Active Character of Cluster Diffusion in Experiments

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Cell sorting in living multi-cellular organisms is a process present in phenomena of interest such as pattern formation during morphogenesis, wound healing, or metastasis. In order to understand these phenomena, it is necessary to further investigate such process. Some animals are known to have great regeneration abilities, reconstructing themselves from complete cell dissociation after cell sorting in a process called segregation. More than this powerful regeneration ability, hydras, fresh water cnidarians, have a simple body structure. They have two main body layers, the endoderm (inner layer) and the ectoderm (outer layer). These altogether made of hydras ideals subjects when working on these topics. Simulations show that when collective behavior is taken into account, cluster diffusion in cellular aggregates do not depend on cluster size, and the mean square displacement grows linearly with time, meaning a normal diffusion. The next logical step is to compare these results with experiments.

In the experiments, 20 to 50 genetically modified hydras expressing different fluorescence wavelengths for each layer are used. The difference in fluorescence allows us to follow different groups of cells. Aggregates resulting from mixed tissue cells dissociated from one another are placed between glasses, in a two dimensional conformation. Next, time lapse images are taken, processed and used to extract information about the clusters diffusion. The preliminary results show normal diffusion to cell clusters during segregation. Beyond that, they indicate that cluster size takes a back seat in cluster diffusion, since an increase or decrease in cluster diffusion does not seem to be associated with its mass, therefore, agreeing with the simulations previous results.