

ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS PART V. NOTE ON THE GILLS OF *AMUSSIUM PLEURONECTES*

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 80, 1937-8, pp. 321-9

The gills of *Amusium pleuronectes* L., a species from shallow water, have been found to be plicate and heterorhabdic, thus differing in structure from those of the deep water species, *A. dalli*, *A. meridionale*, and *A. lucidum*, which Ridewood found to have flat and homorhabdic lamellae. The gills of *A. pleuronectes* closely agree with those of the Pectinidae also possessing plicate and heterorhabdic lamellae. It is concluded that Ridewood's classification of the Amussiidae with the Mytilacea cannot be upheld; the position of this family is with the Pectinacea as in Pelseneer's classifications of 1888, 1906, and 1911.

D. A.

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS

PART VI. THE PATTERN OF THE LATERAL CILIATED CELLS OF THE GILL FILAMENTS OF THE LAMELLIBRANCHIA

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 80, 1937-8, pp. 331-44

The patterns of the lateral ciliated cells of the gill filaments have been examined in a number of lamellibranchs and figures given. In the Protobranchia the lateral ciliated cells, except for a row on the abfrontal side, have no definite shape or arrangement, the ends being pointed and interdigitating; in the higher lamellibranchs there is an orderly arrangement of the rhomboidal cells in rows. The arrangement of the cells in any species appears to be constant. In the group possessing micro-latero-frontal cilia the variation in the pattern in the various families is in marked contrast with the constancy of the general type of pattern found in the majority of the Eulamellibranchia.

D. A.

ON THE CILIARY MECHANISMS AND INTERRELATIONSHIPS OF LAMELLIBRANCHS

PART VII. LATERO-FRONTAL CILIA OF THE GILL FILAMENTS AND THEIR PHYLOGENETIC VALUE

By D. Atkins

Quart. Journ. Micr. Sci., Vol. 80, 1937-8, pp. 345-436

Three types of latero-frontal tracts have been found in Lamellibranchs. The *first* is composed of large cilia, termed *eu-latero-frontal cilia*, together with subsidiary ones called *pro-latero-frontal cilia*, and is found in some or all of the three families of Protobranchia (presence of pro-latero-frontals doubtful in some families); in the Mytilidae and probably the Trigoniidae among the Filibranchia; and in the Eulamellibranchia (of Pelseneer, 1911). A list of the species investigated is given. The *second* is composed of small, tenuous cilia, termed *micro-latero-frontal cilia*, and is found in the Arcidae, Anomiidae, Pteriidae, Pectinidae, Spondylidae, Limidae, Pinnidae, and inferred to be present in the Amussiidae, Vulsellidae and Isognomonidae. A list of species examined is given. These forms were previously considered to lack latero-frontal cilia. The *third* is composed of moderate-sized cilia, termed *anomalous latero-frontal cilia*, together with subsidiary ones called *para-latero-frontal cilia*, and is found in the Ostreidae only.

In bivalves having eu-latero-frontal cilia the arrangement of the various ciliary tracts, frontal, latero-frontal and lateral is fairly constant, notable exceptions being a protobranch, *Nuculana*, and a filibranch, *Trigonia*. In bivalves having micro-latero-frontal cilia the arrangement of the various ciliary tracts is more or less constant.

The homology of the various types of latero-frontal cilia is discussed. The composition of the latero-frontal ciliated tracts has been found to be a constant character, and, as it is correlated with other characters, has taxonomic value.

It is suggested that the variations in the constitution of the latero-frontal tracts show that Ridewood's (1903) classification does not express genetic affinities, nor does Pelseneer's (1911) entirely, and that Pelseneer's order Filibranchia, and Ridewood's orders Eleutherorhabda and Synaptorhabda are not monophyletic.

Families possessing micro-latero-frontal cilia appear to be closely related, and form a group, which, with certain modifications, corresponds to "the Aviculidae and their allies" (Jackson), or the "sedentary" branch of lamellibranchs (Douvillé), previously established largely on shell characters. Thus the constitution of the latero-frontal tracts of the gills supports the findings of palaeontologists with regard to this group.

The relationship of forms with micro-latero-frontal cilia, and the evolution within the group of the eulamellibranchiate or synaptorhabdic gill are dis-

cussed. One family, the Ostreidae, which must be included on account of its relationship with either the Pteriacea or Pectinacea (based on other evidence) has anomalous, together with para-latero-frontal cilia. The anomalous latero-frontal cilia differ in certain respects from the eu-latero-frontal cilia characteristic of the majority of the Lamellibranchia, and are presumed to have arisen independently.

