

## Abstracts of Memoirs

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY.

### Structure of Pearls.

By C. Amirthalingam.

*Nature*, Vol. CXIX, 1927, pp. 854-855.

It is pointed out that in some pearls from *Ostrea edulis* a layer identical to the brown horny layer found on the *inner* surface of the shell of oysters occurs. Microscopic examination of sections of this layer showed a brown matrix in which rhombic crystals were embedded and it could not be stained with water-blue. It would appear that this brown layer is more related to the periostracum, on account of its horny nature and unstainable properties, than to the organic matrix of the prismatic or nacreous layers. It is known that under favourable conditions the secretions—lime salts and albuminous fluid which hardens to form the conchyolin—are so regulated that nacreous layers are formed, and that the brown layer on the inner surface of the oyster shells is probably secreted at the end of the autumn period of growth. Hence the occurrence of concentric layers of horny periostracum-like substance in pearl generally and in the shells of oysters and other molluscs may be due to a disturbance in rhythmic action of the secreting epithelia whereby only the first part of the phase of shell-formation is completed with the oncoming of winter or at the end of a shell-growing period.

C. A.

### The Soluble Silicate Content of Soils.

By W. R. G. Atkins.

*Sci. Proc. Roy. Dublin Soc.*, 1927, 18, 433-436.

The method of Diénert and Wandenbulcke serves for the estimation of silicate in soil extracts. Values from 18 to 124 parts per million of  $\text{SiO}_2$  were obtained from a one to five water extract of air-dry soil. Higher values were given by alkaline than by acid soils, but there was no close parallel between soluble silicate and either pH value or electrical conductivity.

W. R. G. A.

**The Control of the Beat of the Fan Segments in *Chaetopterus variopedatus*.**

**By N. J. Berrill.**

*Nature*, Vol. CXLIX, 1927, pp. 564-565.

Experiments isolating the fan segments and extirpating segmental ganglia were recorded, showing that the rhythmical beat of each segment is controlled by the ganglia of that segment, and that the control of a lateral half segment is by the ganglionic lobe of the same side. Further, that there is a secondary nervous control co-ordinating the rhythm of the two halves of each segment and also the consecutive beat of the three segments involved.

N. J. B.

**Echinochrome.**

**By R. K. Cannan.**

*Biochem. Journ.*, 1927, Vol. XXI, p. 184.

In the course of a survey of the biological field for organic oxidation-reduction systems which develop reversible potentials at an inert electrode, the alleged respiratory pigment Echinochrome has been examined. The pigment was separated from the eggs, perivisceral fluid and test of *Arbacia punctulata*. The pigment does not form a dissociable compound with oxygen but is, rather, the oxidant of an electromotively active reversible oxidation-reduction system. The electrode potentials of the system have been measured over the pH range 2.2 to 9.76. The normal electrode potential at 30°C. is +1995. The alleged respiratory function of echinochrome is discussed.

R. K. C.

**On the Feeding Mechanism of *Nebalia bipes*.**

**By H. Graham Cannon.**

*Trans. Roy. Soc. Edin.*, Vol. LV, 1927, pp. 355-369

*Nebalia* is a mud-living form feeding on food particles filtered from a food stream produced by its foliaceous trunk limbs. The food stream enters anteriorly and makes its exit at the posterior end of the carapace. The current is produced by the oscillatory movements of the trunk limbs. The anterior limbs are the main inhalent pumps, the posterior being exhalent as well as inhalent. The exopodites and epipodites act as valves allowing water to pass out posteriorly and preventing water passing forwards. The trunk limb endopodites are armed along their

inner edges with four rows of setæ. The first and third rows are hooked and those of successive limbs interlock, forming a continuous filter wall on either side of the median chamber between the limbs. The fourth form a row of comb setæ combing the food off the filter walls, and the second a row of brush setæ sweeping the food upwards towards the mid-ventral food groove. The proximal setæ of the first row are stout and are not hooked, and form a gnathobasic series pushing the collected food towards the mouth. On the eighth trunk limb the fourth-row setæ are absent, and the third rows interlock, forming a wall preventing the entrance of water into the filter chamber posteriorly. On the first trunk limb the first-row setæ are not hooked, but two groups towards the base of the limb are very stout and function in pushing large food particles directly on to the mouth-parts. The proximal endites of the maxillules and maxillæ both point between the bifid lower lip towards the mouth. The distal endites bite together in the transverse plane. The mouth-parts, both structurally and in their method of functioning, closely resemble those of a Mysid. From a comparison with *Paranebalia* it is suggested that *Nebalia* evolved from a Mysid, or some other primitive Malacostracan possessing a feeding mechanism similar to that of *Hemimysis*, that took to mud-living habits. The foliaceous limbs are in no way primitive, but evolved from typical biramous Malacostracan limbs in connection with the new method of filter feeding.

