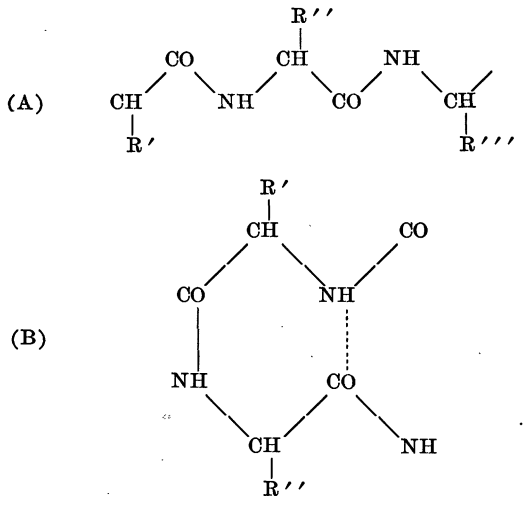

FIG. 1

Knowledge of protein structure has not yet reached the point where it can be indisputably stated that there is but one stereochemistry of the proteins based on the convolutions of the polypeptide chain, even though this conclusion is a likely one. It may be that proteins fall into two groups, morphologically considered, the soluble proteins—egg-albumin, insulin, edestin, etc.—of globular molecular form, and the insoluble proteins—silk, hair, wool, etc.—with chain molecules. Protoplasm will then contain both forms, and to the chain molecules are its elastic, structural, and anomalous properties due.

These are questions which will have to be settled by the organic and x-ray chemists. But the biologist is in the happy position that whatever the answer, he still has sufficient to meet his major demands; namely, a continuity and symmetry in structure which will satisfy the elasticity and non-Newtonian behavior of protoplasm, to which must be added fundamental biological qualities. Among these are certain genetical requirements.

In order that the linear arrangement of genes shall be kept, it is necessary to assume that chromosomes maintain their identity throughout the life of the cell, and not just during mitosis as heretofore believed.

Structural continuity and symmetry in organization are necessary prerequisites of an ordered behavior, and the latter is a fundamental quality of all living matter.

In conclusion, I wish to refer to a recent hypothesis on the mechanism of protoplasmic streaming, in order to indulge in a speculation which makes further use of the theory of protein and protoplasmic structure as here set forth. I made the suggestion[17] that the streaming of protoplasm in slime-molds is due to rhythmic pulsations of the plasmodium, thus attributing to a very primitive form of living matter the same capacity for rhythmic contractiliity possessed by certain tissues of higher organisms. I discarded all older hypotheses of protoplasmic streaming, of which there are several based on surface tension, hydration, and electroendosmosis. In ascribing the outward and inward flow of protoplasm in slime-molds to rhythmic pulsations of the plasmodium, I gave no hint of the possible mechanism of the systolic and diastolic movements. It has occurred to me that these movements may be due to the contraction of folded molecules such as those postulated by Astbury for wool and hair.

As contractility is a property of all living matter, we may make the general postulate that vital contractility, wherever it occurs, whether in the most elementary forms of protoplasm or in highly specialized tissues, is due to the shortening of protein fibers by molecular folding or helical contraction. The energy for this work is supplied by the oxidative processes in the cell.

OBITUARY

WILLIAM WALLACE CAMPBELL

"ALL of his life William Wallace Campbell did difficult things with high courage. There can be no doubt that the most difficult thing he ever did, and the one which required the highest courage, was to end his own life. Most who take their own lives do it from lack of courage. One can not read the pitiful notes left by Dr. Campbell and bring that charge against him. We can do Dr. Campbell this justice and yield no whit in our disapproval of self-destruction."

All Dr. Campbell's friends, who knew of his condition in recent months, will agree with the statement I have just quoted from an editorial printed in the *San Francisco Chronicle* on June 15, twenty-four hours after his tragic death.

It was an act of highest courage dictated by love for his devoted wife and children and desire to spare them the burden of caring, perhaps for long months, for an invalid rapidly approaching the state in which, by reason of blindness and aphasia, he could not even communicate his thoughts or wants to them. "It is better," he wrote, "that I go away now with my powers nearly all gone."

