

Linskens and Heinen<sup>16</sup>, and perhaps offer some clue as to the meaning of the cytochemically detectable 'esterase' activity of the pellicle itself.

O. MATTSSON\*  
R. B. KNOX†  
J. HESLOP-HARRISON  
Y. HESLOP-HARRISON

Cell Physiology Laboratory,  
Royal Botanic Gardens,  
Kew,  
Richmond, Surrey

Received September 14, 1973.

\* Present address: Institute of Plant Anatomy and Cytology, University of Copenhagen, Sølvgade 83, DK-1307 Copenhagen K.

† Present address: Department of Botany, Australian National University, PO Box 4, Canberra ACT.

- <sup>1</sup> Knox, R. B., and Heslop-Harrison, J., *Nature*, **223**, 92 (1969).
- <sup>2</sup> Knox, R. B., and Heslop-Harrison, J., *J. Cell Sci.*, **6**, 1 (1970).
- <sup>3</sup> Heslop-Harrison, J., Heslop-Harrison, Y., Knox, R. B., and Howlett, B., *Ann. Bot.*, **37**, 403 (1973).
- <sup>4</sup> Knox, R. B., Willing, R. R., and Ashford, A. E., *Nature*, **237**, 381 (1972).
- <sup>5</sup> Heslop-Harrison, J., Knox, R. B., and Heslop-Harrison, Y., *Theor. appl. Genet.* (in the press).
- <sup>6</sup> Dickinson, H. G., and Lewis, D., *Proc. R. Soc.*, **B183**, 21 (1973).
- <sup>7</sup> Linskens, H. F., and Kroh, M., *Handb. Pfl. Physiol.*, **18**, 506 (Springer Verlag, Berlin, 1967).
- <sup>8</sup> Lewis, D., *Genetics Today*, **3**, 657 (Pergamon, London, 1965).
- <sup>9</sup> Heslop-Harrison, J., and Heslop-Harrison, Y., *Stain Technol.*, **45**, 115 (1970).
- <sup>10</sup> Jensen, W. A., *Botanical Histochemistry* (Freeman, San Francisco, 1962).
- <sup>11</sup> Pearse, A. G. E., *Histochemistry: Theoretical and Applied*, **2** (Churchill, London, 1972).
- <sup>12</sup> Barka, T., and Anderson, P. J., *J. Histochem. Cytochem.*, **10**, 741 (1962).
- <sup>13</sup> Knox, R. B., and Heslop-Harrison, J., *J. Cell Sci.*, **9**, 239 (1971).
- <sup>14</sup> Knox, R. B., *J. Cell Sci.*, **12**, 421 (1973).
- <sup>15</sup> Green, J. R., *Ann. Bot.*, **8**, 225 (1894).
- <sup>16</sup> Linskens, H. F., and Heinen, W., *Z. Bot.*, **50**, 338 (1962).

## Mitosis in the Cryptophyceae

In a recent issue of *Nature*<sup>1</sup> Oakley and Dodge are critical of my theory on the evolution of the algae<sup>2</sup>. I believe that their criticisms are the result of some misconceptions and inaccuracies. In reference to my article<sup>2</sup> they state "the Cryptophyceae were thought to be ancestral and closely related to the Cyanophyceae". First, there must be some error in sentence structure, for to conclude that the eukaryotic Cryptophyceae are ancestors to the prokaryotic Cyanophyceae is a difficult assumption to make. Second, I never said that the Cyanophyceae were closely related to the Cryptophyceae but that the Cyanophyceae were closely related to the chloroplasts of the Cryptophyceae. Therefore one would not expect cell division in the Cyanophyceae to be similar to that in the Cryptophyceae as they infer.

Oakley and Dodge refer to McDonald's work on mitosis in the Rhodophyceae<sup>3</sup> and state that "It (mitosis in the Cryptophyceae) is quite different from that in the Rhodophyceae" without expanding further. I believe that they have overstated their case, as the only differences in mitosis between the two classes are: (1) the presence of some heterochromatin referred to as a kinetochore in the Rhodophyceae with no such structure in the Cryptophyceae, and (2) the presence of basal bodies in the Cryptophyceae and their absence in the Rhodophyceae (which would be expected since the Rhodophyceae have no flagellated cells) although the polar ring<sup>3</sup> in the latter may prove to be a derivative of a basal body. These differences between mitosis in the two classes are not as significant as Oakley and Dodge seem to believe and do not rule out an evolutionary link between the Cryptophyceae and Rhodophyceae.

