

ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS

PART II. SORTING DEVICES ON THE GILLS

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 79, 1937, pp. 339-73

The following mechanisms are described: (1) Utilization of plicae for sorting in two ways, (a) the frontal currents are in opposite directions in the grooves and on the crests, and particles intended for consumption are carried in the grooves to the safe dorsal channels, e.g. in *Pecten*, (b) the plical grooves open into the safe channel at the bottom of the deep marginal groove, while the crests lead to a superficial path along the lobes of the marginal groove, e.g. in *Pinna*. (2) Acceptance and rejection of material by the opening and closing of a deep marginal groove, e.g. in *Solecurtus scopula*. (3) Presence of guarding cilia on the lobes of the marginal groove, preventing the entry of large masses, but allowing that of small particles, e.g. in *Musculus marmoratus*. (4) Presence of cirri (in addition to the usual frontal cilia), which remove grains of sand and rock from the gills, e.g. in *Mactra corallina*, *Barnea parva*.

Small gills and large palps are found in certain deposit feeding bivalves with long free siphons, and forwardly beating cirri on the ends of the gills provide extra help to draw the current down the long inhalent siphon.

Certain of the ciliary structures are clearly adaptive, correlated with feeding difficulties incidental to the habitat. A preliminary sorting of material on the gills, before it is passed on to the palps, is far from unusual in lamellibranchs.

D. A.

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS

PART III. TYPES OF LAMELLIBRANCH GILLS AND THEIR FOOD CURRENTS

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 79, 1937, pp. 375-421

The gills of some ninety odd species (chiefly marine), belonging to sixty genera and forty-one families, have been investigated and grouped under seven main types (with subtypes) according to structure and ciliary currents.

D. A.

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS

PART IV. CUTICULAR FUSION, WITH SPECIAL REFERENCE TO THE
FOURTH APERTURE IN CERTAIN LAMELLIBRANCHS

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 79, 1937, pp. 423-45

A form of fusion involving only the cuticle has been found between the dorsal edges of the ascending lamellae of the outer demibranchs and the mantle or visceral mass in *Solen marginatus* Montagu, *Ensis siliqua* (L.), *E. arcuatus* (Jeffreys), *Cultellus pellucidus* (Pennant), *Solecurtus scopula* (Turton), *Lutraria lutraria* (L.), and *Tellina tenuis* da Costa; between the dorsal edges of the ascending lamellae of the two inner demibranchs in *Barnea parva* (Pennant); and between the mantle lobes in the mid-ventral line between the pedal and fourth apertures in *Ensis siliqua*, *E. arcuatus* and *Cultellus pellucidus*. A more advanced stage of fusion occurs in this last position in *Lutraria lutraria*. The histological structure of the junction is described, and is especially considered in relation to the condition of the fourth aperture in the Solenidae.

D. A.

CHOLINESTERASE IN INVERTEBRATE MUSCLES

By Z. M. Bacq and D. Nachmansohn

Journal of Physiology, Vol. 89, No. 4, 1937, p. 368

The rate of hydrolysis of acetylcholine by muscle is the same in crustaceans (*Homarus vulgaris*), molluscs (*Eusepia officinalis*) and echinoderms (*Holothuria nigra*). The hydrolysis by the muscle of a sea-leech is apparently a little slower.

Cholinesterase is absent from the sphincter muscle of the sea-anemone.

The hydrolysis of acetylcholine by the brain ganglion of *Eusepia* is more than ten times quicker than by muscle.

Z. M. B.

STUDIES IN TUNICATE DEVELOPMENT. III

DIFFERENTIAL RETARDATION AND ACCELERATION

By N. J. Berrill

Phil. Trans. Roy. Soc. B, Vol. 225, 1935, pp. 255-326

The development of forty-four species was investigated. The rate of cleavage, gastrulation and of differentiation of larval tissues varies directly with the (volume)/(free surface-area) of the egg and embryo. Cell division ceases at an early stage in the larval structures, cell numbers remaining constant, cell sizes

varying with the egg volume. In the permanent organs and tissues cell division continues until a minimal size is reached, so that cell numbers vary with the egg volume.

