Title
THE INTERNAL STRUCTURE OF A DIATOM

Authors
Daniels, Stafford C.
Hayes, Thomas L.

Publication Date
1959-09-11

UCRL-8894

UNIVERSITY OF CALIFORNIA

Ernest O. Lawrence Radiation Laboratory

BERKELEY, CALIFORNIA

DISCLAIMER

UCRL-8894

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

THE INTERNAL STRUCTURE OF A DIATOM

Stafford C. Daniels, Jr. and Thomas L. Hayes

September 11, 1959

Printed for the U. S. Atomic Energy Commission

THE INTERNAL STRUCTURE OF A DIATOM

Stafford C. Daniels, Jr. and Thomas L. Hayes

Donner Laboratory of Biophysics and Medical Physics
University of California
Berkeley, California

September 11, 1959

ABSTRACT

An electron microscope study of a Diatom has shown some of the internal structure of this algae. In particular, the chromatophore was studied and its structure is described.

THE INTERNAL STRUCTURE OF A DIATOM*

Stafford C. Daniels, Jr. and Thomas L. Hayes

Donner Laboratory of Biophysics and Medical Physics
University of California
Berkeley, California

September 11, 1959

Introduction

The fine structure of several algae has previously been investigated by the use of the electron microscope.[1] Algae belonging to the class Bacillarieae have long been important to the microbiologist. The siliceous cell wall and unusual lipid and carbohydrate metabolism have been extensively studied.[2, 3] Since 1936 when the first diatom was photographed under the electron microscope,[4] the study of these unique plants by various outstanding workers has been exhaustive.[5 to 10] The cell wall appears to have received the most attention because of its delicate and intricate structure. It is this intricate pattern that exists in diatoms that has been used as a basis of taxonomy. However, a search of the literature reveals very little information concerning the internal fine structures. The chromatophore, the nucleus and its components, the cytoplasm, or any of the other structures that are found within the cell wall have not been seen in the electron microscope. An attempt is made here to investigate this internal fine structure.

---

*Work done under the auspices of the U. S. Atomic Energy Commission.

Materials and Methods

Several fresh-water pennate diatoms were grown in epiphytic relationship with a green algae Nitella. Small pieces of the Nitella with the diatoms attached were cut and fixed for electron microscopy (1% osmium tetroxide in veronal buffer, pH 7.4). The fixed cells were imbedded in prepolymerized butyl methacrylate and sectioned with a diamond knife on a Servall Porter-Blum microtome. All photographs were taken with an RCA EMU-2 E electron microscope.

Discussion

Figure 1 is a low-power electron micrograph showing several diatoms attached to the cell wall of Nitella. The siliceous cell wall seems to be composed of small blocks of very dense material. Inside the cell wall there is a large chromatophore occupying about half of the cell volume. The chromatophore is a multilamellar structure containing dark oval bodies dispersed in an orderly array along the lamellae (Fig. 2). Each lamella consists of two 50-Å membranes separated about 150 Å. The distance between lamallae is about 400 Å. This chromatophore resembles somewhat the chloroplasts found in other plants.[11, 12, 13] The cytoplasm of the diatom is in the form of strands around many vacuoles. Several mitochondria were seen, and the nucleus was also located in the central portion of the diatom. These preliminary results offer a glimpse of the internal fine structure of the diatom, and the technique of using Nitella as a substrate on which to grow the diatom gives a convenient method for studying these algae. It is hoped that further work will lead to a better understanding of these important unicellular plants.

LEGENDS

Fig. 1. Diatoms attached to cell wall of Nitella (×11,070).

S = Siliceous cell wall of diatom
V = Vacuole
C = Chromatophore
N = Cell wall of Nitella

Fig. 2. Chromatophore of diatom (×54,800).

