effects requires currents of large magnitude, and therefore requires that the ionic effects shall be reduced to a minimum. The currents of high frequency answer these requirements. With them the duration of each wave of current is so brief that the ionic movement set up is imperceptible; the displacement which the ions undergo in the very small fraction of a second for which each wave continues is minute and does not strain the elasticity of the protoplasm, if one may make use of such a phrase. On this account the currents employed may reach an ampere or more, and the usual ionic effects of currents, such as pain and muscular contraction, are absent. The thermal effects become manifest in proportion to the magnitude of the currents employed. The practical recognition of the thermal action of high-frequency currents remained long unnoticed, in spite of the great popularity enjoyed by high-frequency treatment some time ago. Somerville may be said to have awakened medical practitioners to its possible importance by his paper in 1906 on the effect of high-frequency currents in raising the surface-temperature of the body.

When we look back upon the cases which have been reported as cured by currents of high frequency we may now recognise that a large part of them can be justly attributed to thermal actions and the vasomotor effects secondary to these. The circulatory effects, the relief of various states of spasm and congestion, and of painful affections of the joints, of neuritis and neuralgia come into this category. An improvement in the lymph circulation due to the warmth would account for the results obtained with high-frequency currents in certain local infections and inflammations.

In another section of high-frequency treatment, namely that of the use of the effluve or of showers of sparks in cutaneous affections, we also have to deal with thermal effects, intense but minutely localised, though it is possible that in these cases there may be another factor concerned, namely the influence of the ozone, and of the nitric acid vapours which are associated with luminous electrical discharges.

We now perceive that in high-frequency applications we have an agent for the direct warming of the tissues traversed by the current, and that the future development of high-frequency treatment will be based upon these thermal effects. The progress which has been made by Nagelschmidt and others with the large currents obtained from the modern type of high-frequency apparatus, which uses sustained oscillations, and is known under the name of diathermy, serves to emphasise this aspect of high-frequency currents. Duddell's singing arc in a modified form is used for the production of the oscillations in the diathermy apparatus.

Again, in electro-diagnosis we are on the threshold of another change. The long and patient work of many investigators upon the use of condenser discharges has begun to bear fruit, and it is clear that from the condenser we gain greater information than the induction coil and the galvanic current can give us as to the degree of abnormality in muscle in cases of paralysis, while the process of testing with condenser discharges is simpler in application and far less painful to the patient. Whereas hitherto neurologists have been content to divide muscles into two categories, those with "normal" reactions and those with a reaction of degeneration, the condenser method now permits the recognition of a considerabl number of intermediate degrees. The method i based upon the observation of the minimum capacity needed to provoke the muscular contraction. As a muscle deviates from the normal standard it comes to need waves of longer and longer duration in proportion to its degree of damage, and these waves are best obtained by using a series of condensers of progressively increased capacity, charged from a constant source and discharged through the patient. Many of the muscles formerly described as normal because they had not lost the power of responding to induction-coil currents can now be seen to present different degrees of deviation from the normal, and those classed together as showing a reaction of degeneration can also be divided into distinct groups. Working with 100 volts to charge the condensers, one can use a series of ten or twelve capacities, ranging from 0·01 to 2·0 microfarads, and can find muscles showing their initial contraction at almost every step in the scale.

The work of Boudet de Pâris, Hoorweg, Zanietowski, Weiss, Doumer, Cluzet, and of many other patient students of condenser discharges must be gratefully acknowledged in this connection. They have gradually brought their methods through the laboratory stages and rendered them suitable for everyday clinical work so that electro-diagnosis in the immediate future is sure to develop in the direction of condenser discharges, and the old method with induction coil and battery current may be regarded as obsolete.

With these evidences of progress the electrotherapeutist of to-day can feel more hopeful. He is no longer tied to the old routine methods, and sees before him the commencement of a therapeutic method based upon the laws of chemistry and physics. H. L. J.

INTERNATIONAL FISHERY INVESTIGATIONS.[1]

THE series of reports now under review on the work of the International Council for the Study of the Sea furnishes evidence of continued activity in many branches of the work. One of the most interesting new features is described in the hydrographical bulletin, which contains an account of a series of observations on tempera-

[1] Conseil Permanent International pour l'Exploration de la Mer. Bulletin Hydrographique pour l'Année Juillet 1910–Juin 1911.—Bulletin Planktonique pour les Années 1908–11.—Publications de Circonstance, No. 62.—Rapports et Procès-Verbaux des Réunions, vol. xiv., 1910–11.—Bulletin Statistique des Pêches maritimes des Pays du nord de l'Europe. vol. vi., pour l'année 1909.—Investigations on the Plaice. General Report by Dr. F. Heincke. I. Plaice Fishery and Protective Measures (Preliminary brief summary of the most important points of the Report).—Procès-Verbaux des Réunions du Conseil et des Sections, Copenhague, Septembre 1912.

tures, salinities, and direct-current measurements made from ten vessels which were anchored for fourteen days (June 1 to 14, 1911) in a series of positions in the North Sea, selected with the view of studying the principal currents. A repetition of observations of this character from time to time as opportunity offers cannot fail to give information of the utmost value.

