# Simulating Evolution

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**Abstract**

The main purpose of this program is to accurately simulate the genetic evolution of a species. It will attempt to do so using methods such as genetic mutation, genetic drift, and natural selection by means of both microevolution and macroevolution.


**Background**

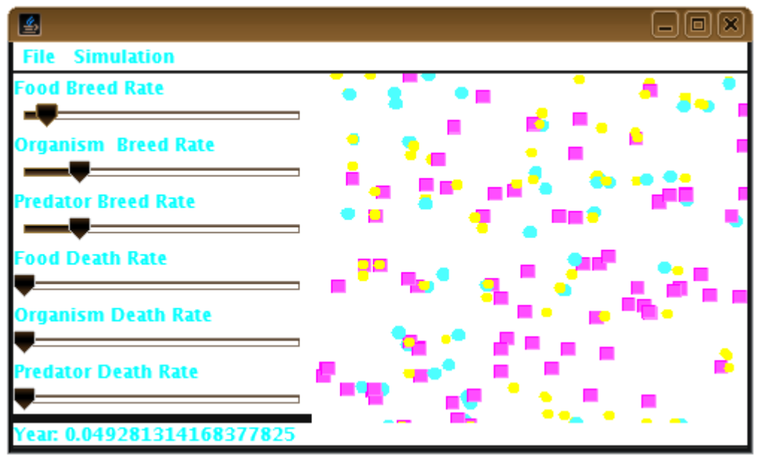
"Genetic changes do not anticipate a species' needs and those changes may be unrelated to the selection pressures on the species. Nevertheless, evolution is not a fundamentally random process."

*Agent-Based Modeling*

The actual evolution simulator is an ABMS with the Organism and Predator classes being the 'agents.' An agent is ``autonomous and self-directed.'' It can ``function independently in its environment and in its dealings with other agents.'' Mostly, an ABMS focuses on the interactions between the agents. In this project, I will be observing both the interactions between the agents and the interaction between the agents and their environment.

*Basic Concepts*

A population of any given species is greatly affected by its environment. This is where an animal will get its food and raise its young. In order to do this, it has to be well adapted to the environment it lives, yet also able to change under stress (such as a change from the norm). This is when evolution will occur. The members of a species that are best able to handle stress are the ones that will live on to populate the species; therefore, their young will acquire the ``better'' traits and be able to live in the newly changed environment. The environment in which a population lives provides resources for the population such as food and shelter. If there is limited food, then the environment will only be able to support a given number of species, meaning that the population will have a max value. The function of the population over time should be logarithmic, approaching that max value. However, this is just a basic model of an environment, void of predators and many other factors that affect the size of the population. If there are predators, then the population size should oscillate in accord with the predators (though there is a slight lag in the predator's population graph).




## Procedures/Methodology

**Steps to Simulating Evolution**

1) Create a changing environment with which a species may interact
2) Create a food source for the species
3) Create a species with designated traits to be tracked
4) Possibly create an herbivorous species and a predator
5) Define how the species may evolve (genetic algorithms)
6) Track the changes in traits and make observations
7) Adjust the model until a balance is achieved

**Algorithms**

1) *Process for Recombination*

The process for creating a new organisms with a new combination of genes mixed from its parents (and sometimes randomly mutated) takes the traits from both parents and gives the child a trait that is either equal to one of the parents, or is a mix of the two (something in between). The assignment of the trait is semi-random.

2) *Randomization for Mutation*

The process by which genes are mutated is completely random. In fact, it is double random because the swapping of genes is random and the chance that it is mutated is also random.