Σημειωτική

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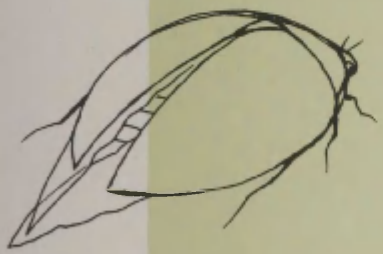
Reading Hoffmeyer, rethinking biology



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Читая Хоффмейера, переосмысливая биологию

Læs Hoffmeyer — nytænk biologien

University of Tartu

Reading Hoffmeyer, rethinking biology

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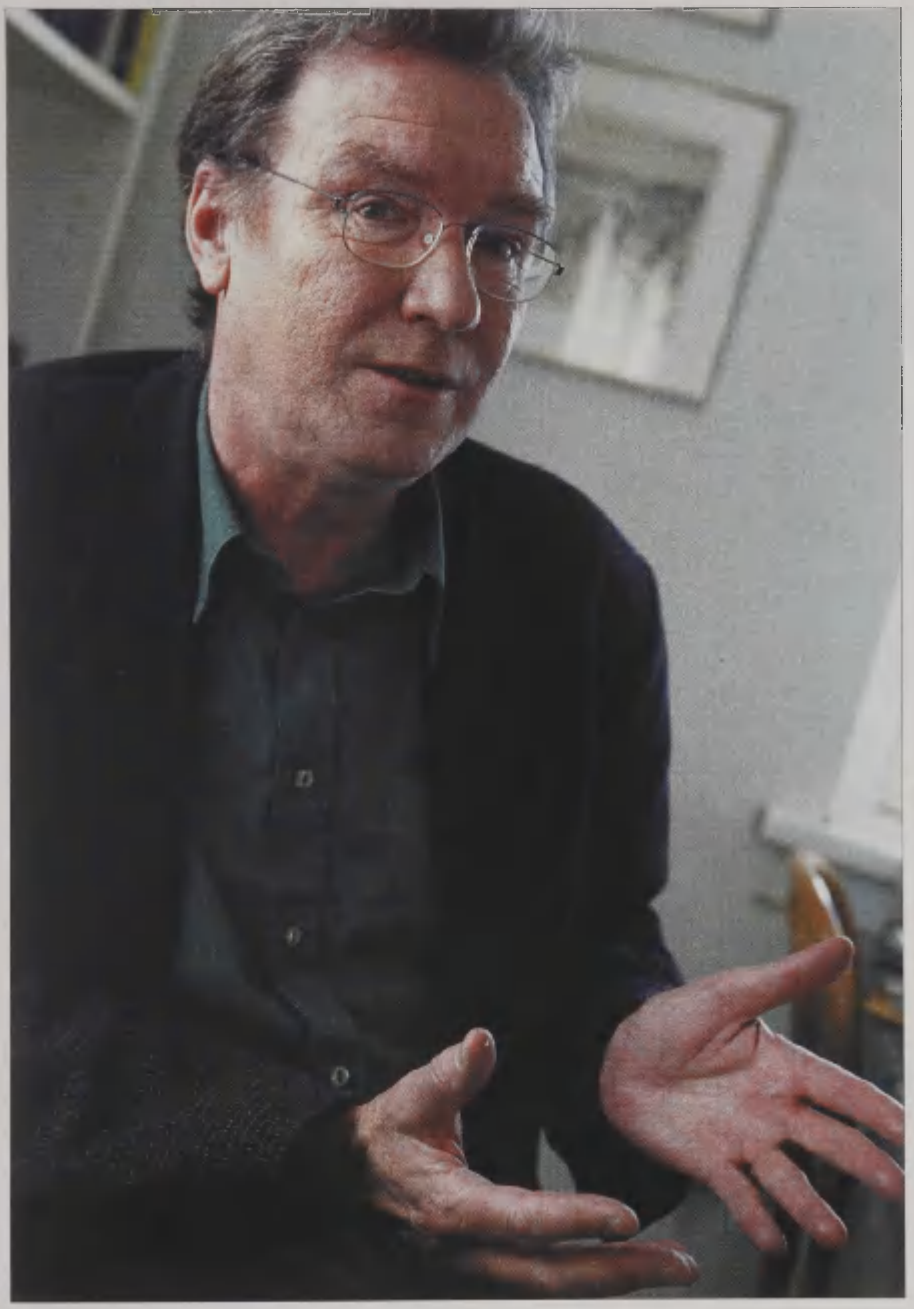

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INTRODUCTION

Entering a semiotic landscape[1]

In the past decade, biosemiotics has become visible in the realm of natural science and philosophy as an emerging network of ideas, concepts and hypothesis of what constitutes life — involving biologists, semioticians, philosophers and others. Biosemiotics could be seen as a biological paradigm in some sense. "Rather than understanding biology as a separate layer 'between' physics and semiotics, we should then see biology as a science of the interface in which these two sciences meets, an interface in which we study the origin and evolution of sign processes, semiosis".[2] Biosemiotics provides a theoretical framework for understanding living systems very differently from the metaphysical idea that cells and organisms are simply organized organic molecules. We think this is an obvious way to introduce the essence of this approach, simultaneously with an introduction to a biochemist, biologist, and semiotician, Jesper Hoffmeyer — as the very concept of biosemiotics has become so deeply associated with his work.

It seems that often the articles most cited are not the best, that the authors whose names are well-known are not those who formulated the ideas attributed to them, and that scientists about whom biographies are written are not necessarily deserving. One method to avoid this — the method which we would like to recommend to everybody — is to reread thoroughly what has been written by a colleague or friend. As we will argue below, reading Hoffmeyer provides a profound set of tools for thought to re-

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1 Cf. Hoffmeyer 2001c: 387.

2 Hoffmeyer 1997c: 363.

evaluate biology as we know it, to reorganize data and empirical findings in a new architecture, that is, to envision a way to understand the evolution of micro-organisms, plants and animals on Earth which does not make it a mystery how the human mind could develop within the physical Universe. According to this view, life, signs, cognition, and interpretation are tightly interconnected, and thus biology (the science of life) and semiotics (the science of signs, their action and interpretation) may not only offer much to one another, but may even belong to one and the same ontological domain.

Biologists understandably look for theory. If they feel understanding life requires mathematics, they will take full courses in it, from algebra to chaos theory; if they conclude that physics explains life, they can study its relevant aspects; if it is chemistry, they go to a lab. The history of biology proves that some have learned such theories so well that they became professionals in both fields. A source may also be philosophy, or linguistics, which will create a new field of theoretical biology. Biology has seen this as an understandable result of its hunger for theory to underpin, organize, and synthesize — and finally to understand — the vast and diverse amount of phenomena it has discovered. Finally, to the extent that some have reached the conclusion that biology is impossible without fundamentals of semiotics, some biologists have decided to do semiotics on a professional basis — or perhaps it is the other way round. More and more biologists are beginning to understand that the essence of life is to mean something, to mediate significance, to interpret signs. This already seems to be, so to speak, unconsciously present even in orthodox Neo-Darwinism and its recurrent use of terms like "code", "messenger", "genetic information", and so on. These concepts hide the final causes Darwinists believed to have discarded 150 years ago, because such concepts allow the researching biologist to look only at that selected train of processes that lead to an organic goal (sorry, to what a gene "codes for"), while many other possible effective causes (one molecule bumping into another without coding and producing nothing but heat) may be discretely left aside. This secret language, where "code" seems to be a code for

final cause, points to the fact that it might be more honest and productive to attack the problem head-on and to formulate an explicit biological theory taking these recurrent semiotics metaphors at face value and discussing them as real scientific problems. This means that a principal task of biology will be to study signs and sign processes in living systems. This is biosemiotics — *the scientific study of biosemiosis*. Semiotics, the general science of signs, thus becomes a reservoir of concepts and principles when it is recognized that biology, being about living systems, at the same time is about sign systems. Moreover, semiotics will probably not remain the same after this encounter with biology: both sciences will be transformed fundamentally while gradually being melded into one more comprehensive field.

There are probably rather many scholars and students in the world who came across the term 'biosemiotics' for the very first time while listening to a talk given by Jesper Hoffmeyer, or reading parts of his work, or finding oneself at his homepage. In the last decade Hoffmeyer's publications in English have all revolved around different aspects of the same field of which he is a founder.

Jakob von Uexküll, a master of biosemiotics, did not use the word 'semiotics'. Those who wrote on 'biosemiotics' in 1960s and 70s (e.g., Rothschild 1962, Stepanov 1971, Florkin 1974)[3] were read by few. Thomas A. Sebeok, the great promoter, organizer, coordinator and author of many publications in the field, became acknowledged by his works in zoosemiotics, the study of animal communication (e.g., Sebeok 1972, 1990). Sebeok, a semiotician at large, and Thure von Uexküll, a leader of European psychosomatic medicine, had created in their interaction and dialogue a basic niche where biosemiotics itself started to be formed.[4] This was supported by a major shift in the views on the scope of semiotics.[5]

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[3] The line of thinking was also prepared, of course, by those who did not use this term but meant more-or-less the same thing (e.g., Thom, Pattee, Goodwin).

[4] On a history of biosemiotics, see Sebeok 1998, 2001, Kull 1999.

[5] A programmatic article by 6 leading scholars in semiotics (Anderson *et al.* 1984) paved the way. This paper introduced a series of concepts from evolutionary biology; however, while speaking about zoo- and endosemiotics, it still — paradoxically — avoided using the term 'biosemiotics'.

However, a generation of professional biologists had to appear who could embrace their contributions and apply their insights in a modern context in order to generate a field of knowledge, or even a whole new paradigm for biology and a biologically informed foundation for semiotics. This generation is still living.

That Jesper Hoffmeyer was born five dozens years ago in Denmark may have some significance. There may be a culture that has, for peculiar reasons, provided the conditions for influential paradigm-makers in many fields. Whether this is due to geographical placement — between the holism of Germany and rationalism of northern Scandinavia, on a seaway between empirical Britannia and the ontological Baltic — or due to a need for nature in a land overfilled by culture; whether this may be explained by subterranean force fields emanating from scholars like Ørsted, Bohr, Jerne and Hjelmslev, it is a fact that both philosophy of nature and semiotics had experienced one of its highest points. The Danish semiotics is among the world's most eminent, and even Danish biologists cannot entirely ignore its development.

Timing is also important, because, as stated in a book about *Thomas Sebeok and the Signs of Life*, "truly, the final decades of the century could be called an 'epoch of signs'".[6] That this has to do with large-scale historical and technological transformations of human societies has, as we shall see, also been investigated by Hoffmeyer.

Jesper Hoffmeyer has written many if not most of his texts on biology and biosemiotics in his mother tongue. His sixth book — *Signs of Meaning in the Universe* — was the first translated into English,[7] and it became a must for everybody who wants to write on the semiotics of life. Many Danish sources that are mentioned in this book spread the flavor of this culture to every pupil in the field (as nicely mentioned by Chebanov 1998). An entire special issue of *Semiotica* (vol. 120, 3/4) was devoted to international reviews of *Signs of Meaning*, a very rare event for the leading journal of semiotics.

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[6] Petrilli, Ponzio 2001: 3.

[7] Hoffmeyer D1993a, 1996a.

In what follows, we will first describe a few core elements of Jesper Hoffmeyer's understanding of biosemiotics. These elements will be presented in the form of 13 theses, extracted and identified through the rereading of his works written since the mid-80s. We believe that these theses may include the crucial cornerstones of a biological paradigm that biologists are only now acknowledging. This chapter is concluded by a brief draft glossary of biosemiotic terms. A short text by Hoffmeyer himself follows; an essay from his Danish collection. A more personal part supplements this essay — through the subjective eyes of the colleagues. Finally, as it may soon become too troublesome to assemble the titles of all of Hoffmeyer's work, we furnish a list of his works now. Hopefully, this will be helpful for anybody who wants to read a piece of good biology and to think about life's meaningfulness.

A BIOSEMIOTIC BUILDING: 13 THESES

In his paper on the concept of the swarming body, Hoffmeyer formulates 8 statements which sum up his position (Hoffmeyer 1997b: 940). He calls these statements *theses*, and despite half of them deal with swarms (the topic of that paper), these begin with the basic units of life in thesis 1, and end up with the phenomenon of thoughts and feelings in thesis 8. Thus, it is an attempt to give a very brief formulation of the whole approach, if not a paradigm. Another version of the same paper, which was published earlier (Hoffmeyer 1995a) but probably written later than the one mentioned above, proposes 9 theses. This is, of course, neither the first[8] nor the last[9] attempt to formulate a semiotic view on living systems in the form of a list of brief statements. However, they provide a good starting point for any further list of biosemiotic principles. Therefore, we are going to use them here, sometimes modifying and splitting or mixing with the formulations from (mainly Hoffmeyer's) other writings.

Thus, we go on with re-reading, which is interpreting. We are going to (re)read and (re)write, to (re)cognise and (re)present again the principles of a semiotic view on life. In doing so, we try to distillate the key ideas from a continuous body of texts, though both are needed for real knowledge (as the principle 2 below says). What follows are the main theses of biosemiotics as extracted from Jesper Hoffmeyer's writings. Each thesis in the form of brief statement is supplied by few illustrative quotations and comments.

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[8] For instance, 'three laws' of biosemiotics have been formulated already 40 years ago (Rothschild 1962; see also Kull 1999b).

[9] Biosemiotics in 22 statements by Stjernfelt (2002) has been formulated almost simultaneously with this text here.

