A cell-sorting model can explain different cone mosaic patterns (of zebrafish and medaka)

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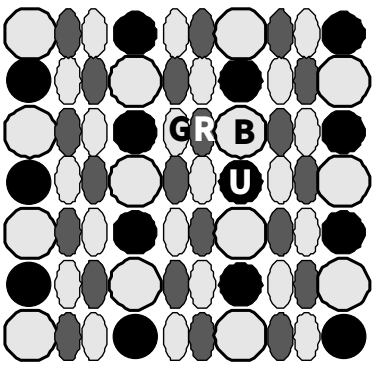
In fish retina, four types of cone photoreceptor cells with different sensitive wave-length of the light (blue, UV, red and green) are arranged in regular pattern, called "cone mosaic". A pair of small cones, one sensitive to red and the other sensitive to green is close in contact and forms a "double cone". The development of cone mosaic has been studied by various experimental techniques, however a mechanism of formation of cone mosaic has not been identified yet.

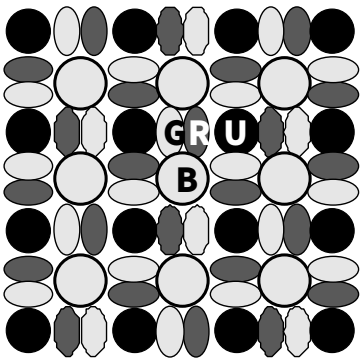
We study the mechanism of formation by analyzing models in which cells are arranged on the 2-dimensional surface, experience interaction between neighbors, and automatically form the regular pattern. We demonstrated that zebrafish mosaic pattern can be generated by the cell sorting model in which cells exchanges their location with neighbors at a rate affected by cell-cell adhesions. Using statistical physics techniques, we estimated probabilities of certain patterns by calculating total adhesion and the number of configurations, and confirmed the theoretical predictions by direct computer simulations.

We also show that the same model can generate cone mosaic of medaka, which is of cell arrangement different from zebrafish, if the appropriate adhesions are given.

Tohya *et al.* (1999) Formation of cone mosaic of zebrafish retina. *J. Theor. Biol.* **200,** 231-244.



zebrafish



medaka