guinea-pigs fail one, in spite of all efforts, and for such occasions a good sample of dried complement would be invaluable.—I am, etc.,

L. A. P. ANDERSON,
Major, I.M.S.

Cambridge, Sept. 17th.

FELO-DE-SE.

SIR,—I would thank your correspondent "Medico-Legal" for his interesting reply (October 1st, p. 614) to my previous letter (September 17th, p. 518). The brevity of my letter appears to have left "Medico-Legal" insufficiently informed. For obvious reasons I did not ask you to publish the evidence which I gave to the coroner, though I did submit it to you for your own information; this possibly explains the fact that the reply in your footnote was more emphatic than that of "Medico-Legal." There was no *post-mortem* examination. My evidence included the statement: "The operation performed proved that the deceased was not pregnant and that she had not recently been so." This statement was accepted by the coroner without question. There was no evidence of importance other than mine. The proved or accepted facts were that, though the woman believed herself to be pregnant, she was not in fact so; that it was her intention to procure abortion; and that no other person was concerned in the act which caused her death. I note with satisfaction that "Medico-Legal" confirms my own opinion that, even had the verdict *felo-de-se* been according to law, such a verdict should not have been returned except after an inquest before a jury. It is, of course, not for me to appeal to the Lord Chancellor for a fresh inquest, and I doubt if the relatives will consider such a course expedient.—I am, etc.,

SYDNEY A. WINSTANLEY.

Manchester, Oct. 2nd.

"ETHER CLONUS": ALDEHYDE AND PEROXIDE.

SIR,—In a letter under the above heading in your issue of September 24th (p. 566) Mr. H. Edmund G. Boyle draws attention to the dangers arising from the production of aldehyde and peroxide when oxygen or a mixture of $O+N_2O$ is passed through ether during its administration for anaesthesia.

The production of peroxide under these conditions is well known to chemists, and it is important that it should be also understood by anaesthetists. There is a further point which is at least equally important—namely, that the rate of formation of peroxide increases greatly as the amount present increases; consequently an ether which contains initially even minute amounts of aldehyde or peroxide will be much more prone to this change than one which is free from it. I draw attention to this matter to emphasize the fact that an amount of peroxide which is undetectable by the *B.P.* test, to which Mr. Boyle refers, will still suffice to accelerate this change. Consequently much more delicate methods of detecting must be applied if the purity of ether is to be maintained at the standard needed for perfect anaesthesia. Details of a delicate method of testing, based on the use of ferrous thiocyanate, were worked out in these laboratories and published in the *Year Book of Pharmacy* (1924, p. 615).

The late Mr. S. R. Wilson of Manchester, in a paper on "Ether convulsions," published in the *Lancet* of May 28th, concluded that "the convulsions are toxic in origin and due to the presence of impurities in ether," and he also advocated the precautionary measure of using only pure ether.

In my view Mr. Boyle is right in drawing attention to the significance of minute amounts of impurities, but in defining pure ether we have to look to a much higher standard of purity than that secured by adopting the *B.P.* test used by Dr. W. Inglis Clarke as mentioned in Mr. Boyle's letter.—I am, etc.,

FRANCIS H. CARR,
The British Drug Houses, Ltd.

London, N., Sept. 27th.

COURTESY CALLS.

SIR,—I was interested in Dr. Rawdon Smith's letter on the subject of courtesy calls (September 17th, p. 520). Some years ago I joined an old established practitioner as partner, and paid the usual calls on neighbouring practitioners. Not one of them returned my visit, and one gave me a very gloomy impression of the prospects of success in the district, and even recommended me to give up the idea of practising in the neighbourhood! I may have had an unfortunate experience, but if newly settled practitioners are accorded the same aloofness I was I am not surprised that courtesy calls are unpopular duties and often shirked.—I am, etc.,

M.B., D.P.H.

September 18th.

Obituary.

WILLEM EINTHOVEN, M.D., PH.D.,

Professor of Physiology in the University of Leyden.

