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BRIEF COMMUNICATION

PATTERNS ON FREEZE-FRACTURED PLASMA MEMBRANES OF LILY POLLEN TUBES

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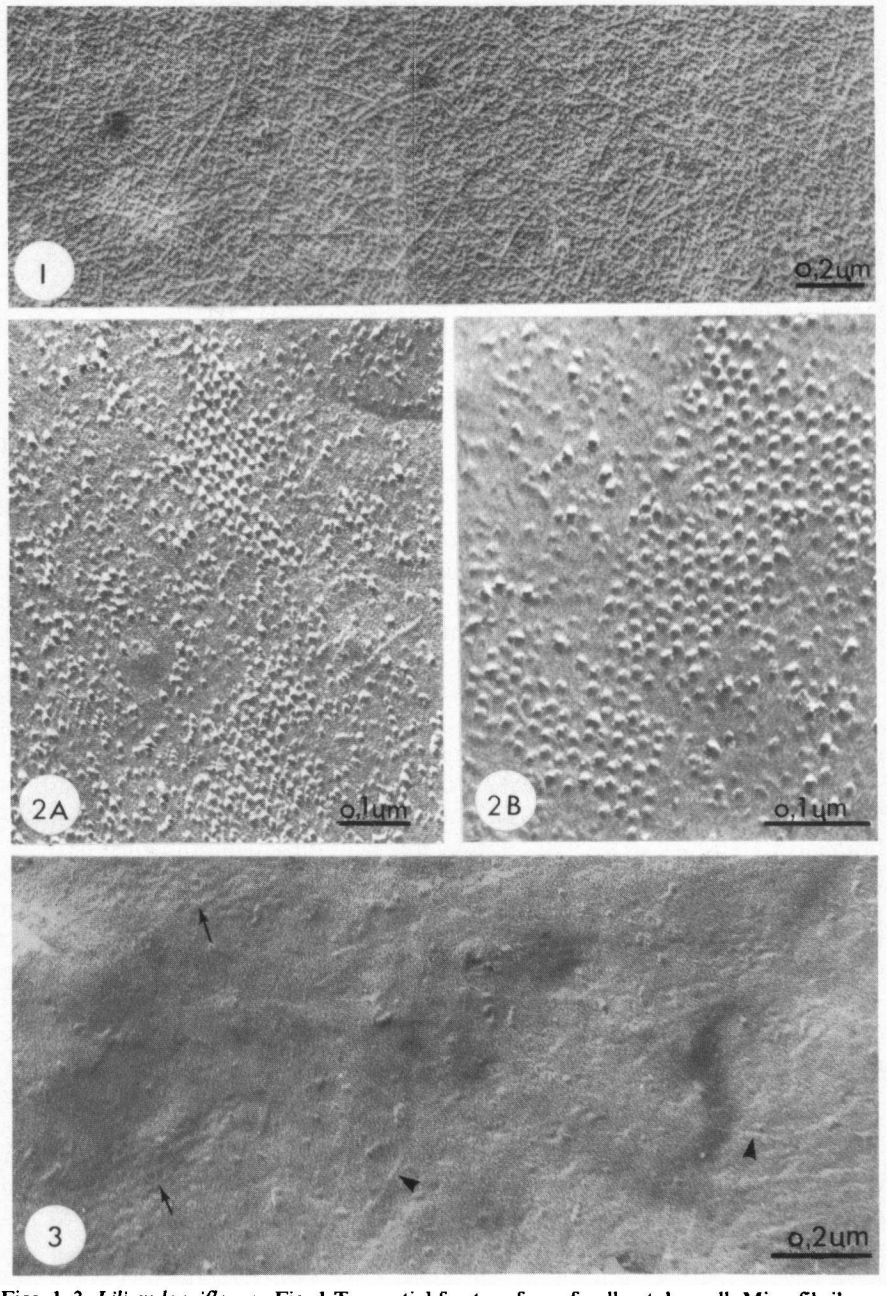
The cell wall of *Lilium* pollen tubes contains less skeletal cellulose (HERTH et al. 1974) than the pollen tube wall of *Petunia* (SASSEN 1964, ENGELS 1974) and *Nicotiana* (KROH & KNUIMAN 1982). A crystalline modification of polymeric β-1,3-glucan predominates in the lily pollen tube wall (HERTH et al. 1974).