1. Signs, not molecules, are the basic units in the study of life.[10]

By representing an organism merely as a composition of small non-living bodies that interact according to the mechanical forces, or quantum mechanical laws, as established in physics, we may never reach the description of life itself that will correspond to a biologist's intuition about its nature, including concepts like organism, metabolism, ecosystem, reproduction, etc., as these have been understood in a tradition of biological culture. However, if we try to include into a model of an elementary living process all what is required for the process to be a model of life, it appears that the set of features we arrive at will include the features that characterise a *sign*, or a sign process. That is, in order to have a set of physical processes to be characterized as living, these have to be realized, partly or fully, through the mediation of signs; 'signs', of course, in a specific sense, as we are taking about a very general notion of signs,[11] more encompassing than just 'conventional symbols'. And it follows that "if signs (rather than molecules) are taken as fundamental units for the study of life, biology becomes a semiotic discipline".[12] This semiotic understanding is also achieved if we include into the features of this model the model-building itself, because models are not the sum of their building blocks but are defined by being about something else; they are complex signs occurring in organisms: "The understanding that biology models the activity of model-building organisms is at the core of biosemiotics, of course".[13] Thus, the statement about the basic units not only concerns the method of study, it also concerns ontology. The element of life is the sign, not the molecule.

But is DNA, to mention a crucial example, not a molecule? Sure it is, but more than that: this molecule is only interesting (i.e., meaningful) in its biological context, because specific parts of it

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[10] Thesis 1, in Hoffmeyer 1997b: 940, and 1995a: 23.

[11] This general concept of signs as relational processes of a certain kind goes back to the American scientist, philosopher and semiotician C. S. Peirce (1839–1914).

[12] Hoffmeyer 1995a: 16.

[13] Hoffmeyer 1999b: 156.

act, within the cell, as specific signs in the metabolism. One may, of course, model DNA purely in chemical terms, but to be biologically significant (for instance, in order to locate genes on a DNA sequence), the chemical findings have to be related to what is significant for a cell or an organism. Thus, it must be significant in two related senses of the word: it must be significant in relation to the biological process in question, and, by virtue of this, it becomes significant for the biologist as a fact of biology.

2. Codes of living beings are dual.

Signs mean messages mean information. Biological information, however, is not a simple issue. "Organisms recognise and interact with each other as analog codes in ecological space, while they (after recombination through meiosis and fertilization in sexually reproducing species) are carried passively forward in time between generations as digital codes".[14] Life (and also "self") does not exist until both — the analogue and digital, or cytoplasm and nucleic acid — are present:[15] "This principle of code-duality in fact can be taken as a definition of life".[16] Thus, this principle can be used to tell life from life-like devices like computers or their software: "This criterium would exclude computers since these have not (at least yet) been constructed to depend on the creative activity of an analogly coded version interacting with real world processes in such a way as to test the fitness of the digital specifications necessary for its own construction".[17] Code duality means an inevitable interplay of self-description and other-description, of genetic and ecologic, of vertical and horizontal, of diachronic and synchronic aspects of the living. "Symbolically this code-duality may be represented through the relation between the egg and the hen".[18]

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[14] Hoffmeyer 1995a: 17.
[15] Hoffmeyer 1996a: 44.
[16] Hoffmeyer 1995a: 17.
[17] Hoffmeyer 1998a: 34.
[18] Hoffmeyer, Emmeche 1991: 126. The principle of code duality — formulated already in Hoffmeyer 1987 and sketched in his Danish introduction to philosophy of biology (Hoffmeyer D1984a) — was inspired by works of G. Bateson (1979) and

Code duality is a principle that recognizes the importance of biological self-reference in life processes. Accordingly, "the chain of events which sets life apart from non-life, i.e. the unending chain of responses to selected differences, thus needs at least two codes: one *code for action* (behaviour) and one *code for memory* — the first of these codes necessarily must be analog, and the second very probably must be digital".[19]

3. The simplest entity to possess real semiotic competence is the cell.[20]

To support this statement, arguments similar to those used for proving the statement that a cell is a minimal living system may be used. However, from the semiotical point of view, a cell is a minimal unit in which the inside-outside distinction appears due to the closed membrane that surrounds cytoplasm. "A spheric surface defines an inside-outside asymmetry and opens the possibility for communicative activity across the membrane".[21] This automatically brings in a whole set of semiotic phenomena, due to the boundary as a semiotically selective and creative mechanism. Also, the analog-digital duality appears in the cell, because it is a self-referential system based on redescription in the digital code of its nucleic acid chains. "It is easy to forget how enormously complicated a cell is".[22] An eukaryotic cell, of course, is already a compound cell which includes membranes and organelles that are also cells.

The semiotic quality of life is grounded the organization of the cell's metabolism. For a biochemist the world consists of molecular *shapes*. Biological sign activity is based on the recognition

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A. Wilden (1980) (and partly by Pattee). It presupposes a concept of information which is not objective in the sense of mathematical information theory (cf. Emmeche 1990, a dissertation written in 1985–1989 on the concept of information in biology). On similar and independent formulations of the same principle by other authors see Hoffmeyer 1995a: 24n2, 2000b, 2001a, and a remark in Kull 1998: 303.

[19] Hoffmeyer, Emmeche 1991: 127.

[20] Thesis 2, in Hoffmeyer 1997b: 940, and 1995a: 23.

[21] Hoffmeyer 1998a: 33.

[22] Hoffmeyer 1992: 104.

capabilities of macromolecules such as proteins and nucleic acids. And molecular shapes play a crucial role in these recognition processes. The biochemist's world of shapes does not easily mingle with the computer scientist's simpler world of *switches.* Information and sign activity at the sub-cellular level is not abstract and therefore it poses no symbol grounding problem as information in a computer.[23] Biosemiotic signs are inherently meaningful due to their direct involvement in the processes they signify.

4. Living systems consist of surfaces inside surfaces which turns inside exterior and outside interior.[24]

The importance of boundaries as semiotically active objects has been repeatedly pointed out by semioticians of culture, but this equally applies to biological systems: "Life is a surface activity. [...] Life is fundamentally about insides and outsides".[25] Most crucial events in macroevolution as well as in individual morphogenesis are related to new contacts between the surfaces of cells and tissues. An example of this is the origin of eukaryotic cell. Surfaces turn into interfaces linking the interior and exterior. "Only then does the system's understanding of its environment matter to the system [...]: relevant parts of the environment becomes internalised as an 'inside exterior', a phenomenal world or perceptual model which was called the umwelt by von Uexküll, and in the same time the interior becomes externalised as an 'outside interior' in the form of 'the semiotic niche'".[26]

This double twist of inside and outside are made possible by the membrane strictly governing the traffic between them and thus making primitive intentionality possible: "The semiotic looping of organism and environment into each other through the activity of their interface, the closed membrane, also lies at the root of the

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23 Hoffmeyer J1997. This aspect has been developed further by Stjernfelt 1992.
24 Hoffmeyer 1998a: 33, 40.
25 Hoffmeyer 2000a.
26 Hoffmeyer 1998a: 40.

strange future-directedness or 'intentionality' of life, its 'striving' towards growth and multiplication".[27]

5. Subjectness is a more-or-less phenomenon.[28]

This implies the inclusion of a controlled notion of "subject" in biology: the "conception of subjectivity — which was developed in an entirely human context — corresponds surprisingly well to the [...] criterion distinguishing living systems from non-living systems: the capacity for selective (i.e., active) incorporation of the present into the future".[29] Accordingly, "subjectness has its own natural history",[30] co-extensive with the natural history of signification.[31] Thus, there is a general semiotic continuity in evolution, which, on the other hand, gives rise to the emergence of new forms and new code systems (such as animal thought and communication, or human language, the other grand code-dual system in evolution).

6. Subjectivity is embodied.

Intentionality, subjectivity, and self-awareness (which are not one and the same thing and whose finer interrelations still remain to be clarified) are not phenomena forever beyond the horizon of science; rather, "the key to a scientific understanding of the mental is *embodied* existence and not the fictitious idea of disembodied symbolic organization"[32] as, e.g., in classical artificial intelligence. The intentionality of human mental life has evolved from something related in evolution; it has been "present as a germ in our most

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[27] Hoffmeyer 1998a: 40.

[28] Thesis 3, in Hoffmeyer 1997b: 940, and 1995a: 23. A whole section on this in Hoffmeyer 1992: 102–107.

[29] Hoffmeyer 1992: 103. Hoffmeyer refers here to Maurice Merleau-Ponty.

[30] Hoffmeyer 1997b: 940.

[31] The Danish subtitle of Hoffmeyer's 1996a book (D1993a) means "The natural history of signification".

[32] Hoffmeyer 1999c: 571.

related animals".[33] Furthermore, the unity of consciousness in humans is "a function of the body's own historical oneness",[34] "the body is effecting an *interpretation* of its situation vis-à-vis the biographically rooted narrative which the individual sees him- or herself as being involved in at that moment. This interpretation is what we experience as consciousness".[35] Consciousness is the body's spatial and narrative interpretation of its existential umwelt.[36]

7. Living body is a swarm.

The unsolved question of multicellular organisms may be approached through the concept of *swarm*; it is "a set of (mobile) agents which are liable to communicate directly or indirectly (by acting on their local environment) with each other, and which collectively carry out a distributed problem solving".[37] From this point of view, there is a fertile analogy between social animal groups and multicellular organisms, so that the latter constitute governed hierarchies of swarms: "Vertebrate bodies are supposed to function on the basis of swarm dynamic principles not unlike those pertaining to social insects. The swarm of cells constituting a human body should be seen as a swarm of swarms, i.e., a huge swarm of overlapping swarms of very different kinds. The minor swarms again are swarm-entities, so that we get a hierarchy of swarms. An image arises in which the brain is functionally integrated into the body. Swarms of immune cells interact with swarms of nerve cells in maintaining the somatic ecology. Thoughts and feelings are not localised entities. They swarm out of our body collective".[38] This also provides a crucial point in an explantion of how mind is embodied.[39]

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[33] Hoffmeyer 1999c: 571.
[34] Hoffmeyer 1996a: 119.
[35] Hoffmeyer 1996a: 120.
[36] Hoffmeyer 1996a: 122. See also the essay on proprioception by Hoffmeyer (below).
[37] Hoffmeyer 1997b: 937.
[38] Hoffmeyer 1997b: 940.
[39] Hoffmeyer 1995c.

8. Whatever an organism senses also means something to it.[40]

Hoffmeyer assigns[41] this statement to Uexküll (1982: 31): "Every action, therefore, that consists of perception and operation imprints its meaning on the meaningless object and thereby makes it into a subject-related meaning-carrier in the respective umwelt (subjective universe)". This is the case even for a bacterium.[42]

9. Wherever a new habit appears, it tends to become a sign for somebody.[43]

Almost everything new that appears in an ecosystem will, earlier or later, be found, recognised, and used by some organism. This constitutes a basic reason why it is possible for the ecosystems to stay in balance, even when new substances (that could earlier never been occurring in the history of Universe) are produced or new relationships established. Hoffmeyer (1997a) formulates it like this: "Whenever there has developed a habit there will also exist an organism for whom

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[40] Hoffmeyer 1997a.

[41] In Hoffmeyer 1997a.

[42] This example is from the English draft version of the Japanese paper Hoffmeyer J1997. "We can use the remarkably sophisticated chemotactic behaviour of the bacterium *Escherichia coli* for illustration. Coli bacteria have been shown to move in the direction which offers more nutrient molecules rather than less. They do this by measuring the saturation of their chemoreceptor-sites while they move. The swimming speed of a bacterium is 10 to 20 bodylenghts per second and by comparing current chemoreceptor occupancy with that during the previous few seconds, the cell is able to make measurements over distances of many body lengths. The task performed here is not only that of comparing measurements over time but also that of communicating the weighted result of this measurement to the flagellar motors who are actually doing the co-ordinated job of moving a cell along its path. [...] The information-processing involved in the simple act of moving appropriately in a nutrient gradient has evolved to satisfy the bacterium's survival-project. In this sense — and only in this sense — does it *mean* something to the bacterium. 'Meaning' here consists in the establishment of an informational loop between the bacterium and its environment. The bacterium of course is connected to the environment by dozens of other loops and the totality of these loops forms what the German biologist Jakob von Uexküll has called the *umwelt* of the bacterium (Uexküll 1982)".

[43] Thesis 4, in Hoffmeyer 1997b: 940, and 1995a: 23.

this habit has become a sign". He calls it a *rule*, and indeed this can be seen as a version of a general law of nature's tendency to take habits formulated in a quite similar way by Peirce. Whether it is a rule in the sense of necessity or a tendency in the sense of probability remains to be determined. In any case, this is a principle of semiogenesis that makes everything tendentially interconnected in an ecosystem, and, in a larger perspective, in the biosphere. "Living systems exhibit extreme semiogenic behaviour based on the semiotic dynamics of *semetic interactions*,[44] whereby habits come to signify the release of further habits in an infinitely long and complex web stretching back to the beginning of life and forward to the global semiosphere of tomorrow".[45]

10. The totality of 'contrapuntal duets'[46] forms the sphere of communication — the semiosphere.[47]

If the biosphere is understood only as a global network or cycle of chemical elements through the organisms, then its character will only be really appreciated as an aspect of the more comprehensive notion of *semiosphere*: "from a biosemiotic point of view the biosphere appears as a reductionist category which will have to be understood in the light of the yet more comprehensive category of the semiosphere".[48] However, if the biosphere is understood as a communicative web, then it leads to a claim formulated by T. Sebeok (2001: 164): "Biosemiotics presupposes the axiomatic identity of the semiosphere with the biosphere".

Semiosphere is thus the totality of interconnected signs, a sphere that covers the Earth. The semiosphere is also a precondition for the functioning and development of semiotic systems, in-

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[44] The term 'semetic' has been criticised by Nöth (2001: 159) from the point of view of its etymology.
[45] Hoffmeyer 1997b: 940.
[46] Uexküll 1982: 54.
[47] Hoffmeyer 1997a.
[48] Hoffmeyer 1997a: 934.

cluding the creation of such sophisticated semiotic systems as thoughts and language.[49]

11. The semiotic niche is the species' home.

A semiotic niche is the biosemiotic elaboration of the notion of "ecological niche": it is "the diffuse segment of the semiosphere which the lineage has learned to master in order to control organismal survival in the semiosphere".[50] The population of a semiotic niche must possess certain specific semiotic abilities with regard to that niche: "The semiosphere imposes limitations on the *umwelt* of its resident population in the sense that, to hold its own in the semiosphere, a population must occupy a 'semiotic niche'. To put it another way, it has to master a set of signs, of a visual, acoustic, olfactory, tactile, and chemical nature, by means of which it can control its survival in the semiosphere".[51] Thus, umwelt and semiotic niche are two different perspectives on the same phenomenon: "The character of the animal's umwelt is what defines the spectrum of positions that an animal can occupy in the bio-logical sphere, its semiotic niche".[52]

12. In living systems, determinacy is built upon indeterminacy.[53]

Instead of a world that is one uniform material collection of particles by mechanical links, the reality of sign action leads us to perceive the world as an unruly mess of processes, each with some agential character or direction. At the bottom of this world one finds nothing like solid, massy, hard, impenetrable, movable

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[49] Hoffmeyer 1997b: 939. It should be added here that Hoffmeyer deliberately changes and extends the meaning of Lotman's "semiosphere" concept from the semiotics of culture, originally referring to the space extended by a culture.

