Collective Search Strategies

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How long does it take to find N targets by M searchers? This question arises, for example, if animals search for food or immune cells chase for pathogens. The usual goal is to minimize the time needed to catch all targets. One obvious possibility would be to increase the number of non-interacting searchers another to search collectively by utilizing communication between the searchers. It is known, that cells of the immune system talk to and influence one another by secreting small proteins that bind to and activate each other. For instance, T cells (a type of lymphocyte) are chemotactic, i.e., they move in response to a chemical stimulus, however, it is unknown if chemotaxis is important for the coordination of the search for pathogens. We use a simulation model of chemotactic active particles together with a self-generated chemorepellent in order to test the possibility and the benefit of collective search strategies in microbiological systems.