H. G. C.

**On the Feeding Mechanism of a Mysid Crustacean, *Hemimysis Lamornæ*.**

**By H. Graham Cannon and Miss S. M. Manton.**

*Trans. Roy. Soc. Edin., Vol. LV, 1927, pp. 219-253.*

*H. Lamornæ* exhibits two types of feeding, one on large food masses and the other on minute particles filtered from a water current. In the filter mechanism the maxilla acts as a suction pump and a true filter. The comb of setæ on the proximal endite forms the filter plate. The filtered food is pushed on the mouth between the bases of the paragnaths by the long setæ of the maxillary proximal endites and the comb of setæ on the proximal endites of the first trunk limbs. It is pushed directly on to the spine-rows of the mandibles. The food stream along the ventral food groove is produced by the swimming activities of the trunk limbs. Each exopodite rotates so that its tip describes an ellipse. By this rotary action a food-bearing stream is sucked down each cone of rotation and passes in between the limb bases to the ventral food groove. Large food masses are held by the trunk limb endopodites and mandibular palps and bitten into by the incisor processes of the mandibles and the distal

endites of the maxillules. The mandibles are asymmetrically arranged so that food bitten off by the incisor processes is automatically passed on to the *laciniae mobiles* and then to the molar processes. Storch's description of the feeding process of a Daphnid and his views on the evolution of the feeding mechanism of Crustacea and Trilobites are criticised. Simple biramous swimming paddle limbs, such as occur posteriorly in *Lepidocaris* are suggested as being the primitive limb rather than a filtering "phyllopodium" as considered by Storch. From primitive articulates possessing biramous limbs there evolved, on the one hand, the Branchiopoda, and the other Crustacea, in which the limbs projected ventrally from the body in two parallel series, and on the other, Marella and the Trilobites, in which the limbs projected laterally. In the Branchiopoda the endopodite became a foliaceous swimming organ, while in the Malacostraca the exopodite became the swimming part, but it became whip-like and not foliaceous. In both cases the swimming activities produced an orally directed food stream. In Marella and the Trilobites the foliaceous exopodite became the swimming branch of the limb. In the Trilobites the pleural shield developed to enhance the food-collecting activities of the exopodites. In both Trilobites and Crustacea the presence of a large labrum assists in sucking food into the mouth region.

H. G. C.

#### **Myothermic Observations on the Dogfish.**

**By A. V. Hill.**

*Journ. Physiol.*, Vol. LXII, 1926, p. 156.

Heat production was studied in the muscles of the lower jaw of the dogfish and the relations found between heat, tension, length and duration of stimulus were similar to those obtaining in muscles from other animals. The great rapidity of response of these muscles entails a rapid increase of heat production with duration of tetanus, and results in a rapid onset of fatigue.

A. V. H.

#### **Fatigue, Retention of Action Current and Recovery in Crustacean Nerve.**

**By A. Levin.**

*Journ. Physiol.*, Vol. LXIII, 1927, p. 113.

The excised limb nerves of crustaceans, which are non-medullated, survive well and form a suitable object for electro-physiological investigation. They are rapidly fatigued by tetanic stimulation, as shown by the

nearly total disappearance of the electric response, and they recover if left at rest for sufficient time. This fatigue goes hand in hand with an increase in the negativity of the nerve, additional to the negativity of the action current and of a more persistent nature. Each single impulse, by itself of very short duration, leaves behind it a state of negativity ("retention of action current"), wearing off in a few seconds; this negativity accumulates if the stimuli follow each other frequently enough and it then takes a longer time to wear off. The greater the amount of the "retention" present at any moment, the greater the reduction in size of the electric response. The disappearance of "retention" is a sign of complete recovery.