Common characters of the group with micro-latero-frontal cilia, in addition to the form of the latero-frontal cilia are: (1) shell characters of the prodissoconch, Arcidae excepted; (2) byssal fixation; (3) considerable free posterior region to the gill axes; (4) considerable development of the muscles of the gill axes, Ostreidae excepted; (5) method of division of the pallial cavity, Ostreidae excepted; (6) gills without a supra-axial extension to the outer demibranch; (7) presence of longitudinal currents at the free ventral edge of both inner and outer demibranchs, and of opposed frontal currents on all lamellae and frequently on the same filament, except in the Pinnidae; (8) absence of pallial sutures; (9) inner fold of mantle margin commonly well developed, especially in swimming forms; (10) insertion of retractor muscles of the mantle margin far from the shell edge, Arcidae excepted; (11) tendency for members to lie on the right valve, Ostreidae excepted; (12) abdominal sense organs on posterior adductor muscle; (13) intercommunication of auricles, Anomiidae excepted.

Two groups of Lamellibranchia are proposed provisionally; group I, Macrociliobranchia (latero-frontal tracts consisting of a row of eu-latero-frontal cilia, with also a row of pro-latero-frontal cilia in all or most members) with the orders Protobranchia (Pelseneer), Filibranchia (emended to contain only the Mytilacea and Trigoniacea), Eulamellibranchia (Pelseneer, 1911) and Septibranchia (Pelseneer); and group II, Microciliobranchia (latero-frontal tracts consisting characteristically of a row of micro-latero-frontal cilia) with the order Pseudolamellibranchia, emended to include the sub-orders Arcacea (less the Trigoniidae), Anomiacea, Pteriacea, Pectinacea, and Ostreacea. The Macrociliobranchia will need revision, for it is probable that the Filibranchia (emended), if not the Eulamellibranchia, are still not monophyletic.

D. A.

BIOCHEMISTRY OF THE ELECTRIC ORGANS OF *RAIA CLAVATA*

By Ernest Baldwin

Biochem. Journ., Vol. 32, 1938, pp. 888-94

A study was made of extracts from the electric tissue of *R. clavata* with reference to its power to catalyse the following reactions:

- (1) Phosphoglyceric acid \rightarrow phosphopyruvic acid;
- (2) Phosphopyruvic acid + adenylic acid \rightarrow pyruvic acid + adenylypyrophosphate;

(3) Adenylpyrophosphate + creatine \rightarrow adenylic acid + creatine phosphoric acid;

(4) Adenylpyrophosphate \rightarrow adenylic acid + phosphoric acid.

The power to catalyse these reactions is characteristic of all vertebrate muscles so far examined, and it has recently been shown that extracts from the electric organs of *Torpedo marmorata* contain enzymes capable of catalysing the same reactions. Extracts from *Raia clavata* have now been shown to possess the same catalytic properties.

Although, weight for weight, the electric organ of *Raia* is considerably less active than that of *Torpedo* and than muscle itself, the difference appears to be due to structural rather than to metabolic features, and it is probable that, in terms of the electrically active disc material, as opposed to connective tissue, the organ is no less active in *Raia* than it is in *Torpedo*.

There is thus reason to believe that in muscle itself, and in electric tissue derived by modification of muscular rudiments (as it is in *Raia* and *Torpedo* alike), we have a case in which different types of effector activity are subserved by common chemical mechanisms. Some preliminary experiments on the electric tissue of *Malapterurus electricus*, which arises from glandular rather than muscular sources, indicate that energy production is here attained by different chemical mechanisms. In electric organs of muscular and glandular origins, therefore, we have a case in which the same type of effector activity is subserved by different chemical mechanisms. E. B.

THE DIGESTIVE SYSTEM OF *AMPHIOXUS* (*BRANCHIOSTOMA*) *LANCEOLATUS*

By E. J. W. Barrington

Phil. Trans. Roy. Soc. Lond. B, Vol. 228, pp. 269-311

In this paper an attempt is made to correlate structure and function in the digestive system of *Amphioxus*. A preliminary account of the cytology is given, and the ciliation is shown to give rise to a complex of ciliary tracts and currents. The cilia of the ilio-colon ring set the food-cord into rotation along its longitudinal axis, and to the rotating cord are conveyed the digestive secretions produced in the "liver". These become mixed with the mass of food, together with secretions from the mid-gut, and portions of the mixed material are swept away from the rotating mass down the hind-gut, where absorption takes place. Some absorption probably takes place also in the mid-gut and in the "liver", but the general trend of the ciliation appears to be away from the latter region. It would seem that absorption, which is associated with the ingestion of solid material, can take place throughout most of the post-pharyngeal region, the limiting factor being the ciliary mechanisms. Some account is given of the nature and distribution of the

digestive enzymes, and in conclusion the homology of the "liver" is discussed. It is suggested that it is at least as plausible to compare this organ with the intestinal diverticula of certain ammocoetes as with a true liver, and it is pointed out that these diverticula, which coexist with a well-developed liver, may themselves have some affinity with the pancreas of the higher Chordata.

