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Computer-Assisted Morphometry of Cell-Substratum Contacts

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Aim. Quantitative analysis of size and shape of the cell-substratum contacts in Dictyostelium and comparison of these parameters between wild-type cells and the cells bearing cytoskeletal protein mutations.
Methods. Reflection interference contrast microscopy (RICM) was used to image the areas of contact between aggregation-competent Dictyostelium cells and weakly adhesive mica surfaces. The cell-substratum contact areas were automatically identified in RICM micrographs by digital image processing. Information about the size and shape of the contact areas was obtained by using the shape descriptors based on two-dimensional geometrical moment invariants.
Results. Lack of either of the two actin-crosslinking proteins, a-actinin and 120 kDa gelation factor, similarly affects the cell-substratum interactions of Dictyostelium cells. The shape descriptors, elongation and dispersion, of the contact areas were reduced by 10% to 30% in mutant cells when compared to the wild type, but the size of the contacts was not affected.
Conclusion. Video microscopy combined with digital image processing and quantitative image analysis is capable of revealing small phenotypic effects of cytoskeletal protein mutations on the level of single cells. Such automated microscopic methods are expected to gain importance and find a widespread use in biomedicine.

Key words: alpha-actinin; cell movement; image processing, computer-assisted; microscopy, interference; cell adhesion; cytoskeletal proteins; Dictyostelium; motility cell; pseudopodia