This experimental fatigue is a combination of local and conduction fatigue. It is considerably greater near the stimulating electrode, but the whole nerve also is fatigued as the result of conducted impulses.

This "retention" of action current is widely encountered in all kinds of excitable tissues and is probably connected with the processes of restitution.

A. V. H.

### **The Viscous-Elastic Properties of Muscle.**

**By A. Levin and J. Wyman.**

*Proc. Roy. Soc., London, B. Vol. CI, 1927, p. 218.*

The viscous-elastic properties of muscles were studied by means of an improved form of myograph which enables very accurate tension-length curves to be obtained for stretches or releases, carried out at any desired constant speed on various types of muscles, smooth and striated. In all these muscles the same general phenomena were found, in connection with the relation between work done and speed of shortening, though some muscles were more suitable for the investigation than others. The quick-moving jaw muscles of the dogfish, however, showed precisely the same characteristics, on a different time scale, as the slow-moving body muscles of *Holothuria*.

The results are discussed theoretically, and it is shown that they can be deduced from the conception that a muscle is a viscous-elastic system containing (*a*) a purely elastic element, and (*b*) a damped elastic element, these being in series with one another; and the bearing of the results upon theories of muscular contraction is considered.

A. V. H.

## A Study of the Fertilisation Membrane in the Echinoderms.

By A. D. Hobson.

*Proc. Roy. Soc., Edin., Vol. XLVII, Part I (No. 7), p. 94, 1927.*

Removal of the zona pellucida of the eggs of *Echinus esculentus* by centrifuging or by means of acid sea-water does not prevent the formation of the fertilisation membrane. Insemination of eggs of *Asterias rubens* in which the nuclear membrane is just beginning to disappear (i.e. at the very beginning of maturation) causes partial activation with formation of Seifriz's "protoplasmic papillæ." Artificial parthenogenesis of the eggs of *Asterias rubens* can be induced by means of isotonic  $\text{CaCl}_2$ ,  $\text{KCl}$ ,  $\text{NaCl}$ , and  $\text{MgCl}_2$ . This indicates that a decrease of surface tension is unnecessary for the formation of the fertilisation membrane. The relation between the pH of the medium and the degree of extrusion of the fertilisation membrane in *Echinus miliaris* has been examined. It is concluded from these results that the osmotic pressure due to the presence of a protein between the membrane and the egg surface is responsible for the extrusion of the membrane. The influence of the salt concentration of the medium supports this view and indicates that the fertilisation membrane is, from the moment of its formation, completely permeable to salts. The origin of the fertilisation membrane is discussed, but in the absence of critical evidence a definite conclusion cannot be reached.

A. D. H.

## Contribution to the Study of *Gromia oviformis* Dujardin.

By Margaret W. Jepps, M.A.

*Quart. Journ. Micr. Sci., Vol. LXX (No. 280), p. 701, 1926.*

1. *Gromia oviformis* Dujardin is a common British Marine Rhizopod, which frequently reaches a diameter of 2 mm.
2. There appear to be two distinct forms of *Gromia oviformis*; a smaller oval variety is provisionally distinguished from the type as the *dubia* form.
3. The apparently homogeneous pseudochitinous shell has a complex microscopic structure, of which some description is given.
4. The protoplasm, which fills the shell, is crowded with stercomata, xanthosomes, and a heterogeneous collection of ingested debris, all of which take a part in giving its colour to the animal.
5. There are numerous nuclei scattered throughout the protoplasm. Some of them are always undergoing a simple kind of division, which, however, involves some rearrangement of the chromatin.

6. A process of sporulation has been seen, occasionally in nature, and frequently in aquarium specimens; repeated divisions of the nuclei results in the formation of very numerous uniflagellate swarm spores, 2–3 $\mu$  in diameter. These swim out of the shell. Their further development has not so far been observed.

M. W. J.

### A Note on Hæmerythrin.

By G. F. Marrian.

*Brit. Journ. Exp. Biol., Vol. IV, 1927, p. 357.*

A brief study of the dissociation curves of oxyhæmerythrin was made, using the colorimetric method of Pantin and Hogben. At pH 7.0 dissociation curves were plotted at temperatures of 0–15–25 and 35° C. From a consideration of these curves, the heat of dissociation of oxyhæmerythrin was calculated to be 10,350 calories per gramme-molecule of oxygen. Variation of pH between 6.0–10.0 appeared to have little effect on the shape of the dissociation curve.

