany, of New York, who with their three children, survives him. In 1909 Dean Polk induced Dr. Lusk to accept the professorship of physiology at Cornell University Medical College in New York City, a post which he filled with distinction until a few days before his death.

At Yale Dr. Lusk started his work on phlorizin diabetes, which led to a prolonged investigation of the sources of glucose in the body. When he came to New York he had the opportunity of extending his observations to the metabolism in human diabetes. In both conditions he found a definite ratio between the dextrose formed in the organism and the protein metabolized as represented by the nitrogen excretion. By means of this D : N ratio he studied the various amino acids as sources of carbohydrate. When he moved to Cornell Medical College he was given the facilities to construct a respiration calorimeter of the Atwater-Rosa-Benedict type suitable for dogs. At last he had the chance to study in detail in hourly periods the metabolism of carbohydrate, fat and protein.

Dr. Lusk's active work as scientific director of the Russell Sage Institute of Pathology began in 1912. By means of an affiliation with the Second Medical (Cornell) Division of Bellevue Hospital he was able to devote the entire small income of this institute to the purchase of apparatus and supplies and the salaries of investigators. A respiration calorimeter for human subjects was constructed near the medical wards of Bellevue Hospital. During the course of the next twenty years he was able to plan experiments on dogs and supplement them by means of the observations on human subjects. For example, his work on phlorizin diabetes on animals could be checked by the study of patients with severe diabetes. He had demonstrated the large amount of glucose that could be derived from the protein metabolism and the relatively insignificant amount that could be ascribed to fat. His figures were the basis for the calculations in all the extensive work on severe diabetes that was being carried on throughout this country in the era before the discovery of insulin. They are still employed in all exact studies of the carbohydrate metabolism.

Many years were devoted to the difficult subject of specific dynamic action of the various foodstuffs, and his carefully planned experiments will always serve as a reservoir of facts. He was never quite satisfied as to theories which would explain these facts. His allegiance to the school of Voit and Rubner as well as his own firm convictions made him an ardent supporter of the significance of surface area in the determination of the basal metabolism. Another great interest was the respiratory quotient and we are indebted to him, more than to any other man, for the realization of the knowledge that can be obtained from quotients when the technique is fully adequate.

Graham Lusk not only excelled as an investigator but also in the many responsibilities that fall upon the head of a department of physiology. He spent a great deal of time and thought upon the teaching of medical students and his course of lectures on nutrition may serve as a model for future generations. Many of the students complained that it was above their heads, but they all realized that it was not above the level where their heads should be. He spoke with force and clearness and never hesitated to give in detail the classical experiments on which the knowledge of nutrition is founded. All felt the stimulus of contact with a great man of the present generation and through him they touched the old masters.

Perhaps the chief service of Graham Lusk was his constant readiness to help younger men. There are hundreds of us who have gone to him with our problems, and we have always received his aid and inspiration. Not only the men who worked in his own laboratory but those from far distant parts of this country and Europe are indebted to him for much of the best parts of their publications. Unless

he himself had taken an active share in the conduct of an experiment he would never attach his name to a paper. Whenever he published with younger men his name appeared last and there were no heart-burnings in his laboratory over that coveted first position on the title page which is of value only to those men who would otherwise remain insignificant. On rare occasions, when he felt that a young man was insincere or totally unprepared for his task he would act firmly and promptly for the good of the scientific world. For all others he was full of encouragement and appreciation, and he cherished the enthusiasm of youth because he himself retained it to the last day of his life.

Scientific meetings were always a particular source of pleasure and he played an important part in such gatherings. He himself had helped to found the Harvey Society of New York, the Society for Experimental Biology and Medicine and the American Society of Biological Chemists. He was an active or honorary member of physiological or scientific societies of Berlin, Great Britain, Edinburgh, Halle, Vienna and Brussels. During the great war he served on the Inter-Allied Scientific Food Commission as one of the representatives of this country. He was a member of the National Academy of Sciences, and a few weeks before his death was notified of his election to the Royal Society of Great Britain. He had been given honorary degrees by the Universities of Yale, Glasgow, Edinburgh and Munich.

A great buoyancy of spirit, cheerfulness, keen sense of humor and genius for friendship were Graham Lusk's chief personal characteristics. He was a prince among men, a delightful host, and in his hospitable home, either in New York or on Long Island, he entertained a succession of visiting scientists and once even the whole International Physiological Congress.

He had overcome in a surprising manner the handicap of deafness which made it difficult for him to follow general conversation and to estimate the finer modulations of his own voice. In spite of this he was a good conversationalist, an effective public speaker, always outspoken, always individual. In many ways deafness was an asset in securing him time to read and write without distraction. A tireless worker with a retentive memory he had accumulated an extraordinary knowledge of the literature and he gave it to the world, well digested, in his text-book, "The Elements of the Science of Nutrition," which appeared in four editions between 1906 and 1928. He had a sense of reverence for the good work of his predecessors and was not slow to take up cudgels in their defense. It was a pleasure to see him go into action with the full force of his own laboratory and the support of his many pupils in other institutions throughout the country. For example, in his recent controversy regarding the formation of glucose from fatty acids practically every one of his former associates published some evidence which strengthened his position. Although emphatic and fearless in dispute, he never lost the friendship of those whose theories he opposed.

Strongly imbued with the spirit of research and the highest ideals of academic culture, he began his work for the reform of medical education at the time he received his first professorship. His efforts in behalf of better compensation for professors were vigorous but only partially successful. He was a leader in the movement to develop teachers in the clinical departments of medical schools who might be capable of research work of the highest order. At first he endorsed the full-time plan for clinical teachers, believing that it was the best way to give them the opportunity to develop strong departments. Later he modified his views and opposed rigid adherence to the full-time program whenever this interfered with academic freedom. Always an ardent supporter of the freedom of faculties and the responsibility of the heads of departments, he fought any influence that he considered dangerous to the vital spirit of our universities.

The physiologists, biochemists and clinicians have lost a leader, a dear friend, a man who represented all that was best in the academic life of our country.

EUGENE F. DU BOIS

SCIENTIFIC EVENTS

THE BRITISH OPTICAL INDUSTRY

A LUNCHEON organized by the optical industry was held recently at the Holborn Restaurant, London, to introduce a number of new instruments, designed and made exclusively by British firms, for the examination of the eyes. Before last September, the London *Times* states, 80 per cent. of the apparatus used in the British optician's practice was imported from the Continent or America. The proportion has now been reduced to about 40 per cent., and it is probable that in the near future there will be a further reduction to 20 per cent. The importance of this British advance in an important scientific industry may be realized when it is stated that approximately 10,000,000 people in Great Britain wear competently prescribed glasses.

Mr. Osmond P. Raphael, chairman of the Optical Manufacturers' Association, who presided at the