



## LIFE: WHAT IS IT, WHAT DOES IT

### SPECULATIONS ABOUT THE VERY NATURE OF LIFE \*

Bruno J.R. Nicolaus and Giorgio Tangorra

With the end of the sparring match between evolutionists and creativists, the rational scheme of the theory of evolution was accepted by modern culture, while what we intend by life ( or state of life) continues to resist the various attempts of physical or philosophical definition. More accessible, although still controversial appears to be the definition of what life does.

Here below, we propose a multifactorial approach to defining what life does, based upon ten axioms, able to discriminate between living and dead organisms.

On our planet, life is based on carbon chemistry, being currently defined as: *<a common state of materia present on the surface of the earth and in the oceans, formed by the complex combination of four principle elements (carbon, hydrogen, oxygen and nitrogen) as well as sulphur, phosphorous and traces of others>* This definition is unsatisfactory, being unable to explain the difference between a test-tube filled at random with chemical agents and a living organism made up with the same agents in highly organized form. The big proteins are not simple sequences of amino acids, linked each other at random: they are vectors of information embodied according to specific sequences and conformation of poly amidic chains. Moreover, one cannot classify an organism as a living organism, just because it is composed by proteins, nucleic acids and other macromolecules. In strict analogy, we are able to distinguish between noises, built up by a heap of acoustic frequencies and a musical melody, where the various frequencies are running after each other, up to the great polyphonic and orchestral music, according to precise rules.

Any definition of life is therefore related to what the living organisms do and what the dead organisms are unable to accomplish. Accordingly, to be called living, any organism should satisfy each of the following ten axioms:

1. Living organisms have a defined and constant form;
2. They are made up of fundamental units (cells), affine for structure and function;
3. They possess the property of building and maintaining themselves at the expense of the chemical substances and energy, which they obtain from the environment;
4. They maintain continuous relationship with the external world and are able to react to determined stimuli;
5. Each species safeguards its genetic information;
6. They are not perennial, given that each individual is destined to disappear at the end of a predetermined life cycle (biological clock);
7. They tend to the maximum possible spread ;

8. They tend to increasing organization and complexity, at cost of the energy of the environment;
9. They are sensitive to the environment (temperature, radiations, pressure..) and life is only possible in a restricted range of temperatures.
10. They are generated exclusively by reproduction out of an already existing living organism.

The safeguarding of genetic information (axiom 5) allows conservation of the information despite a general increase of chaos (entropy), thanks to a complex digital system, like that of the chromosomes. This, unlike that of our electronic technologies, based on two alternatives 1 and 0, adopts four: A,G,C,T (Adenine, Guanine, Cytosine and Thymine), which represent the letters of a living digital language. This language has demonstrated a surprising capacity for conserving the hereditary characteristics of the single species with accuracy, for allowing spontaneous quantum like mutations, for procuring energy from the environment (axioms 3,4), for finding the most suitable environment and multiplying to the highest degree (axiom 7) and for defending them from the most varied external agents.

Perhaps for the first time in history of the Cosmos, we are facing the capacity on the part of some molecular chains of perpetuating themselves, safeguarding the information necessary for the formation of the successive individuals, at the cost of energy captured from the surrounding environment. This is a sort of challenge to the universal tendency of increasing disorder and entropy, which finds its maximum triumph in human beings and in particular in the human mind, with its capability of rational coordination and creative bursts and extending to the conquest of self-consciousness.

Many biologists claim that the synthesis of life from inanimate matter will be possible in the near future. At that point the axiom 10 would fall, according to which living creatures always generate living creatures and only living creatures and thus, the last frontier between the animate and the inanimate worlds would also disappear. This ambitious objective has not yet been reached, despite the fact that we know a lot about the structure of the cells and that the "biochemical building blocks" necessary for their assembly are readily available. Other scientists consider the realisation of life in the test-tube an improbable event because of the complexity of the living matter, which has only been reached through a process of billions of years. Wanting to repeat this process in the laboratory in a brief time with the purely casual approach appears if not unrealistic, at least improbable. The future of this question is uncertain and it is difficult to predict how many years still remain for the classical axiom <*Viventes Viventibus Generantur*> (Spallanzani, 1729-1799).

From quarks to the galaxies and from bacteria to planetary ecosystems, nature tends towards greater complexity and self organisation: the atomic particles become atoms and molecules: these become bio monomers and polymers, and later protobions in pluri cellular structures and organisms, which in turn give rise to social and ecological systems (axiom 8).

The birth in such a short time of all this plurality of organisms and structures reduces the casuality of evolution and alters the possibility of variation in favour of coordinated and coherent results, able to make order prevail over chaos.

\*) Bruno J.R. Nicolaus and Giorgio Tangorra, *Dalle stelle al pensiero (From the stars to the thought)*, Atti Accademia Pontaniana, Napoli vol LI (2002), in stampa; English version on line: [www.brunonic.org/main topics](http://www.brunonic.org/main_topics).

For further questions, contact please: [bruno.nicolaus@virgilio.it](mailto:bruno.nicolaus@virgilio.it)