

# Marine Biological Association of the United Kingdom.

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## Report of the Council, 1927.

### The Council and Officers.

The Council has to record with deep regret the death of Sir Arthur Shipley, G.B.E., F.R.S., Master of Christ's College, Cambridge, who served the Association as Chairman of Council for a period of over twenty years, with conspicuous ability and success, and always had its interests at heart.

The usual four quarterly meetings of the Council were held in London, at which the average attendance was twelve. The meetings were held in the Rooms of the Royal Society.

The Council carried out a revision of the Articles of Association, which was duly confirmed by two Special General Meetings of the Association, the first of which was held in the Rooms of the Royal Society and the second in those of the Linnean Society. The thanks of the Association are tendered to these two Societies for their courtesies in providing hospitality.

In March a Committee of four members of the Council visited and inspected the Plymouth Laboratory and the work upon which the Staff and visitors were engaged.

### The Plymouth Laboratory.

The new building, which was completed in 1926, has been in full use during the year, and has proved in every way satisfactory. The provisions made for the special needs of physiological and biochemical research are adequate, and the separate working rooms have been much appreciated by visiting physiologists and zoologists who have occupied them. The central heating is proving adequate in winter for the whole range of buildings.

The engines and pumps circulating water have been in constant service and have not needed any replacement; the animals in the aquarium are maintained in healthy condition, and a number of consignments of animals acclimatised to aquarium conditions have been sent to the Aquarium of the Zoological Society of London.

The stone building rented at Fisher's Nose continues to be used for storage, and the buildings at Pier Cellars, Cawsand Bay, have been of service in connection with Dr. W. R. G. Atkins' investigations on the penetration of light into the sea and in connection with experiments on

the lunar periodicity in the spawning of molluscs, which have been made by Mr. C. Amirthalingam.

### The Ship and Motor-boat.

The steam drifter *Salpa* has worked continuously and the cost of maintenance is still light for a vessel of this type.

The 25-ft. motor-boat has been in daily use, and its two 3-h.p. paraffin engines have been maintained in satisfactory working order at slight expense.

### The Staff.

Mr. C. F. A. Pantin was given leave of absence for some weeks in the early part of the year to conduct a course of lectures and practical work on Comparative Physiology at University College, London.

Dr. C. M. Yonge, who for three years has been a temporary Assistant Naturalist at the Laboratory, left at the end of September. He has been appointed Balfour Student by the University of Cambridge and also leader of a proposed expedition to the Great Barrier Reef of Australia, which is being organised by a Joint Committee of the British Association.

Mr. O. D. Hunt, who was acting during the early part of the year as Lecturer in the Natural History Department of the University of Glasgow, did not resume his post as Assistant Naturalist at the Laboratory in October, as he had received an important commercial appointment in connection with the prevention of the growth of organisms on the bottoms of ships.

Mr. R. Palmer has received an appointment on the staff of the Zoological Laboratory at University College, London.

### Occupation of Tables.

The following investigators have occupied tables at the Plymouth Laboratory during the year :—

- C. AMIRTHALINGAM, London (Rhythmic spawning in *Pecten opercularis*).
- MISS D. ATKINS, London (Pinnotheres and Loxosoma).
- L. E. BAYLISS, London (Studies on the catch muscle in Pecten).
- MISS L. BEANLAND, Aberystwyth (Community species).
- N. J. BERRILL, London (Regeneration).
- MISS ANNA BIDDER, Cambridge (Yolk absorption in Cephalopods).
- E. BOYLAND, Manchester (Chemical changes in Muscles).
- PROF. H. GRAHAM CANNON, Sheffield (Feeding Mechanisms of Malacostraca).
- DR. S. F. COOK, Harvard (Respiratory pigments).
- E. J. H. CORNER, Cambridge (Marine Algae).
- DR. H. DRYERRE, Edinburgh (Factors affecting the cardiac inhibitory fibres of the vagus in Dogfish heart).
- V. C. WYNNE EDWARDS, Oxford (Life-history of Jassa).

