**Description**

Implement causal inference on dynamic systems using the probabilistic programming language Omega, giving the ability to do inference and counterfactuals. We will do this by taking a set of ODEs/SDEs and simulating data using the Gillespie algorithm. To start we will implement the Lotka-Volterra predator-prey model. Ideally the function will be extended to intake any SBML. Once the data is simulated we can condition on it and make inferences and counterfactuals. We want to look into both inferring rates and species abundances.

Additionally we would like to make comparisons between using probabilistic programming to using an SCM. We would like to explore the exact benefits of using probabilistic programming.

**Deliverables**

1. Implement Gillespie in Julia
   1. **Deliverable**: Code
2. Simulate the Lotka-Volterra model using Gillespie
   1. **Deliverable**: plot of the trace
3. Implement the simulation in Omega
   1. **Deliverable:** Omega code
4. Run different inferences/counterfactuals using Omega
   1. **Deliverable:** Plots of interventions/counterfactuals
   2. Intervention Ideas
      1. Increased prey value
      2. Increase prey at certain time (t\_now)
      3. Treatment effects of culling prey vs increasing predators
5. Implement the ability to intake different SBMLs and ensure they work
6. Create the model using an SCM and make comparisons