

Dimensions of Artificial Life

ALife is (in)famously broad in the range of projects that might fall under its umbrella.
How do we create unity for a community invested in education?
What ought to be present in our minds as we develop goals together?

Open problems in artificial life Bedau, et al. (2000)

- A. How does life arise from the nonliving?
- B. What are the potentials and limits of living systems?
- C. How is life related to mind, machines, and culture?

A. How does life arise from the nonliving?

1. Generate a molecular proto-organism in vitro.
2. Achieve the transition to life in an artificial chemistry in silico.
3. Determine whether fundamentally novel living organizations can exist.
4. Simulate a unicellular organism over its entire lifecycle.
5. Explain how rules and symbols are generated from physical dynamics in living systems.

B. What are the potentials and limits of living systems?

6. Determine what is inevitable in the open-ended evolution of life.
7. Determine minimal conditions for evolutionary transitions from specific to generic response systems.
8. Create a formal framework for synthesizing dynamical hierarchies at all scales.
9. Determine the predictability of evolutionary consequences of manipulating organisms and ecosystems.
10. Develop a theory of information processing, information flow, and information generation for evolving systems.

C. How is life related to mind, machines, and culture?

11. Demonstrate the emergence of intelligence and mind in an artificial living system.
12. Evaluate the influence of machines on the next major evolutionary transition of life.
13. Provide a quantitative model of the interplay between cultural and biological evolution.
14. Establish ethical principles for artificial life

The Past, Present, and Future of Artificial Life - Aguilar, et al. (2014)

properties of living systems

origins of life

autonomy

self-organization

adaptation (evo. & dev. & learning)

our understanding, uses, and descriptions we have of the living

information

living technology

art

philosophy

life at different scales

ecology

artificial societies

behavior

computational biology

artificial chemistries

What Is Artificial Life Today, and Where Should It Go?

Dorin, Stepney (2024)

Artificial Organisms

Artificial Ecosystems and Societies

Open-Endedness

History, Philosophy, and Inquiry Into the Nature of ALife

Tools, Techniques, and Applications of ALife

Dorin, Stepney (2024)

Artificial Organisms

wet
dry (hard)
virtual
simulated

Artificial Ecosystems and Societies

populations
group emergence
ecosystems
simulated worlds and theoretical
techniques

Tools, Techniques, and Applications of ALife

evolution, systems, robotics, models, networks, complexity,
computation, emergence, behavior, and dynamics,
ALife and Society
ethics and morality
Art

Open-Endedness

origin of life
speciation
major transitions
meta-evolution
studies of processes for creativity and novelty generation...
generative systems

History, Philosophy, and Inquiry Into the Nature of ALife

intelligence and life; embodiment; autonomy;
emergence and supervenience;
the role of observers in defining boundaries and therefore living systems;
collections of organisms, such as colonies, societies, and organizations;
grounding and generation of language;
organism to sense or perceive its environment;
the relationship between biology, machines, and computation;
whether biological evolution is in fact open-ended,
what open-ended means and how to measure it;
the relationship between open-endedness, novelty, creativity, and evolution

(A)Life as it Could Be Beer (2024)

constitution

origin

interaction

transformation

Suggestion to Clarify Modeling Efforts :

1. which notion of biological individual they are assuming (rather than simply calling it “lifelike”)?
2. which aspect of living phenomena they are targeting?
3. what particular research program within that branch of investigation they are pursuing?

Bedau, et al. (2000)

1. How does life arise from the nonliving?
2. What are the potentials and limits of living systems?
3. How is life related to mind, machines, and culture?

Aguilar, et al. (2014)

1. properties of living systems
2. our understanding, uses, and descriptions of life
3. life at different scales

Dorin, Stepney (2024)

1. Artificial Organisms
2. Artificial Ecosystems and Societies
3. Open-Endedness
4. History, Philosophy, and Inquiry of ALife
5. Tools, Techniques, and Applications of ALife

Beer (2024)

- | | |
|-------------------|---------------------------------|
| 1. Constitution | 1. notion of bio. Individual? |
| 2. Origin | 2. aspect of living phenomena? |
| 3. Interaction | 3. particular research program? |
| 4. Transformation | |

Who are we teaching?

What background do they have?

What are their intellectual interests?

What is the goals of their program?

How can ALife add the most value?

What techniques are most effective?

Goals: Science, Engineering, Philosophy, Art

Teaching: Breadth vs. Depth

Questions or Ideas?

Post in #dimensions-of-alife channel

Welcome to #dimensions-of-alife!

This is the start of the #dimensions-of-alife channel.

 Edit Channel



Jason Yoder 9:14 AM

Slides: <https://docs.google.com/presentation/d/1JwYOLPMwNMkPUo735P5OD2nEnTrCM9strnUdWnF-kNw/edit?usp=sharing>