

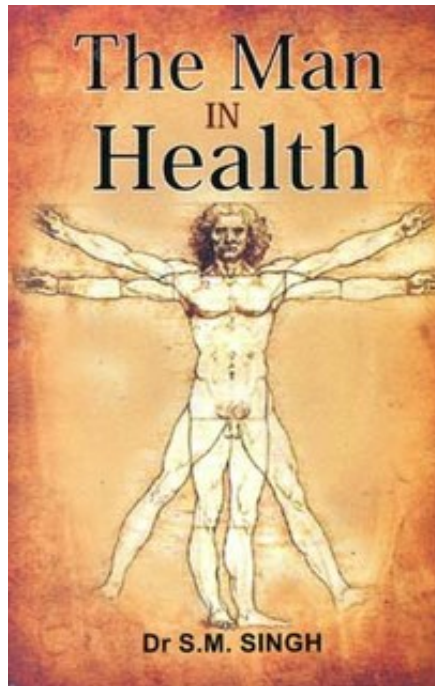
Dr. S. M. Singh The Man in Health

Reading excerpt

[The Man in Health](#)

of [Dr. S. M. Singh](#)

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CONCEPT OF LIFE

Life is a multi-faceted concept. Life may refer to an ongoing process of which living things are a part, the period between the conception (or a point at which the entity can be considered to be an individualised being) and death of an organism, the condition of an entity that has been born (or reached the point in its existence at which it can be established to be alive) and has yet to die, and that which makes a living thing alive.

Defining the Concept of Life

How can one tell when an entity is a life form? It would be relatively straightforward to offer a practical set of guidelines if one's only concern were life on earth as we know it but as soon as one consider questions about life's origins on earth, or the possibility of extraterrestrial life, or the concept of artificial life, it becomes clear that the question is fundamentally difficult and comparable in many respects to the problem of defining intelligence. Moreover, some theories are grounded in the basic assumption that 'ideas have a life of their own'.

A Conventional Definition

In biology, a lifeform has traditionally been considered to be a member of a population whose members can exhibit all the following phenomena at least once during their existence:

1. Growth, full development, maturity.

2. Metabolism, consuming, transforming and storing energy/mass; growing by absorbing and reorganising mass; excreting waste products.
3. Motion, either moving itself, or having internal motion.
4. Reproduction that is, the ability to create entities that are similar yet separate from itself.
5. Response to stimuli that is, the ability to measure properties of its surrounding environment and act accordingly and in harmony with it. This property is also called homeostasis.

Exceptions to the conventional definition

These criteria are not without their uses, but their disparate nature makes them unsatisfactory from a number of perspectives. Infact, it is not difficult to find counterexamples and examples that require further elaboration. For example, according to the above definition, one could say:

1. Mules and people who are infertile, cannot reproduce do not qualify as life forms. Also worker bees and other organisms living in colonies would not qualify and only the queen and the drones (or the whole colony) could be considered 'alive'.
2. Fire and stars could be considered life forms.
3. A virus does not grow and cannot reproduce outside a host cell and hence would not qualify as a life form.

Many individual organisms are incapable of reproduction but are still considered to be life forms for example mules and ants. This is because the term 'life form' applies on the level of entire species of individual genes. It is important to keep in mind the difference between a 'life form' and 'a being that is alive.' One example of sterility does not render the rest of the species a non-life form or any more than one dead animal renders the rest of the species dead.

The two cases of fire and stars fitting the definition of life can be simply remedied by defining metabolism in a more biochemically

exact way. Fundamentals of Biochemistry by Donald Voet and Judith Voet defines metabolism as 'Metabolism is the overall process through which living systems acquire and utilise the free energy they need to carry out their various functions. They do so by coupling the exergonic reactions of nutrient oxidation to the endergonic processes required to maintain the living state such as the performance of mechanical work, the active transport of molecules against concentration gradients and the biosynthesis of complex molecules.' This definition makes it clear that fire is not alive, because fire releases all the oxidative energy of its fuel as heat.

A conceptual problem with saying that fire is life is that it collapses the distinction between 'growth' and 'reproduction.' It is possible to think of a spreading flame as either growing or reproducing, but what would it mean to say that the same act is both growth and reproduction?

