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Pictures in cell biology

Squaring up to the cell-shape debate

These images show bovine capillary endothelial cells growing on square areas of fibronectin (Figs 1 and 2). These squares were generated using a novel process made possible by recent advances in microfabrication technology, which were originally developed for building electronic microchips. Each island of fibronectin is surrounded by a nonadhesive barrier region, so the cell spreads until it reaches the edges of the island and alters its shape to fit the area available. Experiments using squares of different size showed that the degree to which cells are able to spread can have functional consequences, with cells proliferating on larger islands (see Fig. 3) and dying by apoptosis on the very small islands[1]. A subsequent study using the same method showed that cell shape is the dominant regulator of cell-cycle progression under conditions where binding of soluble growth factors and insoluble extracellular matrix molecules are optimal and associated growth signalling cascades (e.g. mitogen-activated protein kinase) are fully activated inside the cell[2]. These studies suggested that cell shape and mechanical forces play a role in cell growth and developmental control. Investigation of the role of cell shape and mechanics is therefore an important aspect of improving our understanding of tissue remodelling and morphogenetic patterning.

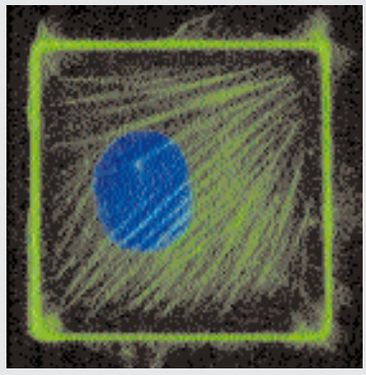

FIGURE 2

The actin cytoskeleton (green) and nucleus (blue) visualized within a single endothelial cell grown on a square island. In this immunofluorescence view, actin microfilaments are labelled with FITC–phalloidin and the nucleus is stained with the DNA-binding dye DAPI.

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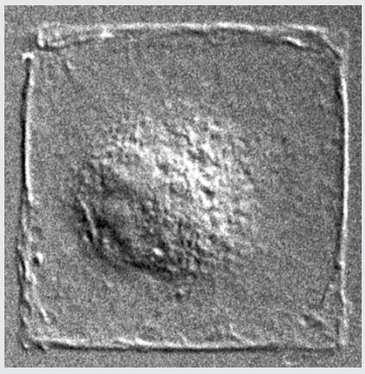

FIGURE 1

A bovine capillary endothelial cell cultured for 24 h on a square adhesive island (edge 50 μm) coated with fibronectin. The square cell is visualized by differential interference contrast optics.

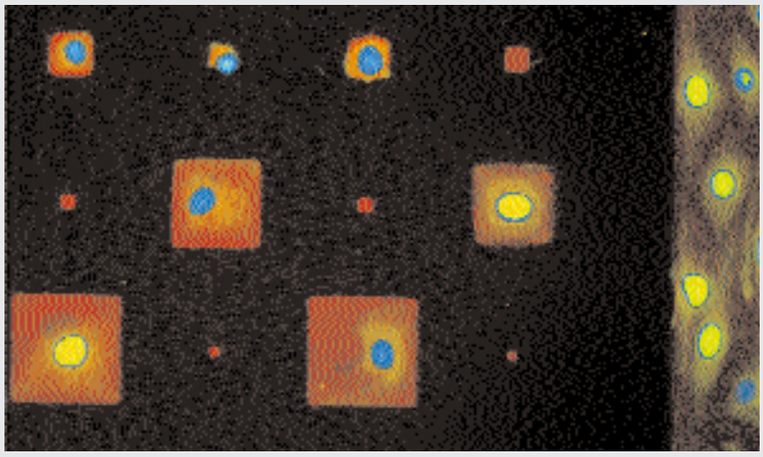

FIGURE 3

A pseudocolour image showing local differentials in growth of endothelial cells cultured on square fibronectin islands of varying size (edges 5–50 μm). The sample was fluorescently labelled with antibodies to fibronectin to visualize the islands (red), DAPI to stain all nuclei (blue) and antibodies to bromodeoxyuridine to label nuclei in S phase (yellow–green). Note that only highly spread cells progress through the cell cycle to S phase (yellow–green).

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