



CoCo Seminar Series Fall 2026

A Biological Arrow of Time and Computational Undecidability

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Friday October 9, 2026 12:15-1:15pm EDT
**Hybrid (EB-T1 & Zoom; meeting link available
on <http://coco.binghamton.edu/>)**

We hypothesise the existence of a biological arrow of time underlying major evolutionary transitions and formalise this conjecture through the lens of computation theory. According to this interpretation, biological organisms are hierarchical dynamical systems that generate regularities in their phase-spaces through interactions with their environment. These emergent patterns can be encoded within the organism (e.g., via the genotype-phenotype mapping), leading to fundamental tensions between what is encodable at a particular evolutionary stage and what is potentially realisable in the environment. We argue that open-ended evolution comprises a continual process in which a resolution of these tensions drives an evolutionary transition, expanding the problem-space and then generating new tensions in the expanded space. Computation-theoretically, the problem-space expands when computational novelty (e.g., a new “code of life”) is generated by self-modelling agents which gain access to meta-simulation, e.g., by Turing oracles or recursively generated logics, or receive the feedback from external environment, e.g., via natural selection.

Prof. Mikhail Prokopenko is the director of the Centre for Complex Systems and member of the leadership team at the University of Sydney Infectious Diseases Institute (Sydney ID). He leads the Modelling and Simulation research group in the School of Computer Science.

For more information, contact Carlos Gershenson (cgg@binghamton.edu).
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