An Application of the Principles of Allometry to the Study of English Senonian Echinocorys

THE following notes summarize the results of an investigation which was curtailed by the War, but

APPROXIMATE VALUES OF GROWTH COEFFICIENTS IN SELECTED GROUPS OF ECHINOCORYS

Zone	Subdivision	Locality	Coeffts. of relative height		Coefft. of relative breadth	
			b	a		
M. cortestudinarium			0·21	1·35	0·87	
M. coranguinum			0·30	1·20	0·83	
Marsupites	Uintacrinus	Northfleet	0·27	1·25	0·79	Southern
O. pillula	depressula		0·12	1·45	0·83	England
Base, B. mucronata		Shawford	0·53	1·10	0·84	
Base, B. mucronata		Bramford	0·40	1·15	0·86	
B. mucronata		Harford	0·33	1·20	0·85	
B. mucronata	Sponge beds	Catton	0·32	1·20	0·83	East Anglia
Ostrea lunata	Grey chalk	Trimingham	0·51	1·05	0·82	
Ostrea lunata	White chalk with O. lunata	Trimingham	0·35	1·15	0·85	
Ostrea lunata		Trimingham	0·20	1·30	0·87	
Holaster planus			0·68	1·05	0·88	
M. cortestudinarium			0·64	1·05	0·89	Yorkshire
Marsupites			0·08	1·50	0·79	
Actinocamax quadratus			0·38	1·15	0·88	

which, though incomplete, has introduced some important conceptions. They concern the size and proportion changes in the Senonian sea urchin Echinocorys[1].

The material was examined in groups, each one from a given horizon and locality, and in each group, breadth and height respectively were plotted against length on a logarithmic grid as described by J. S. Huxley[2].

It was found that breadth was isometric[3] relatively to length, that is, it could be represented by the formula

$$B = b' \times L,$$

where b', in the material examined, varied between approximately 0·8 and 0·9.

Height, on the other hand, was represented by the simple allometry formula

$$H = b \times L^a,$$

where the coefficient a was greater than unity, that is, height was positively allometric relatively to length, and the coefficient b was smaller than unity, so that the ratio H/L tended to be less than 1.

On the whole, a large value for the coefficient b was accompanied by a small value for the coefficient a, and vice versa. The relationship between the two coefficients is expressed by a formula of the same type as Huxley's simple allometry formula, since the values, if plotted double-logarithmically, form approximately a linear figure.

There is some possibility that the changes in size and proportions can be correlated with changes in environment, that is, depth of water in the Chalk sea, in which case, an increase in size correlated with change of environment appears to give rise in many cases to a *decrease* in relative height, whereas a size increase in the ordinary course of the individual's growth gives rise to an *increase*.

A few sea urchins contemporary with Echinocorys were examined along similar lines, and although the material was scanty there was a suggestion that the coefficient a may be identical in contemporary

irregular sea urchins from a given locality. The matter needs further investigation, but its effects on certain taxonomic questions may well be important.

The results are fully described in a thesis accepted by the University of London for the degree of doctor of philosophy, a copy of which thesis is in the University library.

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[1] See Hayward, J. F., *Naturalist* (1941), for references.
[2] Huxley, J. S., "Problems of Relative Growth" (London, 1932).
[3] Needham, J., and Lerner, I. M., "Terminology of Relative Growth Rates", NATURE, 146, 618 (1940).

Expediting Visual Adaptation to Darkness

THE problem of expediting artificially the adaptation of the eye to darkness is of considerable theoretical, and of no less practical importance, as, for example, in the case of night flying under war conditions. It has long been established that the period of adaptation when passing into complete darkness from a brilliantly lighted room is 45–50 minutes, and from a dully lighted room 25–30 minutes.

Proceeding from the theory of trophic adaptation of L. A. Orbeli, who demonstrated that the sense organs are innervated by the vegetative nervous system, I formulated the hypothesis that the process of adaptation to darkness is likewise influenced and controlled by the vegetative nervous system. The influence of this system on the visual apparatus (retina, conducting channels and brain centres) may be modified by exciting other sense organs by stimuli adequate to the latter. In 1937 I experimented in expediting adaptation to darkness by exciting the organ of taste (with sugar), the effect of which was to shorten considerably the period of adaptation[1].

Several months ago we experimented in expediting adaptation by means of light muscular exercise, during which the part of a weak exciter of the central nervous system and the visual organ is played by the nerve impulses imparted by the muscles and cartilages as they changed their length and thickness during muscular exercise.

Experiments made on ten subjects with the help of the adaptometer revealed that it was possible in this way to reduce the period of adaptation from 25–45 minutes to 5–6 minutes. Moreover, it was ascertained that usually sensitivity is roughly 20–30 per cent higher after such exercises than after remaining 45 minutes in darkness in a state of rest.