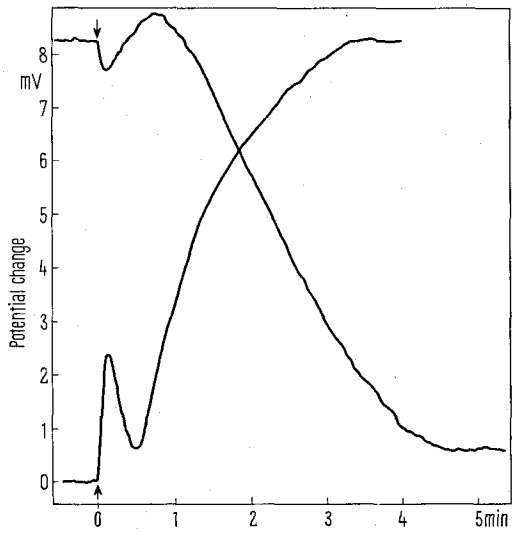

Fig. 2. Kinetics of the light-dependent potential change. The upward pointing arrow marks light on: upward going curve. The downwards pointing arrow marks light off after 4 min in light: downward going curve. Abscissa: time in min. Ordinate: potential change in mV.

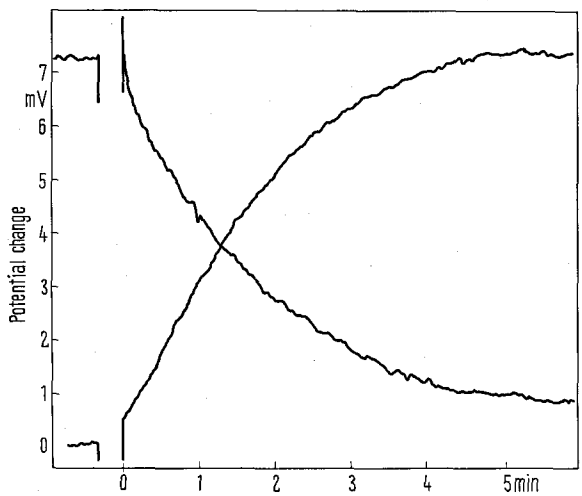

Fig. 3. Kinetics of the redox potential-dependent change of the membrane potential. Upward going curve: after addition of DCPIP ($10^{-4}M$) and ferricyanide ($10^{-4}M$) with ascorbate ($10^{-3}M$) at the time '0'. Downward going curve: change from reduced to oxydized DCPIP and ferricyanide at the time '0'. The gap before time '0' results from the change of the medium. Abscissa: time in min. Ordinate: potential change in mV.

According to this hypothesis, it should be possible to cause a similar effect on the membrane potential by light and by a change in the redox level in the dark. Figure 2 demonstrates the kinetics of the potential change for *Griffithsia* by light on and off. With the current hypothesis, the depolarization by light is equivalent to a reduction of plastoquinone.

Equivalent to this effect, after addition of DCPIP + ferricyanide ($10^{-4}M$) with ascorbate ($10^{-3}M$), $E_h = +121$ mV (related to H_2), a depolarization of the membrane potential can be observed (Figure 3). By change of the medium and addition of oxydized DCPIP + ferricyanide, $E_h = +434$ mV (related to H_2), this effect is completely reversible. But there is a difference in the height of the reaction, the effect by light being smaller in the mean.

Thus the redox change in the dark could directly influence the redox level of plastoquinone. The further reaction mechanism for the change of the membrane potential could be a pure ionic transport function. An alternative possibility would be the effect on a redox component consecutive to plastoquinone or a direct redox effect on the plasmalemma.

Zusammenfassung. Das Aktionsspektrum der lichtabhängigen Potentialänderung entspricht dem von Photosystem II. Mit Entkopplern kann die Beteiligung einer Phosphorylierungsstelle ausgeschlossen werden. Die Redox-Abhängigkeit weist auf die Beteiligung von Plastochinon. Die Depolarisierung des Membranpotentials kann sowohl durch Licht als auch durch reduziertes DCPIP + Ferricyanid im Dunkeln ausgelöst werden.

G. THROM

Botanisches Institut der Universität, Pilgrimstein 4, D-355 Marburg (Lahn, Germany),
1 June 1971.

Manganese in *Pinna nobilis*

It has been known since long that some marine and fresh water bivalve molluscs are able to accumulate manganese in their tissues[1–4]. Recently this ability has been utilized for detecting radioactive contamination in the environment when ^{45}Mn is at levels not otherwise measurable[5,6].

In 1892 GRIFFITHS[7] claimed that a protein containing manganese and having the property of binding oxygen reversibly, is present in the blood of *Pinna*. He called it Pinnaglobin. This finding has been reported in textbooks until recently; however, since 1938 SUTO[8] was not able to detect any manganese in the blood of this animal.

Our determinations have been carried out on *Pinna nobilis* by chemical and X-ray Fluorescence spectrografic methods. The animals were collected from the Adriatic sea during the summer of 1970; the organs were immediately dissected and kept frozen until use. Manganese was determined spectrophotometrically as permanganate after destruction of the organic material with sulfuric and nitric acids followed by oxidation with periodate; the X-ray fluorescence spectrography was made on samples of pressed powder using a Siemens SRS Spectrometer. As reported in Table I, only the kidney of *Pinna* has consistent amounts of manganese, followed at

much lower degree, by the byssus. Our results did not confirm SUTO's data on the presence of large amounts of the metal in the hepatopancreas and gonads.

