Cellular Cognition and the Volitional Turing Machine

Perry Marshall
Founder, Evolution 2.0 Prize
Author, *Evolution 2.0*

EVOLUTION 2.0

flickr/bodellia

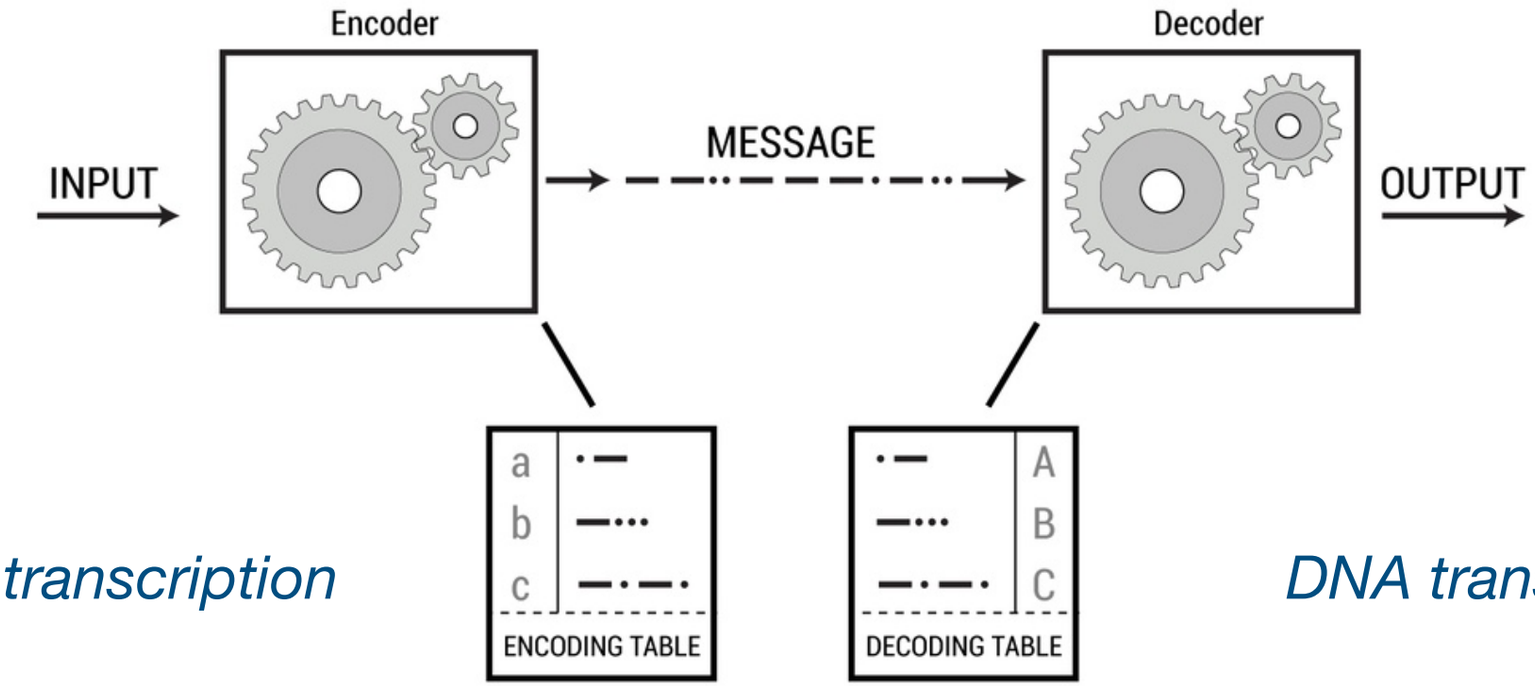
Why Cancer is Still Beating us:

We were told Evolution is blind.

Evolution and Cancer are
Purposeful
and
Volitional.

Unsolved Problems in Biology

1. Origin of the Genetic Code



DNA transcription *DNA translation*

- *Chemicals don't control Information. Information controls chemicals.*
- *The rules of codes cannot be derived from the laws of physics*

Conflict of Interest Disclosure: Author is founder of Natural Code LLC, which offers $100,000 for discovery of a natural process that generates code from non-living material without direct human agency. Its investors offer $10 million to secure patent rights to said process. The prize specification is at www.naturalcode.org.

