

SUMMARY OF Ph.D. DISSERTATION

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<p>Title</p> <p>A system for measuring the pattern of cell divisions in <i>Caenorhabditis elegans</i> embryos</p>		
<p>Abstract</p> <p>The pattern of cell divisions provides crucial information to understand the mechanism of development in multicellular organisms. The pattern of cell divisions holds the position and time of individual cell and relationships between mothers and their daughter cells. Many analyses of development often compare patterns of cell divisions, where differences of timings or orientations of cell divisions and/or positions of cells among wild-type and mutant embryos are investigated. The scales of these analyses are getting larger, so that the importance of objectivity and productivity in measuring the pattern of cell divisions are getting more critical. However, the patterns of cell divisions in <i>Caenorhabditis elegans</i> embryo has been manually measured by direct observation with a microscope, so that the objectivity and productivity of the measurement has been seriously low. Therefore, I developed a system that objectively and productively measures a pattern of cell divisions of <i>C. elegans embryo</i>. This system first automatically detects nuclei in a set of images recorded by the 4-dimensional differential interference contrast (DIC) microscope system using nuclear regions that are image regions detecting nuclei in DIC microscope images; the nuclear regions are produced using the difference in image textures between the nucleus and the cytoplasm distinguished by local image entropy. This system then automatically identifies the 3-dimensional (3D) region of individual nuclei, tracks these 3D regions, and outputs the tracking trajectory. This tracking trajectory is the measured pattern of cell divisions. This system measures a pattern of cell divisions from fertilization to the onset of gastrulation of a <i>C. elegans embryo</i>. This system is the first embodiment that enables the objective and productive measurement of the pattern of cell divisions, which would greatly contribute to the future studies of development in multicellular organism.</p>		