1. Langton’s ant

Langton's ant is a two-dimensional Turing machine with a very simple set of rules but complicated emergent behavior. It was invented by Chris Langton in 1986 and runs on a square lattice of black and white cells. The universality of Langton's ant was proven in 2000. The idea has been generalized in several different ways, such as turmites which add more colors and more states.

Squares on a plane are colored variously either black or white. We arbitrarily identify one square as the "ant". The ant can travel in any of the four cardinal directions at each step it takes. The ant moves according to the rules below:

- At a white square, turn 90° right, flip the color of the square, move forward one unit
- At a black square, turn 90° left, flip the color of the square, move forward one unit

Langton's ant can also be described as a cellular automaton, where the grid is colored black or white, the "ant" square has one of eight different colors assigned to encode the combination of black/white state and the current direction of motion of the ant.

These simple rules lead to complex behavior.

- Simplicity: During the first few hundred moves it creates very simple patterns which are often symmetric.
- Chaos: After a few hundred moves, a big, irregular pattern of black and white squares appears. The ant traces a pseudo-random path until around 10,000 steps.
- Emergent order: Finally the ant starts building a recurrent "highway" pattern of 104 steps that repeat indefinitely. All finite initial configurations tested eventually converge to the same repetitive pattern, suggesting that the "highway" is an attractor of Langton's ant, but no one has been able to prove that this is true for all such initial configurations. It is only known that the ant's trajectory is always unbounded regardless of the initial configuration – this is known as the Cohen-Kung theorem.

2. Brian's Brain

Brian's Brain is a cellular automaton devised by Brian Silverman, which is very similar to his Seeds pattern. It consists of an infinite two-dimensional grid of cells, but unlike Seeds, each cell may be in one of three states: on, dying, or off. Each cell is considered to have eight neighbors (Moore neighborhood), as in Seeds and Conway's Game of Life. In each time step, a cell turns on if it was off but had exactly two neighbors that were on, just like the birth rule for Seeds. All cells that were "on" go into the "dying" state, which is not counted as an "on" cell in the neighbor count, and prevents any cell from being born there. Cells that were in the dying state go into the off state.

Because of the cellular automaton's name, some websites compare the automaton to a brain and each of its cells to a neuron, which can be in three different states: ready (off), firing (on), and refractory (dying).

The "dying state" cells tend to lead to directional movement, so almost every pattern in Brian's Brain is aspaceship. Many spaceships are rakes, which emit other spaceships. Another result is that many Brian's Brain patterns will explode messily and chaotically, and often will result in or contain great diagonal waves of on and dying cells. For example a 2x2 block of on cells will result in an ever-expanding diamond consisting of four diagonal waves that move across the plane at the pattern's speed of light.