

Growing Simulated Bacteria Colonies as Cellular Automata

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First Iteration - Concept

1. Antibiotic vs Bacteria
2. Evolutionary and coevolutionary programming
 - a. mutation, mating, horizontal gene transfer
3. Horizontal gene transfer vs mutation and replication
 - a. HGT, faster genetic mutation, no turning back
4. Genetics encoded as color

First Iteration - Flaws

1. Worked well, but **uninteresting**
2. **antibiotic, no cellular representation**
3. **hill-climbing**
4. **no unexpected or interesting behavior**

Second Iteration - Concept

1. Encoding independence
 - a. > 13k neighborhood states encoded as three attributes in DNA
2. Antibiotic in the matrix
 - a. potency, function of spreading
3. No real fitness function
 - a. Testing survivability

Second Iteration - Flaws

1. Worked, but still chaotic
2. Force it to be more interesting!
 - a. ?
 - b. “Negative space”
3. Unreadable behaviors
 - a. Single generation decision making vs long term goals
 - b. Fluctuating environment, choosing the best move in the current situation?

Final Project - Concept

1. Goal: readability
2. Possible use: “playground” for non-CS or CS beginners
 - a. future project: general CA tool
3. Learn from past mistakes
 - a. Don't keep trying to improve on the previous iterations
 - b. ...do the opposite
4. CA behaviors become interesting when you stop trying?

Final Project - What I did right!

1. Global behavior
2. Simple rulesets
3. Must have a runtime fitness function
4. Minimize randomization
5. Reduce population size, easier to read

Final Project - What I did right! (cont)

1. Long term goals!
 - a. Behavior over time tells a story
 - b. Inferring goals and motivation
2. Energy, prioritizing energy oriented goals
 - a. providing variation, but not chaotic
3. Generalize, simplify genetic encoding
 - a. Diversity!