

Opponent's review

of the Ph.D. dissertation by Jana Svorcova

### **Organic memory in embryonic development**

Jana Svorcova's work deals with a problem of central importance in the contemporary biology. Indeed, the current stage in biology faces what is sometimes called an epigenetic turn, and this turn means a reinterpretation of views to the role of epigenetic processes, including the phenomena of inheritance, learning, and memory in living systems. The concept of organic memory (first introduced as a term by Ewald Hering in 1870) as described and analysed in the thesis is without any doubt one of key problems for theoretical biology.

The concept of memory in biology and in adjacent areas was intensively discussed in the end of the 19th and beginning of the 20th century by E. Hering, S. Butler, H. Bergson, R. Semon, E. Rignano, and others. As noted in a review on the history of biosemiotics (*Semiotica* vol. 127, 1999, ), these works have been among those which prepared the semiotic approach in biology. Most of these scholars were also quite critical to the Darwinian approach which did not pay enough attention to the importance of organism's own activity, the capacity of learning and experience in the organic evolution.

J. Svorcova provides a comprehensive review of the history of organic memory research in biology (Ch. 2 and 3), using both the original sources and later review papers on the topic.

The main point of the thesis argues for the importance of distributed, bodily, and experience dependent organic memory in all living systems. J. Svorcova provides a detailed analysis of developmental memories, including the descriptions of processes that that can prove the independence of epigenetic memory from the genetic one. I completely agree with the main arguments and main conclusions of Jana Svorcova's thesis.

As for a discussion, I have some questions on some particular statements by the author of the thesis.

(1) There are different species or levels of organic memory. As a result of the analysis of this work — what are the main types of organic memory. Please provide the typology of organic memories.

(2) On the p. 37, you write that "genetic [memory is] written in DNA". You also speak about DNA as *recorded*, and as a *representation* (e.g., p. 60). It would be understandable, if to speak about *reading* of DNA, as you also do, but how can anything be *written* or *recorded* in DNA of an organism?

(3a) You use the term engram describing the genetic and epigenetic memory. Do you use this term in the sense of R. Semon?

(3b) B. Russell in his book "The Analysis of Mind" paid much attention to the concept of memory, particularly using R. Semon's work. In his later works, Russell has avoided to mention Semon. Do you find Semon's concept of *mneme* applicable in the contemporary biosemiotics?

(4a) On the pp. 61ff, you write about the distinction between the *natural* (the world in which errors occur; couldn't we call this *semiotic*) and *transcendental* (an errorless world; couldn't we call this *physical*) world. My question is about models that describe the transcendental world — do these models belong to the natural or transcendental world?

(4b) In the conclusion (p. 70, point 8) you speak about real world, instead of natural world. Do you use *real world* and *natural world* as synonyms?

(5) On the p. 58, you say that DNA is a code. According to Barbieri's notion of code, DNA is not a code. What do you mean by code, how do you define it?

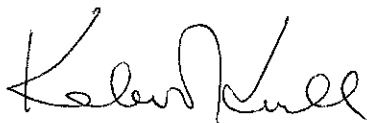
(6a) E. Jablonka and M. Lamb have distinguished between four types of inheritance in living systems. Would you agree, that instead of (or in parallel with) the types of organic memory, we could speak of the types of organic inheritance?

(6b) How should *memory* be defined?

From a technical side, the text of the dissertation includes long quotations from the published texts of the author. However, these quotations include omissions (e.g., p. 60) that are not marked in the quotations.

In general, the thesis is written clearly, its argumentation is sufficient and persuasive. The amount of work — the main text (81 pages) and three articles — (a) published in *Biosemiotics* (coauthor A. Markoš), (b) published in *Theory of Biosciences*, and (c) manuscript (coauthors A. Markoš and J. Lhotský) — is adequate for a PhD thesis.

The overall evaluation is that this work fully satisfies the criteria for allocation of a doctoral degree of philosophy to Jana Svorcova.



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