their problems was equally marked, and equally rewarded.

Lord Bledisloe will long be remembered with affection by those who were privileged to know him, and with deep respect by the many who in farms, villages or research stations had benefited by the encouragement he always gave to those trying to raise the standard of country life.

E. John Russell

Dr. Rosalind E. Franklin

The news of the death of Rosalind Franklin on April 16 came as a shock to many workers in the field of biochemistry and virus studies. It is a special tragedy when a brilliant research worker is cut off at the height of her powers and when exciting new discoveries are expected from her.

Rosalind Franklin was born in London on July 25, 1920, the elder daughter of Mr. and Mrs. E. A. Franklin. She was educated at St. Paul's School, London, and Newnham College, Cambridge, and started her scientific career after studying physical chemistry at Cambridge. Her first employment was in the British Coal Utilization Research Association, where she worked under Bangham on the colloidal properties of cokes and chars. She showed that although the total volume of the pores in the coal increases continuously with increasing temperature, their accessibility decreases, so that finally even helium molecules are unable to penetrate them.

It must have been apparent to her then that it would be impossible to reach an understanding of coals and chars without the use of X-ray diffraction methods. These she was able to acquire when she transferred in 1947 to the Laboratoire Centrale des Services Chimiques de l'État in Paris. Her three years in Paris working with Méring taught her to appreciate the value of monochromatic X-rays for low- and high-angle studies of amorphous substances where bands of indefinite intensity replace the sharp spots given by the more perfect crystals. It was, however, a combination of these analytical techniques with chemical preparatory skill that enabled her to unravel the major processes concerned with the transformation of practically all organic substances into different kinds of chars on heating. In a series of beautifully executed researches she discovered the fundamental distinction between carbons that turned into graphite on heating and those that did not, and further related this difference to the chemical constitution of the molecules from which the chars were made. These studies are of fundamental interest both for the old industry of coking and for the new one of graphite moderators in atomic piles.

Miss Franklin might well have remained in this field in which she had made her name, if she had not been more attracted to that of biophysics, where she was able to turn her newly developed skills to investigate the structure of large molecules of biological importance, particularly in nucleic acids and the viruses.

In 1951 Miss Franklin was awarded a Turner–Newall Fellowship to work at the newly established Biophysical Laboratory at King's College, London. Without any previous biological experience, but with a great grasp of X-ray techniques and their chemical implications, she arrived at a fortunate moment, when X-ray crystallography was breaking away from the more limited field of the study of regular crystals to those in which the molecules were only partially ordered, and in particular those in which the essential form was that of the spiral. Her first paper in this field was one of three in which the first was the now classical paper of Watson and Crick on the double-spiral hypothesis for the structure of deoxyribonucleic acid. In this close collaboration between the Cambridge and London schools it is difficult to disentangle all the contributions of individuals, but what Miss Franklin had to give was the technique of preparing and taking X-ray photographs of the two hydrated forms of deoxyribonucleic acid and by applying the methods of Patterson function analysis to show that the structure was best accounted for by a double spiral of nucleotides, in which the phosphorus atoms lay on the outside.

In 1953 Miss Franklin left the Unit at King's College to take up the direction of research on virus structure at Birkbeck College, London, where her work was supported first by the Agricultural Research Council and later by the United States Department of Health. Here her main study was on tobacco mosaic virus. She took up its X-ray study where it had been left in the work of Bernal and Fankuchen fifteen years before, using her improved techniques. Watson had put forward the hypothesis that the virus structure was also spiral, but one of quite a different order from that which existed in proteins and in deoxyribonucleic acid. Miss Franklin, with the help of very much better X-ray photographs than had hitherto been obtained, was able in essence to verify this hypothesis and to correct it in detail. It was at this point that the extremely fruitful co-operation began between Miss Franklin's unit and Fraenkel-Conrat at Berkeley, Caspar at Yale, and Schramm at Tübingen. Using the method of isomorphous replacement, she showed that the virus particle was not solid, as had previously been thought, but actually a hollow tube. Miss Franklin's greatest contribution to this study was to compare the radial density map of the intact tobacco mosaic virus with that of the nucleic acid-free particles, in which the protein units had been re-aggregated without the ribonucleic acid. This showed that the ribonucleic acid was not to be found in the central cavity but embedded in the protein.

It would also appear from work still unpublished at the time of her death that the ribonucleic acid is in the form of a single strand, following the spiral of the virus particle, thus being very different from the double-wound helices of the deoxyribonucleic acid of the bacterial viruses and higher organisms. The combined methods of chemical preparation and X-ray examination in the hands of Miss Franklin and her associates was a valuable, and indeed a decisive, weapon in the analysis of these complex structures.

As a scientist Miss Franklin was distinguished by extreme clarity and perfection in everything she undertook. Her photographs are among the most beautiful X-ray photographs of any substance ever taken. Their excellence was the fruit of extreme care in preparation and mounting of the specimens as well as in the taking of the photographs. She did nearly all this work with her own hands. At the same time, she proved to be an admirable director of a research team and inspired those who worked with her to reach the same high standard. Her devotion to research showed itself at its finest in the last months of her life. Although stricken with an illness which she knew would be fatal, she continued to work right up to the end. Her early death is a great loss to science.

J. D. Bernal