[50] Hoffmeyer 1998a: 40.

[51] Hoffmeyer 1996a: 59.

[52] Hoffmeyer 1996a: 140.

[53] Hoffmeyer 2000a.

particles as in the Newtonian picture; on the contrary, one finds a certain amount of *indeterminacy* and spontaneity. This indeterminacy is connected to how order is created in biosphere (which is the same as in semiosphere) — via categorization which categorizes materially different phenomena in one and the same category and which thus, so to speak, gives up total determination in order to distinguish. Hoffmeyer extends it even further — to any habit-taking whatsoever.[54] Organisms indeterminate in some respects possess expandable or "open" boundaries that enable them to continue to grow and alter their patterns indefinitely. In symbiosis between different species, the processes of boundary-fusion, boundary-sealing, and boundary-redistribution lead to more persistent organizations in which individuality may be blurred. Traditional symbiosis is just one particular kind of a much more widespread eco-semiotic integration. Individuality and mortality can be only loosely connected, and dynamic boundaries in space and time are not defined by their genetic set-up. The evolution of boundaries and the evolution of the contexts in which they put themselves are assisted by, not caused by, genetic inventions.[55]

13. Biological evolution is a trend toward increased semiotic freedom.[56]

Our universe has a built-in tendency (not conflicting with the laws of thermodynamics) to produce organized systems possessing increasingly more *semiotic freedom* in the sense that the semiotic aspect of the system's activity becomes more and more autonomous, relative to its material basis. The semiotic dimension of a system is always grounded in the organisation of its constituent material components, and cannot exist without this grounding, but evolution has, supported by the constant energy influx from the sun, tended to create more and more sophisticated semiotic interactions which were less and less constrained by the laws of the

[54] Hoffmeyer 1999a: 327.
[55] Hoffmeyer 1999a: 338.
[56] Hoffmeyer 1992: 108–111.

material world from which they are ultimately derived.[57] The combinatorial advantage of the digital code is a certain degree of freedom of constraint from the physical (thus, "No natural law restricts the possibility-space of a written (or spoken) text."[58]).

[57] Hoffmeyer 1992, 1996a, J1997.
[58] Hoffmeyer, Emmeche 1991: 134.

A BRIEF BIOSEMIOTIC GLOSSARY

Jesper Hoffmeyer has pointed to a general trend of moving from analog communication to digital.[59] A similar trend is characteristic to scientific knowledge that goes from good (analog) intuitions towards precise (digital) definitions. Hoffmeyer has usually not given very exact definitions of the concepts he is using. However, at a certain point of the development of the field certain more formal explications unavoidably must take place.

According to our knowledge, the only published biosemiotic glossary until now has been the one compiled by Thure von Uexküll (1982) specifically for the translation of Jakob von Uexküll's *Bedeutungslehre*. In biological dictionaries, few semiotic terms have been included only very occasionally. In semiotic dictionaries one can find them more often, particularly in these compiled or edited by T. A. Sebeok, or published in recent years (Bouissac, Cobley, Nöth). Due to the youth of biosemiotics, of course, such a situation is understandable. However, there already exists a number of specific terms that one has to learn when reading biosemiotic literature. Jakob von Uexküll, Thomas A. Sebeok, and Jesper Hoffmeyer have been the main figures enriching our language in this respect.

But there is one more aspect to note. Since semiotics has been developed for a long time with only a marginal concern for biological sign systems, the existing definitions of semiotic terms do not take the latter seriously into account. Now, when a large part of semiotics community has accepted the lowering of semiotic threshold, many of the existing definitions need to be correspon-

[59] E.g., in Hoffmeyer 2000b: 183–184.

dingly modified. In biology, the situation is even more dramatic. The semiotic view on living systems infers an altering or deviation of many basic biological notions, or introduction of new ones (fortunately, the 'spontaneous semiotics'[60] of the scientists in biology is making this task easier). That is why a biosemiotic glossary needs to include, in addition to the specific terms, also some general ones from both of these fields of knowledge.

The very brief list of terms below is just to mark a step in this endless work — with a special emphasis on the Hoffmeyerian contributions to biosemiotics.

adaptation — an element of an ecological code involving semiotic coherence between organism, umwelt, and ecosystem; also: the process of originating such a code

agency — the ability of an organism to act in order to fulfill needs; may be defined as a "stable integration of self-reference and other-reference"[61]

biology — study of living systems

biosemiotics — theory of semiosis in living systems; biology that interprets living systems as signs systems; the study of biological codes[62]

biosphere — the interconnected web of all living systems on the Earth

Baldwin effect — the phenomenon of an influence upon (e.g., enhancement of) biological evolution through individual learning (via other mechanisms than the inheritance of acquired characters)

categorization — the process of formation of digital from analogical in living systems; the process of distinguishing between subclasses in a class of phenomena by formation of borderlines, enhancing distinguishing capability across borders and lowering such capability within categories; discretization of continuous variability as a result of functional cycle

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60 An expression used by C. Emmeche (1999: 273).

61 Hoffmeyer 2000a, see also 1999b: 156.

62 The latter definition is taken from Sebeok 2001: 164.

code — a general, conventional, or habit-based correspondence between the elements in one domain and the elements in another; an arbitrary correspondence

code duality — the two sets of informational modes present in all living systems — one analogical and implicit (e.g. cell structure and metabolism), the other digital and explicit (e.g., gene sequence); language possesses a similar duality between analogical meaning and digital expression

Crick's postulate, or *the Central Dogma of molecular biology* — a postulate about the directionality of transfer of sequence information in the cell; holds that such (structural) information cannot be transferred from proteins to DNA; this postulate states nothing about other kinds of sign processes

cytosemiotics — semiotics of cellular processes

degrees of subjectivity — if subjectivity appears during the course of evolution, we should expect it to occur in more and less developed forms, probably along an axis from agency and intentionality to consciousness and self-awareness

ecosemiotics — semiotic analysis of nature in culture; or of the relations between natural and cultural processes

ecosystem — a partly bounded spatio-temperal unit of all interconnected organisms within it, including a closed element cycle due to the functioning of organisms of different trophic levels; this interconnectedness is mediated both via material and semiotic processes

endosemiosis — trains of sign transmission inside the organism[63]

endosemiotic codes — intraorganismic codes, e.g., genetic code, metabolic code, immune code, neural code

endosemiotics — study of intraorganismic sign systems

evolution — irreversible change on various levels of organization of the populations of organisms within a lineage in the sequence of generations

exosemiotics — study of interorganismic sign systems.

function — a part of a living system which plays a role in relation to other parts of the system (e.g., the organism), and thus are relatio-

[63] Sebeok 2001: 164.

nally determined by the part-whole relationship, and thus have significance for the whole

functional cycle — a circular process of recognition and action going on between inside and outside of an organism; the concept (*Funktionskreis*) was introduced by J. v. Uexküll

genetic code — a correspondence between the (64 possible) nucleotide triplets of mRNA and the (20 possible) different kinds of aminoacids in a protein; this correspondence being used in protein synthesis in cells; over a dozen slightly different genetic codes are known in different contemporary organisms, among them two different in human cells (one in nucleus, other in mitochondria)

habit — an acquired feature or behaviour in a living system which tends to repeat itself

icon — a sign that refers to its object by virtue of a direct similarity; also used as predicative (iconic aspect) of other sign types

information — a difference that (acting as a sign and thus) makes a difference (the interpretant) to some agent, organism or part of the organism (the interpreter); this difference may actually or potentially signify another object, and thus, simply be a sign; (as, e.g., the non-expressed genes, 'silent' sequences of DNA (such as pseudogenes), may only potentially have significance for the organism or lineage)

immune code — the correspondence between the antibodies and the pattern of organic structures of the organism, thus making an organism capable to distinguish self from non-self

index — a sign that refers to its object by virtue of a direct physical contact (or another form of a physical relation, or causal relationship) between sign vehicle and object; an index may have iconic aspects as well

inner outside — the representation of certain environmental features inside an organism by various means (chemical or neural perception, genetic representation, etc.); (see also *outer inside*)

inside/outside — the distinction that is made possible by a closed boundary (e.g., membrane)

language — a sign system capable to form sentences (or co-ordinate speech acts); a sign system which includes syntactic signs

macroevolution — evolution above population level

memory — a system that can be used for storing information, which still can forget it

microevolution — evolution below species level

microsemiosis — semiosis on the level of a single cell, and below

mimicry — a three-part system in which some features of an organism (mimic) are similar to some other (model), thus causing perceptual misinterpretation by a third (dupe)

mycosemiotics — semiotics of fungi

natural history of signs — evolution of the sign systems (assuming that biology entails semiosis, we should expect evolution to display the emergence of still more complicated sign types)

organism — a functional spatio-temporal whole that lives, and consists minimally of one single cell, or of a coherent swarm of cells

other-reference — the organism's different inner representations of its umwelt

outer inside — the semiotic niche as informed and changed by the inside needs of the organism pertaining to that niche

phytosemiotics — semiotics of plants

scaffolding — an entity or process which supports another, primary process and thus enhances the stability, functioning, or space of possibilities of the latter; especially relevant is semiotic scaffolding by means of signs; genes may be seen as a scaffolding in relation to heredity; membranes in relation to the autocatalytic cycles of metabolites, language in relation to thought, written language in relation to spoken

self-reference — the necessary (genetical) self-description of a stable living (see *other-reference)*

semiochemistry — study on signal chemicals

semiosic — related to semiosis (cf. *semiotic*)

semiosis — a sign process; the creation, action, and interpretation of signs (often used synomynously with communication, though the latter is a less general concept)

semiosphere — the global sphere of signs and communication — coextensive to biosphere

semiotic — related to semiotics (cf. *semiosic*)

semiotic freedom — multiplicity of choice possibilities involved in a sign (due to its categorization and belonging to a sign system)

semiotic niche — the umwelt of an organism as defined by those semiotic interactions it may entertain within it

semiotic threshold the boundary between non-semiotic area and semiotic area; other thresholds may be envisaged between simpler and more complex sign types in the natural history of signs (e.g., between the systems of symbolic signs and non-symbolic signs)

semiotics — study of signs and sign systems; theory of signs; theory of communication and signification

sign — something (e.g., an entity like a molecule or a process like a change in concentration) which stands for something else (e.g., a nutrient source) to somebody (e.g., a cell, or a component of a cell or an organism, or some bigger living system); the sign is an irreducible triadic relation between all three components (sign carrier, signified object, and interpretant)

sign system — semiotic system (a more general concept than language)

subject — a philosophical term typically involving both agency, intentionality, consciousness, and self-awareness; talking about degrees of subjectivity, not all these features need to be present in primitive subject cases

symbiosis — reciprocally supportive (useful) relationship between organisms or populations; a 'plus-plus' relationship (as different from 'minus-minus' relationship which is called *competition*); a symbiosis which is obligatory for both partners is called mutualism

symbol — a sign that refers to its object by virtue of a general (rule- or law-based) habit, or by virtue of a convention; a symbol may include iconic and indexical aspects as well

swarm — a large group of communicatively interrelated organisms, or cells or other living bio-entities, such as groups of neurons in the brain or body; the concept encompasses social animal groups on the one hand, and multicellular organisms on the other

umwelt — the subjective world of an organism; the concept has been introduced by J. v. Uexküll, remains untranslated in English text (plural: *umwelten*)

zoosemiotics — semiotics of animal communication; or, the study of the communicative behaviour of animals that do not have language[64]

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[64] Deely 2001: 154.

PROPRIOCEPTION[65]

by Jesper Hoffmeyer

Are mice conscious? Or spiders? Do mosquito larvae possess a form of consciousness? Most people will answer no to the last two questions, but perhaps many will be ready to say yes to the first. How can we really know the right answer?

It must be admitted that we can't, and we may even never come to know. Because consciousness is not really a decent subject for discussion. Through many years it was a no-word, a word you simply did not bring up in the good scientific community. And even though it has come into favour as a subject of inquiry in the 1990s, with its own distinct professional journals and conferences, it is far from clear what the word signifies. Indeed, many of the most diligent discussants don't think the term refers to any genuine reality.

But this very indefiniteness may provide a key to the phenomenon. If you are the kind of person who thinks that consciousness belongs to human beings, in the same way that light belongs to day, it is tempting to conclude that consciousness is simply the blind spot of natural science, the very thing that this variety of science cannot come to observe.

When I say consciousness is not a decent subject, I mean that consciousness is a phenomenon that can only be known from within. You have to have a consciousness of your own to know the sort of stuff it is. It is as if an objective description of conscious-

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[65] This piece has appeared in Danish in Hoffmeyer (D2001a: 75–80). Translated by Claus Emmeche and Maxine Sheets-Johnstone.

ness is not possible, because this kind of description misses something essential, namely that consciousness is always experienced by somebody, a subject. Natural science is about phenomena that can be described in the third person singular, that is, by words like "this" and "it", but it cannot in principle investigate the first person singular, that is, the "I".

Even though natural science cannot deal with consciousness as such, it is possible by way of science to try to understand what is needed in order for a system to have consciousness. And if you believe that, minimally, a body with a certain complexity of its brain is needed for the body to be labelled conscious, you can begin to consider how such a brain may be able to bring forth this strange phenomenon. And finally you can attempt to find the evolutionary origin of consciousness in organisms that perhaps are too primitive really to have consciousness, but nevertheless may be thought of as having some non-conscious experiences, a sensitivity, or a susceptibility to impressions.