Since microfibril synthesis presumably is a membrane-bound process (BROWN 1985), we studied plasma membranes of lily pollen tubes with the freeze-fracture procedure for comparison with plasma membranes of tobacco pollen tubes (KROH & KNUIMAN 1985).

In vitro grown pollen tubes of *Lilium longiflorum* with lengths of 4–6 times the diameter of the pollen grain were used. The freeze-fracture procedure was as described previously (KROH & KNUIMAN 1985).

Tangential fractures through the pollen tube wall of lily show microfibrils in random orientations (*fig. 1*). The plasmatic fracture face of the plasma membrane (PF) shows areas with non-aggregated intramembraneous particles (IMPs) and areas with IMPs aggregated in hexagonal clusters with an interhexagonal distance of approximately 21 nm (*fig. 2A, B*). These clusters have also been observed on the PF of both (generative and vegetative) plasma membranes surrounding the generative cell of lily pollen (data not shown). Sporadically, particle rosettes consisting of six particles are present on the PF face of the plasma membrane. REISS et al. (1985) have reported on the presence of these particle rosettes in lily pollen tubes with lengths of one half of the pollen diameter. They did not observe clusters of hexagons on the plasma membrane of these short germination tubes. In one case imprints of hexagonal particle patterns were present on the extraplasmatic fracture face (EF) of the plasma membrane together with imprints of microfibrils (*fig. 3*). Hexagonally packed particles on plasma membranes of plant cells have been described before (for literature see VOLKMANN 1984).

Numerous plasma membrane fracture faces of lily pollen tubes reveal a meandering network of ridges (*fig. 4A–C*). The ridges are composed of parallel rows of particles with a size of approximately 7 nm. The distance between the ridges is approximately 14 nm.



Figs. 1–3. *Lilium longiflorum*. Fig. 1 Tangential fracture face of pollen tube wall. Microfibrils are randomly oriented. × 44.000.
Fig. 2A. Plasma membrane (PF) with non-aggregated IMPs and IMPs aggregated in clusters of hexagons. × 90.000.
Fig. 2B. Clusters of hexagons. × 138.000.
Fig. 3. Plasma membrane (EF) with imprints of IMP patterns (arrows) and microfibrils (arrowheads). × 69.000.