I shall not here attempt to pass in full review Dr. Campbell's brilliant career as an astronomer and as a great leader and executive, were it only for the reason that space limitations would forbid. At the "Symposium in Appreciation of the Scientific Contributions of William Wallace Campbell," held at Harvard Observatory on March 31, 1938, Dr. Shapley, in his intro-

[17] W. Seifriz, SCIENCE, 86: 397, 1937.

ductory general sketch of his career, remarked: "It was his fortune and it is ours also this afternoon, that Campbell is versatile and a pioneer." The six speakers who followed emphasized his versatility by the subjects of their addresses: "Eclipses and Eclipse Expeditions," "Planetary Atmospheres," "Pioneer Studies of Stellar Spectra," "Spectroscopic Binaries," "Stellar Motions" and "Nebular Spectroscopy." In all these fields of research Campbell's work has been of outstanding significance, and in some he was a recognized leader.

Born in Hancock County, Ohio, on December 28, 1862, and receiving an engineer's training at the University of Michigan, from which he graduated in 1886, he had already established his reputation as a teacher of mathematics and practical astronomy and as a computer of orbits when he came to the Lick Observatory as astronomer in 1891, to take up spectroscopic work.

Astronomers the world over acknowledge that his pioneer measures of the radial velocities of stars in 1896, with the original Mills spectrograph, designed by himself on sound engineering as well as sound optical principles, set the standard for accuracy in this line of work and that the great program of measuring the radial velocities of all the brighter stars in the entire sky which he then initiated and carried out in the years that followed, at Mount Hamilton and on Cerro San Cristobal in Chile, with the aid of Wright and Moore and other able associates and assistants, has provided the fundamental data for our knowledge of stellar motions in the line of sight.

This great program, with its by-product of the discovery of the high percentage of binary star systems existing among the stars, he himself regarded as perhaps his major contribution to astronomy, but spectrographic work in every form appealed strongly to him and he investigated, sometimes alone, sometimes in collaboration with others, the spectra of the Orion Nebula, the planetary nebulae, the so-called Wolf-Rayet stars, the planet Mars and, in particular, the solar atmosphere at times of total eclipse of the sun. It was, in considerable part, pioneering work, but work so carefully planned, so skilfully carried out that, though some of his conclusions were sharply criticized at the time when they were put forward, the most recent researches, with greatly improved equipment, have sustained them. His work in collaboration with Moore, on the peculiar structural form of the lines in the spectra of the planetary nebulae, offers, as Menzel has said, "the only observational evidence on this problem." His observations of the spectrum of Mars, made at Mount Hamilton and on the summit of Mount Whitney, alone and in collaboration with Albrecht and others, established the fact that the amount of water vapor in the Martian atmosphere was certainly not greater than one fourth that above Mount Hamilton on a dry summer's day.

Dr. Campbell observed his first total eclipse of the sun at Jeur, India, on January 22, 1898. In addition to the stationary camera known as the "Schaeberle 40-foot," and smaller cameras for direct photography, he took along five spectrographs, three of them of novel design, to record "the spectrum of the sun's edge, continuously for a few seconds at the beginning of totality, and a few seconds at the end of totality, by means of plate holders *moving at a uniform rate by clock work*" (italics mine).

This type of spectrograph, which he invented in 1896 when he had expected to go to the Japan eclipse, was Campbell's major contribution to solar eclipse equipment, and it was used by him successfully not only at the eclipse of 1898, but also at those of 1900, 1905, 1908, 1918 and 1922. The results obtained were fully analyzed and discussed by Dr. D. H. Menzel, whom I invited to come to the Lick Observatory (with Dr. Campbell's full approval), in 1926, chiefly for that purpose, and have been published in Volume XVII of the Lick Observatory Publications. In the course of this work, carried out in regular consultations with Dr. Campbell, who was then president of the University of California, Dr. Menzel, like all others who had come to have intimate knowledge of his work, conceived the highest admiration for his resourcefulness and skill as an observer and for his grasp of the problems he had set himself to solve. The eclipse plates were as good as any that could have been obtained under the conditions prevailing at each station, and in particular, the flash spectrum he "obtained in Spain with his moving plate method was superb."

At the Australian eclipse, when Dr. Moore and Dr. Trumpler were his chief fellow observers, his equipment included a battery of cameras specially designed and mounted under his immediate supervision to test the existence of the Einstein effect—the deflection of star light passing through the sun's gravitational field called for by the theory of relativity. Tests for this effect—the first to be made—had been attempted by him at the Goldendale, Washington, eclipse of 1918 with inconclusive results, but those made in 1922 and later analyzed in detail by Dr. Trumpler not only fully confirmed the results obtained by the British observers at the 1919 eclipse but still afford the best evidence we have on this subject.