An increase in proportion of yolk to cytoplasm retards the rate of development up to and including gastrulation. After gastrulation cell division in tadpole tissues has in any case ceased and differentiation is in progress. The rate of this differentiation is retarded to the same degree as early development. But the rate of cleavage and development of permanent tissues becomes progressively accelerated.

Increase in egg volume or increase in proportion of yolk to cytoplasm induces a telescoping of development. The development of larval chordate (tadpole) structure and that of the permanent ascidian structure are virtually independent of one another.

N. J. B.

STUDIES IN TUNICATE DEVELOPMENT. IV

By N. J. Berrill

Phil. Trans. Roy. Soc. B, Vol. 225, 1935, pp. 327-79

An investigation of budding in *Diazona*, *Tylobranchion*, *Morchellium*, *Enherdmania*, *Endistoma*, *Archidistoma*, *Pycnoclavella*, *Chondrostachys*, *Distaplia*, *Colella*, *Clavelina*, *Diplosoma*, *Perophora*, *Ecteinascidia*, *Stolonica*, *Distomus*, *Polyandrocarpa*, *Symplegina*, *Botryllus* and *Botrylloides*.

Budding is usually correlated with autolysis or antero-posterior regression of the zooid. Regression results from the migration posteriorly of yolk-laden trophocytes. The extent of the migration depends upon the nature of the zooid. Where there is no post-abdomen nor enlarged ventral vessel, the abdomen regresses. Where the ventral vessel is enlarged it becomes congested, forming the buds and allowing the rest of the zooid to regress. Isolation of buds is effected by transverse epidermal constriction. The tissues within the bud depend upon the region constricted by the epidermis. When part of the digestive tube persists, bud development is primarily a regeneration, when absent, a reorganization. Highly specialized tissue can survive but is unable to proliferate. Moderately specialized tissue can proliferate to form more of its own kind but no other. Unspecialized tissues, such as epicardial, septal, or atrial, alone are multipotent. The vascular septum of the ventral stolon has no connexion at any time with the epicardium and cannot be considered as an extension of the epicardium into the stolon for purposes of budding.

N. J. B.

STUDIES IN TUNICATE DEVELOPMENT. V.
THE EVOLUTION AND CLASSIFICATION OF ASCIDIANS

By N. J. Berrill

Phil. Trans. Roy. Soc. B, Vol. 226, 1936, pp. 43-70

The morphology and development of the heart and epicardium is described of *Ciona*, *Diazona*, *Phopalea*, *Tylobranchion*, *Enherdmania*, *Sidnyum*, *Endistoma*, *Archidistoma*, *Distaplia*, *Colella*, *Diplosoma*, *Pycnoclavella*, *Clavelina*, *Perophora*, *Ecteinascidia*, *Ascidia* and *Molgula*. A new classification of the Ascidiacea is proposed, based on the nature of the epicardium. The function of the epicardium is found in its most primitive condition in *Ciona*, where it is of a coelomic nature. The importance of the epicardium in the budding stolons of *Diplosoma*, *Aplidium* and the Thaliacea, and as an excretory organ in the Ascidiidae, Styliidae, Pyuridae, and Molgulidae is the result of extreme specialization in different directions of functions present, though poorly developed, in *Ciona*.

