# ECOL8000: Mutualism Simulation Exercise #2

October 18, 2018

In the paper by Doebeli and Knowlton (1998), potential mutualists are defined by phenotypes (a,b) and (a',b'), which parameterize investments in cooperation/mutualism: a and a' denote the initial investment during the first of a series of interactions over the course of a generation, and b and b' denote the rate that the payoff from the previous interaction is invested in the current interaction. Payoff for (a,b) is defined as $B(a') - C(a)$, and similarly $B(a) - C(a')$ for (a',b'), with $B(I) = B_0(1 - e^{-B_1 I})$ and $C(I) = C_0 I$.

1). Use the function `plot_investment_evolution_game_with_generations` to try to recreate the panels in figure 2 in Doebeli and Knowlton (1998).

2). Using the function `plot_and_print_investment_evolution_game_with_generations`, simulate the evolution of cooperation for a small number of generations ($\leq 10$), while varying the number of iterations per generation. Describe what happens to the payoffs over subsequent iterations within a generation. Does the fixation of mutant strategies make sense given the payoffs? Explain.

3). Use the output from `plot_and_print_investment_evolution_game_with_generations` to argue for how the number of iterations per generation will influence the propensity for the initial investment versus the subsequent investment of past payoff to increase.

4). By varying `B_0, B_1,` and `C_0` as inputs to the function `plot_investment_evolution_game_with_generations`, explore how the the parameterization of $B(I)$ and $C(I)$ influences the evolution of both components of the phenotype.

5). Optional and for fun only, try to figure out why my code doesn't seem to produce the same pronounced increases in a, a', b, and b' shown in figure 2.