

authors and their eminent leader have not given their careful attention to the X-ray evidence which has been so well described by Dr. Kathleen Lonsdale. This demands a nearly continuous spectrum of vibrational frequencies in the crystal quite contrary to Raman's theory. Krishnan, moreover, ignores the continuous background to the Raman spectrum of sodium chloride observed by Fermi and Rasetti<sup>8</sup> and stresses only the lines which are superimposed on the background. The lattice theory developed by Born (*loc. cit.*, p. 309) provides an explanation of the X-ray results and also of the small number of lines in the Raman and absorption spectra of crystals. There does not, therefore, seem to be any necessity for introducing arbitrary assumptions into the dynamical theory in order to reduce the number of normal modes of vibration to a few discrete frequencies.

G. D. PRESTON.

<sup>1</sup> Einstein, *Ann. Phys.*, **22**, 180 (1907).

<sup>2</sup> Debye, *Ann. Phys.*, **39**, 789 (1912).

<sup>3</sup> Born and v. Kármán, *Phys. Z.*, **13**, 297 (1912).

<sup>4</sup> Lonsdale, Reports on Progress in Physics, **9**, 256 (1943).

<sup>5</sup> Born, Reports on Progress in Physics, **9**, 294 (1943).

<sup>6</sup> Raman and others, *Proc. Indian Acad. Sci. Bangalore*, 1-102 (1943).

<sup>7</sup> Lederman, *Proc. Roy. Soc., A*, **182**, 362 (1944).

<sup>8</sup> Fermi and Rasetti, *Z. Phys.*, **71**, 689 (1931).

## OBITUARIES

### Sir Joseph Arkwright, F.R.S.

JOSEPH ARTHUR ARKWRIGHT, an honorary member of the staff of the Lister Institute of Preventive Medicine and a former member of the Medical Research Council and of the Agricultural Research Council, died on November 22 after a short illness, a few weeks after the death of his friend and colleague, Sir John Ledingham. He was the son of the late Arthur William Arkwright, of Broughton Astley, Leicestershire, and was born on March 22, 1864. He was educated at Wellington College, and Trinity College, Cambridge, and pursued his medical studies at St. Bartholomew's Hospital, London, qualifying in 1889 and graduating M.D. in 1895.

Arkwright had a many-sided and distinguished career. After postgraduate work at St. Bartholomew's, the Victoria Hospital for Children, Chelsea, and the West London Hospital, he engaged for some years in general practice, chiefly at Hales Owen, Worcestershire; but in 1905 he renounced this work to join the staff of the Lister Institute, first as a voluntary research worker and from 1909 onwards as assistant bacteriologist. He retired from active duty in 1927, but continued to work at Chelsea as an honorary member of the staff. He was elected a member of the governing body of the Institute in 1932 as the representative of the Royal Society and served until January 1 of this year, when the Board recorded its high appreciation of the value of his wise counsel during the period of his service.

Arkwright's work at Chelsea was interrupted by the War of 1914-18 when, after investigating an epidemic of cerebro-spinal meningitis among troops encamped on Salisbury Plain in 1915 and recording his observations on the grouping of meningococcus strains that were isolated, he served in the R.A.M.C. with the rank of major as pathologist at St. George's Hospital, Malta, where with Dr. E. A. Lepper he investigated the occurrence of blackwater fever in the Eastern Mediterranean area. In 1918 he was appointed a member of the War Office Committee on

Trench Fever, and with his colleagues, Bacot and Duncan, demonstrated the constant association of the virus of trench fever with *Rickettsia quintana* in lice. In 1922 he accompanied Bacot to Egypt at the request of the Egyptian Government, to investigate the etiology of typhus fever. After two months work in Cairo, both contracted the disease, to which Bacot unfortunately succumbed; Arkwright recovered from a severe and hazardous illness. Previously, in 1920, he had carried out a series of investigations on foot-and-mouth disease under the auspices of a committee appointed by the Ministry of Agriculture and Fisheries and later became chairman of this committee, as also of the Agricultural Research Council's *Brucella abortus* Committee and the joint committee with the Medical Research Council on tuberculosis.

The subject, however, with which Arkwright's name will always be associated is that of bacterial variation, and his fundamental and luminous researches on the forms of bacteria that he named the "S" and "R" variants, embodied in an outstanding communication to the *Journal of Pathology and Bacteriology* in 1921, gave a new impetus to research in this direction. He was also deeply interested in the carrier problem, and his book, "The Carrier Problem in Disease", published in collaboration with the late Sir John Ledingham, was an important contribution to this subject. He also contributed freely to the Medical Research Council's "System of Bacteriology" and to numerous scientific journals.

Arkwright's active and versatile mind found many channels for its expression. He was appointed a member of the Medical Research Council in 1930 and of the Agricultural Research Council on its inception in 1931. His public-spirited and useful work in these directions only terminated in 1940, when in his seventy-sixth year he retired from the latter of these offices. He was made a fellow of the Royal College of Physicians in 1916 and served on the Council during 1929-31. He was elected a fellow of the Royal Society in 1926, and the honour of knighthood was bestowed on him in 1937 for his outstanding scientific achievements.

Arkwright had a charming personality and extended an ever-helping hand to the younger workers at the Lister Institute, to whom he was a source of encouragement and inspiration. Apart from his special studies he had a broad cultural and scientific background and was a field naturalist of no mean ability, possessing an exceptional knowledge of field botany and of horticulture, and a good working knowledge of other branches of natural science. He married in 1893 Ruth, daughter of the late Joseph W. Wilson, who, with their three daughters, survives him.

R. ST. JOHN-BROOKS.

### Dr. G. A. Tomlinson

WE regret to record the death of Dr. George Arthur Tomlinson, a principal scientific officer at the National Physical Laboratory, on December 1, after a short illness.

Tomlinson was born on January 7, 1885, and educated at Nottingham High School, passing on to University College, Nottingham, where he took the degree of B.Sc. (London) in engineering, with first-class honours. He then spent two years as a research student at St. John's College, Cambridge, on post-graduate research. He also gained honours in electrical engineering in the City and Guilds (London) exam-