In the kidney the manganese is almost entirely confined to the nephrolith bodies. As is known[9], each nephrolith fills almost entirely a cavity surrounded by a monolayer of secreting cells (Figure 1). The stone is formed by concentric layers of red-yellow coloured material which, under the polarizing microscope, appeared isotropic. The nephroliths have been isolated (Figure 2) and analyzed. No diffraction effects were observed in the powder pattern using an X-ray diffractometer. The elementary composition is reported in Table II.

The partial solubility in organic solvents (ethyl and amyl alcohols in HCl, phenol, etc.) and the presence of non-ionic phosphate groups probably linked to aliphatic carbon chains, as revealed by the IR-spectra of the ether extracts, indicate that part of the nephrolith body is formed by organic material.

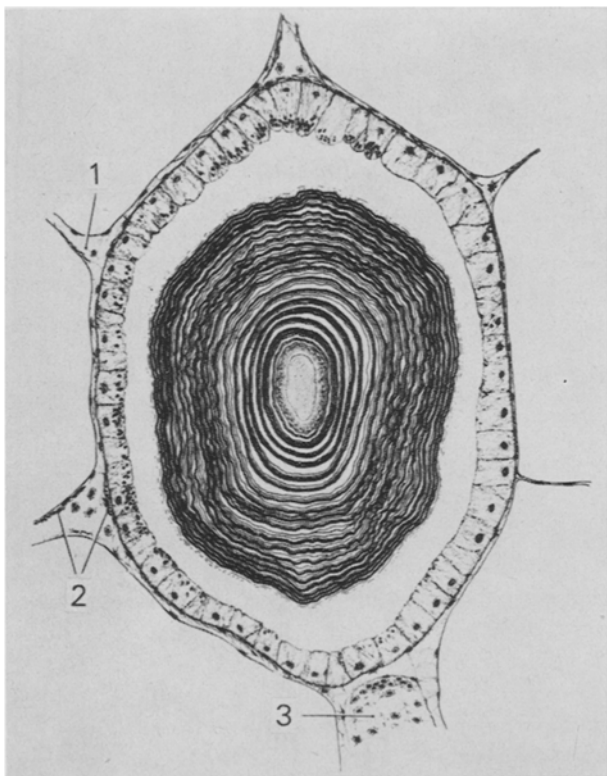

Fig. 1. Section of a renal cavity showing the nephrolith surrounded by secreting cells. The concentric layers of the nephrolith body and the presence of granules in the cells suggest a cyclic secretion of material. (CZIHAH and DIERL[9]). 1. Blood lacuna; 2. Muscle fibers; 3. Blood vessel.

Table I. Manganese (% of dry weight) in body tissues and fluids of *Pinna nobilis*

Kidney	3.9
Byssus	0.095
Hepatopancreas	0.002
Gonads	0.001
Adductor muscle	–
Foot retractor muscle	–
Pericardial fluid	–
Blood	–

Table II. The elementary composition of the nephrolyths of *Pinna nobilis*

Carbon	16.03
Hydrogen	3.26
Nitrogen	0.93
Oxygen	50.01[a]
Phosphorus	11.9
Calcium	11.2
Manganese	3.4
Magnesium	2.4
Sulfur	0.7
Chlorine	0.1
Barium	0.07

[a] Calculated as difference.

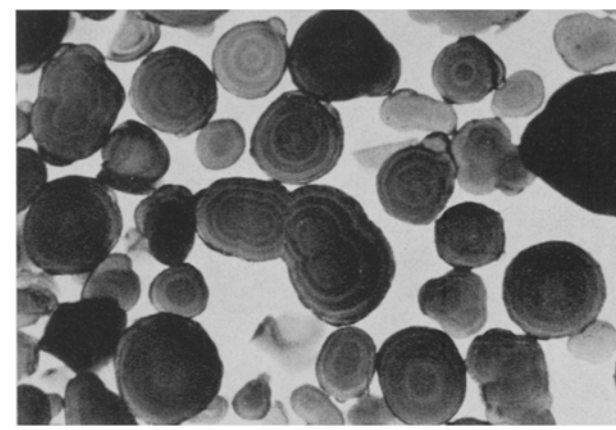

Fig. 2. Isolated nephroliths from the kidney of *Pinna nobilis*. ×138.

Riassunto. Il manganese che, secondo diversi Autori, *Pinna nobilis* accumulerebbe nei suoi tessuti, si trova localizzato quasi eclusivamente dei nefroliti che ne contengono fino al 3.4% del peso secco.

F. GHIRETTI, B. SALVATO, S. CARLUCCI and R. DE PIERI[10]

Institute of Animal Biology, University of Padova, Via Loredan 10, and I-35100 Padova; Institute of Mineralogy and Petrology, Corso Garibaldi 9, I–35100 Padova (Italy), 31 August 1971.

[1] H. C. BRADLEY, J. biol. Chem. *3*, 151 (1907).
[2] H. C. BRADLEY, J. biol. Chem. *8*, 237 (1910).
[3] H. M. FOX and H. RAMAGE, Proc. R. Soc. London, B. *108*, 157 (1931).
[4] A.P. VINOGRADOW, Mem. Sears Fdn. Lond., mar. Res., *2*, 324 (1953).
[5] P. GAGLIONE and O. RAVERA, Nature, Lond. *204*, 1215 (1964).
[6] G. G. CALAPAJ and D. ONGARO, G. Fis. sanit. *10*, 179 (1966).
[7] A. B. GRIFFITHS, C.r. Acad. Sci., Paris *114*, 840 (1892).
[8] R. SUTO, Jap. J. Zool. *8*, 123 (1938).
1961).
[9] G. CZIHAH and W. DIERL, *Pinna nobilis* (Fischer-Verlag, Stuttgart).
[10] Institute of Mineralogy and Petrology, Padova (Italy).