

# BIOMIMIMICRY IN SOFTWARE

# NATURE OF CODE

*Forces and Physics Simulations*

*Oscillations and Waves*

*Fractal Patterns*

*Cellular Automata*

*Agent-based Emergent Behavior*

*Genetic Algorithms*

*Neural Networks*

*Machine Learning + A.I.*

# COMPLEX SYSTEMS

*Simple units with short-range relationships*

*Simple units that operate in parallel*

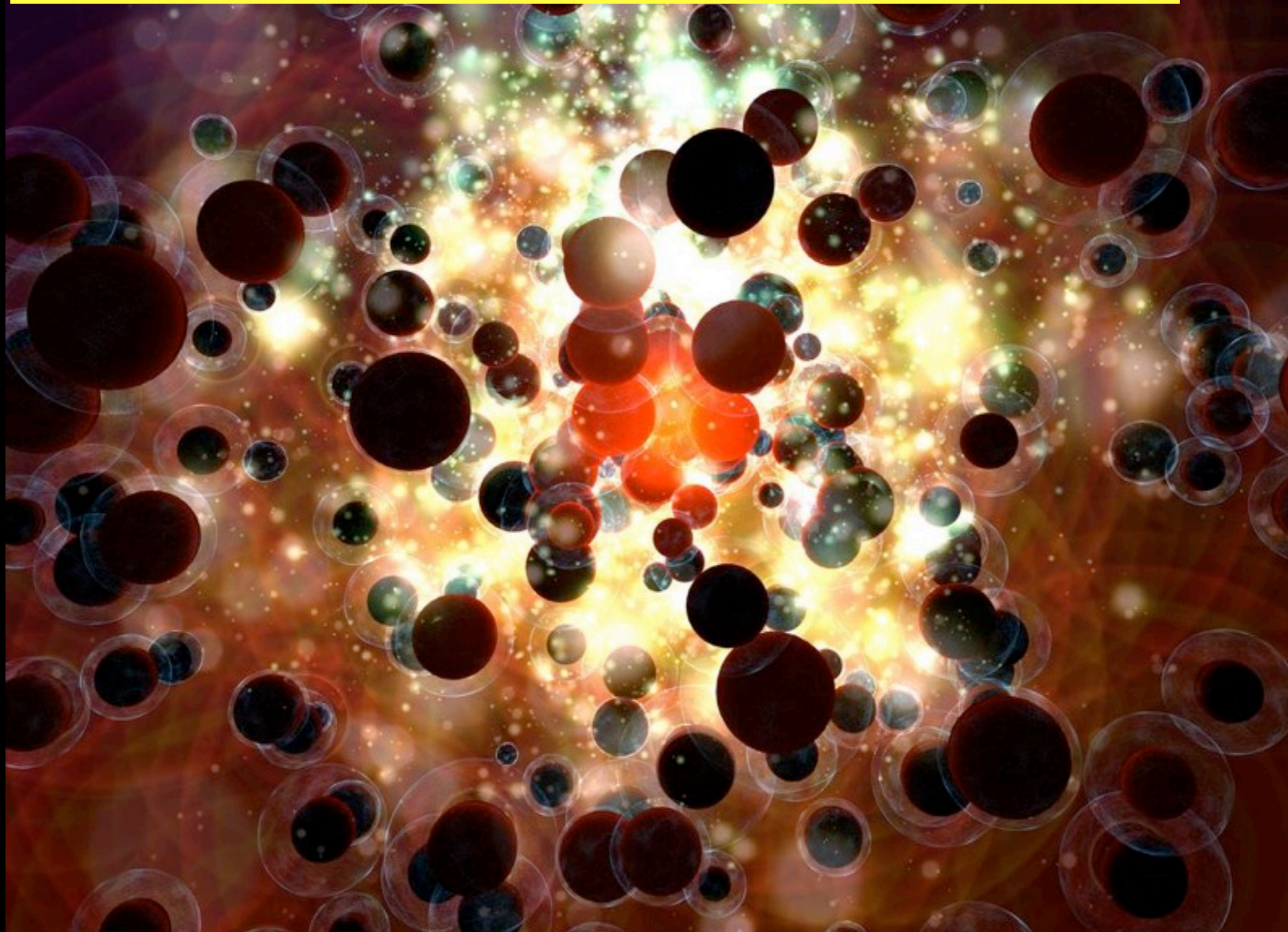
*System as a whole exhibits emergent phenomena*