- MR. and MRS. PHILIP EGGLETON, London (Comparative study of muscles of marine animals).
- DR. T. J. EVANS, Guy's Hospital (Scyphistoma of Cyanea).
- MISS G. H. FAULKNER, London (Filograna).
- DR. GOTTFRIED FRAENKEL, Göttingen (On the Righting Reflex of Starfish).
- MISS SYLVIA GARSTANG, London (Neural gland of Ascidians).
- PROF. E. S. GOODRICH, F.R.S., Oxford (Anatomy of Fish).
- DR. PIXELL-GOODRICH, Oxford (Testing stains for Protozoa).
- J. GRAY, Cambridge (The effect of electrolytes on the contractile tissues of Pecten).
- DR. B. GUTOWSKI, Warsaw (Movements of bile duct).
- PROF. DR. SABRO HATTA, Sapporo, Japan (Vertebrate Embryology).
- C. C. HENTSCHEL, London (Gregarines).
- PROV. A. V. HILL, F.R.S., London (Nervous activity).
- A. D. HOBSON, Edinburgh (1, Artificial Parthenogenesis in *Thalassema Neptuni*. 2, Effect of Electrolytes on muscle of gut of *Dytiscus marginalis*).
- TORSTEN HÖJER, Stockholm (Methylene blue colouring of the nervous system of *Carcinus maenas*).
- DR. ERIC HOLMES, Cambridge (Metabolism of nervous system of Maia).
- F. R. HORNE, Gresham's School, Holt (Colouration of Anthea and Actinia).
- PROF. R. IZUMI, Hirosaki, Japan (Collecting fish eggs).
- DR. CARLO JUCCI, Naples (Physiology of ciliary movement in Anemones).
- P. KIRTISINGHE, London (Fishes).
- MISS F. M. C. LEAK, Sheffield (Studies in the Maxillary Segment of the Crustacea).
- DR. A. LEVIN (the late), Leningrad (Action Current in Crustacean Nerves).
- J. R. LUMBY, Lowestoft (Phosphate estimation).
- MISS S. M. MANTON, Cambridge (Crustacean feeding habits).
- PROF. O. MEYERHOF, Berlin (General Physiology).
- MISS E. A. T. NICOL, Cambridge (Physiology of digestion in Polychaetes).
- DR. YÔ K. OKADA, Tokio (Autolytus).
- M. N. PHADAKE, Cambridge (Cytology of Echinus eggs).
- MRS. KATHLEEN F. PINHEY, Montreal (Hæmocyanin. Tyrosinase in Crustacea).
- DR. H. H. POOLE, Dublin (Light penetration into the sea).
- DR. S. G. M. RAMANUJAM, Madras (General).
- GEORGE RAYNER, Leeds (Development of swim bladder of Clupeoids).
- MISS E. M. REES, London (Algæ).
- J. A. ROBERTSON, Birmingham (Disintegration in Polycelis in relation to gaseous content of water).
- MISS SHARPINGTON, London (Algæ).
- DR. T. A. STEPHENSON, London (Bionomics and Histology of Anemones).
- G. A. STEVEN, Edinburgh (General).
- B. W. TUCKER, Oxford (Effects of Parasitisation of Gyge on Gebia).
- PROF. D. M. S. WATSON, F.R.S., London (Gas content and mechanism of swim bladder of Fishes).
- G. P. WELLS, London (Physiology of Invertebrate Muscle).
- D. P. WILSON, Manchester (Polychæte larvæ).
- DR. J. M. YOFFEY, Manchester (Comparative vertebrate histology and physiology).

The usual Easter Vacation Course in Marine Zoology was conducted by Dr. J. H. Orton, and was attended by forty-two students from Oxford, Cambridge, London, Edinburgh, Manchester, Sheffield, Portsmouth, Southampton, Eton, and Rothamsted.

An Advanced Course in Comparative Physiology and Experimental Biology, conducted by Mr. C. F. A. Pantin, was held during the Summer Vacation and was attended by fourteen students.

Dr. E. W. Shann brought one boy from Rugby, Mr. J. M. Branfoot a class of seven from Oundle, Mr. D. M. Reid a class of two from Harrow, Mr. A. S. Gillespie a class of three from Monkton Combe School (Bath), and M. F. R. Horne a class of four from Gresham's School, Holt, during the Easter Vacation.

During Whitsuntide Mr. W. H. Leigh-Sharpe brought a class of nine from Chelsea Polytechnic.

