New and Notable

"Shimmying Like My Sister" Cell

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Studies on cell movement and attachment have tended to concentrate on the rather slow and steady events revealed by time-lapse analysis of movement and on changes in actin distributions revealed mainly by immunofluorescent staining and by image analysis. Such work has given us much information on movement and adhesion. It has been known since the early work (1) that these events are accompanied by undulations (ruffling) of the leading edge of the cell (undulating membrane or lamellopodium), but analysis of these images has lagged until the article by Pierres et al. (on page 4114 of this issue). The movement that Abercrombie (1) and others seemed to see was almost a shimmying at the edge of the cell. Impressively full two-dimensional descriptions of the events around adhesion have been given and are quoted by Pierres and colleagues and by others (2).

The article by Pierres et al. gives us a much better concept of the nature of these shimmying, almost balletic movements. All previous descriptions were two-dimensional ones but they have added a view of the third dimension. She and her colleagues used interference reflection microscopy, also known as reflection interference contrast microscopy (3), to observe the approach of a monocytic cell to a fibronectin-coated surface. They applied image pixel averaging to reduce the height measurement error (of the gap between cell and substratum) below 1 nm. Time sequences revealed the transverse undulation of the approaching cell surface with a wavelength on the order of a micrometer. Cells seemed to detect the presence of the underlying surface at ~50 nm separation as revealed by the behavior of membrane fluctuations. Adhesion was not immediate; rather the cell-to-surface gap decreased by several tens of nanometers during a few minutes after initial contact. So now we have for the first time some idea of the choreography of the way the "dying" swan (the cell) sinks gracefully to the floor. The elucidation of the full biophysics of these events is likely to involve several processes, including electrical charge distribution during the undulation. Also important may be appreciable mechanical stresses that could occur during membrane undulation (4).

This article appears to point to many new experiments that might be done on the formation of adhesions between cells and substrata.

REFERENCES

1. Abercrombie, M. 1980. The Croonian Lecture 1978. The crawling movement of metazoan cells. *Proc. R. Soc. Lond. B. Biol. Sci.* 207:129–147.
2. Giannone, G., B. J. Dubin-Thaler, O. Rossier, Y. F. Cai, O. Chaga, G. Y. Jiang, W. Beaver, H. G. Dobereiner, Y. Freund, G. Borisy, and M. P. Sheetz. 2007. Lamellipodial actin mechanically links myosin activity with adhesion-site formation. *Cell.* 1283:561–575.
3. Schindl, M., E. Wallraff, B. Deubzer, W. Witke, G. Gerisch, and E. Sackmann. 1995. Cell-substrate interactions and locomotion of *Dictyostelium* wild-type and mutants defective in 3 cytoskeletal proteins: a study using quantitative reflection interference contrast microscopy. *Biophys. J.* 683:1177–1190.
4. Barbee, K. A, P. F. Davies, and R. Lal. 1994. Shear stress-induced reorganization of the surface topography of living endothelial cells imaged by atomic force microscopy. *Circ. Res.* 741:163–171.

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