# The assembly of 3D actin cytoskeleton in migrating cells: dorsal stress fibers and transverse actin arcs function as a platform to build perinuclear actin cap

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## Abstract

In adherent fibroblasts actin cytoskeleton forms morphologically and functionally distinct structures including parallel actin bundles in filopodia, branched polymerizing actin network in lamellipodium and ventral contractile stress fibers present at the base of cells. In addition to these actin structures that are confined to the cell's basal side cells also possess dorsal stress fibers at the leading edge, curved transverse actin arcs on the cell front and perinuclear actin cap that extends from the ventral side to the dorsal side of cells. Although these 3D structures are typical for migrating cells their functions in the cell migration remain largely unknown.

We found that in the wound healing model of cell polarization dorsal stress fibers are interconnected with focal adhesions at the basal side, with actin arcs on the front of the cell and with perinuclear actin cap fibers that are arranged above the nucleus in pole-to-pole manner. During cell polarization, dorsal stress fibers rise toward the dorsal side of the cell where they are crosslinked with transverse arcs. The formation of crosslinked actin arcs – dorsal fibers is necessary for the formation of perinuclear actin cap fibers. Live cell fluorescence microscopy revealed probable mechanism involved in the actin cap formation: crosslinked dorsal stress fibers and actin arcs hijack the preexisting ventral stress fiber and move it to the top of the nucleus. Importantly, the formation of actin cap is required for the nucleus movement and reorientation, and it correlates with the increased directional migration. We present model of mechanical bidirectional signaling between focal adhesions and nuclear envelope that limits the presence of focal adhesions and dorsal stress fibers to the leading edge and thus promotes directional migration.