A joint meeting of the Challenger Society and representatives from Marine Laboratories was held at the Plymouth Laboratory on May 6th-7th.

### **General Work at the Plymouth Laboratory.**

Mr. Ford has again devoted his attention to the study of the herring and its fisheries in the English Channel and off the South-east of Ireland. The first four papers of a proposed series describing the results of his work are now being printed for publication in the *Journal*. Probably the most interesting part of this year's work has been the study of the growth of "whitbait" herrings found in the rivers Tamar and Lynher. On May 26th, 1927, several thousands of young clupeoids, including tiny herrings, were caught by means of a small-meshed Saltash tuck-seine in the Tamar about 3-4 miles above Saltash Bridge. The haul, fortunately, had been taken just soon enough to obtain a fair number of herrings still in the process of metamorphosis, although the majority were completely metamorphosed and fully scaled. Since then, samples, roughly fortnightly, have been taken, both from the Tamar and Lynher, with the result that a good general picture of the increase in average size from month to month has been obtained. An account of this work forms Part 4 of the papers mentioned above, and in it the question of the interpretation of the data is given. The results are of value, confirming as they do the lengths at which the first winter-ring is formed, calculated from measurements of adult scales. Both the adult scales and the direct measurement of the young fishes caught in the two rivers agree in demonstrating that the length at the end of the first year varies over a wide range, and that on an average this length is in the region of 12-13 cm. The examination of the stomach contents of the fishes caught has shown that mysids are by far the most common item of food.

The study of the Plymouth fishery during the winter of 1926-27 confirmed the expectation expressed in last year's Report to the effect that the 1920 year-class would remain in evidence in the catches, although probably less markedly than during the two previous seasons. The younger classes of 1922 and 1923, more particularly the latter, were also well represented, so that it may be expected that they will also make themselves apparent in the season 1927-28.

Dr. Orton's work on sex-change and on the correlation of spawning and shell-growth of the oyster (*O. edulis*) to environmental conditions has been continued for another summer during the past year, and the general results previously obtained have been confirmed and extended. Several thousand oysters have been examined in samples dredged on the same day from beds on the west coast and on the east coast of England. At the same time local variations on each set of beds have been studied. In this way valuable comparative results have been obtained. Special attention has been given to all the seasonal cyclical changes which occur in the oyster, and it has been found that this attitude is essential to an understanding of the primary functions of the organism, namely, growth, reproduction and the accumulation of reserve food products, i.e. fattening, and is also essential to an understanding of the interrelations of these functions. Work on the Fal has shown clearly that there is an early spring period of shell-growth (increase in shell area) (March-April) preceding the summer breeding period, which, in turn, is followed by a distinct post-spawning period of shell-growth and fattening. This sequence has now been followed in a significant amount of material over a period of two complete cycles, and local variations have been studied.

On the Fal have been obtained records which show—contrary to general expectation—that the rate of change of temperature over the main beds is relatively slow, and that the yearly range of temperature is also relatively small. These facts appear to be of fundamental importance in maintaining the main cyclical series on the Fal, namely, spring shell-growth, breeding, and autumn shell-growth, and indicate a fundamental difference of metabolism at least in the summer and other periods. Gonad proliferation occurs at a variable rate in the spring and in the autumn, and rapidly in the summer, and an accumulation of reserves, fattening, occurs during and after the shell-growing period on the Fal in the autumn.

On the River Blackwater, where there is a rapid rise in temperature in the spring, a spring period of growth of shell material occurs, but this period may overlap the beginning of the breeding period. A late summer or autumn growth of shell also occurs on these beds after the main breeding period and apparently before the main fattening period. A similar spring and autumn growth of shell has been observed in other estuarine beds,

especially the River Yealm. It would appear, therefore, that the oyster will ultimately become a valuable subject for the study of differential metabolic processes apparently controlled by different temperature levels. The data obtained on shell-growth are being prepared for publication with a critical examination of possible causative factors.