Unsolved Problems in Biology

2. Evolution

- *Barbara McClintock damaged corn DNA. It re-arranged its genome immediately - without thousands or millions of failed trials*
- *John Torday UCLA: Granddaughter inherits asthma via epigenetics from smoking grandmother*
- *Therefore organisms anticipate the future and evolve proactively*

Unsolved Problems in Biology

3. Consciousness & Agency

- *Sexual Selection = agency and choice*

- *All Living Cells are Cognitive* (Shapiro 2020)*

**Cognition Definition: "The mechanisms by which animals acquire, process, store, and act on information from the environment. These include perception, learning, memory, and decision making." (Shuttleworth 2010)*

Unsolved Problems in Biology

4. All Artificial Intelligence is… *artificial*

- *Turing Test not solved*
- *Animals have Universal Adaptive Learning. Computers don't.*
- *Genetic Algorithms require goals from humans; not a major tool for software developers; do not rival biology*
- *If we understood biology, we could give our computers agency*

Unsolved Problems in Biology

5. Cancer

- ***Stage 4 precious little progress***
- *Schrödinger's "What Is Life" as mysterious now as in 1943*
- *Genome Chaos*
- *After 16 years…*

Convention:

Cognition

↑

Code

↑

Physico-Chemical

Observation:

Cognition

↓

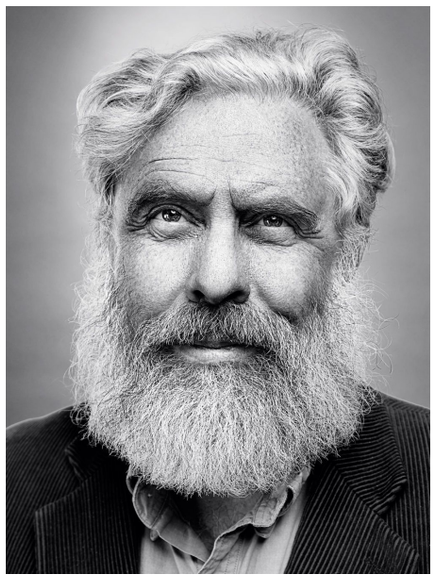
Code

↓

Physico-Chemical

No documented exceptions to date.

Artificial Intelligence + Origin of Life Prize, $10 Million USD



Forbes

Inc.

THE ROYAL SOCIETY

FT FINANCIAL TIMES

nature ecology & evolution

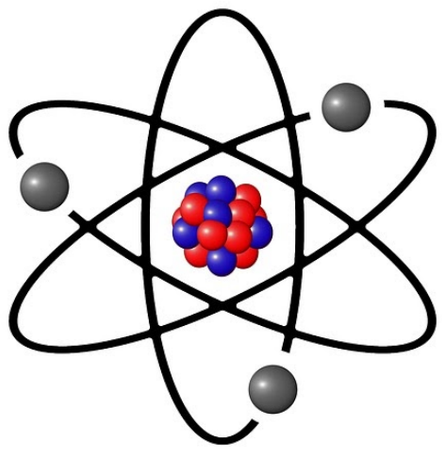
VOX Voices from Oxford

PROGRESS IN Biophysics & Molecular Biology
An International Review Journal

IEEE SPECTRUM

Front Line Genomics

Three Levels of Causation:



Bottom: Physico-Chemical (LAWS)

- **Universal** laws of physics and chemistry: matter, energy, light, heat, fields & waves, weather, stars, planets.

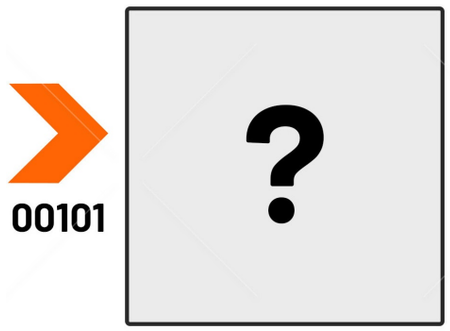
- Change over time is Order → Disorder (entropy)

Three Levels of Causation:

Middle: Code (LOGIC)

- Symbols, communication, computation, languages, machines, algorithms, genetics.
- Freely chosen **local** rules.
- Computation is deductive and deterministic: one output for given input.
- Codes are subject to noise (information entropy).

Three Levels of Causation:



Top: Cognition (CHOICE)

- Agency; action of self interest; meaning; creating codes.
- Cognition is inductive reasoning (choice within uncertainty).
- Change over time is Disorder → Order (negentropy) (Schrödinger 1943).

We’ve gotten cause and effect backwards

Equivalency of Choice Theorem

Within Gödel's Incompleteness Theorem, the following are isomorphic* in information theory:

- Evolution
- Goals
- Choices
- Inductive reasoning
- Assigning meaning to symbols
- Axioms in mathematics
- Consensus on scientific laws
- Negative information entropy

They are *undecidable propositions* which require goals.

