The reports of research committees were, as usual, of a technical nature. They often briefly referred to papers which have been published elsewhere, and thus are not suited for detailed description here. Arising out of the report on anæsthetics was a brief discussion on the advisability of legislation to improve the training of those who are destined to administer anæsthetics, and to prohibit unqualified persons from administering them. Prof. A. D. Waller, F.R.S., in connection with the report on electromotive phenomena in plants, read a paper describing the method used to estimate hydrocyanic acid in plants and animals, with an application of the method to medico-legal purposes. The committee on ductless glands report on a considerable number of researches, the results of some of which have already appeared. The reports on body metabolism in cancer and on mental and muscular fatigue each contain instructive and suggestive material.

Some interesting photomicrographs of muscle fibres were shown by Dr. Murray Dobie, who published his first paper on the structure of muscle in 1848.

Prof. J. S. Macdonald exhibited the respiration calorimeter on two separate occasions. The heat production of a resting man was compared with that of a man riding a bicycle.

A SUGGESTED RESEARCH FUND FOR TROPICAL DISEASES.

THE *Times* of November 2 publishes the subjoined appeal which Lord Northcote has addressed to the Lord Mayor in favour of the allocation of a part of the fund raised for a London memorial to the late King to the establishment of an Edward VII. Tropical Research Fund. The proposal has received the support of leading representatives of many national interests, including Lord Crewe, Secretary of State for the Colonies, Lord Elgin, Lord Kitchener, and Mr. Joseph Chamberlain.

Letter to the Lord Mayor.

My Lord Mayor,—Having noted that you are taking steps to form a representative Mansion House Committee for the purpose of raising a fund to provide a memorial of the late King in London, and that you are receiving numerous suggestions as to the form which that memorial should take, we desire respectfully to offer the following suggestion for your earnest consideration.

(2) The late King, in his beneficent activity for the welfare of his people, was inspired by two ideals—peace for mankind and war on disease. His work in the former of these directions has been recognised by the world at large; it is in following his lead in the second that we think that a fitting tribute to his memory will be found.

(3) Only recently, but now unmistakably, has the nation become alive to the vital importance of its tropical possessions. Their development proceeds apace, but at a heavy cost in human life and vital energy. Rarely does a mail arrive which does not bring sorrow into at least one home in these islands.

(4) For generations mankind have been willing to accept in a fatalistic spirit the death toll levied upon them by what was vaguely known as "the climate." Now this is no longer so. Thanks to the devoted labours of scientific men—among whom our own countrymen hold an honoured place—we know in many instances what the enemy is and how it is to be met.

(5) Those who are not conversant with the subject will be surprised and almost startled to hear the effect on human life of measures taken as the result of such investigations. We give three illustrations, drawn from the history of three of the greatest scourges of the tropics:—

(a) *Malaria*.—In Klang and Port Swettenham, two towns within the protected Federated Malay States, remedial measures were commenced in 1901. The deaths from malaria were in 1901 368 and in 1905 45. In the surrounding districts, where no measures were taken, the deaths for these years were respectively 266 and 351. In Hong Kong remedial measures were commenced in 1901. In that year the admissions to hospital were 1294 and the deaths 132. In 1905 the admissions were 419 and

the deaths 54. In 1904 the United States took over the administration of the zone of the Panama Canal; the deaths from malaria, which in 1906 were 821, had sunk in 1908 to 282.

(b) *Yellow Fever*.—In the city of Havana 35,952 persons perished of yellow fever between 1853 and 1900. The United States Government commenced remedial measures in 1900, and in 1907 only one case of yellow fever was reported.

(c) During the last three years steps have been taken in Uganda to stamp out sleeping sickness, an epidemic which in one district alone had destroyed some 200,000 people out of a total population of 300,000. In 1907 the deaths in the kingdom of Uganda numbered less than 4000, and in 1908 they fell to 1700.

(6) It will be seen that, tested by results, these figures are full of promise, and prove conclusively that the measures taken have proceeded on sound lines.

