of liquid and solid dielectrics (for example, absorption and dispersion should be very large). This interval of frequencies also presents great interest for the study of the mechanical properties of solids and more particularly liquids. This can be done by investigating the propagation through them of artificially produced ultra-sonic or hyper-sonic vibrations the frequency of which approaches that of their heat movements. The process of transforming electrical into mechanical vibrations has already been worked out; what remains is to increase further the frequency of radio-waves. During the last three or four years there has opened up a new way of attacking this interesting and important work by the use of klystrons and other electronic apparatus.

Summarizing, we see that the most interesting problems in physics are those connected either with limiting or with intermediate properties of material bodies. This conclusion holds also for other sciences besides physics, and further, the most topical problems are concerned not with those phenomena which are studied by definite specialized sciences, but with those borderline phenomena which fall between them. It is thus perfectly natural that these problems, besides being the most complicated, are also the least studied. A particular example of this is biophysics, the problems of which have been intensively studied by physicists for some time. In recent years, physics has attracted biologists to help in the solution of these biophysical problems, but physicists have not themselves shown much interest (if we except the physiological aspects of optics and acoustics). I am inclined to think that in the very near future this position must undergo a definite change, and that this part of the science front must conduct an extensive battle for new knowledge. I shall not attempt to enumerate the problems of biophysics because they are innumerable. Besides problems about the properties of gels mentioned above, there are those concerning photosynthesis, nervous and mental activity and electro-physiology (in particular, electrical vibrations in the brain). Finally, not the least interesting problem is that of the mechanics of living organisms (for example, the locomotion of animals and insects).

Not long ago, physical chemistry occupied the intermediate position which is now occupied by biophysics. At the present time, the formerly borderline phenomena have been completely assimilated into physics.

In its impetuous rush of growth, physics has of course been unable to prevent itself encroaching on the region long considered the province of chemistry. In distinction from chemistry, which is a science of materials and their transformations, physics, like sciences of other phenomena connected with matter, has lost this sense, by 'going behind' chemistry in discovering the structure of the chemical atom-elements and showing how to cause their artificial transmutation. In this way, chemistry has become a branch of physics, though it is true one of the largest, most interesting and practically the most important branch. In an exposition of the problems of modern physics, it would therefore be quite appropriate to include also the basic problems of chemistry. I shall, however, leave those problems which belong to chemistry in its narrow sense and pass on to those of the modern 'alchemy' which concern the atomic nucleus.

(To be continued.)

OBITUARIES

Dr. W. A. K. Christie

HIS numerous friends will receive with the greatest regret the news of the unexpected death of Dr. William Alexander Kynoch Christie, which took place in London on June 16, after a very short illness.

Christie was the youngest son of Charles Robert Christie and Margaret Catherine Paterson, both of Edinburgh, where he was born on October 2, 1882. He was educated at Daniel Stewart's College and Heriot's, Edinburgh, and then in succession at the Universities of Edinburgh and Zurich, where he took the degrees of B.Sc. "with special distinction in chemistry", and Ph.D. respectively.

After acting as Prof. Crum Brown's private assistant, Christie went to the Mond Nickel Co. in South Wales, until he was appointed to the staff of the Geological Survey of India to fill the newly created post of chemist to the Department. He took up his appointment in Calcutta on November 17, 1906. This he held until his retirement from the service on October 10, 1932, after a service of nearly twenty-six years, of which slightly more than five years was spent away from the Department. Of this, nearly two and a half years was during the War of 1914–18 in the Indian Army Reserve of Officers, from which Christie was drafted to the Special Reserve of the Royal Engineers in France, where his chemical knowledge was used in the service of his country.

With other officers of the Geological Survey who had gone to the War he was recalled in 1917, owing to the growing realization of the need of geologists and chemists to help in the production of war minerals. In April 1918 Dr. Christie's services were placed at the disposal of the Government of India in the Finance Department, whereon he was posted to His Majesty's Mint, Calcutta, as deputy assay master, later acting as assay master. He reverted to his post in the Geological Survey at the end of 1920.

In 1936, after a few years in retirement in England, Dr. Christie was again employed by the Government of India, this time as civilian technical officer in the Principal Supply Officer's Committee (India) under the Defence Department, India. He was in England on deputation at the outbreak of war in 1939 and was retained at the India Office, where he was still described as a civilian technical officer, a post he held until his death. In 1930 Christie married Miss Winifred Davidson, who survives him.

Christie's scientific activities were not confined to his official appointments, as is shown by the fact that he was a fellow of the Royal Institute of Chemistry, a member of the Institution of Mining and Metallurgy, a fellow and, in 1927, president of the Asiatic Society of Bengal.

Christie was one of those specially useful men of science who are qualified in two sciences, in his case chemistry and geology. While his chemical knowledge took priority and justified his various employments outside the Department, his wide knowledge of geology and mineralogy made him a valuable member of the Geological Survey of India, as he was often able to offer sound advice both to individual officers and to his director on problems involving both chemical and geological knowledge. With this scientific versatility Christie combined a proficient knowledge of French and German, both spoken and written, and an interest in the literature of both countries.