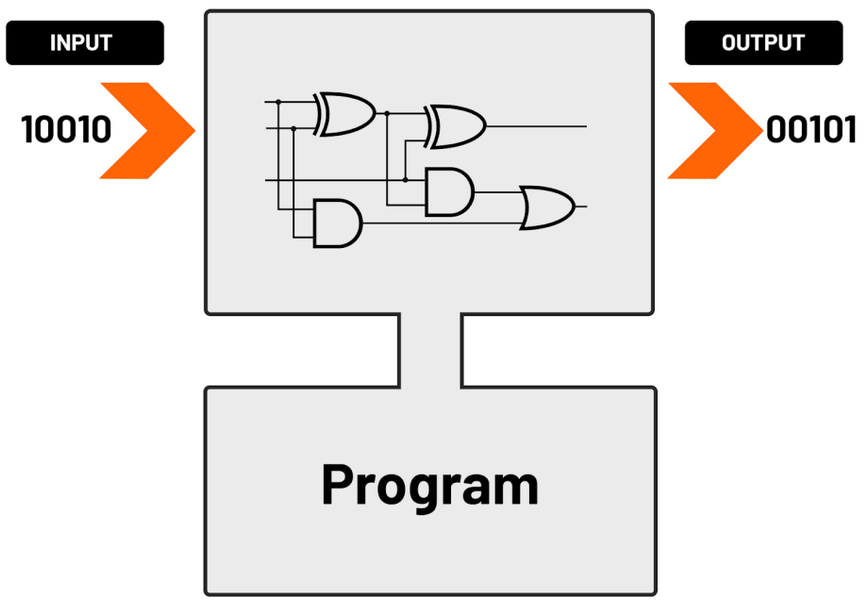
Normal Cells *and* Cancer Cells make decisions that are impossible to compute

*corresponding or similar in form and relations

Cognition Model

AI TODAY

TURING MACHINE

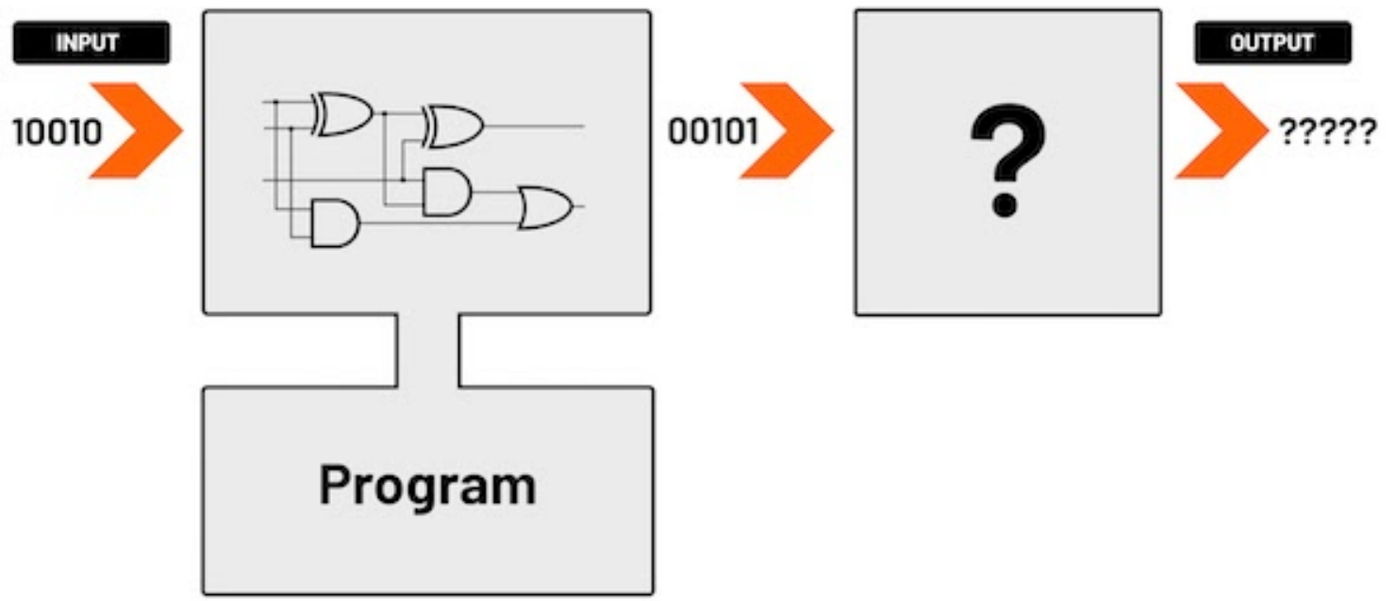


A computer only obeys its program

(DEDUCTION)

WHAT AI ASPIRES TO BE

VOLITIONAL TURING MACHINE



<u>Chooses</u> whether to obey the program or reverse the decision

(INDUCTION)

Cognition

↓

Codes

↓

Chemicals

How to Falsify the Cellular Cognition Model

- **Any experiment that demonstrates chemicals → code *with no assistance from biology*.**

- **Any experiment that demonstrates code → cognition *with no assistance from biology*.**

CONVERGENCE:

What if…

- **Origin of Life**
- **Evolution**
- **Consciousness**
- **AI**
- ***Cancer***

…are not FIVE problems, but ONE?

