Trail Avoidance, Spatial Pattern Recognition, and Tubule-crossing Efficiency in the True Slime Mold Physarum polycephalum

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True slime molds exhibit memory and navigation that may resemble the precursors to functions performed by our complex cognition networks. Physarum polycephalum has been shown to use its trail as an external memory to aid navigation and to be able to anticipate temporal events. This study investigated the interactions of P. polycephalum with slime trail and its ability to respond to patterns. A series of experiments was conducted in 1) trail avoidance: plasmodia were placed in Y-shaped traps with an empty arm and an arm covered in slime trail with a food incentive; 2) spatial pattern recognition: monitored for directionality after following a trail of oats; 3) tubule-crossing efficiency: observed for efficiency behavior when it was necessary to cross slime trail. The results of these tests show that the slime trail avoidance in P. polycephalum overpowers positive chemotaxis towards food; that P. polycephalum detects and anticipates patterns and that it utilizes existing tubule networks when it is necessary to cross its own trail. In addition to creating possibilities for more advanced soft computing, the complexity of the memory and navigational ability of true slime molds mirrors the structure and function of our own brains and hints at a broader definition of intelligence and a deeper understanding of emergent systems.

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