On all his eclipse expeditions he was accompanied by Mrs. Campbell, and he often gratefully acknowledged his indebtedness to her for her care and assistance under conditions that were not infrequently primitive and highly trying.

Not long after his return from the eclipse in India came the untimely death, in 1900, of Dr. James E. Keeler, who had succeeded Dr. Holden as director of the Lick Observatory in 1898. President Wheeler, of the University of California, wrote to twelve of the

most prominent astronomers of the world asking recommendations for a successor to Keeler. Every one replied that he could find no better man anywhere than Dr. Campbell. President Wheeler repeatedly commented on this remarkable tribute.

Thus, on the opening day of the present century, Dr. Campbell began his career as director of the Lick Observatory. On the success of his administration I need hardly comment. The contributions to knowledge made in the twenty-three years that followed, by himself and by the members of his staff, are recorded in the Publications and Bulletins of the observatory and in many scores of papers in the astronomical journals. His success led to repeated offers, as I can testify from personal knowledge, of positions of great honor and importance in Eastern institutions, but he refused them all, saying his ambition was fully satisfied. He preferred the directorship of the Lick Observatory to any position elsewhere that might be offered to him.

On his return from the Australian eclipse, when he was greeted by a deputation of the regents of the university with the offer of the presidency he gave the same reply. But they were in great need of a man of his outstanding executive and administrative ability, his breadth of vision and his strength of character—his "backbone," as one of them said—and they pressed their claims upon him so strongly that he was forced to yield. Even so, he hoped his term of service might prove very short, and therefore retained his title of director and his residence on Mount Hamilton, in full expectation that he would presently return, but the problems facing him in his new office were greater than he had anticipated and kept him at his post until he was stricken on the commencement platform in 1930 by the disease that led ultimately to his death.

Of his work as president, let Chester H. Rowell, regent of the university, speak: "With a hand always gentle but always firm and never shirking, President Campbell ruled the university wisely and well. Whether in its nominally ruling board, in its faculty or in its student body, there are problems great and small in all universities. The great ones, Dr. Campbell faced greatly, seeing them in the full perspective of the long future and of their widest ramifications, as was natural to a scientist whose habitual intellectual background had been the whole harmony of the universe. The petty ones he saw in their infinitesimal smallness and sometimes also in their equally measureless contemptibility. He was no passionless supercomptometer, but a very human person capable of indignation and disgust. But his contempts were all for the contemptible."

Of course he sometimes made mistakes but saying that is only another way of saying that he was a human being. And if his colleagues now and again felt that he was wrong in the stand he took they also knew that he had carefully considered his position and was sincerely bent upon doing what he thought to be best for the observatory or, later, for the university.

The same high qualities of mind and character, the same great organizing ability that made him a successful university president, he exercised in the interest of his fellow astronomers and workers in all fields of science; in 1915, when he not only served as president of the American Association for the Advancement of Science, but helped to organize the Pacific Division of the association, and became its first president, and again, in 1919, when he was one of the leaders in the organization of the International Astronomical Union, of which he became president in 1922, the same year in which he was chosen as president of the American Astronomical Society. Even after his retirement, in 1930, he continued his activities and for four years, 1931–1935, carried, in addition to other great responsibilities, the burden of the presidency of the National Academy of Sciences, and carried it so successfully, despite his ill health and his partial blindness, that he was acclaimed as one of the great leaders of that distinguished body.

Dr. Campbell's work as a man of science, as educator and executive was signalized by the honors bestowed upon him—honorary academic degrees, medals, decorations, honorary memberships in learned societies. His friends gratefully recall these tributes to his worth.

And now, in closing this brief sketch, let me recall for you one of the almost countless vivid memories I have of our long and close association. It was in April, 1896, ten months after I had joined the staff of the Lick Observatory as the junior assistant astronomer. Dr. Campbell was temporarily in charge of the observatory, in the absence of Dr. Holden and Professor Schaeberle. Swift had discovered a comet and Hussey had secured two of the three measures required to compute a preliminary orbit with the expectation of making the third measure and computing the orbit. It was the aim of the Lick observers in those days to get out the first orbit of newly discovered comets, a duty taken over later by the staff of the Students' Observatory at Berkeley. An emergency arose, however, calling Professor Hussey away, and Campbell came in at breakfast time to ask if I would take his place. Naturally, I jumped at the chance, the first I had had.