What is the origin and nature of cognition?

Cancer is
not an algorithm

Cancer is
a disease of identity
and volition

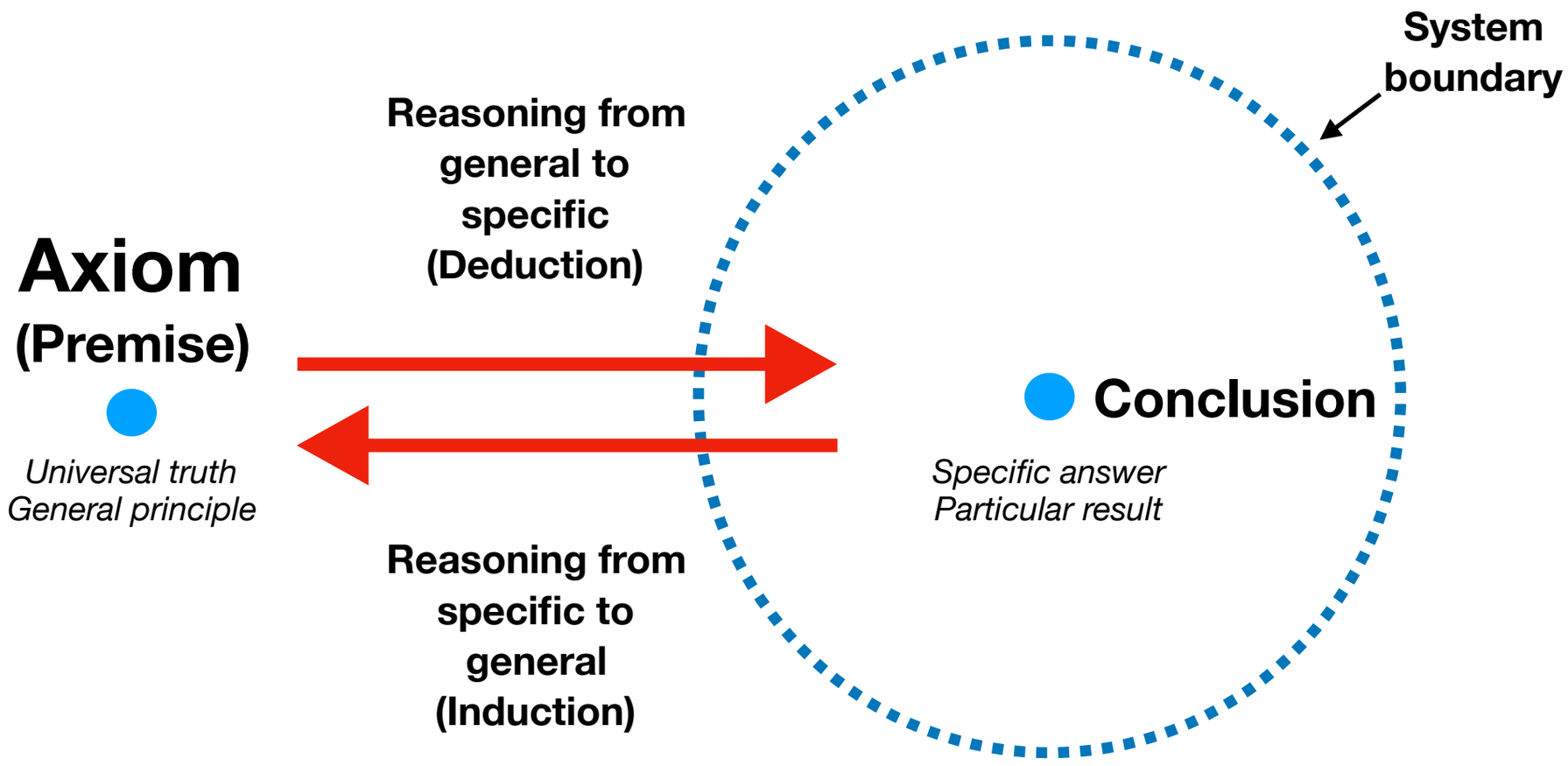
Live Q&A

Monday October 19

1-3pm Eastern Time
on Zoom

To consult references
or comment on my paper:
evolution@evo2.org

Visual Representation of Gödel's Incompleteness Theorem



"Any system you can draw a circle around relies on an axiom outside the system that you must assume but cannot prove."