Spawning records were made during 1927 from samples of oysters dredged simultaneously on west and east coast beds, and the fact established that significant spawning occurred on the east coast beds at the beginning of June at a temperature of about 59°–60° F. On the west coast beds, owing to the cold weather, temperatures fluctuated from 57°–59° F. during June, and a certain amount of indecisive spawning occurred in that month on the warmer portions of the beds, but significant spawning, comparable to that observed on the east coast beds, did not begin until the second week in July when a general rise in temperature to about 59°–60° F. occurred. During the summer significant incomplete and abortive spawning occurred on the Fal beds coincident with the occurrence of low temperatures (i.e. 57°–58° F.) due to the tidal influx of Channel water of low temperature, which in turn is explained by the relative coldness of the summer. This latter observation proves that in a cold summer there will occur in the Fal Estuary beds a heavy loss of eggs and potential oyster larvæ. An account of the observations on spawning in 1926 and 1927 will be prepared for publication in the future.

Dr. Orton has discussed means for preserving the Fal Estuary oyster beds in a report to the Truro Corporation Oyster Committee, and has presented reports on oyster beds to other Oyster Companies. He has also carried out experiments with the rough whelk-tingle, *Murex erinaceus*, and recorded observations which demonstrate the considerable negative economic value of this oyster pest.

During 1926 and 1927 the various phases of the development of the gonad have been studied, and Dr. Orton now recognises more than twenty partly definite and partly arbitrary stages which will be described and figured. By analysing representative samples of about one hundred oysters with regard to these gonad phases, it will be shown that it is possible to compare with a fair degree of accuracy any population of oysters with any other at a given time.

Dr. Lebour's work on the larval crabs of the Plymouth district has resulted in the successful rearing of three species from egg to crab, two of these, *Inachus Dorsettensis* and *Portunus puber*, having reached the seventh young crab stage in about three months, the third, *Xantho incisus*, only reaching the first young stage. All of these were reared in plunger jars on oyster larvæ until they reached the megalopa stage, when they were fed, as before, on pieces of mussel. All the young crabs were also fed on mussel. Amongst other larvæ eaten by the zoeae *Echinus* larvæ

from artificial fertilisations were successfully used but no crab was reared through the whole of its life-history on these.

A paper is finished and is now being printed for the *Journal*, dealing with larval *Ebalia* and Pinnotheres. Zoeae of the rare *Pinnotheres veterum* were found in the plankton and changed into megalopæ in the Laboratory, whilst *P. pisum* was hatched from the egg. A very close resemblance is found between the larvæ of *Ebalia* and Pinnotheres.

Of the thirty-seven crabs known from the Plymouth district twenty-three have now been hatched from the egg, and many of them reared through several larval stages. Of the remaining fourteen all but three can be recognised in one or more stages from the plankton. Those reared from Zoea to crab include *Gonoplax*, *Thia*, and *Pirimela*, and the knowledge gained throws much light on their relationships. A general account of the crab larvæ is nearly ready for publication.

Dr. Lebour has also continued her studies of the planktonic diatoms for the purpose of a book which is intended to be a companion volume to the *Dinoflagellates of Northern Seas*. It is hoped that before long this will be completed.

Hydrographic stations between Plymouth and Ushant have been worked as in previous years, the results of the observations being communicated to the International Council, the French Fishery Department, and the Ministry of Agriculture and Fisheries. The continuous record of these data since April, 1921, is frequently referred to in connection with various investigations. Determination of nitrates in the water of the English Channel has also been continued by Mr. H. W. Harvey, and, in addition, preliminary experiments on the variation in velocity of wind-impelled currents have been made, as a result of which experiments on a larger scale are projected by the Ministry of Agriculture and Fisheries in the North Sea.

Mr. Russell has been occupied for most of the year in working up the collections he made in 1926 with the ring-trawl to study the vertical distribution of young fishes and other plankton animals. The material has been treated in the usual manner, excepting that on this occasion one hundred *Calanus* from each sample were measured and the sex determined and the same number of *Sagitta* measured. It is hoped that thus some light will be thrown on the behaviour of the two sexes of *Calanus*, and on the depth and seasonal distribution of *Sagitta* with regard to age.

All the post-larval fishes have been sorted and measured. We now have continuous records of young fish between the months of April and August for three years, and a further year's material has been obtained this year (1927) in weekly samples caught by means of oblique hauls with the ring-trawl. It should now be possible to draw up a table showing the seasonal distribution of the pelagic young stages of our common



food fishes and of their growth. It is hoped that these results will form a basis on which to check the results of unusual hydrographical conditions on the spawning of fishes in future years.