That evening he met me in the 12-inch dome, recorded for me while I made my observations, checked my reductions and telegraphed the measure to the Central Bureau at Boston. Then we sat down, I to compute the orbit, *he to carry out a check computation.*

By daylight, the work was done, orbit elements and ephemeris put into a code telegram, signed by Campbell as acting director, but *credited entirely to me!*

This was typical of the man who was my friend throughout the years.

ROBERT G. AITKEN

RECENT DEATHS

FRANK BURSLEY TAYLOR, of Fort Wayne, Ind., who was connected with the U. S. Geological Survey from 1900 until his retirement in 1916, died on June 12 at the age of seventy-eight years.

CARL CLAPP THOMAS, formerly professor of mechanical engineering at the Johns Hopkins University, died on June 4 at the age of sixty-six years. He was a member of the faculty from 1913 until 1920, when he was appointed vice-president of Dwight P. Robinson and Company. From 1921 to 1924 he was city director of Pasadena.

DR. F. M. HAYES, of the Division of Veterinary Science of the College of Agriculture of the University of California, died suddenly on June 12 at the age of fifty-three years.

SCIENTIFIC EVENTS

CONFERENCE AT COLD SPRING HARBOR ON PLANT AND ANIMAL COMMUNITIES

THE Biological Laboratory at Cold Spring Harbor, Long Island, N. Y., has invited a group of botanists and zoologists interested in community problems to present a series of papers during the week of August 29. Not more than two papers will be read on any one day, an arrangement allowing ample time for the presentation of each subject and discussion by the members of the conference and visitors. A brief series of trips will allow further illustration and discussion of concepts in the field. There will be nine papers, which, together with edited discussions, will be printed as No. 1, Vol. 20, of *The American Midland Naturalist* for January, 1939.

Ecology is one of the most complex biological sciences because of ramifications into the basic sciences of physics, chemistry, biometry, geology, pedology, climatology, taxonomy, physiology and morphology. It seems highly desirable that within the field of community study, *per se,* ecologists working with such diverse materials as microorganisms, experimental populations, marine and fresh water communities, and terrestrial communities of all ranks, take stock of their common concepts and problems. An attempt to approach an understanding of the causes for such differences as are inherent in the various materials should prove valuable. Such a conference will be of most value to members and visitors, but it is expected that the published proceedings will be of service to ecologists in general.

Investigators interested in the conference may attend and take part in the discussions and field trips without further invitation. Inasmuch as housing facilities are limited at the laboratory, visitors planning to stay over night or longer should make arrangements for rooms in advance by writing the director of the laboratory. Dr. Stanley A. Cain is secretary of the conference and Theodor Just is the editor of the proceedings.

THE WISCONSIN CHAPTER OF SIGMA XI

THE Wisconsin Chapter of Sigma Xi held eight meetings during the year 1937–1938. The programs were as follows:

1937

November 10. "The Geology and the People of Newfoundland" by Professor W. H. Twenhofel, of the geology department, University of Wisconsin.

December 10. "The Fundamental Concept of Statistical Estimation" by Professor Frank Yates, chief statistician at the Rothamsted Experimental Station, Harpenden, England.

1938

January 19. "The Eclipse of the Sun" by Joel Stebbins, director of the Washburn Observatory, University of Wisconsin.

March 2. "The Origin of Species in Plants" by Dr. Fritz von Wettstein, director of the Kaiser Wilhelm Institut für Biologie, Berlin-Dahlem.

March 25. "The Constancy of the Internal Environment in a Condition of Free Life" by Dr. John Beattie, director of research laboratories, Royal College of Surgeons of London, England.

April 13. "Vitamin B_1 and Cell Metabolism" by Dr. R. R. Williams, chemical director of the Bell Telephone Laboratories, New York City.

April 25. "Recent Advances in Intermediary Carbohydrate Metabolism" by Dr. Hanz Adolph Krebs, department of pharmacology, University of Sheffield, England.

May 18. "The Drug Addiction Problem" by Dr. M. Harrison Seevers, associate professor of pharmacology, University of Wisconsin.

At the meeting on January 19 thirty-nine new members were initiated and four associate members were advanced to full membership. The annual dinner meeting of the society was given on May 18 when forty-four new members were initiated and three members were promoted from associate membership. The following officers were elected for next year: *Presi-*