Dr. Ralph Wyckoff.

JAN 3 1983

With best wishes for the new year.

Perusing George Corner's history of the Institute, I was reminded of your seminal role in the X-Ray crystallography of biological molecules.

Could you commend any auto-biographical or historical writings on the early development of the field, and your own role in it?

Yours sincerely,

Joshua

upon J. B. Murphy's cancer studies, to be discussed in Chapter 9, apparently because he and his assiduous colleague, the physicist Harry Clark, were using X rays to stimulate and inhibit lymphocyte action in experimental cancer. A new subdivision of the Institute, formally designated as biophysics and opened in 1927 under Ralph W. G. Wyckoff, undertook to study the biological applications of X-ray crystallography. This was a new method of studying the atomic structure of chemical elements and compounds, developed in 1912 by Max Laue of Berlin and Sir William Bragg of London. It was based on the fact that crystalline materials act as diffraction gratings for X rays by virtue of the regular spacing of their atoms or molecules, exactly as closely ruled lines on a glass plate produce a visible spectrum by diffracting ordinary light. Thus any crystalline substance will deflect an X-ray beam passing through it, and produce on a photographic film a regular geometric pattern characteristic of the kinds and arrangement of atoms or molecules of which it is composed.

Wyckoff was the outstanding American pioneer in the use and refinement of this new method of analyzing crystalline substances. He had begun work at the Geophysical Laboratory of the Carnegie Institution of Washington in 1919, immediately after taking his Ph.D. at Cornell. His most important early contribution was to put the determination of crystal structures on a rigorous basis by applying the mathematical theory of space groups. Lecomte du Noüy, Carrel's brilliant associate at Compiègne during the war and for a few years thereafter in New York, worked briefly with the young physicist in Washington. When he reported that Wyckoff saw a possibility of determining, by X-ray crystallography, the structure of complex organic substances, even proteins, Flexner brought Wyckoff to the Institute as Associate Member in charge of the subdivision of biophysics.

It would have been hopelessly difficult to begin with the enormously complicated protein molecule. Since hemoglobin, the iron-containing respiratory pigment of red blood cells, was one of the proteins toward which the work was pointed, Wyckoff began studying the ammonium chlorostannates, salts far simpler than hemoglobin but, like it, containing nitrogen and complexly bound iron in a highly symmetrical arrangement.

With seven X-ray machines already at his command in 1928, Wyckoff added an X-ray spectrometer of his own design and developed a new work, he appointed Frederick L. Gates, eldest son of F. T. Gates, president of the Board of Trustees, who had joined the Institute in 1913 immediately after graduating from the Johns Hopkins Medical School. A brilliant student, and very ingenious at devising new methods and apparatus, Gates worked at first on bacteriological problems in Flexner's division, associated with Peter Olitsky in investigations on the bacteriology of dysentery and of influenza. Flexner now sent him to the University of Chicago and Johns Hopkins for a half year to prepare for work on photobiology. To collaborate with Gates on the chemical side, he appointed Oskar Baudisch, a European-trained specialist in photochemical synthesis, and Lars A. Welo.

Gates began at once to study ultraviolet light, known to be the effective portion of the solar spectrum in the light treatment of rickets, although the nature of its beneficial action was quite unknown. To simplify the problem, Gates used bacteria as the living material in his earliest experiments. With the aid of accurate thermocouples of his own design for measuring energies available at different wave-lengths, he worked out the action spectra—the relation between various wave-lengths of ultraviolet light and their action, stimulating or destructive according to the circumstances, upon bacteria, bacteriophages, viruses, and enzymes.

The little group Flexner had tentatively organized did not fuse into an effective unit. Baudisch and Welo worked on quite different problems, and Gates's studies were too new to make much impression at the time. Because of an obscure illness, which caused his untimely death a few years later, it was thought he might profit by a change of scene, and he transferred his laboratory to Harvard University in 1929. His work at the Institute on the action spectra of ultraviolet light, continued at Cambridge, was the first definitive study of the subject, and biophysicists now recognize Gates as a pioneer in this field.[28] When in 1936 Northrop made his remarkable discovery that a bacteriophage, regarded as a living biological agent, could be isolated as a chemical substance of protein nature, Gates's determination of the wave-lengths of ultraviolet light which are destructive to bacteriophage served as evidence that Northrop's protein and that of the bacteriophage were identical.

The work which Flexner had called photobiology fully deserved the title of biophysics, but that name had some years before been conferred upon J. B. Murphy's cancer studies, to be discussed in Chapter 9, apparently because he and his assiduous colleague, the physicist Harry Clark, were using X rays to stimulate and inhibit lymphocyte action in experimental cancer. A new subdivision of the Institute, formally designated as biophysics and opened in 1927 under Ralph W. G. Wyckoff, undertook to study the biological applications of X-ray crystallography. This was a new method of studying the atomic structure of chemical elements and compounds, developed in 1912 by Max Laue of Berlin and Sir William Bragg of London. It was based on the fact that crystalline materials act as diffraction gratings for X rays by virtue of the regular spacing of their atoms or molecules, exactly as closely ruled lines on a glass plate produce a visible spectrum by diffracting ordinary light. Thus any crystalline substance will deflect an X-ray beam passing through it, and produce on a photographic film a regular geometric pattern characteristic of the kinds and arrangement of atoms or molecules of which it is composed.

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