THE death of Willem Einthoven, announced on September 29th, robs mankind of one of its most distinguished physiologists. Trained at Utrecht, he was appointed at the early age of 25 to the chair of physiology at Leyden; this post he held till this his 67th year. Unusually well trained and able in physics, Einthoven directed himself mainly to the development and perfection of recording instruments. Amongst these the most renowned is his famous string galvanometer. Starting his researches on the basis of the d'Arsonval galvanometer, he moved to the principle of Ader's instrument for recording submarine signals, an instrument which consisted of a very long single wire suspended vertically between the poles of a magnet. By greatly increasing the strength of the magnetic field, by introducing relatively short and very thin, and therefore light, fibres, and by using an optical projection system of high magnification, he eventually constructed a galvanometer greatly surpassing all previous instruments in sensitivity and quickness of movement. More than twenty years were given to the perfection of this instrument, and of the subsidiary apparatus such as recording cameras and time signals; and he thus created a piece of apparatus which of its kind was of unparalleled delicacy and accuracy. The records yielded by his instrument directly represented in curvilinear form the changes in the flow of current from instant to instant, requiring no analysis, as did curves previously won by means of the highly developed capillary electrometer. It was this feature of quick response, with the consequent direct representation of current flow, that rendered his instrument peculiarly applicable in clinical observation. Einthoven's models formed the basis of the well known commercial models now in use in the hospitals and laboratories of five continents; but the sensitivity of Einthoven's own models has continued until the present time to outstrip by far that of all similar instruments.

Einthoven did more than place his wonderful apparatus at the disposal of other workers. He pointed to many of the ways in which it might be employed. Amongst these he called attention particularly to its capacity to portray the electrical events happening in the human heart. Modern electro-cardiography, and the analysis of irregular heart action by galvanometric means, may rightly be said to have been inspired by, and in large part founded upon, two papers of his published in 1906 and 1908. His adoption of separate leads, pairing the three sets of adjacent angles of an approximately equilateral triangle, and his theoretical calculations of the line of the heart's electrical axis from the resultant curves, has proved fundamental to much later work.

The application of Einthoven's galvanometer to the study of the physiology and pathology of the heart beat followed quickly upon his description of the method; its full application to the study of electrical phenomena in other organs of the body has been more delayed. He himself illustrated the value of the instrument in recording the electrical events in nerve and other structures; for example, he succeeded in displaying impulses passing at each beat of the heart from this organ through the vagus nerve to the brain.

As early as 1894 he and Geluk described a method of registering heart sounds. Later he adapted the string galvanometer to the same purpose, a method that has been extensively and fruitfully followed up by others. In the

last years of his life he brought sound recording to a pitch of extraordinary perfection, using to this end a fibre so light that it responded directly to the sound waves agitating the atmosphere in which it lay, its movements being of sufficient amplitude to be recorded photographically. These were among the greatest of his achievements, though they by no means exhaust them.

Einthoven's renown grew steadily, and in recent years has found expression in many public honours conferred upon him; these culminated in the award of the Nobel prize for medicine in 1924, and, in this country, in his election last year to be a foreign member of the Royal Society.

Einthoven's work will be remembered for all time for the greatness of its contribution to method of observation. Einthoven himself will be remembered by those who knew him personally for his fascinating personality. A man of simple, almost of humble, habits, he was untiring in his work, in its exposition, and in the study of related problems. He awakened in both friends and associates a profound admiration by his genius, by the charming simplicity of his character, by his touching if not childlike modesty of thought and manner, by his patience, by his natural and profound courtesy, by the warmth of his hospitality to those privileged to enter his home, by his unswerving devotion to truth in the most exacting sense. These noble qualities endeared him to all who knew him at all intimately.

THOMAS LEWIS.

Einthoven was born in 1860 in Samarang (Java), where his father was a medical practitioner. After his father's death in 1870 his mother brought her six children home to Holland and settled in Utrecht, where he was educated. He became a student of medicine there in 1878, and after completing his course was assistant to Snelling, and to Donders in the physiological department. From that appointment he was called to the chair of physiology at Leyden, where he spent the remainder of his life.

We are indebted to Dr. LEONARD HILL for the following brief reminiscence of a recent visit to Einthoven's laboratory.

It is just a year ago since I stood in Einthoven's laboratory in Leyden and was shown by him his last form of string galvanometer, in which the string was stretched in a vacuum and, so light and delicate was it, that the photographs of the string showed a ceaseless Brownian movement. Einthoven had there an instrument so responsive that he needed no valves to magnify the electrical effects which he wished to record, and he discountenanced the use of such valves as likely to distort the true reaction. He was then engaged in recording the electrical variations of the sympathetic system of nerves in the living animal—variations set up by natural impulses passing down these nerves—a new and most interesting field of research. And this most charming and modest man of science is now dead, and the book of his records is closed and will receive no more entries from the hand of the master; but the work which Einthoven has done in introducing the string galvanometer as a means of diagnosis, in elucidating the action of the heart in health and disease, and in recording the natural impulses coursing down the nerves stands as a pattern of accuracy and will be carried on by his pupils, using those methods which he has perfected. Einthoven is one of that band of scientific men which has made the University of Leyden so famous. He spoke English perfectly, and was a most cordial friend to his English visitors, a man full of humour and a broad humanity.