*Non-linearity*

*Competition and cooperation*

*Feedback*

# FORCES + PARTICLES



*Robert Hodgkin (flight404), Moment of Fission*

# PHYSICS ENGINES



Polygon Shapes  
Press 1-4 to drop stuff

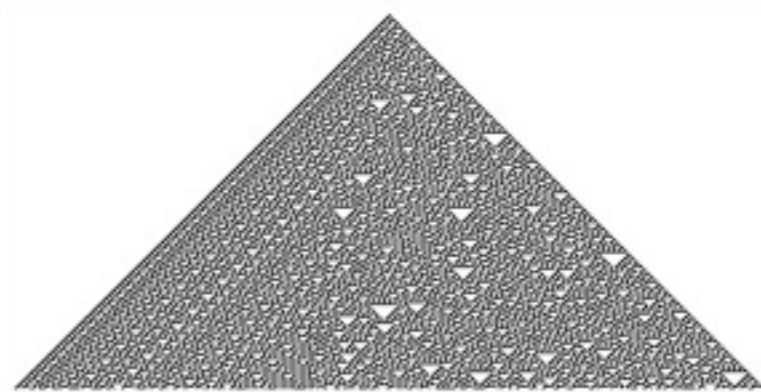
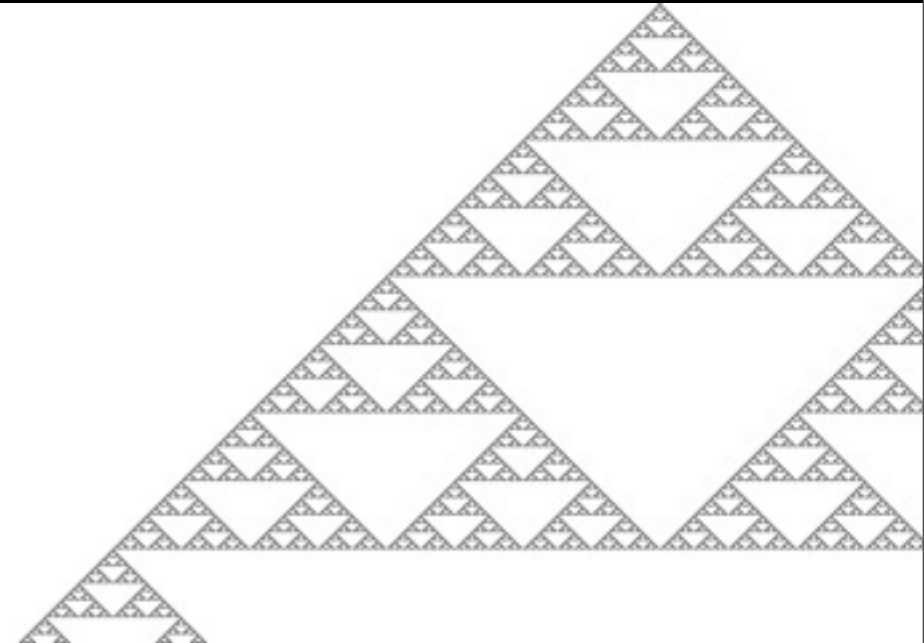
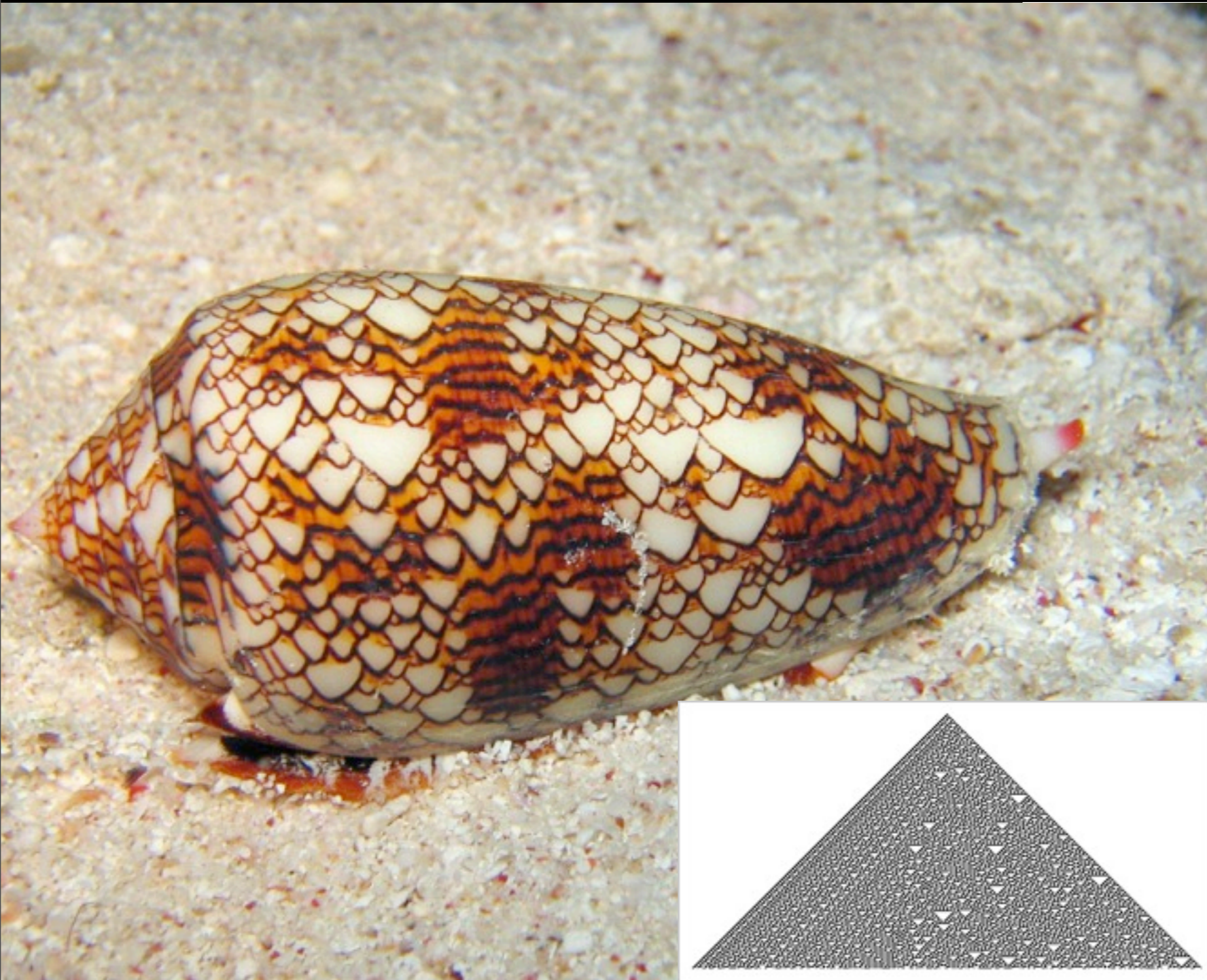


