

ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

UNTERSUCHUNGEN ÜBER DIE EIWEISSVERDAUUNG *IN VIVO* UND *IN VITRO* BEI EINIGEN GASTROPODEN

By Greta Hörstadius, geb. Kjellström, und Sven Hörstadius

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The digestion of proteins was studied in some marine Gastropoda, and the results that refer to work performed at The Marine Biological Laboratory, Plymouth, are as follows:

In *Hermaea dendritica* phagocytosis was with certainty shown to occur in the 'liver' by feeding the animals with algae containing chloroplasts of different size (*Bryopsis* and *Codium*). In the ingested chloroplasts the characteristic starch reaction could be demonstrated.

In *Pleurobranchaea meckeli* phagocytosis was proved with gold fibrin as well as with carmin, in *Archidoris britannica* with gold fibrin (visible colloidal gold particles embedded in fibrin).

In the carnivore *Pleurobranchaea meckeli* the juice in the crop hydrolyzed casein at pH 5.5, fibrin at 7, gelatin and pepton-Witte at 7. Glycyl-glycin was not hydrolyzed at pH 7.5. Extract of the digestive diverticula (liver) hydrolyzes the same substrates as the juice of the crop, and also glycyl-glycin. The strength of the enzymes in the crop shows during the first 10 hr. after feeding a maximum after 3 hr. The dipeptidases do not vary in strength. The juice is very active on Spritblaufibrin, but the extract is inefficient, although both of them hydrolyze casein and gelatine equally. S.H.

RESTING AND ACTION POTENTIALS IN SINGLE NERVE FIBRES

By A. L. Hodgkin and A. F. Huxley

Journ. Physiol., Vol. 104, 1945, pp. 176-95

A technique for introducing micro-electrodes into the interior of a giant axon from *Loligo* is described. The axon was stimulated electrically and direct measurements of the action potential and resting potential were made with an amplifier and oscillograph. Experiments with external electrodes showed that the action potential was conducted for at least a centimetre beyond the tip of the micro-electrode and that the introduction of a micro-electrode had no effect upon the ability of the nerve to conduct impulses. The absolute magni-

tude of the action potential and resting potential are given as about 90 and 45 mV.

Measurements with external electrodes show that the action potentials of *Homarus* and *Carcinus* nerve fibres are also much larger than the resting potential.

These results have an important bearing on theories of nervous conduction. They show that classical physiologists were right in thinking that electrical changes originate at the surface membrane of a nerve fibre, but were wrong in believing that the action potential arose solely from a breakdown of the pre-existing resting potential.

The experiments described in this paper were completed in 1939 but the outbreak of war delayed publication of a full account of the results until 1945.
A.L.H.

THE NEUROLOGICAL BASIS OF THE LOCOMOTORY RHYTHM IN THE
SPINAL DOGFISH (*SCYLLIUM CANICULA*, *ACANTHIAS VULGARIS*).

I. REFLEX BEHAVIOUR

By H. W. Lissmann

Journ. Exp. Biol., Vol. 23, 1946, pp. 143-61

The idea that rhythmically co-ordinated movements of animals are driven and governed by an automatic mechanism within the central nervous system has been steadily gaining ground. Previous research on the dogfish led to the conclusion that the persistent locomotory rhythm, characteristic of spinal preparations, arises from bursts of motor impulses emanating spontaneously from the central nervous system, and is not essentially dependent on afferent stimulation.

The present investigation of body and fin reflexes makes it difficult to accept this picture for the following reasons. (i) If swimming is induced in inactive preparations through a localized exteroceptive stimulus, the position of the initial swimming posture depends solely on the site of stimulation. (ii) Diffuse touch to the ventral surface of a spinal preparation inhibits the swimming movements. Some dogfish remain immobile after the inhibitory stimulation has been discontinued, but they resume their persistent swimming on application of a single excitatory stimulus. (iii) Through feeble transitory stimuli any individual swimming stroke can be retarded, temporarily arrested, reversed, accelerated and augmented. The reaction depends on the site of stimulation and on the momentary phase of the swimming movement at which it is applied. The rhythm emerging after the application of a transitory stimulus is, as a rule, out of phase with the rhythm as recorded prior to the application of the stimulus.
H.W.L.

