Mechanism of the “KUBIRE” formation in the neurula embryo of the ascidian, *Halocynthia roretzi*

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To understand how tissues become shaped is a fundamental issue in the field of developmental biology. In the ascidian embryo, the boundary between the trunk and tail regions can be first recognized morphologically as a bending of the epithelial layer, which we call “KUBIRE” (a Japanese word for “small waist”), at the late neurula stage. We have been investigating which morphogenetic behavior of individual epithelial cells underlies the “KUBIRE” formation and how its position along the anterior-posterior (A-P) axis is determined. Using the live-imaging technique, we have discovered the following phenomena. First, two to four rows of rectangle-shaped epithelial cells became evident and were aligned around all the circumference of the embryo with the exception of the neural tube region right before the “KUBIRE” formation and at the boundary-forming level along the A-P axis. Secondly, the formation of “KUBIRE” was accompanied by epithelial cell division. Thirdly, these epithelial cells divided in different orientations: cells in the anterior part divided along the circumference of the embryo whereas those in the posterior rotated their mitotic spindles 90 degree right before cell division and divided along the A-P axis, forming a sharp boundary that coincides with the “KUBIRE”-forming region. Finally, inhibition of cell division and spindle rotation with the treatment of hydroxyurea and dynein inhibitors, respectively, resulted in abrogation of the “KUBIRE” formation. From these observations, we have proposed a model in which cell divisions with different division orientations contribute to the tissue shaping in the ascidian embryo.