During the course of the research on the diurnal changes in the vertical distribution of plankton it has become evident that certain species live in the daytime very close to the bottom. A stramin net has been improvised which, when attached to the frame of an Agassiz trawl, will fish a few inches above the bottom without catching bottom deposits or animals living thereon that may have been disturbed by the passage of the net over the bottom. Results of considerable interest have already been obtained with this net.

Mr. Russell has published in *Biological Reviews* a paper summarising our knowledge of the vertical distribution of plankton in the sea—both phyto- and zoo-plankton—together with an account of experimental work that has a direct bearing on the behaviour of marine plankton animals. An exhibit illustrating this research was shown at the Soirée of the Royal Society in May.

The investigations which Mrs. E. W. Sexton has been carrying on for a number of years on the Mendelian inheritance of eye-colour in the Amphipod *Gammarus chevreuxi* have made considerable progress, and several papers describing results are well advanced. In co-operation with M. C. F. A. Pantin an explanation has been attempted of the behaviour in inheritance of the mutation known as “changeling,” in which the eye and the body of the just hatched young shows no coloured pigment, but such pigment appears at a later stage in development. The facts may be adequately explained by supposing that in the normal coloured egg there is a precursor substance which is necessary for pigment formation. When this precursor substance is absent from the egg the young are hatched without pigment, and only become coloured after they have fed and grown.

Mr. H. O. Bull has completed for publication in the *Journal* an account of an investigation carried out from January, 1926, to June, 1927, on the relationship existing between the state of maturity and the chemical composition of the liver and muscular tissue of the whiting. Mr. Bull has also been studying the formation of conditioned “responses” in fishes. By this means it has been shown that *Blennius gattorugine* is sensitive to temperature changes of only 0·5° C., momentarily induced in the surrounding water, and to changes in salinity of four parts per thousand also acting for a few seconds only. Responses to olfactory and gustatory stimuli are also being investigated. Two species of Wrasse have been used for the formation of conditioned responses, using lights of different wave-lengths, intensities, and positions, as the signalling stimuli, and a motor response, involving entry into an opaque bottle for food, as



the reaction they were trained to perform. The method is being used also for investigating colour discrimination and responses to auditory stimuli.

During the year Mr. D. P. Wilson has been attempting to rear the larvæ of some common Polychætes, so that they can be identified in plankton samples. A very common post-larval Terebellid, the genus and species of which were previously unknown, has been reared to stages at which it was possible to recognise it as the young of *Loimia medusa*. The comparatively well-known post-larvæ of *Lanice conchilega* have similarly been reared to early bottom stages. Artificial fertilisations of *Sabellaria spinulosa* and *S. alveolata* have been made, and after several attempts the larvæ were reared to stages just prior to metamorphosis, but so far only specimens picked out from the plankton have undergone that change. The early larvæ of these two species cannot at present be distinguished from one another, but the later stages are easily separated. Investigations have also been made into the life-histories of *Polydora ciliata* and *P. hoplura*, two Polychætes which bore into rocks and oyster shells. In both cases the larvæ are retained for a time in sacs attached to the wall of the burrow alongside the parent, but while in the former species they are released comparatively early in development and have a fairly long planktonic life, in the latter they are retained to a late stage and are ready to settle down soon after liberation. One other Polychæte, *Nereis pelagica*, has been reared from the egg to a juvenile stage of about fifty segments.

### Department of General Physiology.

The new laboratories have been fairly well occupied, but only full during the Easter and Summer vacations. They are well supplied with chemical apparatus and reagents, and a more adequate supply of physical apparatus is being got together gradually as funds permit since the individual items are costly. We are indebted to the physical Laboratory, Trinity College, Dublin, and to Prof. J. Joly for the loan of apparatus which is still in use by Dr. H. H. Poole and Dr. Atkins in the prosecution of their work on light penetration in the sea. The photometer cases were machined in the University workshop, and the Physical and Botanical Laboratories lent much of the apparatus used in the overhaul and re-standardisation of the photo-electric photometers, for which the new laboratories of the Royal Dublin Society provided facilities. Dr. Atkins worked there with Dr. Poole for a month at Easter, but was unable to continue the work till completed. Much still remains to be done as regards standardisation of new apparatus and the more extended use at sea of that now available. Measurements of the illumination have now been made down to 65 metres at Station E1.