N. J. B.

CELL DIVISION AND DIFFERENTIATION IN ASEXUAL AND SEXUAL DEVELOPMENT

By N. J. Berrill

Journ. Morph., Vol. 57, 1935, pp. 353-427

In ascidians the development of eggs and of buds are in sharp contrast. In bud development cell sizes are minimal throughout. Gross differentiation of form becomes apparent from the beginning, histological differentiation only when cell division is ending. The position of a cell relative to the whole determines its nature. Multiplication of cells continues until sufficient have been formed for the expression of all specific and other characters. In sexual development the egg is a large cell which divides until the minimal cell sizes characteristic of the species are obtained. The course of cleavage is a curve suggesting the attainment of a state of equilibrium. Commencing before fertilization and continuing during cleavage is a precocious differentiation of certain parts that inhibits further cell division and results in the formation of special larval structures that function when a mere fraction of the whole developmental period has elapsed. This differentiation may be suppressed, or may be retarded, without affecting the development of the rest of the egg. In the remaining parts cell division continues until minimal cell sizes are reached, and only then does histological differentiation become apparent, as in sexual development. The number of cells thus formed is very small compared with that necessary for the expression of the full character of the species, and the newly functional post-larval organism is necessarily peculiar in structure.

N. J. B.

REGENERATION IN *CLAVELINA LEPODIFORMIS*

By N. J. Berrill and A. Cohen

Journ. Exp. Biol., Vol. XIII, 1936, pp. 352-62

The number of rows of stigmata formed during the development of a stolon fragment varies directly with the size of the fragment. In very small pieces development may become arrested at almost any stage, depending upon the quantity of mesenchyme contained in the proximal region of the stolon piece. If sufficient is present to enable development to proceed to the formation of a functional heart, a circulation is established that includes food reserves in the distal part of the stolon, and development proceeds to completion. In shorter pieces, less than 0.4 mm. long, development or regeneration does not begin. Total failure to develop is correlated with the absence of a region of relatively columnar epidermis.

N. J. B.

REORGANIZATION AND REGENERATION IN *SABELLA*. I. NATURE OF GRADIENT, SUMMATION, AND POSTERIOR REORGANIZATION. II. THE INFLUENCE OF TEMPERATURE. III. THE INFLUENCE OF LIGHT

By N. J. Berrill and D. M. Mees

(I) Journ. Exp. Zool., Vol. 73, 1936, pp. 67-83. *(II and III) Ibid.*, Vol. 74, 1937, pp. 61-89

I. When abdominal parapodia are reorganized to form thoracic parapodia during regeneration of a head, a whole thoracic field is imposed at the same time. Failure of regeneration is correlated with a loss of ciliary polarization of original segments. The gradient in time of reorganization of successive segments is due to difference in time of commencement and not to differing rates. Successive decapitations produce a summation of effect. A mixed type of parapodia may appear at the junction of reorganized and normal segments. Posterior thoracic parapodia may appear next to a posterior cut surface. They are to be correlated with a delayed outgrowth of the intestine. Removal of an abdominal parapodium results in the regeneration of a thoracic parapodium.

II. The rate of anterior regeneration and that of reorganization have each a temperature coefficient (Q_{10}) of about 2.4. The range of reorganization under standard conditions in the dark is about four segments. The range is not affected by temperature, $Q_{10} = 1.0$.

III. Light is responsible for reorganization of segments averaging more than four in number. It may increase by twentyfold the number reorganized in the dark. The effective light is within the visible range. It has a threshold intensity of about 15,000 metre-candles below which reorganization is at a minimum. It is most effective during the period of most active morphogenesis, and it acts upon anterior regenerating tissue or tissue adjacent to it.

It is concluded that a photochemical reaction liberates electrical energy rather than a chemical evocator, as a reorganizing force.

N. J. B.

THE EARLY DEVELOPMENT OF ASCIDIAN EGGS

By Arthur Cohen and N. J. Berrill

Biological Bulletin, Vol. 70, 1936, pp. 78-88

When unfertilized nude eggs of *Ascidella aspersa* are stained with Nile Blue it is found that the periphery stains more heavily and is clearly defined from the central region. A tiny peripheral area—the polar pit—remains unstained. Dalcq's statement that the latter is the site of polar body formation could not be confirmed; evidence to the contrary is presented. In the young tadpole the stain becomes confined to the endoderm (gut) and notochord.