These and many more questions form the topic of an exciting journal called *Journal of Consciousness Studies*. In one of the more thought-provoking articles (in vol. 5, no. 3) the American philosopher Maxine Sheets-Johnstone examines the natural history of consciousness.

Her basic idea is that consciousness is deeply connected to movement. It is no accident that animals have brains and plants don't. Plants do not have to move, thus they do not have the problem that forced primitive animals a long time ago to evolve the nervous system. Movement demands that muscle cells at one corner of the organism instantaneously, that is, in microseconds, coordinate their activity with muscle cells at the other end. To achieve this coordination — from the perspective of a single cell — long distance communication became the very art of nerve cells.

But movement has an inner side which, according to Sheets-Johnstone, deliver the key to our problem. This is so because movement is also sensation, it presupposes that the body consistently registers its own change. When we move, we obviously observe that the surroundings are changing, but at the same time,

we feel the movement inside our body. Otherwise we could not direct it — or enjoy it, as when small kids are running, or grown-ups are dancing.

This inner sensation is called proprioception and is due to millions of small sensory cells, devised to measure the pressures and tensions that are produced when the layers of cells inside the body are displaced and sheared against one another. "The astoundingly varied and intricately detailed biological faculty that allows knowing one's own body and body movement and that in the most basic sense allows knowing the world is a dimension of consciousness" writes Sheets-Johnstone.[66] *Corporeal consciousness* she calls it:

"Consciousness is thus not in matter; it is a dimension of living forms, in particular, a dimension of living forms that move".[67]

In his book *A Leg to Stand On* (1984) the American medical doctor Oliver Sacks described his personal experience of what it was like when the proprioceptive sense disappears. He had been injured in one of his legs and had lost the nerve connection to that leg's inner sensory cells.

"Clearly I had a leg that looked completely perfect anatomically [...] but it felt uneasily strange and even looked so — a lifeless copy attached to my body" he writes: "One has oneself, one is one's self, because the body knows itself and affirms itself by this sixth sense" (i.e., proprioception).

It is also well-known that you cannot control your gait only by vision. And even so simple a movement like stretching the arm out for a cup of coffee in fact demands continuous adjustment via proprioceptive sense impressions. Otherwise the movement cannot be performed smoothly. It has been discovered that such proprioceptive guidance is not due to a simple feed-back mechanism. Instead, the movement is guided by an internal model, that is being constantly updated by the inputs from the proprioceptive senses.

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[66] Sheets-Johnstone 1998: 275.
[67] Sheets-Johnstone 1998: 276.

The reason why a simple feed-back isn't good enough is that the proprioceptive signals from arms and legs are too slow to reach the brain in due time to guide the movement. American robot scientist Andy Clark has suggested that the body might solve the problem in a way similar to the solution given by the robot builders, namely by introducing a sort of pseudo-orchestral conductor (in computer lingo, a motor emulator). This pseudo-conductor "models characteristic aspects of the agent's bodily dynamics and may even be used in the absence of usual sensory input" writes Clark. Obviously, the pseudo-conductor has to be perpetually updated with proprioceptive data to be able to remit a virtual feed-back that simulates the kinetic reality.

I don't know how the reader feels about this, but for me a bell rings. If you match Clark's idea with Sheets-Johnstone's idea, it seems likely that this internal model, the pseudo-conductor, constitutes the very primordial basis of consciousness. We should imagine that when animals in the course of evolution developed the conglomerates of nerve cells we call brains, there emerged, little by little, the capacity for making the kind of internal models I have called pseudo-conductors.

That consciousness basically is a kind of virtual reality may not sound like hot news, but it seems far more easy to grasp as we have become used to the virtual reality of the computer. A pseudo-conductor is not in itself a consciousness. But it has the same strange mixture of dependence upon, and autonomy in relation to, the external world, as exhibited by our human consciousness.

The autonomy of the pseudo-conductor is indeed very, very poor as compared to consciousness, but everything starts in small ways.

Pseudo-conductors resemble consciousness by having emancipated themselves from time, though only in tiny fractions of a second. But obviously they lack that special integration of senses and recollections that presumably bring about our experiencing a virtual reality. Stated differently, they lack that little detail that an "I" presupposes: namely, duration as well as unity. We are (normally) only one "I", and this one "I" has a tendency to endure in one time slice after the other.

ON BIOGRAPHY

Let us provide, without attempting any completeness by this brief biographical sketch, a little background information about the person who, in our opinion, has contributed so fruitfully to the potentials for a profound re-orientation of biological thinking.

First, the hard facts — *pace* his own critique of this very notion. Jesper Hoffmeyer was born in Denmark on February 21st, 1942. He lives in Hundested, a small Danish city on the northern coast of Zealand. He works as a researcher and teacher at the University of Copenhagen.

Jesper Hoffmeyer was born into a family with strong anti-conservative and atheist traditions. His father, the medical doctor Svend Hoffmeyer (1866–1951) was active in the Danish social movement of sexual reform. During his formative years, Jesper became influenced, through his family, by the strong intellectual movement of 'cultural leftism' [in Danish: 'kulturradikalisme']. It was led by a society called 'liberal struggle for culture' [Frisindet Kulturkamp], questioning the ideals of 'God, King, and Country'. His father was one of the initiators of their journal *Kulturkampen*[68]. Of his two half brothers, Jørgen Hoffmeyer is a retired lawyer, and Henrik Hoffmeyer (1917–1986) was a psychiatrist, who played a central role in paving the way for introducing the law of free abortion in Denmark in 1973. Jespers mother, Astrid Hoffmeyer (1907–1994), was a librarian and became highly respected for her efforts as a head of the city library in Hillerød to make the library a real cultural centre of the town. His full brother, Klaus Hoffmeyer

[68] May be translated as 'Struggle for Kulture' or 'Struggling about Culture' (in German: Kulturkampf).

(born 1938), worked as a theater and television director and is now chief of actors at the Royal Theater in Copenhagen. Continuing with the vertical dimension of biosemiosis, Jesper's three sons are Kasper Hoffmeyer aged 35, Johannes Hoffmeyer Malmros aged 27 and Max Møller Hoffmeyer aged 12. With the arrival of little Frida, the daughter of Johannes and Sophie, Jesper has just become a grandparent.

Jesper Hoffmeyer received his Master degree [cand. scient.] in biochemistry from the University of Copenhagen in 1967. He attained a science fellowship that brought him to the biochemical institute (Institut de Biochimie générale et comparé) of Collêge de France, in Paris, in 1967-1968. There, besides doing research on basic aspects of bacterial metabolism, he naturally acquired a first hand experience of the students' anti-autoritarian revolt in May 1968. Back in Copenhagen, he joined the general move to overthrow the closed traditional professorial power of the universities and install a more open and democratic decision-making system. He received a temporary teaching and research position [amanuensis] at the Biochemistry Department [Institut for Biologisk Kemi B] at the University of Copenhagen in 1968, where he has held a permanent position as associate professor [lektor] since 1972.

This department, also called 'The Enzyme Division' [Enzymafdelingen] was led by professor Agnete Munch-Petersen, and focused on studying the regulated metabolism of nucleosides and nucleotides — vital components of the cell's DNA — using the bacterium *Escherichia coli* and other microorganisms as model organisms. Jesper's colleagues, together with a handful of other contemporary associate professors and a group of Ph.D. and Master students, have led a very active research unit at the university since the 1970s.

Biochemical research is usually described as extremely competitive, sometimes even with a tendency to create a narrow-minded intellectual milieu allowing to deal with only a single research topic within a department, and one might have expected problems when Jesper Hoffmeyer gradually got involved in other issues during the 1970s. Some of these were about university politics — he was a member of the supreme governing body of the university

[konsistorium] during 1977–1983, and a governmental board for higher education [sektorrådet for videregående uddannelser] 1975–1981 — but he also made an early consequential shift in the orientation in his research, from pure biochemistry towards investigations of a very broad range of problems related to the philosophy and politics of science and environmental problems.

However, the atmosphere at The Enzyme Division was open and the professor and her team recognized his new efforts. For principle reasons the university norm of free and critical inquiry was valued highly, so as to let Hoffmeyer pursue his new research interests on his own, led only by his own curiosity, and obviously influenced by the engaging intellectual climate of the 1970s. Perhaps an additional reason for this acceptance at that time was that it was clear to at least this part of the scientific community of biochemistry and molecular biology that basic research within these areas had a wide horizon of future potential — possibly highly controversial — applications and that specialists, though not prepared, had to enter a dialogue with the public about the risks and benefits of this new area of biology and biotechnology in order to assure legitimacy.

Thus, from the early 1970s, Hoffmeyer became occupied with criticizing ideological elements in the dissemination of scientific results to a broader audience, and commented upon the rise of new genetic determinism (especially sociobiology).[69] He contributed with an internal critique of reductionistic thinking within the neo-Darwinian paradigm of evolutionary biology with its tendency to focus on gene frequencies and ignore the diversity of mechanisms that create the major patterns of phylogeny and ontogeny at various organisational levels.[70] Together with a group of younger scientists and political activists, he founded a critical leftist Danish journal on science and technology, called *Naturkampen,*[71] where he was co-editor 1976–1986.

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[69] E.g., Hoffmeyer D1971, D1975a, D1977c, D1978c, D1980b.

[70] Hoffmeyer D1978b, D1978c, D1979b, and D1979c, these were collected in D1980b.

[71] 'Struggle about Nature', thus the title reverberates the name of the journal of which his father was one of the initiators.

He also became interested more generally in the material relations between science, technology and society in a macro scale historical and cultural perspective.[72] The book he published about the this topic in 1982 was called 'The natural history of society'[73] and had as one of its main theses that neither traditional nor Marxist history were sufficient to account for the complex interplay between a dominating type of technology by which humans manipulate Nature on one hand and the economic relations, social organization, and 'world view' (or view of Nature) that characterise a given society in a specific historical epoch on the other. Hoffmeyer developed an alternative and much more ecologically informed view on human history, and in Denmark the book became an inspiration, not only to environmentalists and historians, but also to experts and citizens engaged in debates over assessment of new technology, especially biotechnology, but also new forms of information technology. By the 1980s, Jesper Hoffmeyer had become one of the most visible intellectuals in the debate on technology and society in Denmark. For his contributions to the public debate and criticism, he received a Danish honour called 'the PH Prise' in 1985, named after the architect, author and cultural critic, Poul Henningsen (1894–1967).

By that time one of the riddles that intrigued Hoffmeyer was how to characterize a new and general 'view upon nature' to characterise a future, more sustainable society that might be based technologically on an extensive use of information and biotechnology. In 1982, he called the new biotechnology, such as gene splicing, a kind of 'biological information technology',[74] and argued that it may be dangerous if used to manipulate those things we do not yet understand, yet if we keep its use restricted to levels we can manage, it is a fantastic tool. Hence, science should both develop new knowledge of these systems and investigate more deeply our non-knowledge. We should not panic and refuse these

[72] See the articles Hoffmeyer D1975a, D1975c, and the booklet D1977d whose subject was investigated in depth in the book D1982.

[73] Hoffmeyer D1982 (not translated into English). The major points of the book is accessible in English in Hoffmeyer 1987, 1988a, 1988b, 2001d.

[74] Hoffmeyer D1982: 257.

techniques outright, but critically access the risks step by step, project by project.[75] Still, Hoffmeyer was also emphatically aware of the complexity represented by that huge pool of 'ecological experiences', so to speak, that the evolutionary processes had inscribed into the genome of each species during its natural history. He knew how difficult it was for bioscientists to interpret the full biological meaning of the genetic message, especially when many microbiologists were dominated — in their thinking, if not in their experimental praxis — by reductionist tendencies to consider genes simply pieces of a chemical substance (DNA) or individual items of information coding for individual proteins. How to overcome this reductionist thinking still so dominate in molecular biology?

The semiotic turn in Jesper's thinking started with his wrestling with this question, and came with his discovery of Gregory Bateson and, soon after, Charles Sanders Peirce. Jesper was deeply inspired by Bateson's ideas when he wrote, based upon his lecture notes,[76] an introduction to the philosophy of biology (Hoffmeyer D1984a).[77] In the book *Mind and Nature*, Bateson compared the processes of thought with what he called the double stochastic system of biological evolution; the latter referred to the (partly random, partly governed) processes of evolutionary change and somatic change (including learning and thought).[78] Hoffmeyer developed these ideas further, emphasizing the interplay between analog and digital codes (D1984a: 238 ff).

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[75] Hoffmeyer D1982: 259.

[76] When Jesper stopped his research in experimental biochemistry in the 1970s, he continued for some years to teach courses in biochemistry. Since about 1982, however, he has taught a course in philosophy of science for biology students.

[77] I (C.E.) remember his fascination with Bateson when I first contacted Jesper to ask him about doing a Ph.D. project in philosophy of biology. He urged me to read Bateson's *Mind and Nature*, a book he later had translated into Danish (cf. Hoffmeyer D1984e).

[78] It is beyond the scope of this book to make a detailed comparison of Bateson's writings (especially Bateson 1979, and the Bateson interpretation of Wilden 1980) with the ideas developed by Hoffmeyer about code-duality. Another important influence is H. H. Pattee's contributions; see Hoffmeyer 2000b, 2001a. Though Bateson 1979 is very sensitive to the communicative aspect of evolution, Bateson was not an explicit semioticean, and he refers only to Peirce in relation to the abductive form of reasoning (Bateson 1979 [1980: 97]).