The stability of oxyhæmerythrin is greatest at pH 8.0–9.0.

A yellow compound which appeared to be analogous to methæmoglobin was obtained by the action of  $K_3FeCy_6$  or  $H_2O_2$  on oxyhæmerythrin. This change occurred spontaneously with some rapidity at pH 3.0–4.0. By reduction of "methæmerythrin" with sodium hydrosulphite at pH 9.0 and subsequent re-oxidation by atmospheric oxygen, oxyhæmerythrin was re-obtained.

Spectroscopic examination showed that oxyhæmerythrin had a weak absorption band at about 5000 Å, which was only visible over a limited range of dilution. "Methæmerythrin" showed a more distinct band at about 4000 Å, which was visible over a greater range of dilution.

Several unsuccessful attempts were made to demonstrate the presence of Anson and Mirsky's hæm in the molecule. No hæmochromagen spectrum was visible after reduction of the pigment in alkaline solution. No coloured extract was obtained by the Schultz separation.

The addition of concentrated sulphuric acid to a solution of oxyhæmerythrin produced a deep purple or reddish brown solution with a marked green fluorescence that had a strong superficial resemblance to acid hæmatoporphyrin. A well-defined absorption band at about 5400 Å was observed in such solutions. After neutralisation no spectrum typical of alkaline hæmatoporphyrin was observed.

Like hæmocyanin, hæmerythrin was shown not to cause blueing of guaiacum in the presence of hydrogen peroxide.

G. F. M.

## The Vertical Distribution of Plankton in the Sea.

By **F. S. Russell.**

*Biol. Rev. and Biol. Proc. Cambridge Phil. Soc., Vol. II (No. 3), pp. 213-262. 1927.*

This is a summary review of our present knowledge of the vertical distribution of plankton in the sea. The possible factors controlling the distribution of the plankton plants and animals are first discussed. Information on variation with depth of such physical factors as light intensity and colour, temperature, viscosity and density, current and wind effects, and pressure are given; salinity, oxygen and CO<sub>2</sub> content, hydrogen ion concentration, and the presence of dissolved nutrient salts are also dealt with. Finally, observations on the swimming speeds of some plankton animals and the sinking speeds of both animals and plants are cited. The vertical distribution of the phytoplankton in the sea is outlined, together with the various changes that are brought about in it by internal and external causes. The vertical distribution of the animal plankton as shown by the results of field collections is dealt with at some length, illustrations being given of the regional, seasonal and daily changes that may occur therein, and also of ontogenetic changes and other alterations that may be due to spawning habits or to hydrographical conditions. The next section gives some of the principal results obtained by experimental work and their bearing on the behaviour of the animals in nature as shown by field observations. Lastly, a discussion of the subject is given in which light is regarded as the most important controlling factor. The paper ends with a bibliography of 168 titles. F. S. R.

## New Mutations in *Gammarus Chevreuxi* Sexton.

By **E. W. Sexton and A. R. Clark.**

*Nature, Vol. 117, pp. 194-195. Feb. 6, 1926.*

Describes several recent mutations in three distinct new stocks of *Gammarus* from the wild; in all three, red-eyes appeared recessive to black-eye. Two of the stocks are of special interest. In the first, two distinct kinds of red-eyes occurred, a bright red, and a very dark, almost blackish red, the exceptional feature being that the dark-red always *lightens* as the animal grows older, but even though it may lighten so much as to become bright-red, the animal always functions as a dark-red. The second stock produced the most striking mutation which has yet appeared in *Gammarus*—a change in the *body*-colour. Instead of the normal pale-green body, dark green gonads, and eggs, the body in this mutation, the gonads, eggs, and, in some cases, the eyes, were pure white. The first White female of this type was mated with a Red male of the same brood which carried white and gave all white-eyed offspring, some of which remained white through life (“Permanent Whites”),



whilst some developed colour as they grew (the "Changeling Whites"), until at maturity they were indistinguishable from normal red-eyed animals. Changeling by Changeling gave reds and whites; Permanent Whites mated together gave all white-eyed young, but the reciprocal crosses of the Permanent Whites mated with Reds or Changelings of their own stock gave remarkable results. White female by any Red or Changeling male, young always white-eyed *at birth*; White male by homozygous Red female, young always red-eyed; by heterozygous Red, or by Changeling female, reds and whites were produced. E. W. S.