An additional facet of this versatility was Christie's

wide knowledge of, and sympathy for, his fellow men. Not only did these qualities cause him to give help unobtrusively to 'lame ducks' both inside and outside the department—no one ever asked his help in vain—but it also caused successive directors of the Survey to value his opinion on matters not strictly chemical or geological. They also made him a valued member of club committees (the Bengal United Services Club, Calcutta, of which he was at one time president, and the East India and Sports Club in London). Everyone who knew Christie will remember his ready wit and mastery of apt phrase. As an example one may recall that on one occasion the late H. S. Bion, very early in his service, telegraphed from the field that he had at last discovered calcareous algæ in the Lower Eocene of Burma. Christie suggested that the director should reply "The whole Department shares your ecstatic joy".

As chemist to the Geological Survey of India much of Christie's time was used on routine work and work for other officers; but on all occasions where ingenuity was needed he proved to be a prince of experimenters, the accuracy of whose work could be trusted to the last recorded decimal.

The total amount of work published from Christie's pen is small, but it is of the highest quality. His greatest achievement was the sampling of the winds of the Rajputana desert during the hottest season of the year, when shade temperatures up to 120° F. and more are registered. The then director of the Geological Survey, now Sir Thomas Holland, had instituted a detailed study of the salt reserves of Rajputana, particularly of Sambhar Lake. He had decided that a probable explanation of this large accumulation of saline materials was carriage by hot-weather winds from the salt-encrusted arm of the sea known as the Runn of Cutch. Christie volunteered to test this hypothesis and went to Pachbadra (intermediate between the Runn of Cutch and Sambhar), where he was aided by the late Rao Bahadur M. Vinayak Rao. All Christie's instrumental ability was brought into play, and, using methods that he had first worked out and apparatus that he had designed and tested in the laboratory in Calcutta, he sampled the wind at Pachbadra during April–July 1908. As a result he was able to show that during the hot weather of that year the amount of sodium chloride in the form of fine dry dust coming from the south-south-west that passed a front 300 km. broad and 100 m. high during the four hot-weather months might be indicated as 130,000 tons. This was in a year when the hot weather winds were unusually weak, so that this figure is probably well below the annual average influx of salt dust. The results of this study are discussed in a joint paper by Holland and Christie (*Rec. Geol. Surv. Ind.*, **38**, 154; 1909).

Christie also visited and discussed the soda lake of Lonar in Berar, and the well-known salt deposits of the Salt Range, in the latter case studying specially the potassic layers.

Another investigation of some interest was of a white efflorescence collected by me at the fissured surface of the Barari colliery, Jharia, then on fire underground. The mineral proved to be cryptohalite, a fluo-silicate of ammonium previously found only at a Vesuvian fumarole; its occurrence, with native sulphur, recalled the long-abandoned hypothesis that volcanoes owed their activity to the combustion of coal underground (*Rec. Geol. Surv. Ind.*, **59**, 16, 233; 1926).

L. L. FERMOR.

Sir John Jarmay, K.B.E.

THE death of Sir John Gustav Jarmay on August 22 at the age of eighty-seven probably removes the last of those heroic figures who, with Ludwig Mond and John Brunner, struggled to found the ammonia soda industry in Great Britain and in the end established our greatest and most successful chemical industry. A Hungarian by birth, he studied at Zurich and came to England in 1875, working for a short time with Roscoe before he obtained a junior position with Greenall Whitley, the Warrington brewers. Ludwig Mond, who lived at first outside Widnes and later at Winnington, must have come across him and brought him in to help in 1877, four years after the start. It is a pity that no one has put these early days on record, days of continuous effort round the clock, of many failures and difficulties and always the courage of Ludwig and Frieda Mond to try again. Another helper was Carl Markel, tutor to Robert and Alfred Mond, a swarthy Stuttgarter of great originality. Jarmay made good and was chief technical manager when Brunner Mond was formed as a company: eight years later he joined the board of the company.

The expansion was rapid, but the technical progress was veiled in reticence and only through patents, many of which bore Jarmay's name, could the outside world glimpse what was happening. Close contact was kept with Solvays at Brussels, and there were developments in the United States and elsewhere, but the real hub of alkali progress was at Winnington. There Jarmay reigned and led a loyal and expanding team. When Ludwig Mond died in 1909, Jarmay took on added responsibility, and he continued to hold the reins firmly until the formation of Imperial Chemical Industries, Ltd.

Naturally he was one of the first consulted by Lord Moulton in 1915, and assumed responsibility for the production of nitrate of ammonia, T.N.T. and phenol. He achieved much and was recognized by the award of the K.B.E.: about the same time the war services of his wife earned her the D.B.E.

It is to Jarmay's credit that the need to establish nitrogen fixation plant in Great Britain was recognized as one which Brunner Mond were in honour bound to study, though it was a task outside their normal business and bound to be arduous and costly. The great works at Billingham and elsewhere to-day are a monument to his wise decision.

Jarmay was married in 1882 to Charlotte Elizabeth Wyman, a lady of great charm, who was of the utmost assistance to him: she made their house at Hartford Lodge the social centre of the staff. She died in 1938.

Jarmay the man looked an aristocrat to the fingertips. He hunted a good deal and was noted for his immaculate appearance in the hunting field—locally he was affectionately known as "The Squire". He spent his holidays abroad, being never more happy than when among the mountains and snowfields. On his retirement he lived in Italy until the outbreak of war.

E. F. ARMSTRONG.

Mr. Henry W. J. Hathaway

HENRY WILLIAM JOHN HATHAWAY, who was killed accidentally on July 4, was born in London on October 27, 1915. He was educated at the Polytechnic School, Regent Street, London, and at the Imperial College of Science and Technology, South Kensington, where he read chemistry and geology, and took his B.Sc.