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Model of Exploratory Search for Mating Partners by Fission Yeast DANIEL HURWITZ, Department of Physics, University of Texas at Austin, FELIPE BENDEZU, SOPHIE MARTIN, Department of Fundamental Microbiology, University of Lausanne, DIMITRIOS VAVYLONIS, Department of Physics, Lehigh University — During conditions of nitrogen starvation, the model eukaryote *S. pombe* (fission yeast) undergoes sexual sporulation. Because fission yeast are non-motile, contact between opposite mating types during spore formation is accomplished by polarizing growth, via the Rho GTP-ase Cdc42, in each mating type towards the selected mate, a process known as shmooing. Recent findings showed that cells pick one of their neighboring compatible mates by randomizing the position of the Cdc42 complex about the cell membrane, such that the complex is stabilized near areas of high concentration of the opposite mating type pheromone. We developed Monte Carlo simulations to model partner finding in populations of mating cells and in small cell clusters. We assume that pheromones are secreted at the site of Cdc42 accumulation and that the Cdc42 dwell time increases in response to increasing pheromone concentration. We measured the number of cells that succeed in successful reciprocal pairing, the number of cells that were unable to find a partner, and the number of cells that picked a partner already engaged with another cell. For optimal cell pairing, we find the pheromone concentration decay length is around 1 micron, of order the cell size. We show that non-linear response of Cdc42 dwell time to pheromone concentration improves the number of successful pairs for a given spatial cell distribution. We discuss how these results compare to non-exploratory pairing mechanisms.

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