In 1985 Hoffmeyer noted that the leading goal in his own research was to show how the specific use of Nature in any given epoch has structured that epoch's view of Nature, and thereby the paradigm within which biology develops.[79] In his 1982 book dubbed *Society's Nature-Foundation* [Samfundets Naturgrundlag], he argued for extending the social historical perspective of classical history of science and newer movements in sociology of science, to include the society's forms of material exchange with nature. Indeed, it was a continuation of this project that led him on to the semiotic track. In 1985 he asked "How will the on-going introduction of information techniques, especially those techniques that are directed toward the processing of 'biological information', effect the nature-foundation of the society?" and how will these changes influence "the paradigms that are basic for the research process in biology?" Furthermore, he stated the hypothesis that the ideas of nature now dominant will increasingly "be challenged by a new paradigm that conceive the living nature as a specific form of language-like system"[80]. In the following year, he used the notion of *The Semiotics of Nature* as a heading for his actual research project in progress, and stated that "central to this work is the increasing use within biology of perspectives and concepts that have been developed within language research or, more, broadly, semiotics".[81] In his paper from a philosophy workshop held in August 1986, he cites both Peirce and Bateson, sketches the idea of looking on living nature from the perspective of analog and digital codes inspired by Bateson, and suggests that this scheme of thought may fit well with the triadic sign-relations of Peirce.[82] He

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[79] The University of Copenhagen's Yearbook [*Kobenhavns Universitets Årbog*] of 1985 (p. 715). These yearbooks, published [in Danish] by the university, contain the reported activity of all researchers affiliated with departments of the university.

[80] *ibid.* (Yearbook of 1985).

[81] Yearbook from the University of Copenhagen [*Kobenhavns Universitets Årbog*] 1986, p. 754.

[82] Hoffmeyer 1987: 199. As mentioned, the importance of analog/digital codes was spelled out in Hoffmeyer D1984a: 236–246. In Hoffmeyer's contribution to a meeting in Dubrovnik held in March 1986 (published as Hoffmeyer 1988a) he writes about translations between analog and digital codes, semiotic freedom, Bateson and Peirce. The Danish physicist Peder Voetmann Christiansen, who was active in a Copenhagen study circle (called 'The Helmuth Hansen circle' after a Danish philosopher Helmuth

also states that "The application in biology of a semiotic paradigm might open our eyes to some aspects of the life process, which has until now been poorly understood, thereby perhaps solving some deep problems inherent in evolutionary biology".[83]

Since then, Hoffmeyer devoted more and more time to develop the idea of a semiotics of nature, or biosemiotics as he chose to call this effort, a view that should make it intelligible that all the phenomena of inherent meaning and signification in living nature — from the lowest level of sign processes in unicellular organisms to the cognitive and social behaviour of animals — can emerge from a universe that was not organized and meaningful from the very beginning. He was still busy disseminating not only his own research but also engaged during 1990–91 in editing a journal called *OMverden*, a name that plays with the Danish 'om' (about) and 'omverden' which means 'surrounding world', or 'environment', and has a connotation to Jakob von Uexküll's word *Umwelt* for the subjective counterpart of an organism's environment.[84] The journal was an intellectual success, but a failure for the publishing company, so the life of the journal was brief. His research led him to deeper contact with the pioneers of biosemiotics, such as Thomas A. Sebeok (1920–2001) and Thure von Uexküll (b. 1908), and their forerunners, as well as an increasing group of semioticians and biologists interested in the new possibilities of cross-disciplinary inquiry offered by the biosemiotic approach. An informal group of people in Denmark was organized at the beginning of the 1990s, called 'DaSeNaSe'[85], who established contacts between

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Hansen), had a key role of introducing Peircean semiotics to the Copenhagen proto-biosemioticians. Jesper joined the circle in 1986 or 1987, and Voetmann always conveyed the metaphysics and semiotics of Peirce in the discussions within the circle in a lively and charismatic way.

[83] Hoffmeyer 1987: 199.

[84] The very word Umwelt was in fact created by the Danish-German poet, Jens Immanuel Baggesen, cf. Sutrop 2001.

[85] Danish Society for the Semiotics of Nature [Dansk Selskab for Naturens semiotik], who held a few informal meetings in Tisvilde in Denmark. The 1991 meeting was visited by, among others, Tom Sebeok, Thure von Uexküll, Peder Voetmann Christiansen, Mogens Kilstrup (a Danish molecular biologist who made interesting contributions to biochemical semiotics), Søren Brier, Frederik Stjernfelt, Claus Emmeche, and Jesper Hoffmeyer.

researchers abroad and within Denmark to explore this new field. A lengthy academic double article on code-duality as a fundamental semiotic principle of biological evolution, including an investigation of the role of various semiotic metaphors in biology, received the award for the year's best paper in the journal *Semiotica*, the so-called Mouton d'Or or "golden sheep" — for a biosemiotician an honourable award indeed.[86]

In 1993 Hoffmeyer published his first comprehensive introduction to the idea of biosemiotics, a broad-ranging, easy-read, but deep and in some senses compressed argument that contained sketches of most of the parts of the 'biosemiotic building', the book that was translated into English a few years later (Hoffmeyer D1993a, 1996a). This was the first major step towards an international recognition for being a pioneer of a new approach to biology. As reflected in his publication list, Hoffmeyer spent more of his time communicating with a cross-disciplinary audience of scientists, philosophers, and scholars from various specialities. He was invited to conferences in the fields of systems theory, self-organizing complex systems, cognitive science, general semiotics, media and communication theory, and, of course, an increasing number of workshops and symposia devoted specifically to biosemiotics and its relation to other fields of semiotics and biology.[87] In 2000, at the 25th Annual Meeting of the Semiotic Society of America in West Lafayette (under the theme "Sebeok's Century"), Jesper Hoffmeyer received the Thomas A. Sebeok Fellowship Award.[88]

Amazingly, Hoffmeyer has continued to spend as much time teaching biology students as ever, first and foremost the course on the philosophy of science for biology undergraduate students (a

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[86] The paper was for technical reason published in two parts, Hoffmeyer and Emmeche 1991, and Emmeche and Hoffmeyer 1991, the latter of which received the award.

[87] In May 2001 in Copenhagen, there was held the first "Gatherings in Biosemiotics" meeting, planned to be continued every year. There is a website for this new habit at http://www.zbi.ee/~uexkull/biosemiotics/.

[88] He became the fourth recipient of this official Award of the Society, the earlier recipients (during the ten-years period of the existence of the award) being David Savan, John Deely, and Paul Bouissac.

course involving such issues as bioethics, causality in biologic systems, modelling strategies for life, reductionism, emergence of life, and evolutionary theory), but also a high-level course in epistemology for biologists, mostly devoted to introducing his own work, and of course, he supervises graduate and Ph.D. students. Furthermore, Hoffmeyer is well-known in Denmark as a contributor for a large Danish newspaper, *Politiken*, writing a weekly column called 'a natural viewpoint' reflecting upon worms, genes, the cosmos, politics, or philosophy, often inventing surprisingly alternative point of views into a debate, or developing upon theoretical accounts of a phenomenon in a non-technical way.[89] The essay on proprioception in this book is an example.

Notwithstanding these activities, a whole life devoted completely to teaching, writing and scholarship would seem like a desert to him. To his friends, he has occasionally expressed mixed feelings about academic life, especially at large formal conferences where one seems to be expected to continue to perform serious professional argumentation not only during the day, but even after dinner. One of his favourite other activities is music, and he meets with local friends in a little jazz band one evening every week, jamming with Jesper on the saxophone.

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In one sense, Jesper Hoffmeyer has been a philosopher of biology his whole life. He has often told the story about his deep fascination as a youngster with the idea that all human action can be explained in essence as a product of the biochemical processes residing in the very stuff our bodies are made of. No need to say how far his own research has taken him from this first love for metaphysical reductionism, and how different a notion of 'the stuff of which we are made' he has come to through his semiotic expeditions. His approach to the philosophy of biology has been diffe-

[89] Hoffmeyer D1997, and D2001a, are two collections of these short essays.

rent from the dominant trends in this field. For instance, in North America the focus is on conceptual clarifications of evolutionary theory 'as it is', but this influential approach does not inquire into the fundamental unsolved riddles and explanatory *aporia* of the neo-Darwinian paradigm.

Jesper is a philosopher in the genuine sense of the word — a lover of wisdom — thus, also keenly aware of the limits of scientific knowledge, of the difference between knowledge and wisdom, and even of the limits of wisdom. As the peculiar character 'The Philosopher' uttered in *The Crock of Gold* by James Stephens:

> Have you learned to smoke strong tobacco as I do? or can you dance in the moonlight with a woman of the Shee? To understand the theory which underlies all things is not sufficient. ... It has occurred to me, brother, that wisdom may not be the end of everything. Goodness and kindliness are, perhaps, beyond wisdom. Is it not possible that the ultimate end is gaiety and music and a dance of joy?[90]

Even though biosemiotics does not dance, it is strong tobacco for theoreticians dealing with the problems of life and mind, and a joyful and daring journey into the land of a new biology, enabling better tools for thought to meet the challenges of the 21st century.

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[90] Stephens 1995: 12.

INVISIBLE WORLDS*

The title refers to Uexküll 1936.

Flash-backs

by C. E.

Being interested in field biology and having finished high school, I was about to start studying biology when I read Hoffmeyer the first time, in my summer holiday in 1975. What I found in his *Dansen om Guldkornet* was an intriguing combination of history of biology, political ecology, philosophical anti-reductionist thinking and much more I had never seen before. I don't think I grasped much of it by that time, but it provoked my conception about the topic I was going to study. Of course, I soon forgot all about the book and became absorbed in the 'real' biology that was taught, at that time, in a very traditional way at the university, with strong emphasis on the rich details of comparative vertebrate anatomy, botanical morphology, and other hot stuff like taxonomy of the kormophytes; all this combined with heavy courses in math, physics and chemistry. I had none of Jesper's courses, if he'd taught some they would have been in the biochemistry programme, but I heard him some times when he was invited to give talks for the student's social and political organizations of which there were numerous in the mid- and late seventies.

He was clearly considered by many as a guru at that time when, just to remind the reader, about 90% of the university students supported an activist and leftist political line that included what was called "internal critique of the scientific speciality", a keyword to be explained in a moment. Jesper was already a prolific writer and had his own style of giving a talk, with a little touch of nervousness he talked absorbingly about the transformation of technology and society in a subdue, serious and imaginative way, always catching his audience and, as one of his critiques once

remarked, somehow with a statue of a prophet. Jesper's talks resonated perfect with the leftist and alternativist *Zeitgeist* of that time. Yet he was very critical of the new left for its ignoring not only science and technology in general, but also the political dimension of a society's whole technical system.

One of the ideas within the West-European students movements after '68 was that of "immanent critique"; for instance, within the sociology and economy programmes, students should critisize not only the calamities created by a capitalist system but also reveal the inner inconsistencies of the neo-liberal economical theories being taught; students within history, literature theory, psychology and other humanities should critisize the perfusion of their study programmes by bourgeois ideology.[91] However, students from physics, chemistry and mathematics had a much harder time to live up to the pervading ideals of this sort of 'internal critique' of a scientific discipline. After all, the very radical idea of the possibility of a difference between a 'bourgeois' and a 'socialist' biology was very easily subjected to ridicule or released signs of warning against repeating tragedies like the Lysenko affair in Soviet Union.[92] So, Jesper belong at that time to the new left movement, who critisized capitalism in the West as well as 'state capitalism' in the East. The new left wanted to save Marx from the marxists, eventually just to re-invent other brands of marxism. Jesper was part of a little group of Danish radical scientists and intellectuals who, among many other things, searched for other ways to reveal deep imprintings of a capitalist society upon even 'pure' and 'objective' natural science. And here Jesper had a case: neo-Darwinism.

In the late '70s, he critisized not only the inherent reductionism in that dominant biological paradigm on philosophical grounds

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[91] The Danish catchword 'intern fagkritik' from that period, translated here as called 'internal critique of the scientific speciality' was conceived as not only including, for instance, the science of biology but also how biology was taught; the didactic and broader ideological aspects of the specialty.

[92] In fact Hoffmeyer addressed this sad story in his '75 book, where he pointed to the theoretical degeneration of marxism as one factor in the Lysenko affair, and later more in detail in a series of chronicles (in the newspaper *Information*, 30.11., 7.12., 14.12., and 21.12, 1979).

(inspired by the American geneticist Richard Lewontin); he brought it into a historical and social context and connected that criticism with the newest and hottest German left-wing theories of science as a special mode of abstraction with certain affinities to the basic economic forms of thought. And even more, he gave a nuanced and critical appraisal of these theories. Intellectually this became for me hotter stuff than the taxonomy of kormophytes, despite I loved these plants. Of course, the whole period was one of criticism on all levels — "attack the headquarters!" as chairman Mao said — and I guess more intellectual power was spent critisizing neighbouring marxist clans than everyday political issues. As a graduate student in the ecology and environmental biology programme (the shit biologists as we were called) I got involved in discussions about philosophy of biology and remember a series of self-organized summer biology seminars, where Jesper's texts and occasional oral presentations always formed a central basis of the food chain of further discussions and criticisms. There seemed to develop a special prestige among us, the younger generation, in 'debunking the debunker', so that that his own critiques of neo-Darwinism was subjected to intense scrutiny and examinations, and not always quite fair counter-criticism. But it was great fun and sometimes produced interesting spin-off articles in such journals as *Niche*, a local "journal for critical biology". One enduring result of this bio-local student activism was that philosophy of biology ('biological theory of science' as it was called) was introduced as a requisite course in the University of Copenhagen biology programme with Jesper as teacher.

When I became a Ph.D. student under his supervision half a decade later, all this activism had faded, and many participants from that time looked back upon their youth activism few years earlier with something like a feeling of astonishment. At the ceremonial Friday afternoon beer that Jesper had with his two good friends and lab workers at the Enzyme Division, Anny and Lizzie, and those others that showed up, he told about how he, by simple observations, suddenly came to realize how absurdly far many of the theoretical discussions within the rapidly splitting branches on the new left tree of political parties, for instance about how to

analyze the society's class structure, were from anything that had to do with real problems of the working class.

In my Ph.D. work, I felt it was a privilege to have Jesper as a supervisor. He was always willing to discuss drafts in the making, or other articles; in general letting me follow my own path through the thesis project, but also asking for critical responses to his own papers in progress. The double paper we did together on code duality and semiotic metaphors came about in what I remember as a lengthy and sometimes difficult and very probing process of trying to explicate ideas and intuitions that were still vague, but we gained from extensive communication with a lot of other people.

