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Cell Shape Dynamics: From Waves to Migration MEGHAN DRISCOLL, University of Maryland, College Park, COLIN MCCANN, University of Maryland, College Park and National Cancer Institute, National Institutes of Health, XIAOYU SUN, JOHN FOURKAS, University of Maryland, College Park, CAROLE PARENT, National Cancer Institute, National Institutes of Health, WOLFGANG LOSERT, University of Maryland, College Park — We observe and quantify wave-like characteristics of amoeboid migration. Using the amoeba Dictyostelium discoideum, a model system for the study of chemotaxis, we demonstrate that cell shape changes in a wave-like manner. Cells have regions of high boundary curvature that propagate from the leading edge toward the back, usually along alternating sides of the cell. Curvature waves are easily seen in cells that do not adhere to a surface, such as cells that are electrostatically repelled from surfaces or cells that extend over the edge of micro-fabricated cliffs. Without surface contact, curvature waves travel from the leading edge to the back of a cell at $\sim$35 μm/min. Non-adherent myosin II null cells do not exhibit these curvature waves. At the leading edge of adherent cells, curvature waves are associated with protrusive activity. Like regions of high curvature, protrusive activity travels along the boundary in a wave-like manner. Upon contact with a surface, the waves stop moving relative to the surface, and the boundary shape thus reflects the history of protrusive motion. The wave-like character of protrusions provides a plausible mechanism for the ability of cells to both swim in viscous fluids and to navigate complex 3-D topography.

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