【理学系様式３】

山口大学大学院創成科学研究科

学　位　論　文　要　旨

論　文 提出者	入学年度	平成　29 年度	専　　攻	基盤科学系
	氏　　名	徳永　優	指導教員	西井　淳
論 文 題 目	A Computational Model of Cell Migration of Fish Keratocytes			

Fish keratocyte usually has a circular shape. When keratocyte begins cell migration, it deforms from a circular shape to a half-moon shape and keeps its shape during migration. It is not clear that how half-moon shape contributes to cell migration of keratocytes. The purpose of this research is to clarify the relationship between keratocyte morphology and motor function by physical simulation experiments considering intracellular mechanism.

Cell migration is affected by the behavior of the actin molecule. The actin molecule extends toward the cell membrane while repeating actin polymerization (AP) and depolymerization. The cell membrane is deformed by being pushed by actin molecules from the inside. On the other hand, it is reported that the actin molecule is pulled by the region called the stress fiber (SF) spreading to the left and right in the rear part of the cell. This effect is called actin retrograde flow (ARF).

In our simulation, the membrane molecule was placed on the cylindrical surface and the actin molecule was placed inside the cell membrane. The cell membrane molecule receives elastic force from neighboring cell membrane molecules and receives repulsive force from the actin molecule. Assuming that the polymerized actin molecule is rod-like, AP was expressed by setting it to be extended by polymerization at one end and contracted by depolymerization at the opposite end. The polymerization direction of actin molecule is randomly determined at the beginning. ARF expressed by stochastically moving each actin molecule towards SF. When the actin molecule entered the low density region of the actin molecule, conditions were set so that it was repositioned near the cell membrane.

As a result, the actin molecule aggregated in a half-moon shape under the condition that SF was expressed by two points at the backward of the cell. Moreover, it was found that the condition that the frequency of polymerization increases in the high actin molecule density region and the magnitude of the influence of AP and ARF are also important for the formation of the a half-moon shape.