E. J. W. B.

OEKOLOGISCHE UND ZELLPHYSIOLOGISCHE STUDIEN AN ROTALGEN
DER ENGLISCHEN SÜDKÜSTE

By R. Biebl

Beihefte zum Botanischen Centralblatt, Bd. 57, Abt. A, 1937, pp. 381-424

Die Lebensbedingungen an der Ebbelinie und in den Tidepools weichen stark von denen in grösserer Tiefe ab. In Uebereinstimmung damit zeigen die Rotalgen dieser Standorte eine verschiedene Resistenz gegen hypo- und hypertones Seewasser. Algen oberhalb der Ebbelinie besitzen eine osmotische Resistenzbreite von ca. 0.4-2.0 fach konzentriertes Seewasser, während Tiefenalgen nur einen Resistenzbereich von durchschnittlich 0.5-1.4 Seewasser aufweisen. Da die Rotalgen im allgemeinen sehr plasmolyseempfindlich sind, fällt meist die obere Grenze ihrer Resistenz gegen konzentriertes Seewasser mit der Grenzplasmolyse bewirkenden Konzentration zusammen. Die meisten Rotalgen der Ebbelinie und der Tidepools zeigen daher Grenzplasmolyse um 2.0 faches Seewasser, während die Tiefenalgen schon in 1.4-1.6 Seewasser zu plasmolisieren beginnen.

Nur *Ceramium ciliatum*, das seinen Standort an der Ebbelinie hat, besitzt trotz grosser Hypertonieresistenz einen niederen osmotischen Wert. Er entspricht 1.5 fach konz. Seewasser. Dieses *Ceramium* ist aber auch die einzige bekannte Rotalge, die Plasmolyse schadlos erträgt. In ähnlicher Weise zeigen plasmolyseunempfindliche Grünalgen (*Cladophora*) bei einer Resistenz gegen mehr als doppelt konzentriertes Seewasser einen niederen osmotischen Wert (1.3 Seewasser).

Sphondylothamnion multifidum stirbt schon bei Temperaturen unter +3° C. ab. Diese grosse Kälteempfindlichkeit wird als eine plasmatische Eigenschaft der Algen wärmerer Meere angesehen, die auch in anderen Verbreitungsgebieten beibehalten wird.

Die Untersuchungen wurden im Marine Biological Laboratory in Plymouth und an der Küste von Wembury (Süddevon) durchgeführt.

R. B.

ZUR PROTOPLASMATISCHEN ANATOMIE DER ROTALGEN

By R. Biebl

Protoplasma, Vol. 28, 1937, pp. 562-81

Die Methoden der protoplasmatischen Anatomie (Resistenzversuche, Zentrifugierung, Beobachtung von Plasmolyseformen und -zeiten, etc.) ermöglichen es auch an zahlreichen Rotalgen deutlich physiologische Unterschiede morphologisch mehr minder gleichartig aussehender Zellen festzustellen. So zeigen eine Reihe von Rotalgen mit flächigem Thallus (*Polyneura Hilliae*, *Cryptopleura ramosum*, *Cryptopl. ram. var. uncinatum*, *Nitophyllum punctatum*) gegen verdünntes Seewasser und andere Lösungen auffallend resistente Randzonen, die in Zentrifugierungsversuchen eine höhere Viskosität des Plasmas erkennen lassen. Sie werden als physiologischer Schutzsaum gedeutet. Andere Algen besitzen wieder besonders empfindliche Thallusrippen (*Phycodris rubens*) oder zeigen in Resistenzversuchen verschiedene Empfindlichkeitsgradienten. Dabei erweisen sich bei manchen Algen die älteren, bei anderen wieder die jüngeren Zellen als die empfindlicheren. Zentrifugierungsversuche ergeben in einigen Algen auch ausgeprägte Viskositätsgradienten, in denen die Zähflüssigkeit des Protoplasmas stets mit dem Alter der Zellen zunimmt (*Callithamnion tetragonum var. brachiatum*, *Antithamnion tenuissimum*, *Polysiphonia urceolata*).

R. B.

SOME NOTES ON SEX RECOGNITION IN *CARCINIDES MAENAS* (L.)

By G. J. Broekhuysen

Arch. Néerl. de Zool., Tome III, Livr. 1, 1937, pp. 156-64

The object of the study was to establish whether the copulating crabs find each other as the result of a stimulating chemical substance produced by the female under certain physiological conditions or whether the sense of touch and the reaction of the female to it, is responsible for sex recognition.

The results indicate that in *C. maenas* there is no distinct sex recognition and that the copulation is probably determined by the reaction of the female to touch.

G. J. B.

SOME CONDITIONS GOVERNING THE SOLUBILITY OF IRON

By L. H. N. Cooper

Proc. Roy. Soc. London, B, Vol. CXXIV, 1937, pp. 299-307

Existing data on the solubility products of ferrous and ferric hydroxides and in the ion, FeOH^{++} , have been used to calculate the maximum activities of Fe^{++} , FeOH^{++} , and Fe^{+++} which may exist in sea water.

The maximum activity of ferrous ion is controlled both by the activity of the ferric ion and by the oxidation-reduction potential of the system.

The total quantity of iron in true solution in water after equilibrium has been attained does not exceed

3×10^{-8}	mg. iron per cubic metre at pH 8.5		
4×10^{-7}	”	”	8.0
4×10^{-5}	”	”	7.0
5×10^{-3}	”	”	6.0

and of this the greater part consists of ferrous and FeOH^{++} ions. In more acid solutions ferrichloric acids may have to be taken into account.

These values apply to iron in sea water, in natural waters and in many physiological fluids.

L. H. N. C.

SELENOCYSTIS FOLIATA (RAY) FROM *SCOLELEPIS FULIGINOSA* CLPDE.
AND ITS IDENTITY WITH *HAPLOZOON* SP.

By M. J. Dobb

Parasitology, Vol. xxx, 1938, pp. 296-308

The so-called parasitic dinoflagellate occurring in the gut of the polychaete worm *Scolecopsis fuliginosa* Clpde. at Plymouth, is really the sexual phase of the gregarine "*Selenidium foliatum*" Ray.

The gametocytes (often very unequal) associate by their posterior ends while *in situ*. One remains attached and its epimerite is transformed into a foot-like organ serving to attach the gametocyst to the host throughout the rest of development. The gametocyst is elongate and pyriform and its formation involves very little alteration in the shape of the gametocytes. Solitary encystment also occurs.

Flagellated isogametes are formed. The spherical spores contain four or eight spindle-shaped sporozoites.

A new genus *Selenocystis* is proposed for this organism, with *S. foliata* (Ray) as the type species. Although schizogony has not yet been found, the probability is that it may still be classified among the schizogregarines.

M. J. D.

THE STRUCTURE AND FUNCTION OF THE ALIMENTARY CANAL OF SOME
TECTIBRANCH MOLLUSCS, WITH A NOTE ON EXCRETION

By Vera Fretter

Trans. Roy. Soc. Edin., Vol. LIX, 1938, pp. 599-646

In *Philine aperta*, *Scaphander lignarius*, *Haminea hydatis* and *Actaeon tornatilis* the muscular buccal cavity, lined by a glandular epithelium, contains a radula

adapted for manipulating the type of food upon which the animal feeds. In *Actaeon* an odontophore is absent. Salivary glands secreting mucus, and in *Philine*, *Scaphander* and *Haminea* a diastatic enzyme, open laterally into the posterior end of the buccal cavity. The oesophagus leads from the dorsal food channel to the stomach and consists of, save in *Actaeon*, a crushing gizzard separating the anterior from the posterior crop. Here extracellular digestion occurs and in these forms the stomach is reduced in size. In *Actaeon* the oesophagus is a simple muscular tube and the stomach is well developed and provided with an extensive caecum in which digestion takes place. Opening into the stomach are the ducts of the digestive gland and from it the coiled intestine, provided with glands concerned in the elaboration of the faeces, leads to the anus. In *Philine*, *Scaphander* and *Haminea* the digestive gland contains a protease, diastase, glycogenase and lipase.

Soluble products and small particles, which are derived from the action of enzymes upon, and the mechanical force applied to the food in the oesophagus, are passed through the oesophageal sphincter to the stomach. They are ingested by the digestive cells of the digestive gland and within these digestion is completed. The digestive gland undergoes a rhythmical cycle involving phases of secretion, absorption and excretion. It also acts as a kidney in taking up waste matter from the blood and building it into a compact form which leaves the body with the faeces.

