

# Existential Logic and the Origins of Chemical and Biological Information

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**Abstract:** Often, analysis of informational concepts presupposes a non-denominative symbolic logic that is held to be “for all time and place.” Thus, Shannon’s theory of information rests on the presumption of the independence of denotative symbols. However, the natural history of our planet is held to pass through a series of perplexifications – such as the emergence of organic matter, the emergence of life, the emergence of eukaryotes, the emergence of consciousness and the emergence of human cultures. Each generative stage of planetary emergence is associated with the genesis of new layers of informed structures, new individuals with species names. This denominative perspective of biological information raises questions about the origin, nature, ontology, and ideology of the logic of denominations:

How does the logic of informed species differ from denotative logic?

How are numbers and operations encoded to generate denominative species?

How does the concept of a denominative identity differ from the concept of denotative identities?

What relates denominative information to dynamics expressed in denotative terms?

What is the ontological status of perplex entities (formed from layers of emergent denominations)?

What are the criteria for construction of a categorical existential logic that relates number, identity, entity and denomination?

A logic for biological information must provide the terms necessary to encode the descriptive attributes of the denominated species. The abstract criteria for encoding properties must include terms and relations for at least four intertwined attributes that describe the properties of matter:

1. The origins of the denominations of matter (elements, identities, entities)

- The origins of different forms of matter, including entities with identical compositions but different forms (isomers)

- The origins of the organization and flows of organic matter through living systems

- The origins of modifiable (but almost stationary) internal sources of biological memory.

In addition, the bio-logic should not be inconsistent with existing theories of chemistry or physics. I propose an existential logic for encoding denominations by simply separating the conceptualization of unit from the conceptualization of number. The primitive sources of simple denominations are two infinite generating functions, one generating function for simple units, the other for numbers. Primitive terms of existential logic form categories by pairings of members of the two generating functions. The primitive terms are denominated (proto units and proto numbers) and then used as collative sources (multisets) of perplex units. A specialized arithmetic operates on proto units and proto numbers to generate layer after layer of perplex species. Iterated extension within this perplex arithmetic depends on both classes of terms (proto units and proto numbers). Extension is conservative in the sense that it preserves the mereoploidy (multisets) of the initial

collection of proto units and proto numbers. Thus, this form of arithmetic extension parallels the conservative rules of chemical theory. The resultants of this specialized arithmetic is a particular mathematical object, a labeled bipartite graph (a particular form of a network of specific relations within a multiset.) The denomination thus encodes memory of number, position and relation within a graph.

Generative operations on primitive terms encode information as logical inferences (illations) with respect to name, number and position. The first layer of description of generative pairings (elements) describes stationary objects that are emergent with respect to the primitive terms. Subsequent illations encode symbols for proto units and proto numbers alternately. The alternation of symbol classes is essential to account for local balance relations. The motivation for the alternating illations originates in a chemical theory of value. A particular organic species is a particular mereoploidic arrangement of the components representing a particular set of values. The denomination creates a name of a species with an existential identity (molecular structure). Higher layers of emergent denominatives describe species as non-stationary objects. Every non-stationary object is composed from lesser denominative objects by generative operations. The number of potential generative operations for perplex numbers is unbounded but, as with the primary layer, the illative operations conserve the supply of primitive existential terms.

Generative illations on particular organic species rearrange the positions of the parts; the encoded denominations are the sources of parts. As with operations on primitive terms, the mereoploidy of a system is conserved under rearrangements. The conservation of the denominative parts provides the source of memory for existential logic. Denominative, not denotative, memory becomes the source of biological closure. The existential origin of biological metabolism and reproduction is thus constructed logically from number, mereoploidic identity, and multisets of such entities.

The re-coding of existential logic to the more usual denotative mathematical logic is termed sublation. Sublation re-labels / re-codes the terms of informed perplex numbers into new logical terms. Recoding denominative terms from species to properties of matter (meters-kilogram-seconds units of measure) generates the terms that are commonly used in physical and engineering calculations. Commutative diagrams can link the ordinary usage of natural language with the (non-existential) logic of mathematics / physics with the existential logic of chemistry and biology as well as the sublations linking the existential and non-existential logics.

Finally, I note that existential logic creates simple, rational starting points for theories of biological evolution in terms of internal chemical processes within a chemical entity.