# OSCILLATION



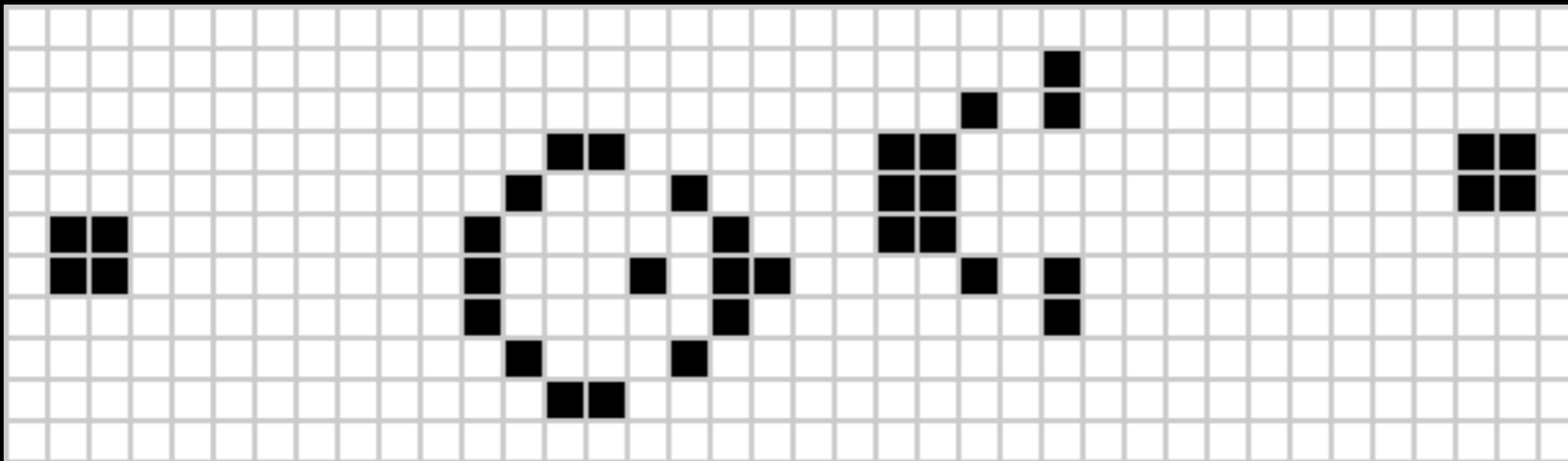
*Gabriella Levine, prototyping motion of SNEEL*