SVANTE ARRHENIUS.

Director of the Physico-Chemical Department of the Nobel Institute, Stockholm.

PROFESSOR SVANTE ARRHENIUS, who died on October 2nd at the age of 68, is acknowledged to have been one of the masters of modern physical chemistry. This high place was achieved with one vivid theoretical contribution—his theory of electrolytic dissociation. Poincaré, in his book on the *Foundations of Science*, writes: "There are facts common to several sciences, which seem to be the source of streams diverging in all directions. They are like that knoll of St. Gothard whence spring waters fertilizing four valleys." Such are the facts upon which is built the theory of electrolytic dissociation. No hypothesis has proved more fertile to our understanding of the behaviour of solutions. It has revolutionized our principles and methods of study. It has dominated every field of scientific inquiry in which the methods of chemistry find employment. We can afford to smile at the recollection that when Arrhenius presented the elements of his theory in a thesis for a doctorate it found small favour with his professors.

Biology has been particularly enriched by the conception of electrolytes and their ionization. Consider only the case of the dissociation of water and its relation to the activity of acids and bases. The modern technique of biochemistry, physiology, bacteriology, and experimental biology is dominated by the conception of the hydrogen-ion concentration which derives immediately from this hypothesis. Building upon these foundations such men as Sorensen, Michaelis, Lawrence Henderson, Mansfield Clark, Van Slyke, and J. Loeb have raised that amazing edifice of precise measurement, exact control, and quantitative definition of vital phenomena such as we find at its highest in the modern statement of the intricate electrolyte equilibria of the blood and tissues. The whole complex physico-chemical equilibrium which we call the living cell will submit to no quantitative definition in terms which do not involve the principles of electrolytic equilibria. To trace in detail, however, the echoes of this hypothesis in physiology is, in a measure, to cloud the most precious contribution of Arrhenius to biology. Arrhenius was one of those who insisted upon the imperative necessity for measurement in the study of vital phenomena. "Les propriétés des corps sont les propriétés des nombres," remarked De Charcourtois. Arrhenius vigorously challenged those who contended that the invasion of biology by mathematics was a mischievous thing. "With the help of formulae," he wrote, "which may be empiric or rational, scientific progress will be much more rapid than without them, and as the experimental material increases the empiric formulae will probably give place to rational ones. So will new laws of nature be detected." His argument and his evidence are presented in his book *Quantitative Laws in Biological Chemistry* (1915). The same faith is seen in his collaboration with Madsen in the latter's extensive study of the chemistry of the immunological reactions. Here, again, his concern was to condense into formulae the regularities which were disclosed in the elusive reactions of toxins and antibodies, agglutinins, precipitins, and lysins. The volume in which he told the story of this endeavour was quickly translated into English and published in the familiar book *Immuno-Chemistry*. Arrhenius, who was born in 1859 near Upsala, wrote in Swedish.

While we acclaim the imagination which gave birth to the theory of electrolytic dissociation, we acknowledge the faith which taught us that, although the "mathematical mill" would only grind out those same facts which we put into it, yet would it grind them "exceeding small."

R. K. C.

Dr. CHARLES GEORGE MACVICKER of Street, who died on August 30th at the age of 64, was a native of Londonderry, and received his medical education at Belfast and Edinburgh; he graduated M.B., B.Ch., B.A.O. in 1891. He commenced medical practice at Almondsbury, near Bristol, then removed to Isleham in Cambridgeshire, and from 1899 onwards lived at Street, where he was medical officer to the Street district of the Wells Union and to the Abbey Grange School for mentally deficient children. He was a member of the visiting staff of the Butleigh Hospital, to which, at the time of his death, he was senior medical officer. He was a member of the committee of the Somerset County Nursing Association from its foundation. He was an ardent Conservative in politics, and for over twenty-two years had been a churchwarden, serving under five successive rectors. He was vice-chairman of the parochial church council, vice-president of the Church of England Men's Society, and of the Ringers' Guild, and the moving spirit in many other church activities. He was a council school manager and a member of the committee of Cox's Charity,