The Effect of Oat Mass on Physarum Polycephalum Path Efficiency

Cho, Soyee (School: Olathe North High School)

Physarum polycephalum is an acellular, multinucleate organism that reacts to environmental stimuli (pressure, light, chemical stimuli, etc.). Physarum polycephalum's morphological changes in response to food availability were studied to test the hypothesis that if the mass of available food on an agar plate increased, the area of plate agar covered by P. polycephalum mold would increase. Varying amounts of equally sized oats were placed a standard distance away from cubes of P. polycephalum cultured agar (with dimensions of 0.5 cm) on gel agarose plates. Images of each plate were taken after two days of growth in a dark room. These images were then analyzed to compare P. polycephalum areas and conduct a Sholl analysis on each plate's paths. 95% confidence intervals were found and a single factor ANOVA test was performed on the calculated areas. Averaged path areas generally decreased as oat amount increased (0.1895 cm. sq. for one oat versus 0.1368 cm. sq. for three oats). Averaged path areas analyzed using an ANOVA single-factor test resulted in an F critical value of 4.256 greater than the F value of 0.601. Sholl's regression coefficients generally increased as oat mass increased. Comparisons of path areas proved inconclusive, while comparisons of Sholl's coefficients pointed towards a negative relationship between oat mass and path complexity. Understanding and manipulating the effect of food availability on P. polycephalum growth will support further experimentation related to "shortest path" problems, experimental urban planning using P. polycephalum, and bio-memristor development.

Awards Won: