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Science, New Series, Vol. 114, No. 2963. (Oct. 12, 1951), p. 395.

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Fri Nov 3 11:05:34 2006

whether potato "apyrase" is a mixture of ATPase and ADPase, the ratio of which in any given preparation depends upon the procedure employed.

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Nudibranch Spicules Made of Amorphous Calcium Carbonate[1]

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The occurrence of amorphous calcium carbonate in nature has rarely been proved. The principal known case is that of the calcium carbonate in some arthropod exoskeletons. Mayer and Weineck (*1*) demonstrated by x-ray diffraction that the exoskeletons of *Astacus* and *Julus* contained amorphous calcium carbonate.

A second interesting case is that of the spicules in the tissues of the nudibranch mollusks. Fifty per cent of the dry tissue is made up of calcium carbonate spicules about .5 mm long. The mineralogical form of these spicules has been in dispute. Schmidt (*2*), using optical methods and specific gravity measurements, concluded that they were vaterite. But Rinné (*3*) found no x-ray diffraction pattern and concluded that the spicules were amorphous. Mayer and Weineck (*1*), on the other hand, found an x-ray diffraction pattern characteristic of vaterite. Their specimens had been preserved in 70% alcohol.

In the present study three careful attempts were made to obtain an x-ray diffraction pattern of the spicules in the dried tissue of *Archidoris*.[2] Only a faint halite pattern was obtained from the few halite crystals visibly scattered among the preponderance of calcium carbonate spicules in the dried tissues as teased under a microscope. After ashing, the x-ray diffraction powder pattern consisted of a strong calcite pattern and the same weak halite pattern. These studies are a confirmation of the presence of amorphous calcium carbonate in the spicules of the nudibranch *Archidoris*. It seems likely that the vaterite may occur as a transformation product resulting from conditions of preservation. The submicroscopic morphology of these amorphous but birefringent spicules is an unsolved colloid problem.

In the case of these spicules, as in the cases of other biological skeletons, a consideration of three levels of integration is required. Molecular patterns alone do not yield a complete description, for the arrangement of the molecular units at colloidal and microscopic levels is also a major aspect.

In their gross form the spicules of *Archidoris* resemble the calcite spicules of some octocorals and the opal spicules of some sponges. It was Schmidt (*2*) who generalized that organisms often build similar skeletons out of entirely different chemical substances.

[1] From a dissertation on The Biogeochemistry of Strontium, presented to the faculty of Yale University in partial fulfillment of requirements for the Ph.D. degree. Grateful appreciation is expressed to G. E. Hutchinson for his direction and to Horace Winchell, of the Brush Mineralogical Laboratory, Yale University, for use of x-ray facilities.

[2] Obtained by G. E. Hutchinson and H. W. Harvey from Plymouth, Eng.

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The Heparinoid Nature of a Serum Mucoprotein[1]

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A possible role of the serum mucoprotein fraction in blood coagulation mechanisms was suggested by its acidic properties and high polysaccharide content—characteristics common to heparin and to synthetic sulfonated polysaccharide esters (*1*) with anticoagulant activity. Increase in the polysaccharide/protein ratio and reduction of the protein component within

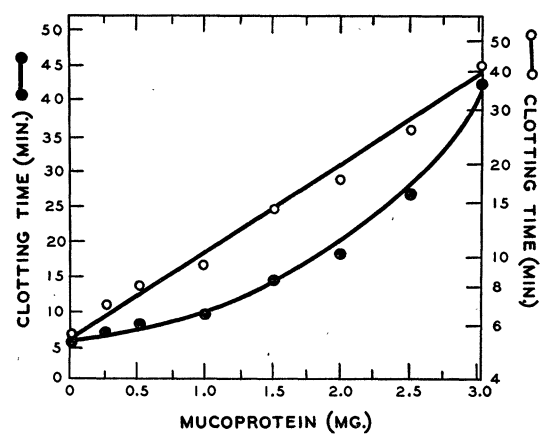

FIG. 1. Influence of mucoprotein concentration on the whole blood coagulation time (Lee-White) of 0.9 ml of fresh human blood. Fresh blood was added to 0.1-ml aliquots of an ox mucoprotein solution prepared in *M*/5 phosphate buffer (pH 7.4).

[1] A preliminary report. These studies were initially presented at the Conference on Folic Acid Antagonists in Neoplasia, March 11, 1951, The Children's Hospital, Boston, Mass.

[2] With the technical assistance of J. Dolores Johnson.