V. F.

THE STRUCTURE AND FUNCTION OF THE ALIMENTARY CANAL OF AEOLID MOLLUSCS, WITH A DISCUSSION ON THEIR NEMATOCYSTS

By Alastair Graham

Trans. Roy. Soc. Edin., Vol. LIX, 1938, pp. 267-307

The food of *Eolidina alderi* (*Heliactis bellis*), *Facelina drummondi* and *Cratena glotensis* (hydroids) is bitten off by the jaws and raked into the buccal cavity by the radula lubricated by the secretion of salivary glands and by mucus secreted by the pedal gland. In the stomach it is exposed to a protease secreted by the digestive gland. Soluble products of digestion are absorbed by the cells of the stomach and digestive gland; particulate matter is ingested by the latter and digested intracellularly. Indigestible matter accumulates in these cells and is later extruded with the faeces. Ciliary currents bear food particles to the gland and secretion and waste to the stomach. Owing to the absence of a mantle cavity there are no intestinal glands and the faeces are expelled in an uncompacted condition. As nematocysts do not discharge spontaneously in sea water they can be ingested undischarged; secretion of mucus aids in preventing discharge and in protecting the aeolid. The pH of

the gut is too high to cause explosion. The mechanism of their discharge by aeolids is concluded to be mechanical pressure exerted by the contraction of circular muscles around the cnidosacs or by a predator. A. G.

STUDIES IN THE PIGMENTARY SYSTEM OF CRUSTACEA. IV. THE UNITARY
VERSUS THE MULTIPLE HORMONE HYPOTHESIS OF CONTROL

By L. H. Kleinholz

Biol. Bull., Vol. LXXV, 1938, pp. 510-32

Experiments were performed to determine whether one or more than one hormone is involved in the control of the crustacean pigmentary system. Blood transfusions from black- and from white-adapted individuals into white-adapted *Crangon* evoked darkening in about 25 % of the test animals; injection of rostral region extract was only slightly more effective. Superficial cautery of the rostral region had no permanent effect on colour mutability; deep cautery in sixty-nine animals resulted in nine individuals which became permanently pale. Because all of these nine individuals were abnormal in their swimming and equilibratory movements, it is suggested that the results were due to injury of the brain and consequent interference with the regulation of Hanström's sinus gland. The validity of the unitary hormone hypothesis was subjected to biological test by a study of the retinal and integumentary pigments in *Hippolyte*, which had been reported to undergo a diurnal rhythm in the activity of the integumentary effectors. No persistent activity could be found in the retinal pigments of *H. varians*; *H. pleuracantha* showed a persistent cyclic rhythm of the distal retinal pigment, but not in the phase expected in *H. varians*. Further study showed that the reported periodicity of colour change in *H. varians* was due to a direct effect of darkness on the body chromatophores. Threshold limits of the retinal and integumentary cells to eye-stalk hormones were determined in *Leander adpersus*. The lower threshold limit for the distal retinal pigment was found equivalent to 0.016 mg. (wet weight) of eye-stalk; that for the integumentary pigment was 0.0008 mg. These values do not support the unitary hormone hypothesis which requires that the minimal threshold for the retinal pigments be lower than that for the body chromatophores. The responses of the distal retinal pigment to various concentrations of stalk extract are plotted in curves which show a direct relation between response and the injected dosage. L. H. K.

THE FEEDING MECHANISM OF THE OYSTER. I. ON THE PALLIUM AND THE BRANCHIAL CHAMBERS OF *OSTREA VIRGINICA*, *O. EDULIS*, AND *O. ANGULATA*, WITH COMPARISONS WITH OTHER SPECIES OF THE GENUS

By Thurlow Christian Nelson

Journ. Morph., Vol. 63, 1938, pp. 1-61

This study forms the first part of an investigation of the feeding mechanism of the oyster. Anatomical features formerly overlooked or unknown are shown to be important in this process. Separation of the mantle from the visceral mass on the right side in deeply cupped species of oyster provides a shorter channel for egress of water from the right demibranchs. Correlated with this change is reduction in size of the right epibranchial chamber beneath the adductor together with backward displacement of the adductor itself. This water passage, designated the promyal chamber, develops during the first week after attachment of the oyster larva. The greatest displacement of the adductor and the largest promyal chamber occur in *O. frons*. The mantle border shows three reduplications of which the innermost, the pallial curtain, controls the amount and the place of entrance and egress of water. The importance of pallial curtains and promyal chamber to survival in turbid waters is discussed; oysters with the promyal chamber have invaded the river mouths, the flat oysters without this chamber have remained in the clear waters of high salinity near the sea. The bearing of these factors on the disappearance of fossil oysters is considered. It is proposed to relate to the genus *Ostrea* all flat, larviparous oysters which lack the promyal chamber and to raise the subgenus *Gryphaea* to generic rank to include all deeply cupped oviparous oysters with the promyal chamber. Anatomical and histological features of the pallium and branchial chambers are considered in detail.

