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The Effects of Germline Sequestration on Multicellularity

Odion Asikhia

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There have been many transitions in the history of evolution. For example, the transition of prokaryotes to eukaryotes, asexual to sexual populations, primate to human societies and so forth. We are specifically interested in the transition from unicellular to multicellular organisms. This transition is particularly interesting because multicellularity requires an immense amount of *cellular cooperation*. Our previous research focused on how relatively simple mechanisms such as growth and dispersal affected the evolution of multicellularity.

In this study, we investigated the importance of germline sequestration (differentiation). A germline is the cellular lineage of an organism. Germ cells, distinct from other cells, pass their genetic material to following generations. The segregation of germline cells happens early in development. Previous research suggests the presence of germline cells play a role in the transition to multicellularity. The goal of our experiment is to manipulate the germline cells and observe how they influence the presence of multicellularity.

We created multicellular pseudo-organisms using *Dictyostelium discoideum* and 3D printed plates. *D. discoideum* is a eukaryote that transitions from a unicellular amoeba to a multicellular slug to form a fruiting body when starved. A fruiting body consists of an upright stalk (composed of dead cells) with a mass of surviving cells at the apex. A key characteristic of multicellularity is cooperation. We grew the pseudo-organism with three different life cycle structures over many generations. We theorize that the presence of cheaters, which are non-cooperative, should break down the multicellular system, but some types of germline sequestration pattern may prevent this from occurring.