THE NEUROLOGICAL BASIS OF THE LOCOMOTORY RHYTHM IN THE
SPINAL DOGFISH (*SCYLLIUM CANICULA*, *ACANTHIAS VULGARIS*).

II. THE EFFECT OF DE-AFFERENTATION

By H. W. Lissmann

Journ. Exp. Biol., Vol. 23, 1946, pp. 162-76

The persistent swimming rhythm, typical of a spinal dogfish, is completely abolished as soon as all afferent excitation is cut off by severance of all the dorsal roots. The rhythm still emerges clearly when about half the number of the dorsal roots is transected, irrespective whether the anterior or the posterior half of the animal be de-afferented, or whether complete unilateral de-afferentation is performed. Extensively de-afferented preparations may exhibit swimming movements only after exteroceptive stimulation or after electrical stimulation applied directly to the spinal cord; these swimming movements do not persist. If only a small patch of the body surface remains sensitive, then, on stimulation of this region, the preparation exhibits a static reflex posture.

No evidence has been found to support the view that the locomotory waves of the spinal dogfish result from a spontaneous and automatic activity in the central nervous system; the experimental findings suggest that the locomotory waves can be essentially considered as moving sites of nervous integration, and that peripheral stimulation plays a fundamental role in this process.

H.W.L.

RELATIVE GROWTH OF THE EUROPEAN EDIBLE CRAB, *CANCER PAGURUS*.

III. GROWTH OF THE STERNUM AND APPENDAGES

By Donald C. G. MacKay

Growth, Vol. 7, 1943, pp. 401-12

The results of a study of form changes in the European edible crab, *Cancer pagurus*, have been analysed by Huxley's method and have been presented in three papers of which this is the third and final one. The study was carried out at the Marine Biological Laboratory at Plymouth during the year 1934-5.

The results of the study indicate that males and females differ only slightly in the growth of the sternum. In male crabs, both immature and mature, the appendages studied display positive heterogony. In females the chelae are positively heterogonic, the walking legs negatively so. The growth coefficient is higher for the chelae of mature males than for immature ones. Growth changes are such as to produce larger chelae and longer legs in males than in females of corresponding carapace length.

Altogether twenty-six body measurements were studied. The highest growth coefficients in males were found for the chelae of immature crabs (for

length, $k=1.48$; for width, $k=1.40$). For females the highest growth coefficient was found for the 4th abdominal segment of adults ($k=1.50$).

In general, *C. pagurus*, like *C. magister* which had been studied previously, shows a low degree of heterogony and consequently is able to grow to a considerable size (10–12 lb.) without marked changes in the form of the body.

D.C.G.M.

THE DETERMINATION OF THE DEPTHS AND EXTINCTION COEFFICIENTS OF SHALLOW WATER BY AIR PHOTOGRAPHY USING COLOUR FILTERS

By J. Grange Moore

Phil. Trans. Roy. Soc. Lond. A, Vol. 240, pp. 163–217

Submerged beaches viewed vertically from the air vary in apparent brightness with the depth and effective extinction coefficient of the water. If one be known, the other may be calculated from sensitometric measurements on a single air photograph taken through a suitable filter.

If neither be known, a pair of photographs is taken simultaneously through contrasting filters; in average coastal water and with suitable photographs, depths exceeding 20 ft. may then be determined with an error of less than $\pm 10\%$, by making use of a general relationship between extinction coefficients at any two given wavelengths; from these depths extinction coefficients may then be calculated.

The theoretical and practical details, the limitations and uses of the method, and the results obtained during a year's work over Cornish and Mediterranean beaches and elsewhere, are described and illustrated. Records for interpretation by oceanographers, marine surveyors and engineers can rapidly be obtained over large areas of coastline.

J.G.M.