Among them, the knowledgeable Mogens Kilstrup from the Enzyme Division is a good example of the division's open spirit of curiosity towards theoretical biology, and inspired by Jesper, he developed his own semiotic notation of biochemical reactions paths. The well-known cybersemiotician Søren Brier was also one of many who received profound impulses from Jesper. And of course, my co-authors Frederik and Kalevi, and many others should be mentioned. Gradually, as described above, a little group of people gathered in various informal networks out of which the biosemiotic trend grew. It has been exciting to participate in the project of developing a new perspective upon biology as a science of communication and living sign action, and I am grateful that Mr. Biosemiotics, as Jesper ironically called himself in an interview,[93] made this possible.

Ironically, because he hates to see himself as a promoter or salesman of an idea that can be nicely packed and transferred as a simple message. In his teaching, his approach is almost Socratic, as recently remarked by Mette Böll, one of his students well versed in biosemiotics, he prefers that the course participants themselves come to reflect upon the problems of traditional theories before he sketches new models for solutions.

In the 1980s Jesper Hoffmeyer, as many other of his generation, gradually came to conceive the meaning of political engagement in a different perspective, and this was of course influential upon his

[93] Interview by Vibeke Wern in *Berlingske Tidende*, *Univers*, p.5, December 9, 2000.

own research that he, from the time he left 'pure biochemistry' in the early 1970's, had conceived as being so much in coherence with his political engagement. And still it is! I think that the very spirit of searching for something profoundly better than what is merely the dominating (often felt pale and shallow) understanding of the world, is an intellectual impetus that always has played a pivotal role in Jesper's work, even though it took other directions.

Impressions

by K. K.

Recognition between minds is a fascinating issue. For the formation of biosemiotics, the role of Thure von Uexküll's person — not only his writings, but also his organisational talent and communication initiatives — has seemingly played a much bigger role than can be noticed from outside. The remarkable events were the two meetings he organised together with his local colleagues from Freiburg, in 1990 and 1992. According to Sebeok, an International biosemiotic society had been established. In fact, no formal society was born despite some calls to form it, but undoubtedly these Freiburg meetings were the real predecessors of the current Gatherings in Biosemiotics.[94] Categorisation for biosemiotics has started.

Thus, it was near Freiburg, in Glottertal, a beautiful village in South Germany, where we first met, in 1992. For some reason, Jesper arrived later, only for the last day, and we could speak to each other quite briefly.

Early spring of 1994, I took a bus from Tartu to Copenhagen (there was a direct bus line via Tallinn and Stockholm) and spent two weeks in a University guestroom just next to Jesper's office. I could eat myself through the bookshelves Jesper had collected. I felt myself to be a pupil.

Jesper's office is itself a meaningful sign (of the type of index, expectedly). Situated in the Molecular Biology Building, it is separated from all other rooms, so that the only way from the labs to biosemiotics is through the open air. It's a former gate-keeper's apartment.

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[94] On the same Glottertal meetings, see also Hoffmeyer 2002.

In autumn of the same year, Jesper visited Tartu. He gave a couple of lectures, and we had an idea to write something together. However, it took much more time than we then expected before this could happen.[95] Sergey Chebanov from St. Petersburg was my other guest in Tartu at that time, and so another new contact arose.

Indeed, our backgrounds ten years ago were very different. I had worked on mathematical modelling in biology and plant ecophysiology, and was fond of theoretical biology classics and the radical nomogenetic movement in Russian biology. Jesper's part was not at all math, and the philosophers he had read were unfamiliar to me. He had worked practically in a molecular biology lab, and had written imposingly many essays on socio-ecological themes. I also discovered a difference in our approaches to nature: local flora and fauna has always been in my interest, whereas Jesper's impressions either came from particular phenomena in nature, including biochemical knowledge, or from a more philosophical approach. What he understands well is the role of arts in human relationships with nature. Although we already expressed the same ideas, the tongues in which we had learned it were different.

Jesper's intuition is indeed awesome. In trying to describe his method of research, his way to formulate ideas, it is hard to find a better portrayal than a very sensitive, attentive and educated search where an intuitive feeling itself expresses what is wrong and what is worth further inspection. One has to add to this that Jesper has read a lot, and he is an attentive reader.

More talks followed. We met in Belgium, Canada, Finland, Germany, USA, again in Copenhagen, and once more in Tartu. A logical consequence of these meetings, I guess, is joint involvement in the organisation of the Gatherings in Biosemiotics.

When his book appeared in English, we discussed it with students in our biosemiotics seminar in Tartu — chapter by chapter, every week, for a whole semester.

After an initial period of "categorisation", biosemiotics has reached a noteworthy period of creative dialogues, actually multi-

[95] Hoffmeyer, Kull 2002.

logues. At this stage, differences in views are also those which unite.[96]

The biosemiotic building is far from being finished. From the scientific point of view, very little has been done, most of the work is ahead. However, there is already very much — a clear view. This part of the work would be unthinkable without an intellect of intuition based on profound biological culture. The right words have to be found for the understanding. That's him.

Biosemiotics is a scientific study of signs and semiosis in living systems. And Jesper Hoffmeyer is the leading essayist and thinker in the field of the last decade — and of the next, I expect.

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[96] Slight differences in our theoretical views which I've noticed seem to be best explainable through a short note by Hoffmeyer on his concept of semiotic materialism (Hoffmeyer 1998d: 292n1).

Recollections

by F. S.

Being 15 years my senior, Jesper Hoffmeyer was already a bigshot in the intellectual leftist circles of Copenhagen when I arrived there as a young ambitions boy from Jutland in the mid-70's. He was considered *the* 68 leftist biologist and was the leading force behind the critical journal *Naturkampen* ("The Nature Struggle") having borrowed the name from an earlier Hoffmeyer's famous journal of the 30s *Kulturkampen* ("The Culture Struggle") — see the outline of a Hoffmeyer biography. I recall vaguely that I, with the arrogance of youth, regarded his position with radicalist scepticism by then, and I had absolutely no idea that we should end up being fellow travellers some decades later. I began studying philosophy and literature and became interested in the theoretical foundations for literature analysis. This took me to semiotics, initially to the French Saussurean tradition, around 1980. An old interest in the sciences made me reflect upon a prize question about René Thom's catastrophe theory and its relation to semiotics in the mid-80s. As Jesper had by then taken the step from a political criticism of biology to the more ambitious stance of investigating its theoretical foundations, two trains now seemed to be set on tracks unknowingly approaching each other in the night. René Thom's semiotics was anti-Saussurean, informed by Peirce, Uexküll, Tesnière, Jakobson among others, and he saw biology and linguistics as tighly intertwined disciplines, both supposedly to be enriched by the introduction of topological description formalisms able to depict their combination of stability and the possibility for swift changes to other stable states — "catastrophes". Moreover, Thom was the president of the French society for theoretical

biology. I learned an enormous amount from Thom whom I later invited to Denmark, and I still consider his work a sort of *Geheimtip* in (bio-)semiotics where it is far from sufficiently known. But his work opened my eyes for the weaknesses of the Neo-Darwinist doctrine in biology — and more generally for the importance of the basic assumptions of biology, also for the human and social sciences, and for semiotics especially. In the latter half of the 80's, Jesper's development had taken him to Bateson and further on to the emerging biosemiotics discussions around Thomas Sebeok and *Semiotica*, so now the scene was set for our first meeting which I am ashamed to admit I do not remember at all. Maybe because Jesper was such a public figure in Denmark I feel it like I have known him always — which is positively not the case. In any case, I was invited to join the Helmuth Hansen discussion circle which had its meeting in Jesper's secluded cottage like structure at the Dept. for Biochemistry, and I presented my work on Thom there and got acquainted with Jesper as a both sharp and friendly discussion partner. Because of its awkward meeting time (6 PM), I had to leave the HH circle when I had kids — but another coincidence kept me coming to Jesper's office: I lived right along the street, and furthermore my eldest daughter went to a nursery right next door to Jesper. So once in a while I looked him up with a baby under my arm, and gradually things took off. Jesper reviewed my work on Thom very favourably in the Danish daily Politiken, he invited me to a small Thure von Uexküll seminar in Northern Zealand and even took care of my paper from that seminar so it was published in one of the first collected biosemiotics volumes, the *Semiotic Web 1991*. By now, I had got acquainted with Jesper's ideas of biological code duality and regularly read his papers. In 1993, I reviewed the Danish version of his *Signs of Meaning in the Universe* ("En snegl på vejen", meaning "A snail on the road", referring to an old Danish song going: "En snegl på vejen/ er tegn på regn/ i Spanien" — "A snail on the road/ is a sign for rain/ in Spain ...") in the daily *Information*, and I was very impressed with the broad biosemiotic project laid out in that book. At around the same time, Jesper enriched his network by adding to semiotics that of theoretical

biology (including Depew, Weber, Deacon, Rosen, etc.) which, in turn, have fertilized biosemiotics, both in its Copenhagen and its international versions.

It would be an exaggeration to claim that Jesper and I entertain a very close relation — for strange and old and almost mythical reasons the relatively vast amount of semiotic scholarship in Denmark does not sum up to any collected effort, but rather remains a disseminated bundle of single scholars. But as Jesper and I began to meet at least a couple of times a year to conferences — mainly outside of Denmark — in some respects a lucky coupling of "active sites" seemed to take place, maybe because of our symmetrical institutional positions: Jesper a humanist and philosophical-minded scholar in a science department — myself exactly the mirror version. So these valencies easily matched. Spontaneously, we seem to like and dislike more or less exactly the same persons, for (yet) unknown biosemiotic reasons, and the two of us even seem to suffer from a common, specific social illness likely to breaking out at international conferences: that of hating to stand freezing in a group of 7 or 12 scholars in a road unable to decide what to do and indulging in hourlong discussions of which way to take — "now, we must wait here until the 3 others reach us from behind, we should all remain together, and we must be sure to agree what to do ... etc. and so on, and so forth". If you know the situation, you'll probably know the disease. One cure only is possible, to float out of the group tacitly, turn down a small side street and into some dark cellar where some beer is flowing. Jesper and I have been forced to choose this radical cure not a few times, and we need not exchange any words, barely any biosemiotic signs at all, in order for our coordinated exit to take place. To some extent this breakout strategy maybe has had a metaphorical parallel in politics: as Jesper broke out of his old leftist *Wahlverwandschaften* to seek a position in the centre of Danish politics, I did something analogous, probably for different reasons, but I am quite sure that Jesper's choice resulted in more personal suffering than did mine — due to the much more politicized generation to which he belongs.

In the mid-90's we tried (together with Claus Emmeche and a series of other scholars) to establish biosemiotics as an academic tradition in Denmark by applying for support to the foundation of a Center, unfortunately without success. A Danish organization for the Semiotics of Nature was founded; I believe I am still formally its accountant, but no formal activity is going on, and the (very small) fortune of the organization is dwindling away at some fiendish postal account. Surprisingly, this has not hindered Danish semiotics, and biosemiotics in particular, from developing, and I am glad to have had the opportunity of being a sort of fellow traveller on that road, having followed, at least for the last decade, Jesper's philosophical and scientific development with constant interest.

PUBLICATIONS BY JESPER HOFFMEYER

Below is a list of published texts of Jesper Hoffmeyer, which we have tried to make as complete as possible. The publication data for few translations to other languages, as well as for his early publications in the sources of restricted distribution were not all available for us. The most incomplete part concerns the publications in Danish. During many years, he has written a large number of philosophical columns to newspapers, and most of these are not included below. However, a selection of these short texts has appeared in two books in Danish (D1997, and D2001a). Although, there have been published more interviews, and many more essays and chronicles by Jesper Hoffmeyer in Danish newspapers than could be included in this list.

The list is chronological, except the works in co-authorship which appear in the end. [All quotations above refer to the publications in English; if otherwise, a letter before the year of publication refers to the language: D — Danish, E — Estonian, F — French, G — German, J — Japanese, N — Norwegian, S — Swedish.]

In Danish

Hoffmeyer, Jesper 1971. Naturvidenskaberne og den menneskelige natur. *Vindrosen* (København) 2: 47–60.

— 1972. Overlevelsespolitik — tilværelsespolitik. In: Gade-Lorentzen, O.; Henningsen, K.; Kruse, A. M. (eds.), *Socialpolitik. Socialmedicin. Socialpædagogik*. København: Hans Reitzels Forlag, 211–220.

— 1975a. *Dansen om guldkornet*. København: Gyldendal.
— 1975b. Atomkraft — økologisk set. In: Kyrø, Øjvind (ed.), *Med fremtiden som indsats*. København: Gyldendal, 94–110.
— 1975c. Mennesket i biosfæren. In: Witt-Hansen, Johannes; Sørensen, Arne (ed.), *Fremtidens verden*. København: Politikens Forlag, 100–145.
— 1975d. Visdom eller kaos. *Fælleden* 3: 15–20.
— 1975e. Vor biologiske plads. In: Damborg, Peter; Dyregaard, Helge (ed.), *Fremtiden bestemmes af menneskers handlinger*. København: Chr. Erichsens Forlag, 103–118.
— 1976. Genetisk registrering. *Naturkampen* 2: 10–14.
— 1977a. Barry Commoner: Energiens elendighed. *Nordisk Forum* 12: 107–112.
— 1977b. Gen-tænkningens sammenbrud. *Naturkampen* 6: 25–34.
— 1977c. Hjernens epigenetiske landskab — en model. In: Lunau, Ib (ed.), *En grim ælling*. Ørsted: Nucleus, 67–77.
— 1977d. *Økologiske produktivkræfter*. København: Forlaget Klods-Hans.
— 1978a. Det er energi — det er dejligt. In: Juulsgaard, Jørgen (ed.), *Kan det nu betale sig?* København: Danmarks Radio.
— 1978b. Gen-tænkningens historie. *Naturkampen* 7: 17–24.
— 1978c. Sociobiologien. *Naturkampen* 8: 22–30.
— 1979a. Efterskrift. In: Gorz, André (ed.), *Økologi og frihed*. København: Politisk Revys Forlag, 64–76.
— 1979b. En fetich falder ikke ned fra himlen. *Naturkampen* 11: 15–21.
— 1979c. Konturerne af et alternativ. *Naturkampen* 10: 23–30.
— 1980a. Biologi og ideologi. *Niche* 1/2: 122–145.
— 1980b. *Evolution. Økologi. Historie*. København: Politisk Revys Forlag.
— 1981a. Bioteknologien og den materielle produktion. *Naturkampen* 22: 40–49.
— 1981b. Energi, information og global politik. *Naturkampen* 22: 21–26.
— 1981c. Et forsvar mod neodarwinismen. *Niche* (Århus) 2: 153–174.
— 1981d. Historien og naturgrundlaget. *Den Jyske Historiker* (Århus) 21: 75–96.