This work is a natural corollary of that upon the minor constituents of sea-water, which is being continued. The acres of the ocean have depth as well as area, but the effective depth is limited by the supply of light energy required in photosynthesis. The minor constituents at present known to be essential and to exist in limiting amounts, may not be a complete list. Work on others is contemplated when opportunity occurs. The same applies to the continuation of Dr. Atkins' work on net preservation, but it is difficult to carry on the observations and tensile tests on the numerous treated nets at the same time as the work on illumination and on the minor constituents of sea-water. The preservatives already studied include catch, the Dutch method, the use of copper oleate, a mixed fatty acid copper soap, and a naphthenic acid copper soap together with methods for incorporating resin, tar, or anti-fouling paint as binders. Certain treated nets have now been under test for "rotting" for over twenty-six months without loss in strength. The action of sunlight and general weathering of fabrics due to rain and wind is also receiving attention.

Mr. Pantin has made progress with his work on amoeboid movement. Investigation of the action of non-electrolytes has been extended. By diluting isotonic mixtures of sodium chloride and calcium chloride with isotonic glycerol it is shown that it is the ratio of Calcium to Alkali metal ion that is important and not the absolute Calcium concentration. Urea has a peculiar action on amoeba in relation to the presence of Calcium and work is shortly to be undertaken on this.

The effect of absence of Oxygen on amoeboid movement has been extensively studied. As mentioned last year movement continues in the absence of Oxygen, but ultimately stops. It is found, however, that the sensitivity of amoeba to traces of toxic substances is enormously enhanced in the absence of oxygen. Concentrations of these substances which are without effect on the amoeba in the presence of oxygen inhibit movement in five to six hours when it is absent.

In pure de-oxygenated sea-water amoeba can maintain activity for thirty to sixty hours before inhibition occurs. As in muscle and cilia, the inhibition is reversible.

### Published Memoirs.

The following papers, the outcome of work done at the Laboratory, have been published elsewhere than in the *Journal* of the Association.

AMIRTHALINGAM, C. *Structure of Pearls*. "Nature," Vol. CXIX, 1927, pp. 854-855.

ATKINS, W. R. G. *Preservation of Fishing Nets*. Nos. 1-4. The Fishing News, 1927, No. 715, p. 31; No. 717, p. 57; No. 719, p. 8; No. 721, p. 39.