Viruses reproduce, flames grow, some software programs mutate and evolve, machines move and proto-life consisting of metabolising cells without reproductive apparatus exist. Still, some would not call these entities alive. Generally, all five characteristics are required for a population to be considered a life form.

Other Definitions

Biologists who are content to focus on terrestrial organisms often note some additional signs of life and these are:

1. Living organisms contain molecular components such as carbohydrates, lipids, nucleic acids and proteins.
2. Living organisms require both energy and matter in order to continue living. «
3. Living organisms are composed of at least one cell.
4. Living organisms maintain homeostasis for some period of time.
5. Species of living organisms will evolve.

All life on earth is based on the chemistry of carbon compounds. Some assert that this must be the case for all possible forms of life throughout the universe; others describe this position as 'carbon chauvinism'.

The systemic definition is that living things are self organising and autopoietic (self producing). These objects are not to be confused with dissipative structures (for example, fire). Variations of this definition include:

- i. Francisco Varela and Humberto Maturana's definition of life (also widely used by Lynn Margulis) as an autopoietic (self producing), water based, lipid-protein bound, carbon metabolic, nucleic acid replicated, protein readout system.
- ii. 'A system of inferior negative feedbacks subordinated to a superior positive feedback' (J. theor Biol. 2001).
- iii. Tom Kinch's definition of life as a highly organised auto-cannibalising system naturally emerging from conditions common on planetary bodies and consisting of a population of replicators capable of mutation around each set of which a homeostatic metabolising organism, which actively helps reproduce and/or protect the replicator(s) has evolved.
- iv. Stuart Kauffman's definition of life as an autonomous agent or a multi-agent system capable of reproducing itself or themselves, and of completing at least one thermodynamic work cycle.
- v. A system converting entropy to negentropy using flow of energy.

Descent with modification: a 'useful' characteristic

A useful characteristic upon which a definition of life could be based is that of descent with modification that is, the ability of a life form to produce offspring that are like its parent or parents, but with the possibility of some variation due to chance. Descent with modification is sufficient by itself to allow evolution, assuming that the variations in the offspring allow for differential survival. This study is called

genetics. In all known life forms (assuming prions are not counted as such), the genetic material is primarily DNA or the related molecule, RNA. Another exception might be the software code of certain forms of viruses and programs created through genetic programming, but whether computer programs can be alive even by this definition is still a matter of some contention.

Origin of Life

There is no 'standard' model of the origin of life, but most currently accepted models build in one way or another on the following discoveries, which are listed in the order of postulated emergence:

1. Plausible pre-biotic conditions result in the creation of the basic small molecules of life. This was demonstrated in the Urey-Miller experiment.
2. Phospholipids spontaneously form lipid bilayers, the basic structure of a cell membrane.
3. Procedures for producing random RNA molecules can produce ribozymes which are able to produce more of themselves under very specific conditions.

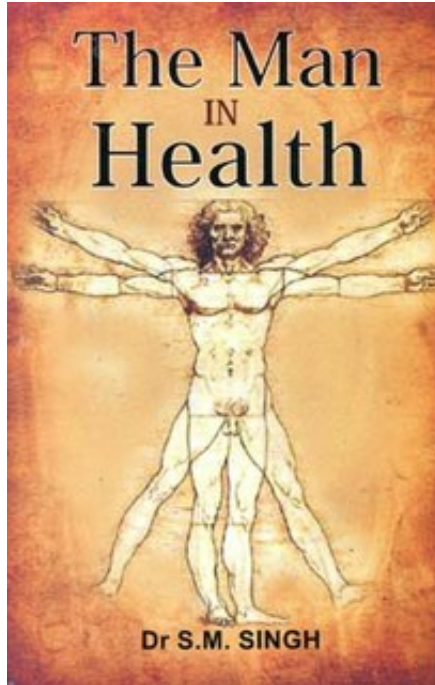
There are many different hypotheses regarding the path that might have been taken from simple organic molecules to protocells and metabolism. Many models fall into the 'genes-first' category or the 'metabolism-first' category, but a recent trend is the emergence of hybrid models that do not fit into either of these categories.

CONCEPT OF PHYSICAL WORLD

Physical: Means pertaining to the world of matter and energy and its study or in another sense, natural philosophy Dictionary.

World: Means the earth or the earth and its inhabitants.

(Both definitions are from Chamber's Dictionary).



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