# CELLULAR AUTOMATA



# CONWAY'S GAME OF LIFE

## Demo



# AGENT-BASED MODELING

*When the actions of individuals form the behavior of groups.*



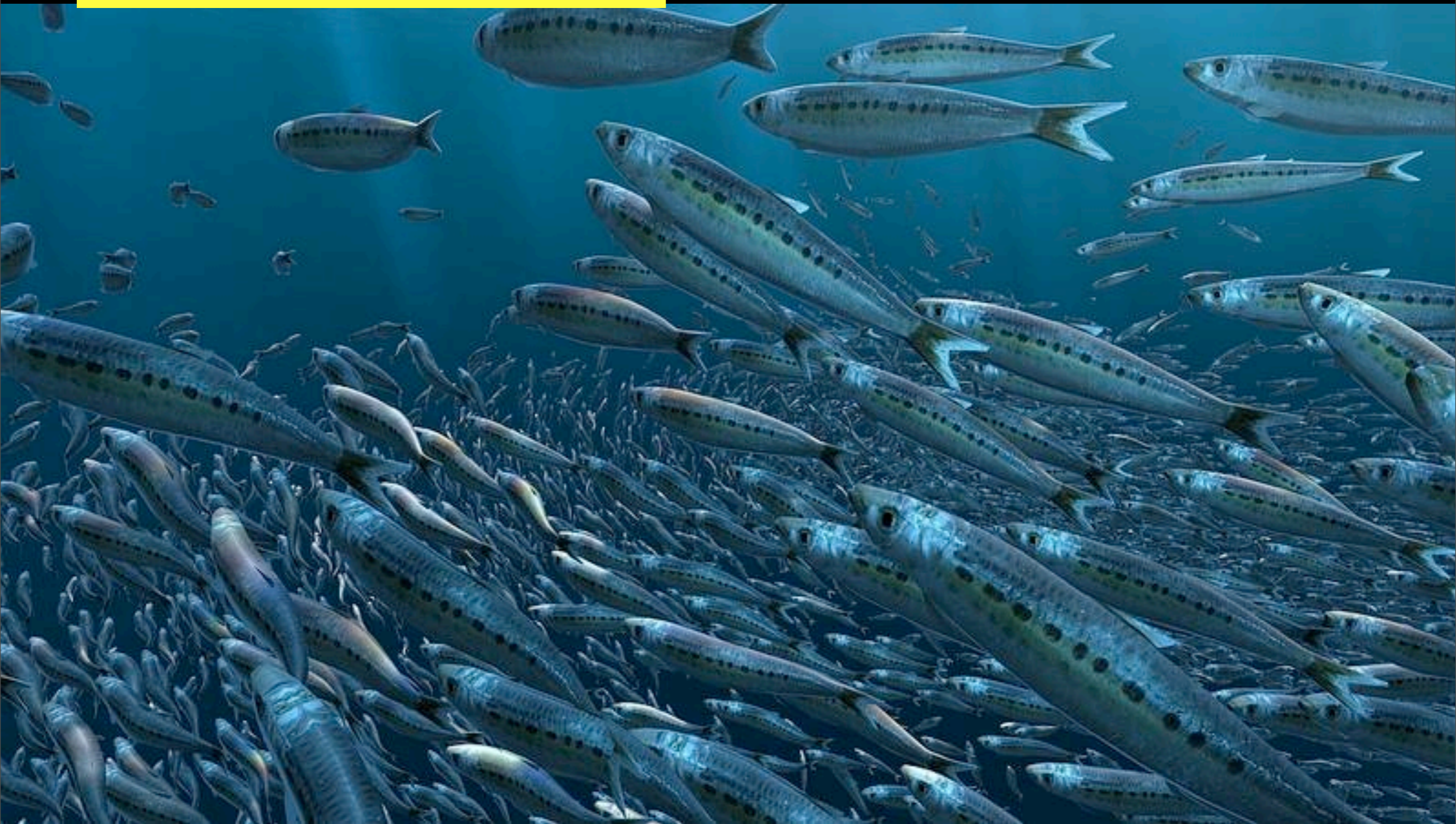
# AGENT-BASED MODELING

- *An autonomous agent has a limited ability to perceive environment.*