- ATKINS, W. R. G. *The Methods of using Copper Soaps to Preserve Fishing Nets.* Journ. de Conseil, Vol. II, 1927, pp. 144-150.
- ATKINS, W. R. G. *The Soluble Silicate Content of Soils.* Scient. Proc. Roy. Dublin Soc., Vol. XVIII (N.S.), 1927, pp. 433-436.
- ATKINS, W. R. G., AND WILSON, E. G. *The Colorimetric Estimation of Minute Amounts of Compounds of Silicon, of Phosphorus and of Arsenic.* Biochem. Journ., Vol. XX, 1926, pp. 1223-1228.
- ATKINS, W. R. G. *Histological Applications of Measurements of Acidity or Alkalinity and of Oxidation or Reduction.* Lee, Microtomists' Vade Mecum, Chap. 28, pp. 359-375. New ed. revised by J. B. Gatenby. In the press.
- BAYLISS, L. E. *A Conductivity Method for the Determination of Carbon Dioxide.* Biochem. Journ., Vol. XXI, 1927, pp. 662-664.
- BERRILL, N. J. *The Control of the Beat of the Fan Segments in Chaetopterus variopedatus.* "Nature," Vol. CXIX, 1927, pp. 564-565.
- CANNAN, R. K. *Echinochrome.* Biochem. Journ., Vol. XXI, 1927, pp. 184-189.
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- CANNON, H. G., AND MANTON, S. M. *On the Feeding Mechanism of a Mysid Crustacean, Hemimysis Lamornæ.* Trans. Roy. Soc., Edin., Vol. LV, 1927, pp. 219-253.
- HARVEY, H. W. *Fundamental Problems relating to River Pollution.* "Nature," Vol. CXIX, 1927, pp. 463-464.
- HARVEY, H. W. *Stream and Drift Currents and Effect of Wind.* Marine Observer, Vol. IV, 1927, pp. 181-183.
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- HOBSON, A. D. *A Study of the Fertilisation Membrane in the Echinoderms.* Proc. Roy. Soc., Edin., Vol. XLVII, 1927, pp. 94-117.
- JEPPI, M. W. *Contribution to the Study of Gromia oviformis.* Dujardin. Quart. Journ. Micr. Sci., Vol. LXX, 1926, pp. 701-720.
- LEBOUR, M. V. *Life History of the Edible Crab.* Fishing News, Vol. XV, 1927, No. 742, pp. 32-36.
- LEBOUR, M. V. *Researches on Rearing a Crab.* Discovery, Vol. VIII, 1927, No. 94, pp. 311-313.
- LEVIN, A., AND WYMAN, J. *Viscous Elastic Properties of Muscle.* Proc. Roy. Soc., Ser. B, Vol. CI, pp. 218-243.
- MARRIAN, G. F. *A Note on Hæmerythrin.* Brit. Journ. Exp. Biol. Vol. IV, 1927, pp. 357-364.
- ORTON, J. H. *On Incomplete Spawning and the Problem of Fertilisation in O. edulis.* "Nature," Vol. CXX, 1927, pp. 403-404.
- ORTON, J. H. *The Habits and Economic Importance of the Rough Whelk-Tingle (Murex erinaceus).* "Nature," Vol. CXX, 1927, pp. 653-654.
- RUSSELL, F. S. *The Vertical Distribution of Plankton in the Sea.* Biol. Reviews and Biol. Proc. Camb. Phil. Soc., Vol. II, 1927, pp. 213-262.
- SEXTON, E. W., AND PANTIN, C. F. A. *Inheritance in Gammarus chevreuxi* Sexton. "Nature," Vol. CXIX, 1927, pp. 119-120.
- STEDMAN, ELLEN, AND STEDMAN, EDGAR. *Hæmocyanin. Part IV. The Dependence of the Shape of the Oxygen Dissociation Curve on the State of Ionisation of the Protein.* Biochem. Journ., Vol. XXI, 1927, pp. 533-543.

- WOODLAND, W. N. F. *A Revised Classification of the Tetrphyllidean Cestoda, with Descriptions of some Phyllobothriidæ from Plymouth.* Proc. Zool. Soc. Lond., 1927, pp. 519-548.
- WOODLAND, W. N. F. *On Dinobothrium septaris* Van Beneden, 1889, and *Parabothrium bulbiferum* Nybelin, 1922. Journ. Parasitology, Vol. XIII, 1927, pp. 231-248.
- YONGE, C. M. *Formation of Calcareous Tubes round the Siphons of Tereido.* "Nature," Vol. CXIX, 1927, pp. 11-12.
- YONGE, C. M. *Food from the Sea. I. The Shellfish Industry.* Review of Reviews, 1927, No. 445, pp. 137-141.
- YONGE, C. M. *The Absence of a Cellulase in Limnoria.* "Nature," Vol. CXIX, 1927, p. 855.

### The Library.

The thanks of the Association are again due to numerous Foreign Government Departments, and to Universities and other Institutions at home and abroad, for copies of books and current numbers of periodicals presented to the Library. Thanks are due also to those authors who have sent reprints of their papers to the Library, and the Council are specially grateful to Dr. G. P. Bidder for a full set of the Reports of the *Valdivia* Expedition.

### Finance.

The Council wish to express their thanks to the Development Commissioners for their continued support of the work of the Association. They have to thank, also, for generous grants, the Fishmongers' Company (£600), the British Association (£35), the Ray Lankester Trustees (£20) and the Universities of Oxford, Cambridge, Bristol, Birmingham, Leeds and London.

Thanks are due to Mr. E. T. Browne for an additional donation of £200 to the building Fund.

### Vice-Presidents, Officers and Council.

The following is the list of gentlemen proposed by the Council for election for the year 1928-29 :-

#### *President.*

SIR E. RAY LANKESTER, K.C.B., LL.D., F.R.S.

#### *Vice-Presidents.*

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 The Earl of STRADBROKE, K.C.M.G.,  
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