(7) It will naturally be asked: How have these results been achieved? The answer, so far as this country is concerned, is by private effort in close cooperation with the Government. Leaving out of account the Liverpool School of Tropical Medicine, which has been generously endowed by the citizens of that city, the bodies which are responsible for sustained and organised effort are the Royal Society, the London School of Tropical Medicine, the Sleeping Sickness Bureau, and the African Entomological Research Committee, all of which are associated with the metropolis. The first of these enjoys no direct Government support, and has carried out its work by a committee which includes some of the most eminent names in the profession of tropical medicine, who have given their services freely and gratuitously. The London School of Tropical Medicine at the Albert Dock, which owes its establishment, in part, to private generosity, receives an annual grant from Government of 1300*l*. The Sleeping Sickness Bureau is supported entirely by Government, the annual cost being some 1200*l*. The African Entomological Research Committee has recently been established to investigate the insects which convey disease to men, animals, and plants in the tropics, and includes among its members the best authorities on the subject. It receives a Government grant of 2000*l*. a year, and it is working in close cooperation with the Natural History Museum. In addition to the foregoing grants, a grant of 750*l*. a year is made to the University of London for the purpose of assisting work which has an important bearing on tropical medicine.

(8) The three cases which we have mentioned above are those in which the most striking results of scientific research have hitherto been obtained, but it is hardly necessary to say that they cover only a small portion of the field. Notwithstanding the rapid advance of knowledge in tropical diseases, there are many as yet unknown or imperfectly understood. The causation of blackwater fever, of dengue, of beri-beri, and of many other diseases still calls for investigation.

(9) We submit to your committee that no more appropriate memorial to our late Sovereign could be proposed than the establishment of a fund to carry on and extend the work of research into tropical disease. We further submit that it is eminently appropriate that London, the metropolis of the Empire, should take the lead in a movement for giving the full benefit of British administration to these outlying portions of the King's dominion, which have contributed in no small measure to her prosperity in the past, and will, by their development, give still ampler ground for her gratitude in the future.

(10) There can be no class in this great city to which the scheme will not appeal. To the rulers, the missionaries, the philanthropists, and all those who concern themselves with the welfare of the millions of coloured races whom Providence has committed to our charge it will appear of transcendent importance. To those whose kith and kin have gone out to bear their part in the work of civilising our tropical possessions, in whatever station of life, it will appeal no less strongly. To the man of business, in whose profit and loss account the dangers to the health of his employés figure so largely, our proposal will need no further recommendation. The ultimate aim is the creation of a Tropical Britain whose peoples are freed from the scourge of sickness, and where

the work of civilisation moves forward without the present toll of life and health. It is impossible to overestimate the results, both moral and material, that such a consummation would entail.

(11) We suggest that a fund should be established—to be known as the Edward VII. Tropical Research Fund—the interest of which should be devoted to furthering the objects which we have indicated. We think that the cause which we have at heart will be best served by not attempting to define too strictly the way in which this revenue should be appropriated. It is probable that in the first instance, and to a large extent, it would be most usefully expended in subsidising the efforts of the institutions to which we have already referred, being administered by a body whose composition will be a guarantee to the subscribers that their moneys are being wisely and economically applied.

We are, my Lord Mayor, yours faithfully,
NORTHCOTE.

25 St. James's Place, S.W., October 27.

MODERN SCIENTIFIC RESEARCH.¹

RESEARCH is a word much used in newspapers and in public discussions nowadays, but few people outside purely scientific circles have any clear idea as to its meaning. Of course, the dictionary tells us that it signifies a searching again or a careful search, but the question then arises, What is the object of the search and are there any rules to guide?

The object may be purely visionary, as was the object of the early chemists and alchemists, whose operations, extending through the dark centuries of the Middle Ages, left behind practically nothing but an extensive, though barren, literature, the witness of the credulity and ignorance of those times. The lesson to be derived from the whole of this strange history is one which needs to be continually revived and set in the new light of modern discovery and invention. The lesson is simply that until men began to observe and interrogate nature for the sake of learning her ways, and without concentrating their attention on the expectation of useful applications of such knowledge, little or no progress was made. In other words, until a sufficient foundation of pure science has been successfully laid there can be no applied science. Real progress comes from the pursuit of knowledge for its own sake.

I say, again, this truth needs to be continually reiterated, for there are still too many people who think that the true and only business of science is to find out useful things, and who regard all the rest as waste of time.