Observation on the membraneless nude egg shows that it undergoes a series of changes in shape from the time of polar body formation to first cleavage.

A. C.

A RELATION BETWEEN THE LYOTROPIC SERIES AND FREE ENERGIES

By L. H. N. Cooper

Nature, Vol. CXXXIX, 1937, p. 284

A relationship is traced between the lyotropic series of anions, which summarizes their behaviour in many physico-chemical reactions, with their free energies of formation.

The position in the series of ions less commonly investigated is forecast together with the probable value for the free energy of formation of the thiocyanate ion. It is suggested that a more quantitative examination of the series from the thermodynamic standpoint may lead to results of value.

L. H. N. C.

SOME CONDITIONS GOVERNING THE SOLUBILITY OF IRON

By L. H. N. Cooper

Proc. Roy. Soc., Ser. B, Vol. 124, 1937, pp. 299-307.

Since experiment had shown that the amount of ionic iron in true solution in sea water is extremely small, theoretical methods were invoked to calculate the maximum activities of the ions, Fe^{++} , FeOH^{++} and Fe^{+++} , which can exist in sea water at equilibrium. The activity of ferrous ion is controlled by that of ferric ion and by the oxidation-reduction potential of the water, reversible or irreversible. Maximum activities, expressed as mg.-atom/m.³ Fe, may be summarized:

<i>p</i> H	$a_{\text{Fe}^{+++}}$	$a_{\text{FeOH}^{++}}$	$a_{\text{Fe}^{++}}$	
			Governed by $a_{\text{Fe}^{+++}}$ and reversible oxygen potential	Governed by $a_{\text{Fe}^{+++}}$ and irreversible oxygen potential
8.5	4×10^{-16}	5×10^{-10}	2×10^{-15}	1×10^{-10}
8.0	1.3×10^{-14}	5×10^{-9}	2×10^{-14}	1.5×10^{-9}
6.0	1.3×10^{-8}	5×10^{-5}	2×10^{-10}	4×10^{-5}

These amounts are all far less than could be detected by the most delicate methods of analysis. Other tables and equations show the effect on the iron system of change in pH and oxidation-reduction potential. The results are applicable to all natural waters and to many physiological fluids where equilibrium is attained.

L. H. N. C.

ON THE FEEDING MECHANISM OF *APSEUDES TALPA*, AND THE EVOLUTION OF THE PERACARIDAN FEEDING MECHANISMS

By Ralph Dennell

Trans. Roy. Soc. Edin., Vol. LIX, Pt. I, No. 2, 1937, pp. 57-78

The respiratory current of *Apseudes* is produced mainly by the movements of the pedunculate hemispherical epipodite, which closely invests the rounded and swollen base of the second thoracic limb. The oscillation of the epipodite is effected by the alternate action of the peduncular muscles and fluid pressure within the peduncle. Movements of the second and third thoracic limb exopodite produce currents assisting the respiratory current.

An anterior membranous flap on the epipodite margin controls the filter exit—the lateral gap between maxillule and maxilla—and enables the epipodite to draw a current of water—the filter current—through the filter chamber. The maxilla is thus a passive filter. It bears typical filtratory setae, but the maxillipedal brushing setae are prevented from scraping them effectively by a second row of stouter maxillary setae. True maxillary filter-feeding is therefore of little importance. In addition to raptatory feeding, food particles are retained directly by the maxillipedal brushing setae.

The feeding of *Apseudes* is compared with that of other Peracarida, and the functional evolution of the peracaridan feeding mechanisms is discussed.