- *An autonomous agent processes the information from its environment and calculates an action.*
- *An autonomous agent has no leader.*

# FLOCKING

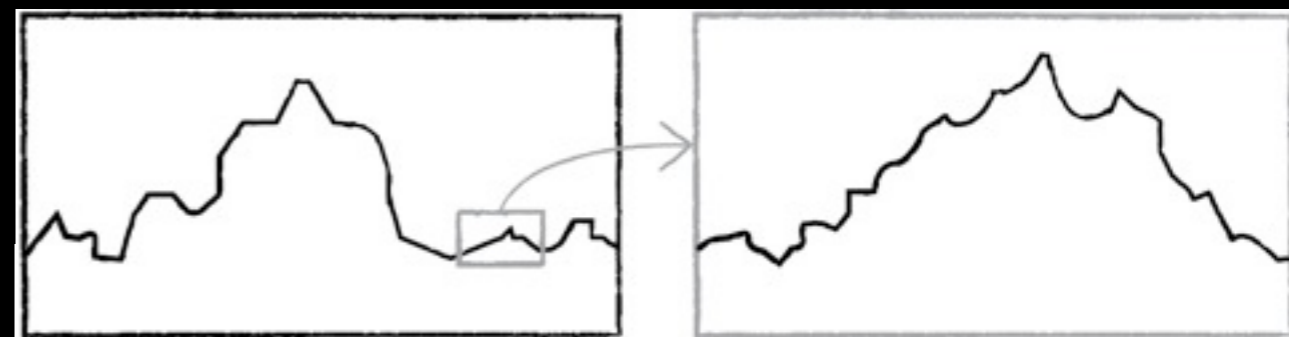
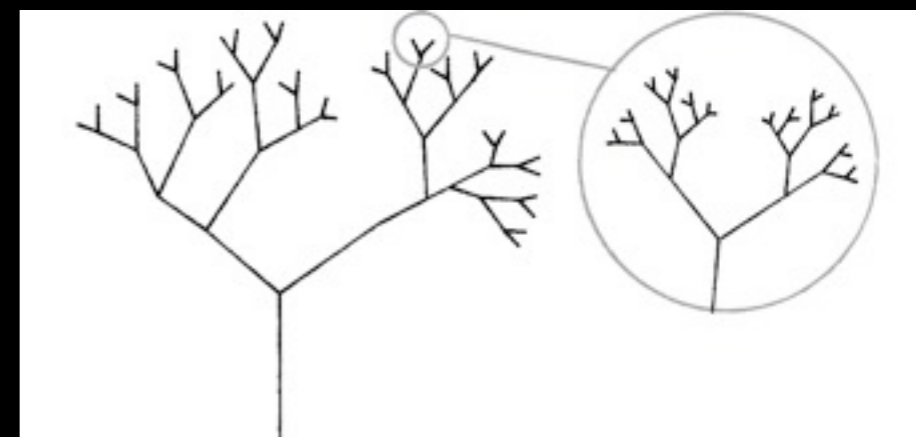
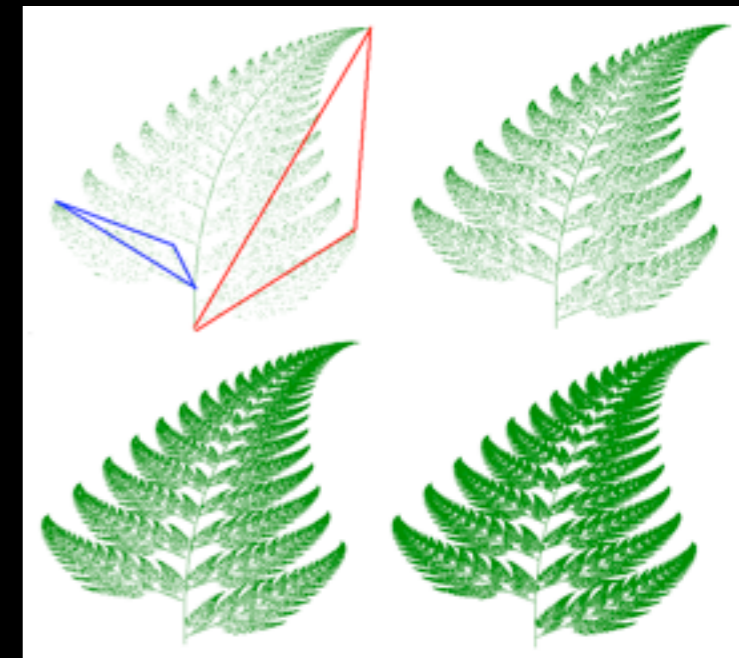
○ - *separation, alignment, cohesion*

