PARAMYLON IN A CHRYSOPHYTE

D. R. KREGER and J. VAN DER VEER

Botanisch Laboratorium, Rijksuniversiteit, Groningen

During a study of small marine flagellates belonging to the Chrysophyta the second author observed that a species described by him as *Pavlova mesolychnon* (VAN DER VEER 1969) has in its cytoplasm highly refractive inclusions. In the Chrysophyta these are supposed to contain a water-soluble storage product usually indicated in the older literature as leucosin (FRITSCH 1935). More recently the term chrysolaminarin has been coined on account of the similarity of the products involved, at least in *Hydrurus* and *Ochromonas* species, to laminarin, the storage product of Phaeophyta. For references see MEEUSE (1962).

In *Pavlova mesolychnon* two types of inclusions could be distinguished, which appeared to be granular and on which we have collected some further data.

The granules of one type, each enclosed in a membrane (VAN DER VEER 1969), could be collected on the centrifuge from a pure culture of cells which had been homogenized in their culture liquid by ultrasonics. After washing and drying a white powder of small, more or less reniform granules was obtained, which measured up to about 6 μ in length and showed some transverse cracks or grooves on the hollow side. In water they were faintly negatively birefringent with reference to their longitudinal direction and did not stain with an iodine – sodium iodide solution.

It has long been known that the green flagellates, as well as the colourless forms, of the Euglenophyta contain a granular storage product deviating from starch, which has been named therefore paramylon (GOTTLIEB 1850). Although identified as a glucose polymer its further structural details were not elucidated until over hundred years later, when it was found to consist of chains of β–1,3–linked glucose residues (KREGER & MEEUSE 1952). The conclusion was based on the correspondence of the X-ray powder diagram of paramylon with that of the acid insoluble fraction of the cell walls of baker's yeast, a substance which had been shown by chemical methods to be a β–1,3–linked glucan (ZECHMEISTER & TOTH 1934) and has been termed later yeast hydroglucan (HOUWINK & KREGER 1953). The β–1,3–linkage of paramylon was confirmed along the lines of polysaccharide chemistry (CLARKE & STONE 1960; LEEDALE *et al.* 1965), and no indication for points of branching could be found, nor for the presence of non-glucose residues.

These data induced us to investigate the *Pavlova* granules by means of X-ray diffraction. Their X-ray powder pattern turned out to exhibit a set of diffraction lines which is identical to that produced by the paramylon from a

Euglena viridis – *E. gracilis* mixture shown in the paper of Kreger & Meeuse. The authors did not mention the X-ray spacings of the paramylon in question, but they are as follows (in Å): *13.3*, 7.75, 6.75, 4.83, *4.51*, *3.92*, 3.60, 3.44, 2.98, 2.90, in which the spacings corresponding to the more intense reflections are in italics.

As far as our knowledge goes, this is the first conclusive evidence of the occurrence of paramylon granules in algae not belonging to the Euglenophyta.

The other type of inclusions of the *Pavlova* cells are smaller and more nearly globular than are the paramylon granules. They are most easily distinguished from the latter under the polarizing microscope by their very strong birefringence. Frequently there are two paramylon granules in a cell, each accompanied in its close vicinity by a body of this type. These bodies are not as easily collected from a homogenate as are the paramylon granules, and their nature remains to be established.

REFERENCES

CLARKE, A. E. & B. A. STONE (1960): Structure of the paramylon from *Euglena gracilis*. *Biochim. Biophys. Acta* **44**: 161–163.

FRITSCH, F. E. (1935): *The Structure and Reproduction of the Algae*, Vol. I, p. 508. University Press. Cambridge.

GOTTLIEB, J. (1850): Über eine neue, mit Stärkemehl isomere Substanz. *Ann. Chem. Pharm.* **75**: 50–61.

HOUWINK, A. L. & D. R. KREGER (1953): Observations on the cell walls of yeasts. An electron microscope and X-ray diffraction study. *Antonie van Leeuwenhoek. J. Microbiol. Serol.* **19**: 1–24.

KREGER, D. R. & B. J. D. MEEUSE (1952): X-ray diagrams of *Euglena*-paramylon, of the acid insoluble glucan of yeast cell walls and of laminarin. *Biochim. Biophys. Acta* **9**: 699–700.

LEEDALE, G. F., B. J. D. MEEUSE and E. G. PRINGSHEIM (1965): Structure and physiology of *Euglena spirogyra*. III–VI. *Arch. Mikrobiol.* **50**: 133–155.

MEEUSE, B. J. D. In R. A. LEWIN ed. (1962): *Physiology and Biochemistry of Algae*, p. 298. Academic Press, New York.

VEER, J. VAN DER (1969): *Pavlova mesolychnon* (Chrysophyta) a new species from the Tamar Estuary, Cornwall. *Acta Bot. Neerl.* **18**: 496–510.

ZECHMEISTER, L. & G. TÓTH (1934): Über die Polyose der Hefemembran I. *Biochem. Z.* **270**: 309–316.