R. D.

THE ACTION OF A SINGLE VAGAL VOLLEY ON THE HEART OF THE EEL AND THE TURTLE

By Ernst Fischer

Amer. Journ. Physiol., Vol. 117, 1936, p. 596

The chronotropic effect of a single vagal volley is markedly dependent on the cycle phase at which the volley reaches the pacemaker. The experimental results can be explained by the assumption that around the pacemaker there are two mechanisms of liberation of an acetylcholine-like substance (A.C.): a quick mechanism with a short latent period, and a slow mechanism with a long latent period. Vagal fatigue or small doses of atropine depress the quick chronotropic A.C. liberation process more than the slow one. Neither the dromotropic nor the inotropic vagal action is dependent on the cycle phase.

Eserine and acetylcholine act more strongly on the inotropic and dromotropic mechanism than on the chronotropic. The results are interpreted as indicating that the different vagal fibres affecting the heart are not only functionally distinct, but that there exist several chemical transmitters for the vagal action.

E. F.

THE STRUCTURE AND FUNCTION OF THE ALIMENTARY CANAL
OF SOME SPECIES OF POLYPLACOPHORA (MOLLUSCA)

By Vera Fretter

Proc. Roy. Soc. Edin., Vol. LIX, 1937, pp. 119-64

The anatomy and histology of the alimentary canal of *Lepidochitona cinereus* are described in detail and compared with that of *Acanthochitona crinitus*, *Ischnochiton magdalenensis* and *Cryptochiton stelleri*. All agree in the most important points. The physiology of the gut is studied in *Lepidochitona cinereus* and *Acanthochitona crinitus*.

The buccal cavity containing the odontophore, the openings of a pair of salivary glands and the subradular sac, leads into the oesophagus which expands laterally into a pair of anterior pouches and receives the ducts of a pair of posterior pouches or "sugar glands". The "sugar glands" secrete a diastatic enzyme which passes with the food into the stomach, where it is also mixed with a proteolytic enzyme secreted by the digestive gland. The products of digestion and the undigested food are passed into the anterior intestine whence the soluble products are squeezed into the liver ducts by the action of an intestinal valve or sphincter. The valve regulates the passage of food through the gut and also shapes the oval faecal pellets, which are further moulded and coated with secretion from the gland cells in the extensive coils of the posterior intestine.

Structurally the alimentary canal shows remarkable similarity to that of the lower gastropods.

V. F.

I. AMPHIPODA. II. DECAPOD LARVAE FROM NEWFOUNDLAND WATERS

By Nancy Frost

Reps. Faunistic Series No. 1, Div. Fish. Res. Nfld., 1936

The Amphipoda and decapod larvae collected in Newfoundland waters during the period beginning fall 1931 and ending fall 1935 are listed. Of the twenty-eight species of Amphipoda, eight belong to the Hyperidea and twenty to the Gammaridea. Of the latter, one is a new species of the genus *Hippomedon*. This is described and figured.

Decapod larvae of sixteen species are recorded with detailed descriptions where necessary. The most common were found to belong to the genera

Pandalus, *Spirontocaris*, and *Hyas*. Of these the megalopa attributed to *Hyas araneus* (Linn.), apparently, has not been described before. Among the less common decapod larvae are species belonging to the genera *Caridion*, *Pontophilus*, *Sabinea*, *Cancer* and *Latreillia*. In addition a description is given for the first time of a young stage of *Latreutes fucorum* Stimpson. N. F.

THE LIFE HISTORY OF SOME MARINE PLANKTON DIATOMS

By F. Gross

Phil. Trans. Roy. Soc. B, Vol. 228, 1937, pp. 1-47

The observations and experiments described were made on cultures of *Ditylum Brightwelli* and several other species.

Mitosis was found to be very similar to that of other algae. Resting spores occurred regularly in *Ditylum* cultures during autumn, winter and early spring, not in summer. They are spherical bodies formed inside the parental shell by contraction of the protoplast.

The interaction of three factors was found to cause the formation of resting spores: (1) changes of the medium due to crowding; (2) low temperature; (3) low light intensity. Before the density of the cultures reaches such a degree that persistent resting spores are formed, their formation takes place for some time overnight, followed by germination in the course of the next day. The process of germination is described.

