possession, by the cæcæ, of setiferous brushes penetrating the outermost lamellar layer. From the disposition of the periostracum and the dried mantle relative to the hinge line, it also appears that the pseudodeltidium is deposited by an extension of the ventral mantle, the outer lobe of which fuses with the outer lobe of the dorsal mantle to produce a single thickened periostracal sheet lying across the hinge line as in terebratuloids. There is therefore no reason for supposing that the pseudodeltidium of adult *Lacazella* at least originates differently from the rest of the shell.

Moreover, the resemblance between the tubercles of *Lacazella* and the spicular surface of the strophomenoids is only superficial. In strophomenoids, as in most brachiopods, the calcite fibres of the inner shell layer are disposed obliquely to the lamellar layer, changing direction only in narrow zones peripheral to the embedded spicules. In *Lacazella* the fibres are inclined at high angles to the lamellar layer, and are segregated into closely spaced bundles in such a way that the fibres of each bundle splay out slightly, to lie more or less normal to the irregularly tuberculate inner surface of the shell. Consequently, the bundles in cross-section appear to be made up of a core of vertically disposed fibres surrounded by a zone of radiating ones. It is these bundles which have previously passed as pseudopunctæ; but they do not possess a non-fibrous core of any kind, and are unrelated to the strophomenoid spicules.

Unusual as this shell-structure is, it is not unique. The tubercles of the terebratuloid *Megerlina lamarkiana* (Davidson) appear to be identical in origin with those of *Lacazella*; although since the tubercles of *Megerlina* are widely spaced, the fibres between them revert to the more usual oblique angle of disposition. Indeed, allowing for their wide scatter and taking into account punctation, the similarity between the shell-structure of the two stocks is striking.

The above observations emphasize the urgent need of a re-investigation of the development of *Lacazella*. Meanwhile, serious consideration must be given to the possibility that the thecideids were derived neotenously, not from the strophomenoids, but from the schizolophous young of some Triassic terebratuloid or punctate spiriferoid.

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[1] Beecher, C. E., *Amer. J. Sci.*, Ser. 3, **44** (1892).
[2] Cooper, G. A., "Index Fossils of North America" (Wiley, 1944). Arber, M. A., *Geol. Mag.*, **77** (1940).
[3] Kovalevskii, A. O., *Izvyest. Imp. Obshch. Lyub. Estest. Antrop. Étno.*, **14** (1874).
[4] Kozłowski, R., *Palaeont. Polonica*, **1** (1929).
[5] Elliott, G. F., *Ann. Mag. Nat. Hist.*, Ser. 12, **6**, 693 (1953).

Shell-structure of Thecidean Brachiopods

In thecidean brachiopods, which range from the Rhaetic to the present day, the shell-structure is less definite, and shows more variation, than in many other brachiopod sub-orders. Investigations I have carried out of this point[1], as part of work undertaken for a "Treatise on Invertebrate Paleontology", resulted in the conclusion that the structure was initially obscurely pseudopunctate, becoming densely punctate when a certain degree of structural organization was attained. This punctation never shows the regular *en quinquonce* pattern of the terebratuloids: it was attained in different stocks at different dates.

These results were obtained from a study of thin sections prepared from specimens of the type-species of various thecidean genera. Since the major types of brachiopod shell-structure, impunctate, pseudopunctate and punctate, characterize large divisions of the phylum, further investigation was undertaken of available material and sections prepared of twenty-seven thecidean species ranging in age from Lower Jurassic to Recent.

The results show that eighteen of these species are clearly punctate, and a further six are identified as "fibrous; ? scattered punctae". Two are fibrous, without punctae; only one is clearly pseudopunctate, and this genus (*Davidsonella*, Lower Jurassic) differs from all other thecideans in the extreme elongation of the brachial cavities. Clear punctation appears in certain species as early as the Lower Jurassic, and without association with brachial complexity as previously stated. This early punctation was noted by Deslongchamps[2] and inadvertently overlooked by me.

In view of the very small size of those brachiopods and the varied preservation of the material examined, the evidence summarized above is now interpreted as indicating that the thecidean brachiopods are punctate.

This punctation is very irregular in development throughout members of the sub-order, and does not show the regular patterning of terebratuloid punctation. Investigation of the physiological significance of punctae in living brachiopods might throw light on this condition.

Davidsonella, exceptional in shell-structure and brachial form, may be of separate evolutionary origin, although conveniently grouped at present with the others.

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[1] Elliott, G. F., *Ann. Mag. Nat. Hist.*, Ser. 12, **6**, 693 (1953).
[2] Eudes-Deslongchamps, E., *Mém. Soc. Linn. Normandie*, **9**, 230 (1853).

Feeding of Barnacles

At the start of an investigation into the rate of feeding of the different species of intertidal barnacles, I was surprised to find that there was very little published information on the methods employed for the capture of food or on the organisms eaten by these ubiquitous animals. Darwin[1] noted the presence of Infusoria and Confervae in the gut as well as the remains of quite large Crustacea, and the newly settled spat have been reared on pure cultures of unicellular Algae[2]; but Gruvel[3] and Batham[4] have described only a macrophagous method of feeding, whereby animals that touch the extended third to sixth cirri are immediately drawn into the shell by the cirri and masticated by the mouth-parts. It is therefore interesting to report that some experiments in progress show that the adult barnacle can feed on a very wide range of organisms, from a size of 1 mm. down to 2μ.

For example, a specimen of *Balanus perforatus* captured and ingested the following organisms, as demonstrated both by their removal from the water around the barnacle and their appearance in the fæcal pellets: