

## ENERGY, INFORMATION & LIFE

Outline of an Essay on Natural Philosophy

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Reality is the real business of physics.

Albert Einstein. Cited in N. Herbert. *QuantumReality*.

Information is information, not matter or energy.

Norbert Wiener. *Cybernetics*.

Any specific binding between two molecules involves information.

Christian de Duve. *Blueprint for a Cell*.

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### THE TALK IS ORGANIZED AS FOLLOWS:

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1. **ENERGY (E), INFORMATION (I)& +I/-E SYSTEMS VS +E/-I SYSTEMS**
2. **I/E RATIOS IN GEOLOGY**
3. **I/E RATIOS IN RELATIVITY & QUANTUM PHYSICS**
4. **I/E RATIOS IN CYBERNETIC CONTROL**
5. **I/E RATIOS IN GENES & THE BRAIN**
6. **I/E RATIOS IN INTELLIGENT SENSORIMOTOR CONTROL & CONSCIOUS SENTIENCE**
7. **I/E RATIOS IN SEMIOTIC COMMUNICATIONS, LANGUAGE & SOCIETY**

ARGUMENT: Energy has been a central concept in modern science from force for Newton, to electro-magnetic energy in Einsteinian relativity. Everything, physics says, needs energy. But today information science is on the rise. So one might ask, How are energy and information connected? We know that information is central to life, to genes and sentient organisms, semiotic communications, language, and intelligent control. All have high Information to Energy (I/E) ratios. Machines in contrast are systems with contrasting high Energy to Information (E/I) ratios. The contrast of I/E information systems with mechanical E/I systems raises questions such as:

*Is information contained in or transmitted by inorganic systems, like rocks, as well as by living organic systems like genes, brains, languages & societies?*

*What is information, apart from energy? Is it bits, sensory data, messages, or signs? And*

*Is information essential to intelligent control in cybernetics, organisms & humans?*

To answer these questions I propose the following two Hypotheses:

- 1: ***Reality involves varying mixes of Information (I) & Energy (E).***
- 2: ***Only I/E systems can enable and support Intelligent Sensorimotor Control, Conscious Sentience, & Semiotic Communications.***

And I postulate two contrasting types of system, namely...

**+I/-E** communications media are Information flows. They send and receive messages such as sensory data, symbols, words, bits, etc. Since **I/E** systems process information they embody / are regulated by Communicative Efficiency, Communicative Efficiency, not Mechanical, dominates in and controls life forms and intelligent organisms, ie, those with nervous systems / brains.

**+E/-I** Energy-intensive Mechanical Systems like machines & rocks, or **E/I** Systems. Since Mechanical Systems do work they embody / are regulated by Mechanical Efficiencies, and cannot send or receive messages or control life forms, intelligent organisms, or technical systems.

Confusing Communicative Efficiency with Mechanical Efficiency is a common mistake, which systematically distorts inquiries and inhibits understanding of physical, biological, social and human phenomena. So I focus on I/E systems and Communicative Efficiency, for they alone make possible *Intelligent Sensorimotor Control, Conscious sentience, Semiotic Communications & Language* in cybernetic systems, genes & animals & humans.

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#### IMPORTANT WORKS

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