— 1981e. Teknisk udvikling i et makroperspektiv. In: Knudsen, Morten (ed.), *Teknologi og samfund.* København: Teknologisk Institut, 94–101.
— 1981f. Venstrefløjen og det tekniske system. In: Beck, Strange; Eistrup, Ole; Schanz, Hans-Jørgen (eds.), *Mellem håb og forudanelse — venstre fløjen i firserne.* Århus: Modtryk, 55-68.
— 1982. *Samfundets naturhistorie.* København: Rosinante.
— 1983a. Chipsen og den dialektiske nysgerrighed. In: Green, Gunnar; Kruchov, Chresten; Moos, Lejf; Rasmussen, Jens (eds.), *Mikroteknologi, skole og opdragelse*, København: Unge Pædagoger, 197–208.
— 1983b. Dialektoriet for sans og samling. In: Warming, Per (ed.), *Fremtidens videnskab: En debatbog om Grundtvigs videnskabssyn i vor tid.* København: Samleren, 115–126.
— 1983c. Evolution og sociobiologi. In: Schroll-Fleischer, Erik (ed.), *Evolution kultur og samfund. Udviklingsteoretiske problemer i human- og samfundsvidenskaberne.* Herning: Systime, 26–49.
— 1984a. *Naturen i hovedet.* København: Rosinante.
— 1984b. Det nye naturbegreb. *Pædagogisk Orientering* 5/6: 8–16.
— 1984c. Folkeskolen og fremtidens koder. In: Nørgaard, Ellen (ed.), *Temarapport om uddannelsesforskning vedrørende Informationsteknologi og skole.* København: Udvalget vedrørende uddannelsesforskning, DLH, 221–238.
— 1984d. Naturbeherskelse. *Naturkampen* 31: 14–18.
— 1984e. Om Gregory Bateson. In: Bateson, Gregory, *Ånd og Natur.* [Translated by Harry Mortensen from Bateson: *Mind and Nature*, 1979.] København: Rosinante, 9–12.
— 1985a. Det er synd for Gud. *Naturkampen* 37: 16–18.
— 1985b. Era Lamarck til Lysenko. In: Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.), *Naturens historiefortællere Vol 1: Udviklingsideens historie fra Platon til Darwin.* København: Gads Forlag, 173–197.
— 1985c. Informationsteknologien i et historisk perspektiv. In: *Tidens stemme/ Tema: Informationssamfundet.* Gyldendal, 2–4.
— 1985d. Ligestilling og ny teknik. In: Pruzan, Vita (ed.), *Kærlighed, køn & kultur.* København: Ligestillingsrådet, 144–151.
— 1985e. Naturlig udvælgelse. *Naturkampen* 37: 11–15.
— 1985f. Naturvidenskab og humaniora. *Uddannelse* (København) 8: 476–481.

— 1985g. Tvedelingen mellem kultur og natur. In: Söderqvist, T. (ed.), *Informationssamfundet: Bidrag til forståelsen af information, individ og samfund*. Århus: Forlaget Philosophia 47–60.
— 1986a. En ny bio-kultur? In: Holdgaard, Jens (ed.), *Bioteknologi i dansk industri*. København: Industrirådet, 66–68.
— 1986b. Form og information. *Arkitekten* (København) 23: 516–518.
— 1986c. Forsvarlig handlemåde og mulighederne i moderne teknologi.. In: Sass, Hans Henrik (ed.), *Grænser?* København: LOK, 167–195.
— 1986d. Hvilken fred? — Hvilket Europa? *Fredag* (Kobenhavn) 7: 78–85.
— 1986e. Mig og Halleys komet. *Pædagogisk orientering* (København) 2: 3–6.
— 1987a. By-økologi. In: Bang, Sesse et al. (eds.), *Naturen stopper ikke ved bygrænsen, Miljøskrift nr. 4*. København: Miljøministeriet, 92–99.
— 1987b. Menneskestyret evolution. In: Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.), *Naturens historiefortællere,* Vol. 2: *Fra Darwins syntese til nutidens skrise*. København: Gads Forlag, 516-533.
— 1987c. Epilog. In: Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.), *Naturens historiefortællere,* Vol. 2: *Fra Darwins syntese til nutidens skrise*. København: Gads Forlag, 534-539.
— 1987d. Historisk naturalisme. In: Andersen, Svend (ed.), *Naturens bog*. Århus: Forlaget Anis, 145–155.
— 1987e. På plads i fosterstillingen. *Fredag* (København: Gyldendal) 11: 44–53.
— 1988a. Arv. In: Andersen, Flemming; Balslev, Carl-Jørgen (eds.), *Gyldendals bog om småbørn*. København: Gyldendal, 28–30.
— 1988b. Bioteknik kræver biokultur. *LOF nyt* (København) 4(juli): 15–20.
— 1988c. Bioteknologien i U-landeneø. *Gen-debat* (København: NOAHs Forlag) 2: 2–4.
— 1988d. DNA er ikke Gud. *Samtiden* (Oslo) 5: 2–4.
— 1988e. Etikken og grænserne for selvforvaltning. In: Jensen, Ole; Pedersen, Jørgen Lindgaard; Simonsen, H. B. (eds.), *Etik og bioteknologi*. Kobenhavn: Teknologinævnet, 33–39.
— 1989. Semiosis og liv. *Almen Semiotik* 1: 58–63.

— 1990a. Bæredygtig udvikling: Fra "teknikkens vidunder" til "kodens vidunder". *Nordisk tidsskrift for Politisk Ekonomi* (Oslo) 24.
— 1990b. Liv & kultur i omverden. *OMverden* 1: 3–4.
— 1990c. Den globale organisme. *OMverden* 3: 38–39.
— 1991a. Hjernen foreslår, bevidstheden vælger. *OMverden* 5: 11.
— 1991b. Proteiner har anstandsdamer. *OMverden* 6: 25.
— 1991c. Skæbne. *OMverden* 8: 9–10.
— 1991d. Den sidste vals. Et svar til Per Aage Brandt. *Almen Semiotik* 3: 152–157.
— 1991e. Naturen i hovedet. Nye opfattelser af det levende i informationsalderen. In: Lundgren, Lars J. (ed.), *Människan och miljøn: XXI Nordiska Historikermötet*. Umeå: Umeå Universitet, 11–26.
— 1991d. Selvet i naturen. Nye opfattelser af det levende i informationsalderen. *OMverden* 7: 22–25.
— 1992a. Det humane genomprojekt. In: *Gén-vejen. Biologien før og nu*. Det etiske råd, 85–98.
— 1992b. Det ufærdiges etik. In: *Forskning*. Undervisningsministeriet, 24.
— 1992c. Tilbage til naturen med tak for lån. In: Petersen, Knud O. (ed.), *På strejftur i tiden. Jubilæumsbog udgivet i anledning af Superfos' 100 års jubilæum*. Vedbæk: Superfos A/S, 36–41.
— 1993a. *En snegl på vejen. Betydningens naturhistorie*. København: Rosinante/Munksgaard.
— 1993b. De ikke-menneskelige subjekter. *Kritik* 104: 42–47.
— 1993c. Semiosfæren i biosfæren. *Universitetslæreren* (København) 1(Februar): 14–15.
— 1993d. Når vaner bliver til tegn. *Samvirke* 11: 42–44.
— 1994a. Naturen er ikke dum. *Uddannelse* 7: 316–320.
— 1994b. Kroppen, psyken og tegnene. *Samvirke* 10: 40–43.
— 1995a. Kroppen som fortolker af vores omverden. *Tidsskrift for sygeplejeforskning* 1: 85–89.
— 1995b. Biosemiotik. In: *Den Store Danske Encyklopædi. Danmarks Nationalleksikon. Bd. 3.* København: Gyldendal, 35.
— 1996a. Samfundsmylderets træge kreativitet. In: Bald, Søren; Cour, Peter la; Larsen, Steen Nepper (eds.), *Demokrati 40 Indlæg*. Krogerup: Krogerup Højskole, 63–67.
— 1996b. Umælende tale. *Kvinder & Køn Forskning* (København) 5(2): 96–97.

— 1996c. Max erobrer virkeligheden i sproget. In: *Glæden ved sproget. Modersmålsselskabets årbog 1996.* København: Retzels Forlag, 85–91.
— 1997. *Shorts. 40 artikler om natur, videnskab og liv.* København: Munksgaard-Rosinante.
— 2001a. *Hvorfor banker hjertet? Små rapporter fra grænsen til naturen.* København: Politiken.
— 2001b. Semiogen afstivning i naturen. In: Thellefsen, Thorkild Leo (ed.), *Tegn og Betydning: Betydningsdannelsen i filosofisk, biologisk og semiotisk perspektiv.*: Akademisk Forlag, 121–140.
— 2002. Biosemiosis som årsagsbegreb. *Kritik* vol. 155/156: 101–119.
Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.) 1985. *Naturens historiefortællere,* Vol 1: *Udviklingsideens historie fra Platon til Darwin.* København: Gads Forlag.
Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.) 1987. *Naturens historiefortællere,* Vol. 2: *Fra Darwins syntese til nutidens skrise.* København: Gads Forlag.
Bonde, Niels; Hoffmeyer, Jesper; Stangerup, Henrik (eds.) 1996. *Naturens historiefortællere Vol 1: Udviklingsideens historie fra Platon til Darwin, Vol. 2: Fra Darwins synttese til nutiden skrise.* København: Gads Forlag. [Updated edition of the volumes from 1985 and 1987].
Hoffmeyer, Jesper; Emmeche, Claus 1988. Naturen som sprog. *Hovedområdet* 18(7): 7–13.

In English

Hoffmeyer, Jesper 1968. Inhibition of growth of Salmonella typhimurium by Adenosine. *Abstract no 493, FEBS 5th Meetin*g, Prag.
— 1971. Metabolism of exogenous purine bases and nucleosides by Salmonella typhimurium. *Journal of Bacteriology* 106: 14–24.
— 1977. Energy and the need for a new socio-political homeostasis. *Proceedings of the Conference: A Case of Democratic Control of Sciences: The Nuclear Issue.* Namur: Université de Namur, 296–345.
— 1987. The constraints of nature on free will. In: Mortensen, Viggo; Sorensen, Robert C. (eds.), *Free Will and Determinism: Papers from an Interdisciplinary Research Conference.* Århus: Århus University Press, 188–200.

— 1988a. Bioinformation techniques and the view of nature. In: Thill, G.; Kemp, P. (eds.), *The Triumph of Biotechnologies: The Domestication of the Human Animal.* (Acte du Cours de l'Inter-University Centre, Dubrovnik, march 1986.) Namur: Presse Universitaires de Namur, 83–92.
— 1988b. The historical logic of domestication. In: Thill, G.; Kemp, P. (eds.), *The Triumph of Biotechnologies: The Domestication of the Human Animal.* (Acte du Cours de l'Inter-University Centre, Dubrovnik, march 1986.) Namur: Presse Universitaires de Namur, 107–115.
— 1992. Some semiotic aspects of the psycho-physical relation: The endo-exosemiotic boundary. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *The Semiotic Web 1991: Biosemiotics.* Berlin: Mouton de Gruyter, 101–123.
— 1993a. Asian perceptions of nature. *Tidsskrift Antropologi* 27: 183–184.
— 1993b. Biosemiotics and ethics. In: Witoszek, Nina; Gulbrandsen, Elizabeth (eds.), *Culture and Environment: Interdisciplinary Approaches.* (Nature and Humanities Series vol 1.) Oslo: Centre for Development and the Environment, University of Oslo, 152–175.
— 1995a. The swarming cyberspace of the body. *Cybernetics and Human Knowing* 3(1): 16–25.
— 1995b. Biosemiotics and ethics. In: Shiva, Vandana; Moser, Ingunn (eds.), *Biopolitics. A Feminist and Ecological Reader on Biotechnology.* London: Zed Books, 141–161.
— 1995c. The semiotic body-mind. In: Tasca, Norma (ed.), *Essays in Honor of Thomas A. Sebeok.* (*Cruzeiro Semiótico* 22/25). Porto, 367–383.
— 1996a. *Signs of Meaning in the Universe.* Bloomington: Indiana University Press. [A translation of Hoffmeyer D1993a, by Haveland, Barbara J.]
— 1996b. Evolutionary intentionality. In: Pessa, E.; Montesanto, A.; Penna, M. P. (eds.), *The Third European Conference on Systems Science, Rome 1.–4. Oct. 1996.* Rome: Edizioni Kappa, 699–703.
— 1997a. The global semiosphere. In: Rauch, Irmengard; Carr, Gerald F. (eds.), *Semiotics Around the World: Synthesis in Diversity. Proceedings of the Fifth Congress of the International Asso-*

ciation for Semiotic Studies. Berkeley 1994. Berlin: Mouton de Gruyter, 933–936.
— 1997b. The swarming body. In: Rauch, Irmengard; Carr, Gerald F. (eds.), *Semiotics Around the World: Synthesis in Diversity. Proceedings of the Fifth Congress of the International Association for Semiotic Studies. Berkeley 1994.* Berlin: Mouton de Gruyter, 937–940.
— 1997c. Biosemiotics: Towards a new synthesis in biology. *European Journal for Semiotic Studies* 9(2): 355–376.
— 1997d. Molecular biology and heredity: Semiotic aspects. In: Uexküll, Thure von (ed.): *Psychosomatic Medicine.* Baltimore: Urban & Schwarzenberg, 43–50.
— 1997e. Somethings or someones? *Advances. The Journal of Mind-Body Health* 13: 22–24.
— 1998a. Surfaces inside surfaces. *Cybernetics and Human Knowing* 5(1): 33–42.
— 1998b. Life: The invention of externalism. In: Farré, George L.; Oksala, Tarkko (eds.), *Emergence, Complexity, Hierarchy, Organization (Selected and edited papers from ECHO III).* Espoo: Finnish Academy of Technology, 187–196. (*Acta Polytechnica Scandinavica, Mathematics, Computing and Management in Engineering Series* 91).
— 1998c. Semiosis and biohistory: A reply. *Semiotica* 120(3/4): 455–482. (In *Semiotics in the Biosphere: Reviews and Rejoinder. Special issue of Semiotica*)
— 1998d. The unfolding semiosphere. In: Vijver, Gertrudis Van de; Salthe, Stanley; Delpos, Manuela (eds.), *Evolutionary Systems: Biological and Epistemological Perspectives on Selection and Self-Organization.* Dordrecht: Kluwer, 281–293.
— 1998e. Biosemiotics. In: Bouissac, Paul (ed.), *Encyclopedia of Semiotics.* New York: Oxford University Press, 82–84.
— 1998f. Umwelt. In: Bouissac, Paul (ed.), *Encyclopedia of Semiotics.* New York: Oxford University Press, 623–624.
— 1998g. Receptors. In: Bouissac, Paul (ed.), *Encyclopedia of Semiotics.* New York: Oxford University Press, 536–537.
— 1998h. Semiosis and living membranes. In: Santaella, Lucia (ed.), *Biossemiótica e Semiótica Cognitiva.* Sao Paulo: COS/PUC-SP, 9–19.
— 1999a. Order out of indeterminacy. *Semiotica* 127(1/4): 321–343.

