Lane's landscapes

Biologists such as Nancy Lane are venturing into previously unexplored and strangely beautiful realms of the cell, using sophisticated microscopes allied with familiar, age-old visual techniques.

Martin Kemp

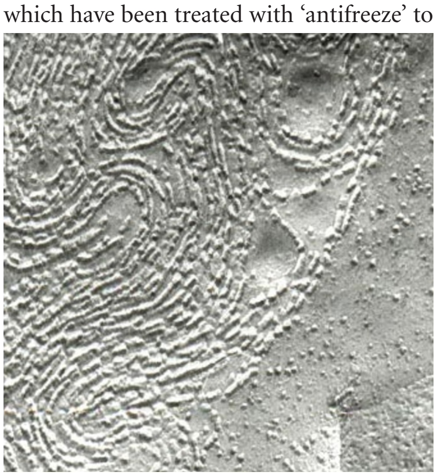
Lane's "Freeze-fracture replica of plasma membranes in a septate junctional area from the midgut of the moth, *Manduca sexta*" (× 28,000).

Just as Robert Hooke in the seventeenth century was beguiled by the microcosmic wonders of the world in miniature disclosed by his microscope, so the successively refined techniques of modern electron microscopy have repeatedly occasioned visual excitement in pioneers and practitioners alike. And, in keeping with the perceptual practices of those who first looked through optical devices, the topographies of the unfamiliar worlds are certified by analogy to morphological features visible within the normal compass of our unaided vision. The metaphorical language of science often speaks of this mode of seeing and describing.

When Gerd Binnig viewed the multiple diamond pattern of the 7 × 7 surface of silicon in the scanning tunnelling microscope, which he had invented with Heinrich Rohrer in 1982, he responded rhapsodically, talking in terms of aesthetic revelation: "Here one saw little hills, and the hills formed a complicated pattern with this symmetry. We like symmetry. If something is symmetrical, it is very pretty. This was complicated but regular, extremely surprising and pretty."

The less overtly symmetrical landscapes of organic tissues are equally 'pretty' in their own way. The Cambridge cell biologist, Nancy Lane, talks of the freeze-fracture replicas of plasma membranes as "providing stunning evidence, if such were required, of the beauty of the cell". Yet it is a beauty that can only be disclosed by complex techniques of preparation.

Lane's technique involves the fast freezing of plasma membranes of eukaryotic cells from invertebrates, mainly arthropods, which have been treated with 'antifreeze' to avoid crystal formation. The two adhering membranes that make up a junction are cleaved with a knife in an evacuated chamber, the fracture plane running medially through either membrane. The resulting relief surfaces, each of which may carry some residues from the other half of the membrane, are then shadowed with a heavy metal 'sprayed' at an angle onto the sides of the hills and valleys. The surface is next 'faced up' with a thin film of carbon — non-opaque to electrons — and the biological tissue is removed when the preparation has been thawed. The metallic "death mask", as Lane calls it, is then examined under a transmission electron microscope.



Lane's "Detail showing septate junctional intramembranous particles in linear arrays" (× 65,000).

What we see in the microdomains are the configurations of intramembranous particles that form the intercellular junctions. In some places we see the prominences of the proteins anchored in their 'sea' of lipid. In others we see the depressions which retain, in negative, the imprint of the projecting features from the half-membrane that has been cleaved away.

Reading the complex and subtle configurations of convexities and hollows involves considerable visual agility, accentuating the positive and, unlike the popular song, not eliminating but asserting the negative.

Navigating through the landscape, devoid of the recognizable features of our human terrain, requires disciplined scrutiny, the cultivation of visual memory and considerable perceptual control — and the 'correct' orientation of the highlights and metallic shadows as if lit, ideally, from the upper left, if prominence and hollow are not to be misleadingly reversed. Newly accessible territories are yielding their secrets through the exercise of enduring visual habits. □

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