Cy = Cytoplasm
V = Vacuole
G = Dark oval bodies along lamellae
C = Multilamellar chromatophore
S = Siliceous cell wall

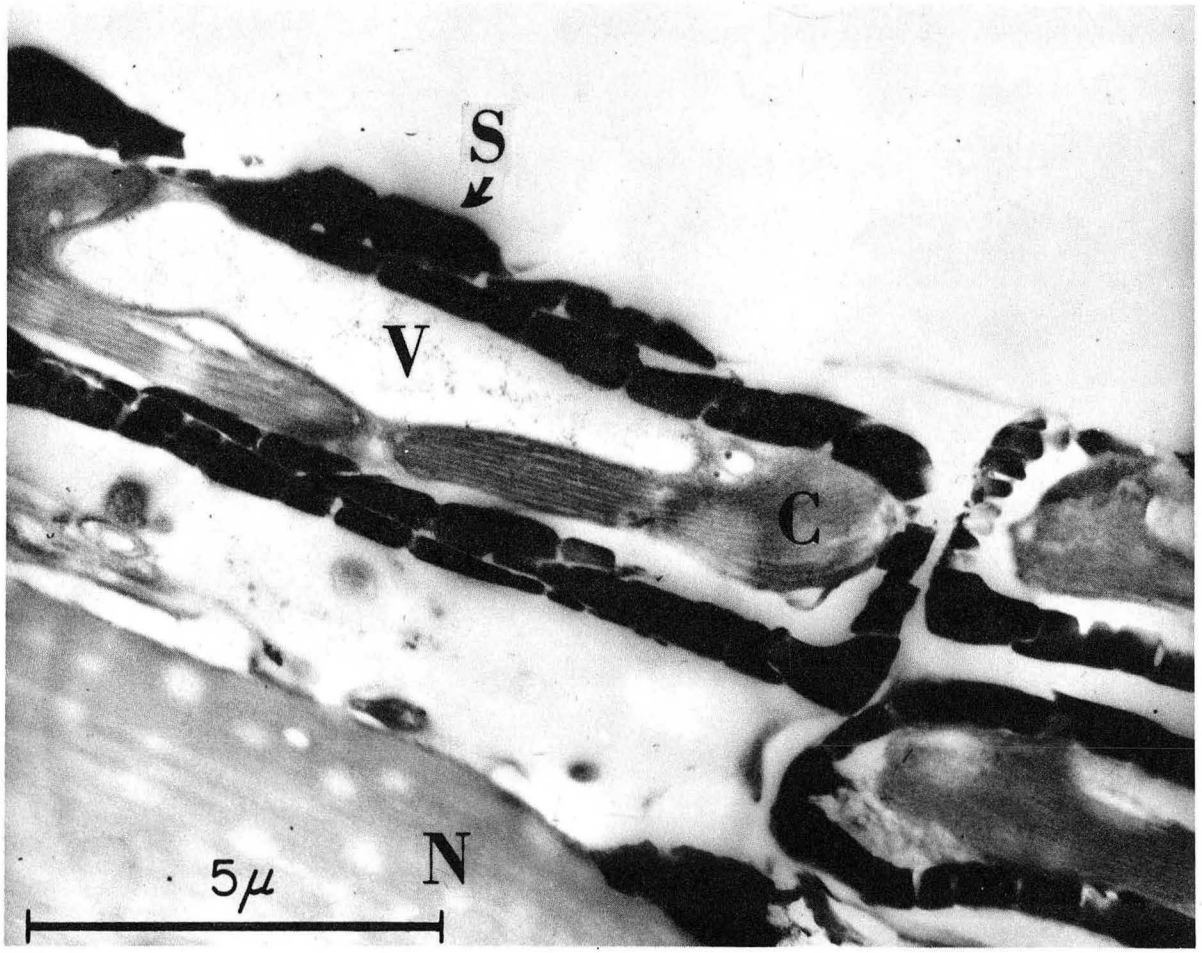

Fig. 1

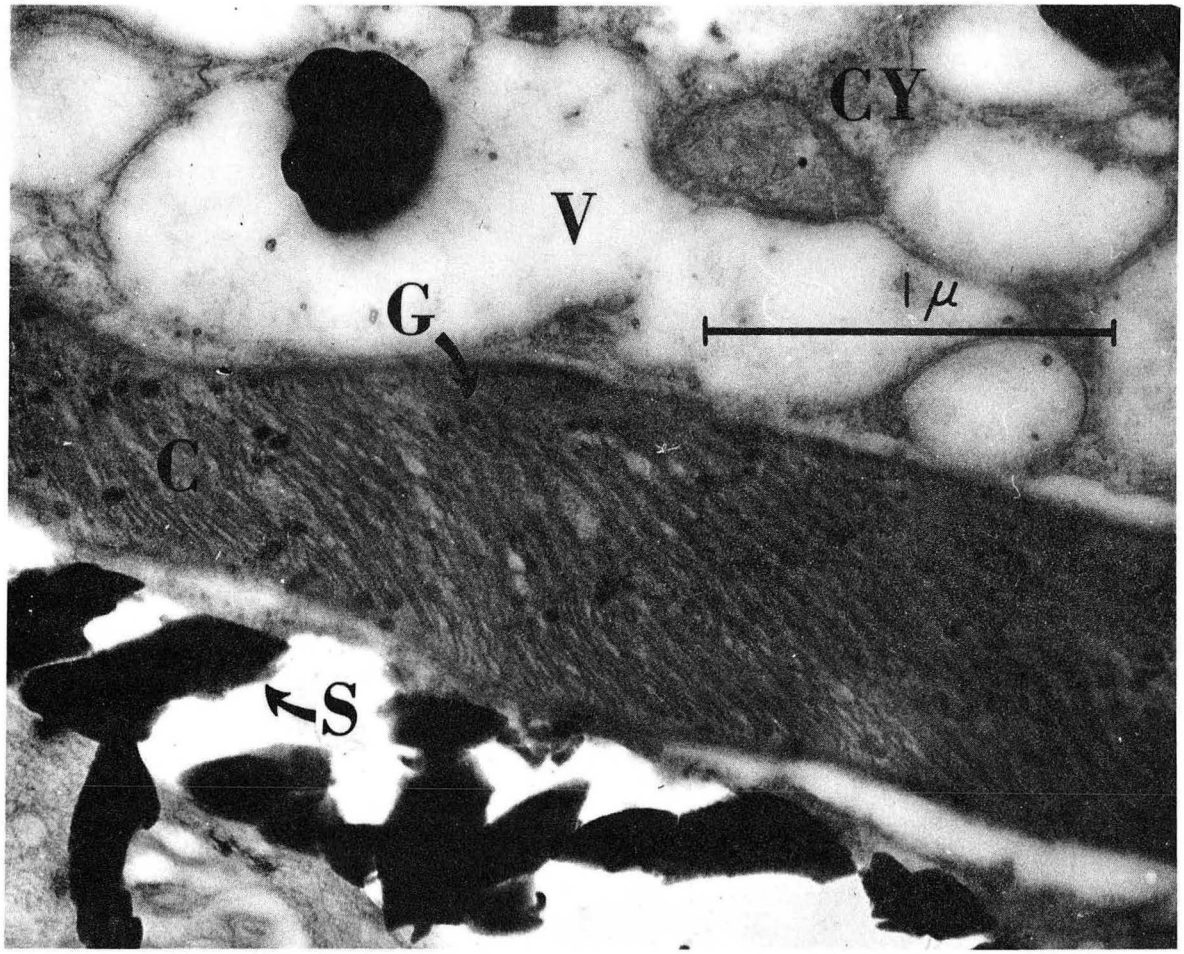

Fig. 2

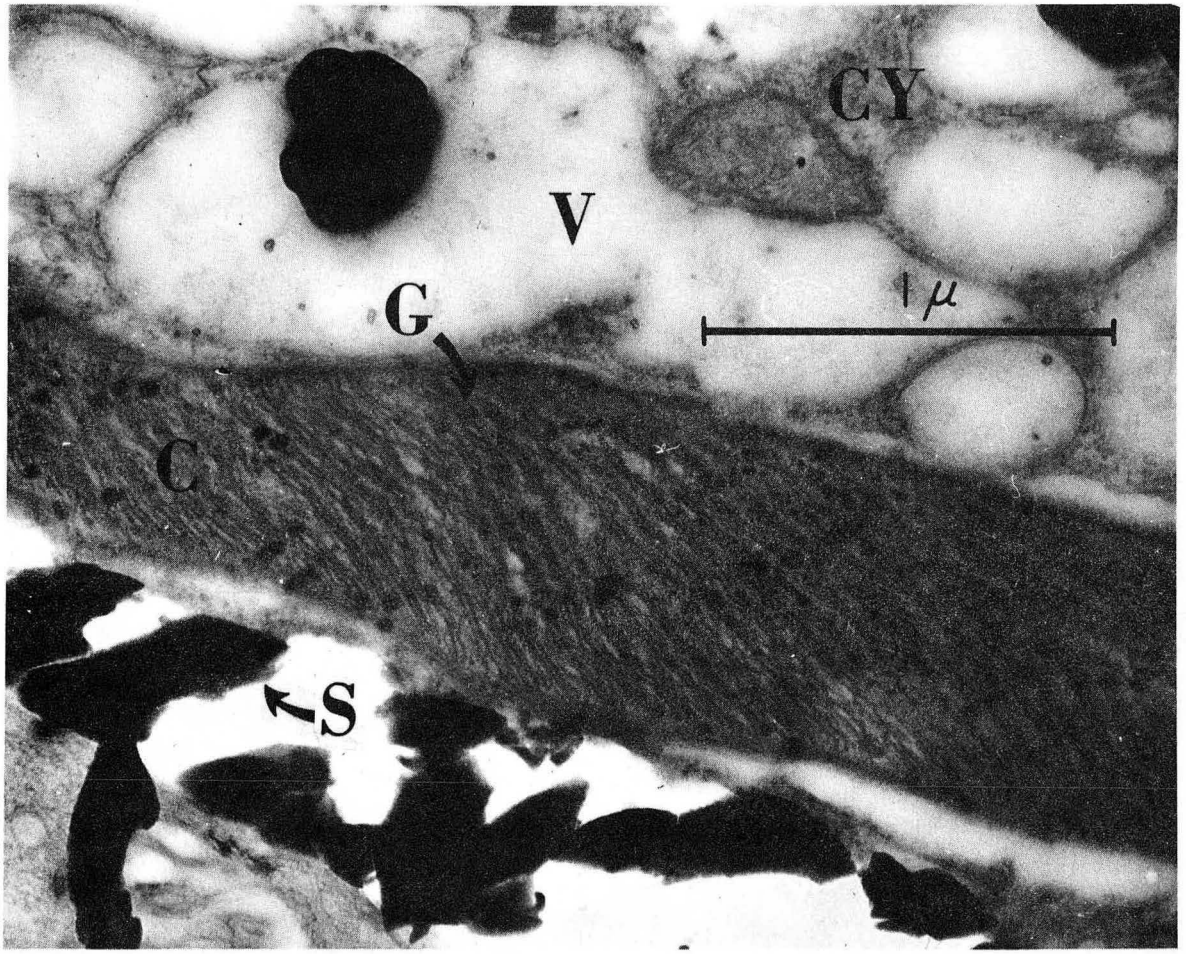

Fig. 2

REFERENCES

1. M. Brody and A. E. Vatter, Observations on Cellular Structures of Porphyridium cruentum, J. Biophys. Biochem. Cytol. 5, 289 (1959).
2. F. E. Fritsch, The Structure and Reproduction of the Algae, Vol. 1 (Cambridge University Press, Cambridge, England, 1935).
3. D. H. Cushing, Studies of Plankton Populations, J. conseil, Conseil permanent intern exploration mer 19, 3 (1953).
