British Association, would it not be in the best interests of science to remember the failures as well as the successes, and to encourage all serious workers in important fields of research to furnish in the common cause a record of their work, even when their aim has not been achieved, giving a faithful account of all the difficulties and all the efforts made to surmount them? Who knows but that many of the so-called failures of yesterday may only be waiting for other hands to-day to carry them on to a greater success than the world has yet known? Left to themselves they will lie in oblivion, yet, for all we know, two of them may fit together and provide the answer to one more of the riddles of the universe.

Knowledge forms the working tools of science, and my proposal is in no way aimed at giving the scientific workers of to-morrow an easy task. They will probably have a far more difficult task than ours, but I do not think it fair to condemn them to spend part of their time in a preliminary and possibly fruitless search for tools which we have forged and hidden.

"As one lamp lights another, nor grows less," science of to-day will partly fail in its clear duty if it fails to pass on to to-morrow any of the knowledge which it has been privileged to acquire, or if it forgets that it is for to-morrow, rather than to-day, to assess the true value of to-day's success and failure.

Obituary.

PROF. W. EINTHOVEN, For. Mem. R.S.

PROF. WILLEM EINTHOVEN, whose death on Sept. 28 at the age of sixty-eight years has been announced, was one of the foremost of modern physiologists. For nearly forty-two years he has been professor of physiology at Leyden, Holland, being invited to succeed Heynsius in November 1885, and actually taking up his duties, after passing his final State examination in medicine, on Feb. 24, 1886. For the first twenty years of his office the chair of physiology was combined with that of histology.

Einthoven was born in Semarang, in the Dutch Indies, where his father was in medical practice. After his father's death, his mother with her six children settled in Utrecht, where Einthoven was educated at school and as a medical student in the University. He spoke with gratitude of his teachers there, particularly of the physicist Buys Ballot, and then of the anatomist Koster, the ophthalmologist Snellen, and the physiologist Donders. His first scientific investigation was carried out with Koster on the mechanism of the elbow joint; he assisted Snellen both in private practice and in the clinic; and in 1885 his dissertation, "Über Stereoskopie durch Farbendifferenz," was approved by Donders for the degree of doctor of medicine.

Einthoven's investigations cover a wide range, but they are all notable for the same characteristic —the mastery of physical technique which they show. Einthoven, in spite of his medical training and his office, was essentially a physicist, and the extraordinary value of his contributions to physiology, and therewith indirectly to medicine, emphasises the way in which an aptitude—in Einthoven's case a genius—for physical methods can aid in the solution of physiological problems. His papers are published in the *Nederlandsch Tijdschrift voor Geneeskunde*, *Archives Néerlandaises*, *Archives Internationales de Physiologie*, *Brain*, *Quarterly Journal of Experimental Physiology*, *Annalen der Physik*, and especially in *Pflüger's Archiv für die gesammte Physiologie*. He wrote an article in Heymann's "Handbuch der Laryngologie und Rhinologie," and edited ten volumes of "Onderzoekingen Physiologisch Laboratorium, Leiden."

Einthoven's name is connected chiefly with the string galvanometer and the electrocardiogram. The potential differences involved in the electrical phenomena of the heart beat are fractions of a millivolt and occur in thousandths of a second. The problem of recording these small and fleeting changes, previously attempted without complete success with the capillary electrometer, was solved in 1903 by the invention of the string galvanometer; to-day there are hundreds, probably thousands, of these instruments all over the world, and they have been applied not only to their original purpose of registering the action current of the heart (and incidentally of muscles, nerves, and retina), but also to such diverse uses as finding the velocities of shells, receiving and recording wireless signals, and locating enemy guns; and I believe it is true that Einthoven never received any material profit from his invention. In 1909 he published the first complete description of the instrument, while in the last few years, employing fibres of almost ultramicroscopic size working in a high vacuum, he has succeeded, in collaboration with his son, an electrical engineer, in recording potential changes of frequencies of the order of 100,000 per second. It may be mentioned also that recently, by means of fibres of extreme thinness, he was able to register directly, and with very little distortion, sound waves of more than 10,000 vibrations per second.

Einthoven's most important work, for which he was awarded the Nobel Prize in 1924, was his discovery of the mechanism, of the manner of production, of the electrocardiogram and its characteristic waves. In many directions the diagnosis of maladies of the heart has improved in recent times, but the greatest single advance was made by Einthoven in applying the string galvanometer to the investigation of the electrical phenomena of the normal heart-beat. This work was followed up, particularly by Sir Thomas Lewis in London, and has resulted in a clearer understanding of the cause of some common disorders of the heart, and in improvement in their treatment.