# SWARMS



*Robert Hodgkin (flight404), Boil Up*

# FRACTALS



# FRACTALS



*Lindenmayer systems, used for modeling plant growth*

# GENETIC ALGORITHMS

- *Population size and mutation rate*
- *The fitness function*
- *Genotype and Phenotype*

# GENETIC ALGORITHMS



*Karl Sims - Evolved Virtual Creatures*

# NEURAL NETWORKS

*Can a computational entity process its environment and generate a decision?*



*Adam Harvey - OpenCV Face Detection Visualized*

# BIOMIMIMETIC INTERFACES

share

▼ recent

*Seaquence.org, by Gabriel Dunne, Daniel Massey, and Ryan Alexander*

# BIOMIMETIC INTERFACES



*Biophilia, by Bjork, Scott Snibbe Studio and MOMO*

# BIOMIMETIC INSTALLATIONS



*Studio Simon Heijdens, Lightweeds*

# BIOMIMIMETIC DESIGN TOOLS

nervous system

help

login

cart: 2 items =

## Cell Cycle WEBGL design app

CREATE YOUR OWN 3D-PRINTED JEWELRY.  
PLAY WITH AN INTERACTIVE PHYSICS  
SIMULATION TO FORM UNIQUE CELLULAR  
RINGS AND BRACELETS.