A continuous decrease of the average cell diameter could be established in all the species investigated. When the diameter of the diatoms reaches a certain minimum size no further division is possible and they perish unless they form auxospores which develop into big cells. Formation and development of auxospores are described. It only takes place in diatoms of a certain diameter, and may be induced by environmental factors.

Cytological observations support the view that reduction division and an autogamic sexual process precede auxospore formation. No microspores take part in this process. F. G.

THE NERVE NET OF THE ACTINOZOA. V. TEMPERATURE AND FACILITATION IN *METRIDIUM SENILE*

By D. M. Hall and C. F. A. Pantin

Journ. Exp. Biol., Vol. XIV, 1937, pp. 71-8

The chief protective response of *Metridium* is due to the contraction of the longitudinal mesenteric muscles and not to contraction of the sphincter as in *Calliactis*.

A simple apparatus for electrical stimulation of Actinozoa is described.

As in *Calliactis*, the response to electrical stimulation in *Metridium* does not depend on the intensity of individual shocks but on their number and fre-

quency; moreover, *Metridium* obeys the rule that a stimulus produces no effect. As in *Calliactis*, graded responses can be produced in *Metridium* by varying the frequency of stimulation. The longitudinal mesenterics require the highest frequency for a facilitated response, the parietals require a lower frequency and the sphincter requires a relatively high frequency but its action is delayed owing to its slow rate of contraction. The graded responses of different muscles to stimulation are controlled by facilitation; they are not connected with differences in threshold.

Both contraction and relaxation of *Metridium* are slowed at low temperatures ($Q_{10} = 2$). The facilitating effect of a stimulus endures more than three times longer for a fall in temperature of 10° C. Temperature thus greatly influences the decay of the facilitation process.

D. M. H.

A STUDY OF THE HISTOLOGY OF THE PITUITARY GLAND OF THE SKATE

By N. H. Howes

Quart. Journ. Micr. Sci., Vol. 78, Pt. 4, 1936, pp. 637-51

A study has been made of the pituitaries of young and adult *Raia maculata* Mont., *R. clavata* L., and *R. brachyura* Laf.

The gland shows two distinct regions of growth whose size can be correlated with the size of the animal. These are situated at the anterior and posterior end of the pars anterior.

The pars anterior can be subdivided into three regions differing by the staining reactions of their constituent cells: (a) an anterior region where deep purple chromophil cells are found; (b) a middle, where they are faintly basiphil; and (c) a posterior, where they are mainly acidophil.

It is suggested that these regions are homologous with the pars tuberalis, basiphil, and oxyphil areas respectively of the pars anterior of the mammalian pituitary.

The ventral lobe is a completely separate structure from the pars intermedia, although it may run along the ventral surface of the latter for some distance.

N. H. H.

ON THE PROTOZOAN PARASITES OF *CALANUS FINMARCHICUS* IN THE CLYDE SEA AREA

By Margaret W. Jepps

Quart. Journ. Micr. Sci., Vol. 79, 1937, pp. 589-658

An account is given of the parasites reputed to be of protozoan nature which were observed in *Calanus finmarchicus* in the Clyde Sea Area during the years 1933 to 1936. These comprise *Blastodinium*, *Syndinium*, some gregarines, an ectoparasitic ciliate new to science, *Paradinium*, *Ellobiopsis*, and *Ichthyo-*

sporidium, besides early stages in the development of some platyhelminth worms. A special study is made of *Paradinium*, which was plentiful throughout the summer months, and of the effect of the plasmodial parasites on their hosts.