The first qualification for research is undoubtedly that kind of inspired curiosity which can never be eradicated, and which we know by many examples is not defeated by such obstacles as poverty, or ill-health, or pressure of other necessary occupations. Another qualification is some knowledge of the subject chosen for inquiry. As to this latter qualification considerable differences of opinion have been expressed. Priestley, whose statue stands near the Town Hall in Birmingham, and many of the chemists of his time, had very little preparatory instruction, but some of them made discoveries of fundamental importance. Priestley seems to have been of opinion that very little preparation is necessary, and the discoveries which might result from experiment were regarded by him as largely the result of chance and to be compared with the game which might fall to the gun of a sportsman in a new country, and whether fur or feather cannot be foretold. But though this might have been partly true in Priestley's time, it is certainly very far from true in our day, when the accumulation of knowledge, however imperfect, is still immense.

Every great discovery is the culmination of a long series of discoveries each of which is a necessary step, and ignorance of these preliminaries stands in the way of advance.

It will be worth while to examine a few cases by way of illustration. No better example can be found than the establishment of the great principle in chemistry commonly called the periodic law. According to this law, the proper-

ties of the elements and of their compounds stand in a definite relation to their atomic weights.

Modern views concerning the constitution of gases affords another illustration of the way in which the possession of one kind of knowledge leads to more knowledge. Forty years ago students were led to believe that there were two kinds of gases, namely, on the one hand, those which by the action of cold, or pressure, or both together could be liquefied, and on the other hand some half a dozen which could not be reduced to the liquid state. This was attributed to some fundamental difference of constitution in the two kinds of gas.

If we look for an example drawn from the domain of biology there is the doctrine of evolution, now universally accepted, which is based on the results of the patient collection of facts by Darwin and Wallace. But those facts would perhaps not have been collected, and they would certainly have been without meaning, but for the results of the study of comparative anatomy by previous generations of naturalists and palæontologists, as well as the recognition of the great doctrine of uniformitarianism in geology proclaimed and established by Lyell.

The examples cited will not appeal to the practical man in the same way as some instance taken from a direct application of science to business or practical affairs. If it is really necessary to consider a case of that sort, nothing could be better than the *dynamo*, which, as a transformer of energy, comes into prominent daily use in connection with lighting, traction, and as a general motive agent. The detailed history of the evolution of the dynamo would be a long story, and on this occasion it is only necessary to point out one or two facts. For the fundamental principles involved we must go back to Benjamin Franklin, and Galvani and Volta, all in the eighteenth century, and later to 1831, when Faraday discovered the generation of induced currents by moving a conductor in a magnetic field. But doubtless the experiments made by Franklin with the kite, by Galvani on frogs' legs, and by Volta and Faraday with bits of wire, were by the people of their day looked upon with a mixture of amusement and contempt, just as some people even at the present time are apt to exclaim, "Who cares whether there is oxygen in the sun?"

It is obvious, then, that whatever may have been possible in Priestley's time, the wholly uninstructed person cannot expect to meet with much success in these days in the discovery of new facts; and although the exceptional man may acquire in a very short time some knowledge of a special part of a subject, he is in perpetual danger of falling into great mistakes. It seems to me that a considerable amount of knowledge, skill, and experience is an indispensable equipment for anyone who enters seriously into the practice of scientific research. Not that these qualifications alone serve as inducements to such a career, for it would be quite easy to point to examples of learned people who have added nothing new to the branch of knowledge with which they are best acquainted. This is not necessarily due to indolence, nor to ignorance of the methods of research, but is merely the result of peculiarity of temperament which lacks that divine curiosity which alone supplies the stimulus.

I am speaking now only of real scientific research, the inquiry into the secrets of nature, not of the occupation of those who have only practical ends in view.

Looking back over the great principles of natural science, we see that in every case they have been established by the efforts of the amateur, and by amateur I mean all who have undertaken the work for the pure love of it. This includes, not only men of independent position like Cavendish, Lyell, and Darwin, but a large number of men who have held the office of professor or teacher, but who, in this country at any rate, are neither paid to do such work nor required by the conditions of their appointments to undertake it. So far as I know, there is but one institution in this country in which the professors are not required to teach, but only to press forward into the unknown, and that is the Royal Institution in London. But the character which that famous place has assumed during the last hundred years is not that with which it began its career. It was started at the end of the eighteenth century by Count Rumford with purely utilitarian purposes in view, namely, for teaching the

¹ Presidential address delivered to the Vesey Club, Sutton Coldfield, on October 13, by Sir William A. Tilden, F.R.S.