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Three-dimensional Observation of Cell-Cell and Cell-Matrix Interactions during Myofibrillogenesis of Embryonic Heart Tube.

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We performed 3D observation of myofibril formation, cell-cell and cell-matrix adhesions of whole-mounted chicken embryonic heart tube by means of confocal scanning microscopy (CSLM). We found that 1) from the earliest stages of myofibrillogenesis, myofibrils in neighboring myocytes interconnected with one another and constituted circumferential alignments at the bottom of the inner myocardial cell layer. 2) The arrangement of myofibrils developed in association with changing cell-cell and cell-matrix adhesions. 3) Inhibition of FAK, which is a main substrate of tyrosine phosphorylation at the bottom of the inner cell layer, results in disruption of the integrity of the looping heart tubes (i.e., ballooning). 4) After the initiation of myofibrillogenesis (E 9.5 and later), small G protein rho localized at the z-band of the developing myofibrils both in the outer and the inner myocardial layer cells. Inhibition of rho by Y27632 inhibited formation of the tubular heart and perturbed myofibrillogenesis. These results suggest that cell-cell and cell-matrix interaction is crucial for myofibril formation and organization, and looping of the heart tube.

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