Of the more personal side of Einthoven's life one might write of the grace, beauty, and simplicity of his character. He spoke with ease three languages as well as his own; he was a regular attendant at international gatherings; he threw all his influence on the side of good international relations in science. Last summer he was present at the International Congress of Physiology at Stockholm, and attended the various functions, and took part in many of the excursions, including a trip to the north of Sweden and back by sea along the Norwegian coast. It was a wonderful thing to be his guest and to enjoy the delightful hospitality of his home. He invited me some years ago, while we were attending a German congress of physiologists at Tübingen, to stay with him at Leyden on my way back to England. We arranged to meet at a station in North Germany and to travel the last part of the journey together. I waited until his train arrived. He came literally running along the platform to meet me, seized my bag out of my hand, carried it to the carriage, where he had kept me the best seat, and made me feel that whatever the difference of our age and position, I was from that moment his honoured guest. In 1924 we sailed together to America, and at night under the starlit sky we walked on the upper deck discussing the random movements of electrons in conducting fibres and other matters equally strange. These personal details will emphasise what a loss his passing will be, not only to his older colleagues and to his younger friends, but also to all the good fellowship of physiologists throughout the world.

Einthoven was elected an honorary member of the Physiological Society in 1924, and in return he invited the Society to hold one of its meetings in his laboratory. The occasion will be a happy memory in the minds of those who were able to go to Leyden in April 1925. In 1924 he visited the United States to deliver a course of lectures at Boston, and while there, the award to him of the Nobel Prize for medicine for 1924 was announced. He was elected a foreign member of the Royal Society in 1926.

A. V. H.

PROF. SVANTE ARRHENIUS, FOR. MEM. R.S.

THE annals of physical science bear abundant testimony to the native genius and energy of Sweden, and in this respect Svante August Arrhenius, who has just passed away, upheld with honour and distinction the reputation of his country. Born near Upsala in 1859, as the son of a land steward, Arrhenius obtained his early education in the school and university of that town, moving later to the University of Stockholm, the atmosphere of which was more congenial and stimulating to the young physicist. His researches there on electrical conductivity and its relation to chemical activity, although lightly esteemed by the Upsala professors, brought him recognition abroad, whilst the theory of electrolytic dissociation, put forward in 1887 during his *Wanderjahre*, secured for him an established position in international science.

During these *Wanderjahre*, with financial support provided by the Swedish Academy of Sciences, Arrhenius visited quite a number of active research centres. Thus he worked with Ostwald at Riga, and later at Leipzig (the laboratory which van 't Hoff in 1888 termed the 'Hauptagentur fur Ionenspaltung'), with Boltzmann at Graz, with Kohlrausch at Würzburg, and with van 't Hoff at Amsterdam.

Refusing an invitation to settle at Giessen, Arrhenius returned to Sweden in 1891, and acted first as lecturer and afterwards as professor in the newly established Technical High School at Stockholm. Somewhat later he acted as Rector of the same institution for a number of years. Giessen was not the only foreign university which made an effort to secure Arrhenius, for in 1905 he was invited to Berlin. This honour was likewise declined, and in the same year he was appointed Director of the Nobel Institute at Stockholm. Arrhenius occupied this position up to the time of his death, and the numerous communications published by the Institute bear witness to the activity of this centre of research under his inspiring leadership.

Arrhenius was a frequent visitor to England, and although his scientific views met with a critical reception in various quarters, his genial and attractive personality made him always a welcome guest. His work secured extensive recognition from British scientific bodies, and he was a foreign member or honorary fellow of the Royal Society, the Chemical Society, the Physical Society, and the Royal Institution. Honorary degrees were conferred on Arrhenius by the Universities of Oxford, Cambridge, Birmingham, and Edinburgh, whilst the Royal Society awarded him the Davy Medal in 1902, and by invitation of the Chemical Society he delivered the Faraday Lecture in 1914.

In Europe and America also his international standing was marked by his election as corresponding member of numerous academies and learned societies, whilst honorary degrees were conferred on him by the Universities of Heidelberg, Groningen, Oslo, and Leipzig. Further, he was the recipient of the Nobel Prize for chemistry in 1903.

The honoured place which Arrhenius occupied in physical science was without doubt mainly due to his bold and original ideas on the condition of dissolved electrolytes, as expressed in his theory of electrolytic dissociation, and it is on this ground that he is justly regarded as one of the founders of modern physical chemistry. The genesis of this theory in Arrhenius's mind, on the basis of his own experimental work and in correlation with van 't Hoff's researches on osmotic pressure, is worth recalling, for it constitutes one of the most interesting chapters in the history of physical chemistry.

Investigation of the electrical conductivity of forty to fifty substances in dilute aqueous solution had led Arrhenius in 1883 to two striking conclusions: (1) that in regard to conduction of the electric current only part of the electrolyte is to be regarded as 'active,' this proportion increasing on