

An epistemological view on information in biology

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Abstract

In this paper we analyze how the concept of information has an epistemologically relevant role in biology. We discuss if information has relevant traits that allow to analyze the biological specificity by analogy with the Theory of information (Shannon) and cybernetics.

Recalling Wiener's study, it allows us to individuate the specificity of the ontological informational phenomena, also in biology.

In our analysis biological information consists of a three-way molecular model: source, message and receiving decoder.

While the codifying process in computer science means a translation of the input in a codified message into a new language, in biology the language is already fixed and consists of transcription and activation: this is what happens when mRNA activates ribosomes which already possess an algorithm to carry out the informative content received at a chemical-physical level.

The possibility of the triadic model deals with a modelling based on the Shannonian scheme. But the philosophers are not satisfied with this view and in many studies (Peter Godfrey-Smith) they believe we can speak about information only if there is the possibility of misrepresenting. Information hasn't only a quantitative sense. It is the typology of semantic information transported that gives shape to the messenger and to two-pole communication. In biology it shows the different realizations and forms that living beings encompass on the basis of the information that informs them. Maynard Smith claims that it is the symbolic nature of molecular biology that allows for the existence of an indefinitely broad number of biological forms.

So in the biological field we found both a weak and a strong meaning. The minimal meaning is connected to causality and to the laws of nature, like genes that contain information on the proteins they codify for and on the phenotype.

The strong meaning is characterised by the intentionality and semantic relevance of information. The semantic relevance forces the presence of a meaning, making reference also to Stegmann, who analyzes the processes of transcription and duplication and shows how these respond to the three fundamental characteristics that semantic content must show: aboutness, error, store.

Intentionalism philosophically characterises a type of information, which needs the intentional act of the source which sends it, and the corresponding possibility of the decoder of receiving and decoding it through adequate decoding activities. This is a central epistemological point, such as in the case of the opposition between DNA and environment, that is a explanatory way for the

comparison of nature VS nurture.

Finally we analyze if in biological dynamics it circulates the same kind of information we study in computer science or, otherwise, if that kind of information has specific features due to the “living” component. So we are particularly interested in studying if we can talk about complex system when we look to the biosphere, that's a place where environment and living beings have a lot of interaction also based on the exchange of information.