

A Structure of the Fibronectin Net According to the External Mechanical Stress

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BACKGROUND: Fibrils of extracellular matrix (ECM), in particular fibronectin, are known to be closely connected with the cytoskeleton via focal contacts. Every alteration of the cytoskeleton is transmitted to ECM while the latter may modulate tension generation via feed back mechanisms for achieving an appropriate balance of cellular forces [1]. However the experimental evidence of the feedbacks between ECM deposition and mechanical forces is still scarce.

METHODS: Effects of modulation of mechanical stresses upon the dynamics of fibronectin deposition at the inner side of the blastocoel roof of the early gastrula *Xenopus laevis* embryos have been studied. In the 1st series of operations the circumferential tensions of embryonic ectoderm were relaxed as described in [2] and the samples were fixed from 5 min to 1 h after operations. In the 2nd series pieces of the blastocoel roof were explanted, stretched by glass needles either longitudinally (in antero-posterior direction) or transversely and fixed within the same time interval. Fibronectin was stained by immunohistochemical methods and visualized by confocal microscopy (Figs 1-3).

RESULTS: Fibronectin deposition turned out to be quite sensitive to the modulations of mechanical stresses. 45 min after relaxation, fibronectin net became less dense and more fragmented than in the intact embryos (cf Fig. 1 and 2). In the artificially stretched explants already in 10 min after operation fibronectin fibrils became oriented along the direction of applied stretching irrespectively of its orientation with respect to the embryo axis (Fig.3).

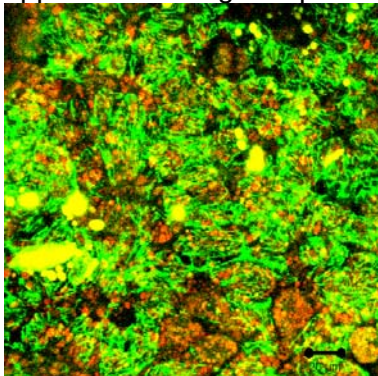


Figure 1. A Blastocoel roof of an intact embryo, stained for fibronectin. Scale bar 20 μ m

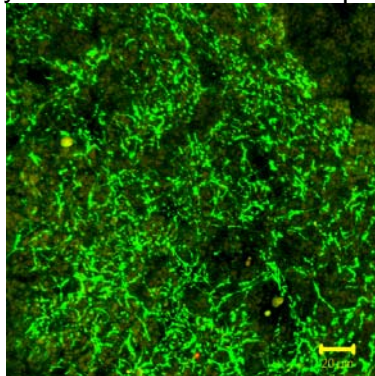


Figure 2. A Blastocoel roof of the relaxed embryo, 45 minutes after operation.

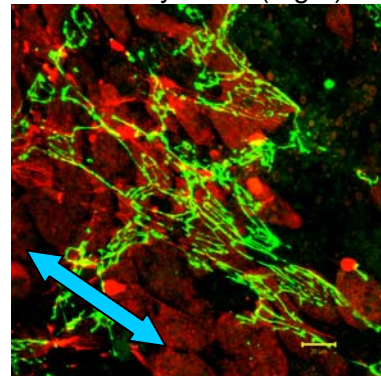


Figure 3. A Blastocoel roof of the stretched explant. A double-head arrow indicates the direction of the stretching.

CONCLUSIONS: We present the first direct experimental evidences on the mechanosensitivity of fibronectin ECM deposition in amphibian embryos. We show that in few minutes after modulation of mechanical stresses, the structure and orientation of fibronectin net is extensively changed.

REFERENCES

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- [2] Lev V. Belousov et al. Effects of relaxation of mechanical tensions upon the early morphogenesis of *Xenopus laevis* embryos. *Int. J. Dev. Biol.* 34: 409-419, 1990