T. C. N.

ENZYMIC PHOSPHORYLATIONS IN INVERTEBRATE MUSCLE

By Severo Ochoa

Biochem. Journ., Vol. xxxii, 1938, pp. 237-42

In enzyme preparations from muscle of the common lobster (*Homarus vulgaris*) adenylic acid is ineffective in activating the transfer of phosphate from phosphopyruvic acid to arginine whereas, in absence of the latter, it is readily phosphorylated to adenosine triphosphate. Addition of arginine to the muscle extract a few minutes after incubation with phosphopyruvic and adenylic acids, results in a synthesis of phosphoarginine of the same order as can be obtained with equivalent amounts of adenosine diphosphate or

triphosphate. Thus the presence of arginine appears to inhibit the phosphorylation of adenylic by phosphopyruvic acid. Manganese can replace equivalent amounts of magnesium in the enzymic transfer of phosphate from phosphopyruvic acid to arginine in lobster muscle extract. Owing to the ineffectiveness of adenylic acid and cozymase in this enzymic reaction, the observation of von Euler that some adenosine diphosphate is set free on mild alkaline hydrolysis of cozymase has been confirmed by a biological method. Fish muscle extracts (*Raia clavata*) also phosphorylate readily adenylic acid in presence of phosphopyruvic acid, even if creatine be present, so that adenylic acid activates here (as in other vertebrate muscles) the transfer of phosphate from phosphopyruvic acid to creatine. Neither is arginine esterified by *Raia* muscle extracts nor is creatine by those of *Homarus*. S. O.

COZYMASE IN INVERTEBRATE MUSCLE

By S. Ochoa and C. G. Ochoa

Nature, Vol. 140, 1937, p. 1097

A comparative study of the quantitative distribution of cozymase in muscle from marine invertebrates. Both the oxidized (CO) and reduced (COH₂) forms have been determined in fresh muscle and after 4 hr. autolysis at 18°. The strong tail muscle of *Homarus vulgaris*, the adductors of *Ostrea* and *Pecten* and the swiftly contracting mantle muscle of *Sepia* contain as much cozymase as mammalian muscle does (0.24–0.45 mg. per g.). Very little was found to be present in the less active muscles of *Metridium*, *Holothuria* and *Echinus*. The ratio CO/COH₂ is fairly constant (30–45% COH₂) in all the muscles examined and of the same order as in mammalian muscle. The amount of autolytic inactivation ranges from 30 to 50% of the cozymase originally present and is definitely lower than in mammalian muscle where it ranges from 80 to 95%. A certain parallelism was found between the content of cozymase and other phosphorus compounds particularly adenylypyrophosphate which is chemically and functionally related to cozymase.

S. O.

THE STOLONIZATION AND THE SEXUAL CHARACTERS OF THE STOLON IN THE SYLLIDIAN POLYCHAETES (Studies on the Syllidae. III)

By Yô K. Okada

Japanese Journ. Zool., Vol. VII, 1937, pp. 441–90

In this part of the serial study of Syllidian Polychaetes the process of schizogamy is investigated. The author has first made a general survey of the methods of stolonization in this group of animals, and has distinguished two

different types of gemmation having distinct origin in *Trypanosyllis*, the synchronous plural formation of stolons in *Syllis ramosa* and the lineal successive production of new individuals in *Myriamida* and *Autolytus* beside the simple division of the body in two in other forms. The stolonization is compared with the process of regeneration, new animals being produced in the Syllinae on the median ventral surface of the last segment (sometimes more than one segment) of the stock with as many centres of proliferation as the number of resulted stolons, whereas in the Autolytinae the formation of new animals is limited to the posterior end of the stock with a common source for all individuals.

The position of stolonization is sometimes fixed. It varies in the Autolytinae only according to the rule of fragmentation. In any case, however, stolonization never occurs in the extremely anterior (before the 13th set. segment) or posterior part of the body.

Finally the development of the sexual characters in the stolon is analysed. The modification of the eyes and the cephalic appendages are intimately related (through humoral agents) with the ripening of the sexual elements in the gonad, whereas the change of parapodia including the elongation of setae, though it takes place likewise in close connexion with the ripening of the gonad, has no humoral connexion with the latter.