— 1999b. The vague boundaries of life. In: Taborsky, Edwina (ed.), *Semiosis, Evolution, Energy: Towards a Reconceptualization of the Sign*. Aachen: Shaker Verlag, 151–169.
— 1999c. On the origin of intentional systems. In: Carr, Gerald F.; Harbert, Wayne; Zhang, Lichua (eds.), *Interdigitations: Essays for Irmengard Rauch*. New York: Peter Lang Publishing Inc., 569–578.
— 2000a. The biology of signification. *Perspectives in Biology and Medicine* 43(2): 252–268.
— 2000b. Code-duality and the epistemic cut. *Annals of the New York Academy of Sciences* 901: 175–186. [Chandler, Jerry; Vijver, Gertrudis Van de (eds.), *Closure. Emergent Organizations and their Dynamics.*]
— 2001a. Life and reference. *BioSystems* 60(1/3):123–130. [Rocha, Luis Mateus (ed.), *The Physics and Evolution of Symbols and Codes: Reflections on the Work of Howard Pattee* (special issue).]
— 2001b. The idea of a semiotic nature. In: *Proceedings of the Third Yoko Civilization International Conference*, Vol. 1. Tokyo: L. H. Yoko Publishers, 227–241.
— 2001c. Seeing virtuality in nature. *Semiotica* 134(1/4): 381–398. [Kull, Kalevi (ed.), *Jakob von Uexküll: a paradigm for biology and semiotics* (special issue).]
— 2001d. S/E > 1: A semiotic understanding of bioengineering. *Sign Systems Studies* 29(1): 277–290.
— 2002. Obituary: Thomas A. Sebeok. *Sign Systems Studies* 30(1).
Emmeche, Claus; Hoffmeyer, Jesper 1991. From language to nature: The semiotic metaphor in biology. *Semiotica* 84(1/2): 1–42.
Emmeche, Claus; Hoffmeyer, Jesper; Kull, Kalevi 2002. Editors' comment. 1*Sign Systems Studies* 30(1).
Hoffmeyer, Jesper; Emmeche, Claus 1991. Code-duality and the semiotics of nature. In: Anderson, Myrdene; Merrell, Floyd (eds.), *On Semiotic Modeling*. Berlin: Mouton de Gruyter, 117–166.
Hoffmeyer, Jesper; Emmeche, Claus (eds.) 1999. Biosemiotica II. *Semiotica* 127(1/4): 133–655.

In Estonian

Hoffmeyer, Jesper; Emmeche, Claus 1997. Topeltkodeeritus ja elusilooduse semiootika. *Akadeemia* 9(10): 2114–2148. [A translation of Hoffmeyer, Emmeche 1991, by Mikita, Valdur.]

In French

Brevet, A.; Hoffmeyer, Jesper; Roche, J.; Hedegaard, J. 1968. Sur la réversibilité de la degradation de la l-histidine en acide imidazolelactique chez differents microorganisme. *Comptes Rendus des Séances de la Société de Biologie* 162: 1054.

In German

Hoffmeyer, Jesper 1995. Molekularbiologie und Genetik in semiotischer Sicht. In: Uexküll, Thure von *et al.* (eds.), *Psychosomatische Medizin* (5. Auflage). München: Urban & Schwartzenberg, 53–62.

— 1996. Für eine semiotisch reformulierte Naturwissenschaft. *Zeitschrift für Semiotik* 18(1): 31–34.

In Japanese

Hoffmeyer, Jesper 1997. Semiotic emergence. *Revue de la Pensée d'Aujourd'hui [Contemporary Thought]* 25–7(6): 103–117.

— 1999. [*Biological Semiotics*]. Tokyo: Seido-sha. [A translation of Hoffmeyer 1996a, by Matsuno, Koichiro; Takahara, Yoshinori.]

In Norvegian

Hoffmeyer, Jesper 1977. *Flukten fra det levende*. Oslo: Pax Forlag. [A translation of Hoffmeyer D1975a.]

— 1984. Sociobiologi: Biologi basert på dårlig biologi. In: Stenseth, Nils Christian; Lie, Thore (ed.), *Evolusjonsteorien: Status i norsk forskning og samfunnsdebatt*. Oslo: Gyldendal Norsk Forlag, 241–252.

— 1994. *Livets Tegn: Betydningens naturhistorie*. Oslo: Pax Forlag. [A translation of Hoffmeyer D1993a.]

In Swedish

Hoffmeyer, Jesper 1982. Rätten till mångfald — mänsklig rättighet. In: *Bioteknik — vår sköne nya värld?* Udgivet af LO og TCO. Stockholm: Tidens Forlag, 89–95.

— 1984. *Samhällets Naturhistoria.* Stockholm: Gidlunds Förlag. [A translation of Hoffmeyer D1982.]

— 1988. *Naturen i huvudet.* Stockholm: Rabén & Sjögren. [A translation of Hoffmeyer D1984a.]

— 1989. Har naturen blivit modern? *Ord & Bild* (Göteborg) 1: 68–89.

— 1997. *Livstecken: Betydelsens naturhistorie.* Stockholm: Bonnier Alba. [A translation of Hoffmeyer D1993a.]

Interviews

Hoffmeyer, Jesper 1990. [Interview.] In: Wilken, Lisanne (ed.), *Krystalkuglen: Fremtrædende danskeres fremtidsvisioner*. Inst. for Fremtidsforskning og undervisningsministeriet, 62–67.

— 1995. Død over Darwin [interview]. In: Munck, Knud; Haar, Leif, *Menneske & teknologi. Indføring og tekstudvalg,* Gesten: OP-forlag Aps, 153–160.

Forthcoming or submitted publications
(list completed in January 2002)

Hoffmeyer, Jesper. Semiotic aspects of biology: Biosemiotics. In: Posner, Roland; Robering, Klaus; Sebeok, Thomas A. (eds.), *Semiotics. A Handbook on the Sign-Theoretic Foundations of Nature and Culture, vol. 3.* Berlin: Walter de Gruyter.

— . Origin of species by natural selection. *Athanor.*

— . A semiotic nature in a semiotic age. In: Hansen, Niels Viggo (ed.).

— . Homage á Thure von Uexküll: Biosemiotics as a unifying perspective in medicine.

— . The Central Dogma: A joke that became real. *Semiotica.*

— . Semiogenic scaffolding in nature. *Communication and Information Science Research.*

Hoffmeyer, Jesper; Emmeche, Claus. Inside the biology of signification. In: Fehr, Drude von der (ed.), *La Semiotique*.

Hoffmeyer, Jesper; Kull, Kalevi 2002. Baldwin and biosemiotics: What intelligence is for. In: Weber, Bruce; Depew, David (eds.), *Evolution and Learning: The Baldwin Effect Reconsidered.* Cambridge: MIT Press.

REFERENCES

Anderson, Myrdene; Deely, John; Krampen, Martin; Ransdell, Joseph; Sebeok, Thomas A.; Uexküll, Thure von 1984. A semiotic perspective on the sciences: Steps toward a new paradigm. *Semiotica* 52(1/2): 7–47.

Bateson, Gregory 1979. *Mind and Nature: A Necessary Unity*. London: Wildwood House.

Chebanov, Sergey V. 1998. Totality of semiosphere. *Sign Systems Studies* 26: 417–424.

Clark, Andy 1997. *Being There: Putting Brain, Body, and the World Together Again*. Cambridge: MIT Press.

Cobley, Paul (ed.) 2001. *The Routledge Companion to Semiotics and Linguistics*. London: Routledge.

Deely, John 2001. Anthroposemiotics. In: Cobley 2001: 154.

Emmeche, Claus 1990. *Det biologiske informationsbegreb*. Aarhus: Kimære.

— 1999. The Sarkar challenge to biosemiotics: Is there any information in a cell? *Semiotica* 127(1/4): 273–293.

— 2001. The emergence of signs of living feeling: Reverberations from the first Gatherings in Biosemiotics. *Sign Systems Studies* 29(1): 369–376.

Florkin, Marcel 1974. Concepts of molecular biosemiotics and of molecular evolution. *Comprehensive Biochemistry* 29A, 1–124.

Kull, Kalevi 1998. On semiosis, umwelt, and semiosphere. *Semiotica* 120(3/4): 299–310.

— 1999a. Biosemiotics in the twentieth century: A view from biology. *Semiotica* 127(1/4): 385–414.

— 1999b. On the history of joining bio with semio: F. S. Rothschild and the biosemiotic rules. *Sign Systems Studies* 27, 128–138.

Nöth, Winfried 1998. Comments on Jesper Hoffmeyer's "Semiosis and living membranes". In: Santaella, Lucia (ed.), *Biossemiótica e Semiótica Cognitiva*. Sao Paulo: COS/PUC-SP, 21–23.

— 2001. Biosemiotica. *Cybernetics and Human Knowing* 8(1/2): 157–160.

Pattee, Howard H. 1977. Dynamic and linguistic modes of complex systems. *Int. J. General Systems* 3: 259–266.

Petrilli, Susan; Ponzio, Augusto 2001. *Thomas Sebeok and the Signs of Life*. Cambridge: Icon Books.

Rothschild, Friedrich Salomon 1962. Laws of symbolic mediation in the dynamics of self and personality. *Annals of New York Academy of Sciences* 96: 774–784.

Sacks, Oliver 1984. *A Leg to Stand On*. London: Duckworth.

Sebeok, Thomas A. 1972. *Perspectives in Zoosemiotics*. The Hague: Mouton.

— 1990. *Essays in Zoosemiotics*. Toronto: Toronto Semiotic Circle.

— 1998. The Estonian connection. *Sign Systems Studies* 26: 20–38.

— 2001a. Biosemiotics: Its roots, proliferation, and prospects. *Semiotica* 134(1/4): 61–78.

— 2001b. Biosemiotics. In: Cobley 2001: 163–164.

— 2001c. *Global Semiotics*. Bloomington: Indiana Unversity Press.

Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.) 1992. *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter.

Sheets-Johnstone, Maxine 1998. Consciousness: A natural history. *Journal of Consciousness Studies* 5(3): 260–294.

Stepanov, Yurij S. 1971. *Semiotika*. Moskva: Nauka.

Stephens, James 1995 [1912]: *The Crock of Gold*. Dublin: Gill & Macmillan.

Stjernfelt, Frederik 1992. Categorical perception as a general prerequisite to the formation of signs? On the biological range of a deep semiotic problem in Hjelmslev's as well as Peirce's semiotics. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 427–454.

— 2001. A natural symphony? To what extent is Uexküll's Bedeutungslehre actual for the semiotics of our time? *Semiotica* 134(1/4): 79–102.

— 2002. Tractatus Hoffmeyerensis: Biosemiotics as expressed in 22 basic hypotheses. *Sign Systems Studies* 30(1).

Sutrop, Urmas 2001. Umwelt — word and concept: Two hundred years of semantic change. *Semiotica* 134(1/4): 447–462.

Wilden, Anthony 1980 [1972]. *System and Structure: Essays in Communication and Exchange*. 2nd ed. New York: Tavistock Publications.

Uexküll, Jakob von 1936. *Nie geschaute Welten: Die Umwelten meiner Freunde. Ein Erinnerungsbuch*. Berlin: S. Fischer Verlag.

— 1982 [1940]. The theory of meaning. *Semiotica* 42(1): 25–82.

Uexküll, Thure von 1982. Glossary. *Semiotica* 42(1): 83–87.

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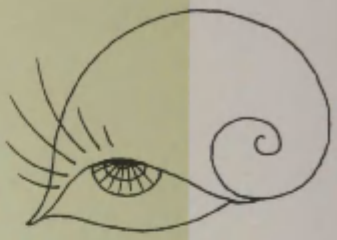

This book is about *biosemiotics* — a paradigm for both biological and semiotic thinking — as approached through the work of one of its pioneers, Jesper Hoffmeyer.

Another founder of the field, late Thomas A. Sebeok (2001c: 33) characterizes the scope of biosemiotics like this:

"The medical crafts should be seen as the ultimate cradle of — and a lengthy if tacit prologue as well as a vivid backdrop to — not merely endosemiotics but its comprehensively encompassing domain, which has become increasingly known in the last quarter of our century as biosemiotics. This embraces, according to one recent exposition (Hoffmeyer 1998e: 82), *all processes that take place in animate nature at whatever level, from the single cell to the ecosystem*, as *concerned with the sign aspects of the processes of life itself*."

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