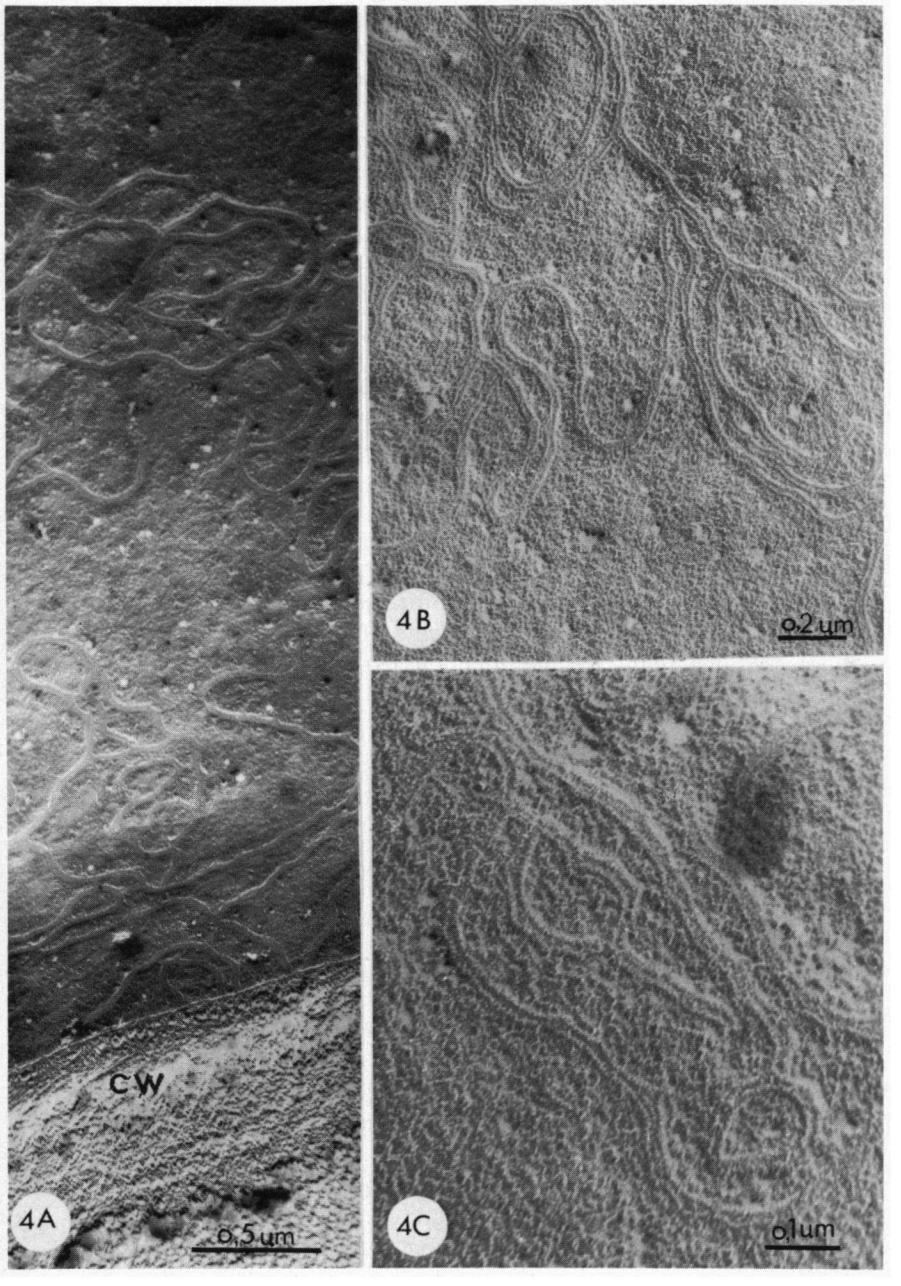


Fig. 4A–C. *Lilium longiflorum*. Plasma membrane with meandering network of ridges. CW = cell wall. × 34.500 (A), × 44.400 (B), × 90.000 (C). Fig. 4B and C show clearly that the ridges are composed of parallel rows of particles.

To our knowledge such patterns have not been described to occur on fracture faces of plasma membranes of lower or higher plants. Similar, but not identical, patterns have been found on freeze-fracture faces of cell junctions (BERDAN et al. 1985, ANDRIES et al. 1985). Dispersions of saturated phosphatidylcholines stored at −5 °C show a somewhat similar pattern. Under these conditions lipids adopt a non-bilayer configuration, which has been revealed by freeze-fracturing (SINGER & FEINGOLD 1985). The phase transition is possibly the result of a partial dehydration of the head-group region (RUOCCO & SHIPLEY 1982). Very recently we did come to know that PLATT-ALOIA et al. (1986) observed ridges of lipid nature of unknown origin and function in folds of the undulating outline of the generative cell of freeze-fractured dry and hydrated *Phoenix* pollen.

Up till now we can only speculate on the possible function of the network of ridges on the plasma membrane of lily pollen tubes. It is known that non-bilayer lipid structures may be important in mediating some membrane functions, fusion in particular (CULLIS & DE KRUIFF 1979). The arrangement of particles in meandering parallel rows might create a channel system which would facilitate the transfer of ions (e.g. Ca^{2+}) or other molecules involved in fusion processes during deposition of tube wall material. The ridges may also be regarded as junctions between plasma membrane and underlying ER. In this manner membrane compartments would be formed, which may control local tensions and/or create and maintain gradients, thus having functions analogous to those attributed to intercellular junctions (STAEHELIN 1974).

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