### BASIC STRUCTURE

☒ 2-LAYER

☐ 1-LAYER

HORIZONTAL CELLS

REBUILD

VERTICAL CELLS

inside

outside

### SIZING AND STYLING

CHOOSE A SIZE

DIAMETER 17.4 mm

ROUNDNESS

inside

outside

THICKNESS 1.1 mm

TWIST

### FINALIZE AND PURCHASE

CHOOSE A MATERIAL

PRICE

\$108 ships in 5 weeks

SAVE / SHARE

ADD TO CART

✓ Like

7

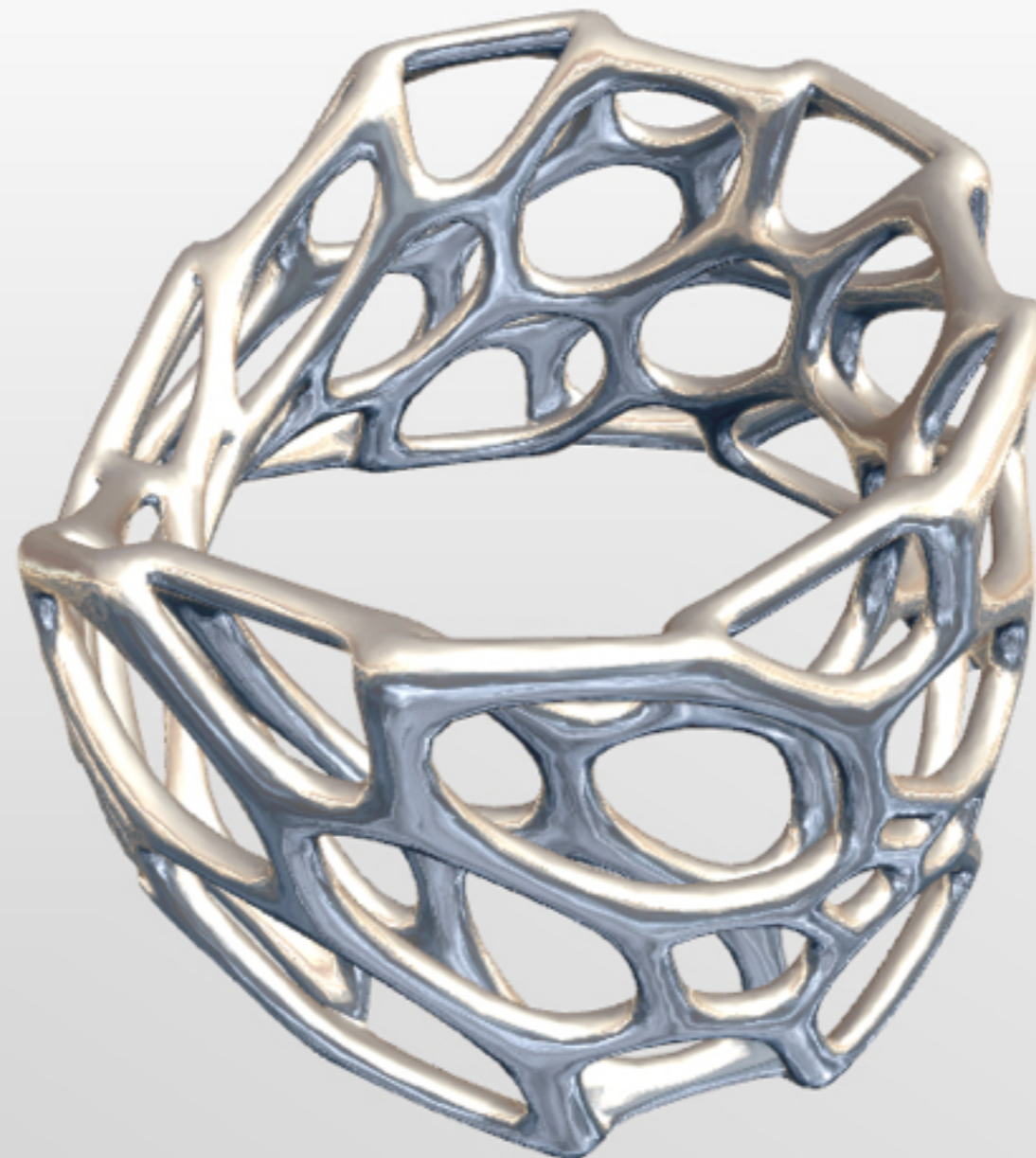


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☐ INSIDE ☒ OUTSIDE

2D VIEW



Nervous System Design

# BIOMIMETIC DESIGN TOOLS



*Nervous System Design - Reaction Diffusion inspired by Biology*