Y. K. O.

THE RATES OF CONDUCTION OF NERVE FIBRES OF VARIOUS DIAMETERS IN CEPHALOPODS

By R. J. Pumphrey and J. Z. Young

Journ. Exp. Biol. Vol. 15, 1938, pp. 453-66

The rates of conduction of nerve fibres of *Sepia* and *Loligo* varying from 30 to 718 μ in diameter have been estimated from records of their action potentials, and the limits of conduction velocity found to be 2.2-22.8 m./sec. at 20° C. Although the fibres examined have different functions, and come from animals which differ considerably in structure and mode of life, yet the conduction rates of all of them can be expressed approximately as a single function of the diameter. That is to say they do not differ greatly from each other except in size. The exact relationship of conduction velocity to diameter cannot yet be determined, but is such that the velocity increases with a power of the diameter somewhat higher than the square root but less than the first power.

The possession of giant fibres produces a significant saving of time for the animal, it being calculated that the reaction time of a squid is about half that which it would be in a similar animal which possessed no giant fibres. The presence of rapidly conducting fibres is also an advantage in that it decreases

the discrepancies between the times of contraction of parts of the mantle at varying distances from the central nervous system. In *Loligo* there is a graded series of fibres with the larger in the longer nerves, and this is apparently a further device for ensuring more nearly simultaneous contraction.

J. Z. Y.

A REVISION OF THE GENUS *CAMPANULINA* VAN BENEDEEN, 1847

By W. J. Rees

Ann. Mag. Nat. Hist., Ser. II, Vol. 3, 1939, pp. 433-47

The revision of the genus *Campanulina* van Beneden, 1847, has resulted in the almost complete dismemberment of the genus. *C. tenuis* van Beneden 1847 (non 1866) has been shown to be the sole species of the genus. The other subsequently described species of "*Campanulina*" have been referred to other genera. The medusa-bearing species have been referred to four genera, viz. *Aequorea*, *Campomma*, *Phialella*, and *Eirene*, while the species with fixed gonophores have been placed in *Opercularella*. Species whose gonosomes are unknown are placed provisionally in *Opercularella*.

W. J. R.

FURTHER OBSERVATIONS ON THE EFFECT OF TREMATODE PARASITES ON *PERINGIA ULVAE* (PENNANT) 1777

By Miriam Rothschild

Novitates Zoologicae, Vol. XLI, 1938, pp. 84-102

The sampling of large collections of *Peringia ulvae* from different localities and habitats established several additional points regarding the relationship of this mollusc and its trematode parasites. The study is complicated by the great variation which is found in size (growth), shell colour, shell shape and shell texture of the snail—probably due to environmental rather than genetic factors. In all collections, however, irrespective of growth conditions, trematode parasites were found to produce relative gigantism in the host, which involves both soft and hard portions of the body.

The normal sex ratio of *P. ulvae* also varies from sample to sample, but female specimens consistently outnumber males in the largest size groups and also attain greater dimensions. More males than female snails are infected with trematodes, sometimes the ratio was found to be as high as 16:1. This fact in conjunction with the gigantism produced by the parasites, can combine to obscure or even reverse the normal difference in size usually displayed by the sexes. The penis of all infected males is abnormal, being greatly reduced

in size, and it is possible that some infected snails without a penis are totally castrated males. There is also some evidence to support the theory that infected females grow a penis. This would explain the apparent excess of parasitized males, over females.

M. R.

THE EXCRETORY SYSTEM OF *CERCARIA CORONANDA* N.SP., TOGETHER WITH NOTES ON ITS LIFE-HISTORY AND THE CLASSIFICATION OF CERCARIAE OF THE SUPERFAMILY OPISTHORCHIOIDEA VOGEL 1934 (TREMATODA)

By Miriam Rothschild

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The excretory system of a typical pleurolophocercous cercaria from *Peringia ulvae* (Pennant) 1777 was found to be of an extremely aberrant type. The main collecting tubes divide about the level of the ventral sucker and the flame cell pattern is $2 [(2+2)+(2+2)] = 16$. This illustrates once again that the greatest caution is necessary when using the excretory system as a basis for a natural classification.

Closely allied cercariae are notoriously difficult to distinguish specifically. The most important characters for differentiating between the pleurolophocercous cercariae from *P. ulvae* were found to be: (1) Shape and size of the body under a coverslip *at death*. (2) The precise extent, position and shape of the caudal fin-folds. (3) Pigmentation of the body. (4) Behaviour and length of life of the cercaria.

In the laboratory *Gobius ruthensparri* Euphras. serves as a second intermediate host. The cysts are situated in the lateral muscles of the body. The metacercaria develops a crown of 15 spines round the oral sucker and the anterior cornua of the excretory vesicle extend anteriorly into the oesophageal region. A gonotyl is present. Feeding experiments were unsuccessful, but from the morphology of the metacercaria it is thought that the fluke pertains to the subfamily Neochasminae Van Cleave and Mueller.