### **Inheritance in *Gammarus Chevreuxi* Sexton.**

**By E. W. Sexton and C. F. A. Pantin.**

*Nature*, Vol. 119, pp. 119-120. 1927.

The white body mutation described in the previous note is discussed with special reference to the Changeling Whites, i.e. those animals which, arising from a mating of Pure White female by Red male, are hatched with white body and white eyes, but develop green body- and gonad-colour and red eye-colour as they grow. It is shown that Changelings occur only where Reds would be expected; that they always have a white-body mother; always behave genetically as Reds—but are always heterozygous for white body. The following hypothesis is suggested. Normal individuals possess a gene for body colour which corresponds to the white-body mutant gene. Individuals homozygous for white-body factor cannot lay down body-pigment or red eye-pigment, consequently white-body females lay eggs with no pigment. The developing embryo has therefore no pigment, even if the fertilising sperm carries the colour factor. A White individual results which changes to Red as life proceeds, since the colour factor from the sperm is able later to make good the deficit of pigment. E. W. S.

### **A revised Classification of the Tetracystid Cestoda, with Descriptions of some Phyllobothriidæ from Plymouth.**

**By W. N. F. Woodland.**

*Proc. Zool. Soc., London*, 1927, pp. 519-548.

Twelve species of Phyllobothriidæ are described, including three new species, and one new genus—*Scyphophyllidium*—is proposed. The characters of the family Phyllobothriidæ are re-defined, together with those of the families Proteocephalidæ and Tetrarhynchidæ, and all three families are included in the Order Tetracystida, which is also re-defined. The Tetrarhynchidæ are thus deposed from ordinal rank, and Braun's family Lecaniccephalidæ and Southwell's Order Heterophyllidæ are shown to be purely artificial groupings. W. N. F. W.

**On *Dinobothrium septaria* van Beneden 1889, and *Parabothrium bulbiferum* Nybelin 1922.**

**By W. N. F. Woodland.**

*Journ. Parasitology*, Vol. XIII, 1927, pp. 231-248.

The scolices and mature and gravid proglottids of *Dinobothrium septaria* (a Phyllobothriid) and *Parabothrium bulbiferum* (a Bothriocephalid) are described in detail and some conclusions drawn respecting the affinities of the Tetrabothriidæ and the value of the scolex as a classificatory character.

W. N. F. W.

**Formation of Calcareous Tubes Round the Siphons of *Teredo*.**

**By C. M. Yonge.**

*Nature*, Vol. CXIX, 1927, pp. 11-12.

Calcareous tubes form round the siphons of *Teredo norvegica* after animals are left in still (e.g. tank) water for some months; there is a great deposit of faecal matter, largely wood, around the openings, and the siphons retain communication with the surrounding water by means of these calcareous tubes. The longest were some  $\frac{3}{8}$  inch. This condition of affairs is normal in the giant shipworm, *Kuphus arenarius*, which lives embedded in mud in mangrove swamps in the Pacific, and is in constant danger of being silted up.

C. M. Y.

**The Absence of a Cellulase in *Limnoria*.**

**C. M. Yonge.**

*Nature*, Vol. CXIX, 1927, pp. 855.

A series of experiments, using the ground-up bodies of great numbers of *Limnoria lignorum* and incubating the extract for 2-4 weeks with sawdust at 32° C, failed to show any indication of the digestion of wood. Starch was quickly digested by the same extract. Although wood fragments are always found in the gut, there is apparently no enzyme capable of digesting cellulose, such as is present in *Teredo*. There is no evidence of symbionts, such as are found in Termites. Since *Limnoria* has been found boring into the insulation of submarine cables, wood is not necessary to it as in the case of *Teredo*. The view is put forward that *Limnoria* (and also *Chelura terebrans*, for which the same results were obtained) bore into wood for *protection only*, and not, as in the case of *Teredo*, for nutrition as well.

C. M. Y.