Lastly, Oakley and Dodge infer that *Chroomonas* (a Cryptophyte with a chloroplast) is a primitive genus in my scheme on the phylogeny of the algae<sup>2</sup>. This is not so as this type of organism is fairly advanced along the evolutionary pathway. If they were seeking a more primitive organism to investigate they should have chosen a Cryptophyte without chloroplasts or one with cyanelles (endosymbiotic Cyanophyceae).

ROBERT EDWARD LEE

University of the Witwatersrand,  
Jan Smuts Avenue,  
Johannesburg

Received October 1, 1973.

<sup>1</sup> Oakley, B. R., and Dodge, J. D., *Nature*, **244**, 521 (1973).

<sup>2</sup> Lee, R. E., *Nature*, **237**, 44 (1972).

<sup>3</sup> McDonald, K., *J. Phycol.*, **8**, 156 (1972).

Drs Oakley and Dodge reply: In regard to Dr R. E. Lee's correspondence, our letter to *Nature*<sup>1</sup> was not intended to be particularly critical of Dr Lee's previous article on endosymbiosis and the evolution of the algae<sup>2</sup>. In fact Dr Lee's theory was only mentioned very briefly. Nevertheless we should like to respond to his comments. Of course when we stated that "the Cryptophyceae were thought to be ancestral and closely related to the Cyanophyceae", there was no intentional implication that the Cryptophyceae were ancestral to the Cyanophyceae but rather that they were ancestral algae. Since Dr Lee's scheme regards them as ancestral to every group of algae other than the Cyanophyceae we feel that it is fair to regard them as ancestral. Although Dr Lee does not state explicitly that the Cryptophyceae are closely related to the Cyanophyceae, his chart (Fig. 1) giving phylogenetic relationships places two groups of cryptophytes, the colourless cryptophytes and those with cyanelles, closer to the Cyanophyceae than any other groups of algae. We do not feel, therefore, that our statement was unfair.

This point, however, is of little importance. A much more important point, and the point we were making, is that Dr Lee's scheme implies that the Pyrrophyta with very little histone<sup>3</sup>, extremely unusual base pair composition<sup>4</sup>, and an apparently primitive mitotic apparatus<sup>5</sup> has evolved from the Cryptophyceae which show no such apparent primitiveness or uniqueness. Similarly, the mitotic apparatus of the Euglenophyceae seems to be much more primitive than the cryptophytes from which they have evolved according to Dr Lee's scheme.

In fairness, Dr Lee does not feel that the cryptophytes with chloroplasts are ancestral to the Pyrrophyta. He feels that the colourless cryptophytes and those with cyanelles are more primitive than those with chloroplasts. With regard to the colourless cryptophytes, our results were so similar to the light

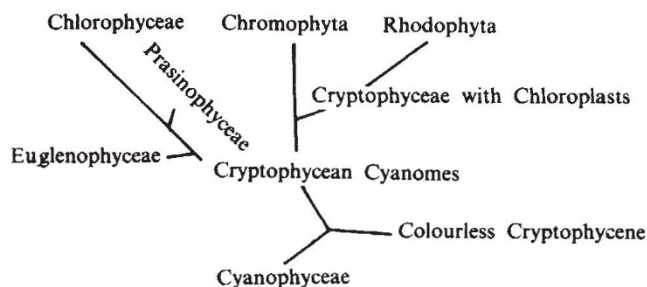


Fig. 1 Fig. 2 from ref. 2. The origin of plastids from a Cyanophyceae alga involved in an endosymbiosis with a colourless Cryptophyte. The remainder of the eukaryotic algae then evolved from this Cryptophyceae cyanome (endosymbiotic Cyanophyceae alga plus the host cell).