The plankton bulletin is composed entirely of tables, recording the species found in samples taken during the years 1908 to 1911; and from the number of records given it is evident that this side of the investigations has recently received far less attention than was formerly given to it. This is probably due to two causes. In the first place, the amount of time which is necessarily consumed in examining and recording a large series of plankton samples is very great indeed, and in the second place a doubt exists in many minds as to whether any very useful results will accrue from an indefinite continuation of work on the plan which up to the present has been followed. What seems to be required at the moment in plankton work is more freedom and liberty to the individual worker to devise and test new methods of quantitative investigation, which may eventually enable a trustworthy estimate of the annual and seasonal fluctuations to be arrived at by some means less open to criticism on the ground of trustworthiness and at the same time not so prohibitively laborious as the enumeration method of the Kiel school of workers.

For investigations on the minutest plankton forms—the nannoplankton of Lohmann—the enumeration method will doubtless have to be retained, and the plan for the preservation of samples for this purpose, described by Gran in *Publications de Circonstance*, No. 62, marks a useful step in advance. The method consists in adding to samples of sea-water, taken with a water-bottle from known depths, a small quantity of Flemming's strong solution. The samples may be kept in this way for many months, and, without any attempt at washing out the Flemming's solution, portions of the sample can be centrifuged, the minute plankton forms which are thus separated out being identified and counted under the microscope.

Vol. xiv. of the *Rapports et Procès-Verbaux* contains a number of papers of great interest dealing with investigations of food fishes. Dr. P. P. C. Hoek reports on the Clupeoids (other than the herring), Prof. D'Arcy Thompson on the later stages of the Gadoids, Dr. Masterman on the later stages of the Pleuronectidæ, and Dr. Johansen on the eggs, larvæ, and later stages of Pleuronectidæ from the Baltic. Dr. Ehrenbaum contributes a summary of a more extensive report which he is preparing on the mackerel, which not only brings together previous work, but also gives much new information on the habits and life-history of this important fish, at the same time making it clear that much further investigation is necessary. He points out amongst other things that little or nothing is known of the small adult stages of this common fish, which, in spite of extensive fishing with nets that certainly ought to capture them, have rarely been taken, and then only in very small numbers.

Finally, the volume contains a useful report by Dr. Redeke on the present condition of our knowledge of the races of marketable fishes, in which the importance of further researches into this subject is made clear.

The International Council publishes as a separate volume what is described as a "preliminary brief summary" of the first part of Prof. Heincke's general report upon investigations on the plaice. This first part is entitled "Plaice Fishery and Protective Measures," and from the *procès-verbaux* of the meeting held in Copenhagen in September, 1912, we learn that the summary was then laid before the council and referred by it to a special committee. The latter committee was not, however, prepared to adopt immediately the recommendations made by Prof. Heincke, and the matter was further deferred.

These recommendations, put forward in a somewhat tentative way, comprise the imposition upon an international basis of a size-limit for plaice, below which the fish may be neither landed nor sold. It would appear that the great destruction of immature plaice which now takes place could only be effectively stopped if this size-limit were fixed at 25 to 26 cm. Such a high limit would, however, mean the immediate ruin of many inshore fisheries carried on by sailing trawlers. As most of these vessels on the continental side land their plaice *alive*, Prof. Heincke suggests that a lower size-limit of 22 or 23 cm. might be allowed for fish which are so landed. It must be pointed out, however, that this would not meet the difficulty in English ports such as Lowestoft and Ramsgate, where a size-limit of 25 or 26 cm. would probably mean the ruin of the trawling industry. Prof. Heincke emphasises the fact that the introduction of a size-limit would, in the first instance, be in the nature of an experiment, and that it is not possible to say beforehand with any certainty exactly what effect it would have on the fishery. The problem is, in fact, a much more complex one than it at first sight appears to be. A consideration of the present preliminary report rather suggests that the International Council has not yet had that problem adequately laid before it in all its numerous aspects and in a sufficiently comprehensive way. The council would scarcely at present be justified in proposing restrictions which would certainly, in the first instance, injure very seriously the livelihood of many owners and fishermen who are dependent upon the smaller boats.

AMERICAN UNIVERSITIES AND COLLEGES.

THE seventh annual report of the president and treasurer of the Carnegie Foundation for the Advancement of Teaching bears ample witness to the stimulating powers which come from the wise administration of an income of