4. F. Krause, Elektronenoptische Aufnahmen von Diatomeen mit Magnetischen Elektronenmikroskop, Z. Physik 102, 417 (1936).
5. T. V. Desikachary, Electron Microscope Studies on Diatoms, II. J. Roy. Microscop. Soc., 76, 9 (1956).
6. J. G. Helmeke and W. Krieger, Diatomeeschalen um Elektronenmikroskopischen Bilt, 1-2. Transmare-photo, Berlin, 1953-4.
7. Kendley, Cushing, and Ripley, Electron Microscope Studies of Diatoms, J. Roy. Microscop. Soc., 74, 22 (1954).
8. H. Okuno, Electron Microscopical Study of Antarctic Diatoms, J. Japan. Bot. 27, 347 (1952b).
9. V. N. Werzuer, Some Structural Details of Diatom Pleurosigma as Observed with the Aid of an Electron Microscope, Compt. rend. acad. Sci. U.R.S.S., 44, 118 (1944).
10. Georg Wolfgang, Nature of Granules in Cytoplasm of Oscillatoria amoena, Osterr. Botan. Z., 104, 531 (1958).
11. Hodge, McLeon, and Mercer, A Possible Mechanism for the Morphogenesis of Lameller Systems in Plant Cells, J. Biophysical and Biochemical Cytology, 2, 597 (1956).

12. V. H. Leyon and D. V. Wettstein, Der Chromatophoren-Feinbau bei der Phaeophyceen, Z. Naturforsch 96, 7 (1954).

13. R. Sager, G. E. Palade, Structure and Development of the Chloroplast in Chlamydomonas, Biophys. Biochem. Cytol. 3, 463 (1957).