M. W. J.

STUDIES IN SUBLITTORAL ECOLOGY. II. RECOLONIZATION AT THE UPPER MARGIN OF THE SUBLITTORAL REGION; WITH A NOTE ON THE DENUDATION OF *LAMINARIA* FOREST BY STORMS

By J. A. Kitching

Journ. Ecol., Vol. xxv, 1937, pp. 482-95

Recolonization of artificially denuded rock surfaces at the upper margin of the sublittoral region was followed during a period of two years. On an upward-facing horizontal surface at Dancing Ledge, Dorset, an area originally densely populated by *Corallina squamata* was colonized in the first year by *Himanthalia lorea* and various non-calcareous red algae. *Corallina* reappeared in the second year. It was concluded that normally *Corallina* excluded these early colonists by occupying all the available space. The motile fauna was little affected by changes in the algal population, but sedentary molluscs did not become established on the non-calcareous red algae.

On a denuded overhanging rock surface at a similar level in Wembury Bay, Devon, for an area originally populated by *Distomus variolosus* (Tunicate) and sponges, the sequence of recolonization was (1) *Balanus* spp. within the first half year, (2) *Lomentaria articulata* (red alga), various hydroids, *Halichondria panicea*, and *Diplosoma listerianum* (Tunicate) within the first year, (3) *Distomus variolosus* in the second year. It was concluded that *Distomus* normally restricts the earlier colonists by occupying most of the available space, but that hydroids and *Lomentaria* might remain projecting through the carpet of *Distomus*.

From an examination of *Laminaria* plants cast up by storms, it was concluded that—for the occasions in question—neither overloading of the stipes with epiphytes nor the deprivations of the limpet *Patina pellucida* had contributed materially to the uprooting of the *Laminaria*. It was also concluded that in the sublittoral region *Balanus crenatus* was an early colonist of storm-denuded rock surfaces, but that this barnacle was eventually overgrown by *Laminaria*.

J. A. K.

COLOUR CHANGES IN *HIPPOLYTE VARIANS*

By L. H. Kleinholz and J. H. Welsh

Nature, Vol. 140, 1937, p. 851

A repetition of certain of the observations of Keeble and Gamble on colour changes of *Hippolyte varians* confirmed most of their findings. There is a distinct nocturnal blue phase and a darker day phase and these are due to changes in light conditions accompanying day and night. These phases persist, to some

extent, when the eyes and eye-stalks are removed due to a direct effect of light on the chromatophores. There is in this species, however, no persisting diurnal rhythm in colour change under constant illumination or in constant darkness as claimed by Keeble and Gamble.

The crustacean eye-stalk hormone, when injected into *Hippolyte* in which the dark chromatophore pigments are dispersed, causes a concentration of these pigments and the appearance of the diffuse blue in the surrounding tissues; hence, in this respect, *Hippolyte* is like other members of the group *Natantia* which have been studied.

J. H. W.

THE ACTIVITY OF THE HORIZONTAL SEMICIRCULAR CANAL OF
THE DOGFISH, *SCYLLIUM CANICULA*

By Otto Löwenstein and A. Sand

Journ. Exp. Biol., Vol. XIII, 1936, pp. 416-28

The responses of the ampullary sense organ of the horizontal semicircular canal of *Scyllium* were investigated with an amplifier and oscillograph. The organ was stimulated by rotating the fish on a large turntable in the horizontal plane. It was found that these receptors, like the receptors of the lateral line, display a spontaneous activity which gives rise to a persistent discharge of impulses in the nerve. The discharge is increased during ipsilateral rotation.

During contralateral rotation the discharge is abolished or reduced. This is a type of sensory effect which has not been hitherto described. It shows how a sense organ can discriminate the two phases of a two-way stimulation. The observation helps to account for the way in which an operated animal with only one functional labyrinth can still perform reflex responses to both clockwise and anticlockwise rotation.