M. R.

OCCURRENCE OF YOUNG *OPHIOTHRIX FRAGILIS* WITHIN THE GENITAL BURSA OF THE ADULT

By J. E. Smith

Nature, Vol. 141, 1938, p. 554

Recently metamorphosed *O. fragilis* are, on occasions, to be found within the genital bursa of the adult. The presence of young within the bursa of an adult ophiuroid has frequently been taken to indicate a viviparous habit. This is clearly an unjustified assumption since, in an oviparous species such

as *O. fragilis*, the young forms must have entered the bursa after metamorphosing elsewhere.

J. E. S.

LES MOUVEMENTS PROTOPLASMIQUES AU COURS DE LA FÉCONDATION
DE L'ŒUF D'ASCIDIE

By G. Vandebroek

Arch. f. exper. Zellf. Vol. XIX, pp. 411-19

In this preliminary note on researches on the development of Ascidians, it is shown that from the moment of penetration of the spermatozoon till the first segmentation, deformations and protoplasmic movements occur in the egg of ascidians (*Ascidia aspersa* and *scabra*). Certain of these phenomena may be followed by the simple observation of eggs from which the membranes have been removed; others are only visible if stained marks have been made on the surface of the egg.

During this period, the egg exhibits bilateral symmetry four times. Stained marks show that this bilateral symmetry coincides exactly with the bilateral symmetry of the tadpole. The first of these deformations consists in the flattening of a lateral face immediately after penetration of the spermatozoon. This flat face will give rise to the mesoblastic face of the blastule. The occurrence of the same phenomenon after activation (by overstaining) indicates that the plan of bilateral symmetry pre-exists in the unfertilized egg. The formation of a flat face must be ascribed to a change of the surface tension on a heterogeneous mass. The three other deformations respectively coinciding with the emission of the first and the second polar bodies, and with the first karyokinesis, are correlated with the appearance of the spindle and aster figures.

Protoplasmic movements may be observed twice: (1) immediately after the penetration of the spermatozoon, whilst a constriction wave is being propagated from the animal to the vegetative pole; (2) on the moment of conjugation of the pronuclei. The first seems to be due to the change of surface tension already mentioned; the second to the displacement of the attraction sphere at the time of conjugation of the pronuclei.

Identical phenomena have been observed in *Ciona*, *Corella* and *Molgula*.

G. V.

THE PHOTIC CONTROL OF PIGMENTARY RESPONSES IN TELEOST FISHES

By Ursula Wykes

Journ. Exp. Biol. Vol. XIV, 1937, pp. 79-86

Many shallow water teleosts, e.g. *Gobius paganellus* and *G. ruthensparri*, *Ctenolabrus rupestris*, *Lepadogaster gouani* and *Phoxinus phoxinus*, when blinded, show a pigmentary response to photostimulation.

This response was analysed quantitatively in *Lepadogaster gouani*. The melanophores of the blinded animal contract in darkness and expand when illuminated by a 100 W. light. In the normal animal on a light background the latter response is checked by a secondary contraction.

The dermal response of these animals is thus closely comparable to that of the chameleon, and it is possible that it may be similarly controlled. No such dermal response was observed in *Pleuronectes platessa*.

It is evident from the experiments, however, that many colour-changing teleosts do exhibit pigmentary responses which are independent of visual stimulation and which depend on the intensity of the incident light.

U. W.

THE NATURE AND SIGNIFICANCE OF THE MEMBRANES SURROUNDING THE DEVELOPING EGGS OF *HOMARUS VULGARIS* AND OTHER DECAPODA

By C. M. Yonge

Proc. Zool. Soc. Lond., A, Vol. 107, pp. 499-517

The developing eggs of *Homarus* are surrounded by two secreted membranes. The inner of these is of chitin and is secreted by the walls of the oviduct when the eggs descend. The outer membrane is identical in all respects with the cuticle which constitutes the outermost layer of the integument. This membrane is secreted by the numerous cement glands present in the pleopods of the female. These glands resemble in all respects the tegumental glands which secrete the cuticle. The eggs are attached to the non-plumose setae on the pleopods by strands of the same "cement". There is good evidence that the ducts of the cement glands open on these setae. The limited permeability of the outer membrane renders osmotic hatching possible. In *Homarus* fertilization is almost certainly external and the complicated nature of the spermatozoa is probably correlated with the necessity for penetrating the inner membrane. In decapod Crustacea there is an intimate association between ecdysis and egg-laying, the sequence of events being outlined. Egg attachment in the Decapoda thus represents the exploitation of a substance which forms the outer layer of the integument. The properties of this substance—low surface tension, slow solidification in water, final hardness and limited permeability—make it ideal for this purpose.

C. M. Y.