A. S.

A COCCIDIAN FROM THE EGGS OF *THALASSEMA NEPTUNI* GAERTNER

By D. L. Mackinnon and H. N. Ray

Parasitology, Vol. XXIX, No. 4, 1937, pp. 457-67

A certain percentage of female echiurid worms of the species *Thalassema neptuni* at Plymouth have their eggs parasitized by a large sporozoan which Ray Lankester (1885) named *Monocystis thalassemae*.

The organism, although vermiform when adult, is not a gregarine. Gametogenesis and sporogony are those of a typical coccidian. The number of chromosomes is seven and the reduction division is zygotic.

The schizogonic phase occurs in the same situation as do the sexual forms, i.e. in the eggs of the host, as these lie in the genital pouches.

A new genus, *Ovivora*, is created for this sporozoan, which should now be named *Ovivora thalassemae* (Lankester). Its affinities seem to be with the *Aggregatinae*.

D. L. M.

ON THE NERVOUS SYSTEM OF THE STARFISH
MARTHASTERIAS GLACIALIS (L.)

By J. E. Smith

Phil. Trans. Roy. Soc., B, Vol. 227, 1937, pp. 111-73

This account of the distribution of the nervous elements, sensory and motor, in the starfish *Marthasterias glacialis* shows that the sensory elements are primary sense cells distributed throughout the entire ectoderm (4000 or more per sq. mm. of surface), but especially numerous in the tube feet and around the bases of the spines and pedicellariae. Below the ectoderm is a plexus of neurofibrils constituted by the central fibres of the sense cells and by the fibrillae of association ganglion cells. The subepithelial plexus is especially well developed in the radial cords, the circumoral nerve ring, and in the tube feet, where it exhibits a zoning which has been interpreted as indicating a polarity of the nervous system in that impulses are conveyed via the tube feet and radial cords to the co-ordinating centres of the circumoral nerve ring.

The motor system is represented by fibrils situated internal to the subepithelial plexus and separated from it by a boundary zone of connective tissue. The latter is, however, penetrated by neurofibrils so that the sensory and motor divisions of the system are in intercommunication.

The motor system consists of Lange's nerves—below the radial cords and nerve ring—and of a lateral motor system. The latter is made up of segmentally arranged nerves which arise at points lateral to the tube feet and opposite the adambulacral ossicles. These nerves enter the perivisceral cavity of the arms and run in the coelomic epithelium where they innervate the circular, longitudinal and apical musculature of the arms.

An account is also given of the histology of the nervous elements of the optic pits and of the sensory-motor arcs of the pedicellariae.

J. E. S.

STUDIES ON THE PHYSIOLOGY OF *ARENICOLA MARINA* L.

PART I. THE PACE-MAKER ACTION OF THE OESOPHAGUS, AND
THE ACTION OF ADRENALINE AND ACETYLCHOLINE

By G. P. Wells

Journ. Exp. Biol., Vol. XIV, 1937, p. 117

Lugworms were placed in glass tubes, designed to resemble the burrow, and watched. The majority showed a well-marked activity cycle, periods of anterior end activity (either proboscis extrusion or acts similar in nature but less vigorous in execution) alternating with periods of rest. Each activity cycle occupies 6.6 ± 2.13 minutes. It is suggested that *Arenicola* normally feeds in periodic outbursts, corresponding to this activity cycle.

By considering a series of dissected preparations, it can be shown that the activity cycle is due to a pace-maker action of the oesophagus. Outbursts of rhythmic activity originate in the oesophageal wall, and the excitations travel, via the neuromuscular structures in the wall of the proboscis, to the nerve ring and nerve cord, and thence to the body-wall musculature of the anterior end of the worm.

Application of adrenaline excites the oesophagus, which now discharges a continuous series of rhythmic excitations forwards into the proboscis and body wall. If intact worms are injected with adrenaline, they continue, for half an hour or longer, to show vigorous rhythmic burrowing movements. Acetylcholine causes partial contracture of the oesophagus, but does not significantly modify its normal rhythmic pattern.

Some biological implications of these results are discussed.

G. P. W.