biosemiotics
salzburg 2006

Gathering in Biosemiotics 6

6. Internationaler Kongress für Biosemiotik

5. - 9. Juli 2006

Die Wissenschaft
vom Leben
auf dem Weg
in Kultur
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ICT&S Center
Advanced Studies and Research in Information and Communication Technologies & Society
University of Salzburg

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Gathering in Biosemiotics 6

Salzburg

(Austria)

5 – 9 July 2006

Pre-Programme

Programme

and

Abstracts

bio semiotics salzburg 2006

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Center for Advanced Studies and Research in Information and Communication Technologies & Society
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in co-operation with

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Institut für Sozio-Semiotische Studien, ISSS, Vienna
Scientific Society: Dynamics – Complexity – Human Systems, Vienna

Content

Pre-Programme

Biosemiotics in Transdisciplinary Contexts

All statements of the pre-programme will be held at the

ICT&S Center

Center for Advanced Studies and Research in Information and Communication Technologies & Society
University of Salzburg
Sigmund-Haffner-Gasse 18, A-5020 Salzburg
Entrance: Max-Reinhard-Platz / Wiener Philharmonikergasse
(next to Triangel)
Tel.: +43.662.8044.4800

Tuesday, July 4, 2006

MORNING Chair: Don Favareau

09.00 – 09.15	Introduction	Wolfgang Hofkirchner
09.15 – 09.45	Talk 1	Jesper Hoffmeyer
09.45 – 10.15	Talk 2	Frantisek Baluska
10.15 – 10.45	Talk 3	Peter W. Barlow
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11.15 – 11.45	Talk 4	Randy L. Jirtle
11.45 – 12.15	Talk 5	Kalevi Kull
12.15 – 12.45	Talk 6	Guenther Witzany

AFTERNOON Chair: Wolfgang Hofkirchner

14.20 – 15.30	Talk 7	Nikolaus Bresgen
	Talk 8	Erich Hamberger
	Talk 9	Klaus Fuchs-Kittowski
15.30 – 16.00	**Coffee Break**	
16.00 – 16.30	Talk 10	Don Favareau
16.30 – 17.00	Talk 11	Albert Duschl
17.00 – 17.30	Talk 12	John Collier
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Biosemiotics in Transdisciplinary Contexts

Frantisek **BALUSKA**	Neurobiological Communication in Plants: From Molecules to Plant Synapses
Peter W. **BARLOW**/ Jaqueline **LÜCK**	L-systems and other Symbolic Means of representing morphogenetic events in plants
Nikolaus **BRESGEN**	Signal and Context
John **COLLIER**	Do Systems Biology and Biosemiotics have anything to tell each other?
Albert **DUSCHL**	Evolution and Mechanisms of Mixed Analog / Digital Information Processing in Living Cells
Don **FAVAREAU**	Animal Sensing, Acting and Knowing: Bridging the Relations Between Brains, Bodies and World
Klaus **FUCHS-KITTOWSKI**	Biosemiotics, Bioinformatics and Responsibility: Ambivalence of the Effects of the Deciphering of the Human Genome on Society and Science
Erich **HAMBERGER**	Signal - Sign - Word: Transdisciplinary Remarks on the Fieldmof Research called (Bio-)semiotics
Jesper **HOFFMEYER**	Gregory Bateson as a Precursor for Biosemiotics
Wolfgang **HOFKIRCHNER**	Introduction
Randy L. **JIRTLE**	Biological consequences of Divergent Evolution of M6P/IGF2R Imprinting
Kalevi **KULL**	Diversification: Biosemiotics Approach
Ingolf A. **SCHMID-TANNWALD**	Towards a more comprehensive Scientific Model of Man
Guenther **WITZANY**	The Agents of Genomic Creativity

Programme

All sessions will take place at the

St.Virgil conference center

Ernst-Grein-Straße 14, A-5026 Salzburg-Aigen
Tel: +43/662/65901-0 Fax: +43/662/65901-509
E-Mail: office@virgil.at

Wednesday, July 5, 2006

15:00 - 18:30 Registration at St. Virgil conference Centrum

18:45 Welcome Drink at St.Virgil and warm reception by the vice-governor of the county of Salzburg, Dr. Wilfried Haslauer - "Everyone is welcome".

Thursday, July 6, 2006

MORNING Chair: Kalevi Kull

Semantics in Biosemiotics

08.45 – 09.15	Talk 1	Stacey E. Ake: *From Semiotics to Biosemiotics: The Insurrection of Life*
09.15 – 09.45	Talk 2	Marcello Barbieri: *The Origin and Evolution of Semiosis*
09.45 – 10.15	Talk 3	Joao Queiroz/Charbel El-Hani: *Towards a Multi-level approach to the Emergence of Meaning Processes in Living Systems*
10.15 – 10.45		**Coffee Break**
10.45 – 11.15	Talk 4	Tommi Vehkavaara: *Meaning of Life*
11.15 – 11.45	Talk 5	Adam Sibinski: *'Meaning' as an Aspect of Living: What does 'Meaning' mean in Biosemiotic Perspective?*
11.45 – 12.15	Talk 6	Konrad Talmont-Kaminski: *Active Externalism and Biosemantics*

AFTERNOON Chair: Günther Witzany

Methods of Biosemiotics

14.30 – 15.00	Talk 7	Kalevi Kull: *Methods of Biosemiotics*
15.00 – 15.30	Talk 8	Sergej Chebanov: *The Current Situation in Modern Biosemiotics*
15.30 – 16.00		**Coffee Break**
16.00 – 16.30	Talk 9	Peter Harries-Jones: *Editing Biosemiotcs in 'Wikipedia'*
16.30 – 17.00	Talk 10	Helmut Löckenhoff: *Integrative Biosemiotics: A Transdisciplinary Systemic Approach*

Semiotics in Biosemiotics

17.00 – 17.30	Talk 11	Donald Favareau: *How To Make Peirce's Ideas Clear*
17.30 – 18.00	Talk 12	Cornelius Steckner: *Peirce's sop to the Cerberus and the Biosemiotic Self as the interpretant of Object and Sign – An experimental Approach*
18.00 – 18.30	Talk 13	Alfred Lang; *A-Dualistic Generative Semiotic*
20.00 – 22.00		**DISCUSSION**

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MORNING Chair: Wolfgang Hofkirchner

Applied Biosemiotics

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09.30 – 10.00	Talk 15	A. Farina, D. Morri, S. Scozzafava: *The Eco-field Hypothesis and the Human Use of Resources in Cultural Landscapes*.
10.00 – 10.30	Talk 16	Timo Maran: *Structural and Semiotic Aspects of biological Mimicry*
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11.00 – 11.30	Talk 17	Toshiyuki Nakajima: *Evolution of Life in the Global Network of Genetic Exchange: Sexuality and the Universal Genetic Code.*
11.30 – 12.00	Talk 18	Guenther Witzany: *Applied Biosemiotics: Fungal Communication*
12.00 – 12.30	Talk 19	Gèrard Battail: *Impact of Information Theory on the Fundamentals of Genetics*

AFTERNOON Chair: Tommi Vehkavaara

Biosemiotics and Information Theory

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15.00 – 15.30	Talk 21	Assen I. Dimitrov: *How Could Nature Turn into a Manufacture?*
15.30 – 16.00	Talk 22	I.Schmid-Tannwald/J.Huber: *Human Life: An "Endless Semiosis" through Different Human Sign-Systems*
16.00 – 16.30		**Coffee Break**
16.30 – 17.00	Talk 23	Paolo Manzelli: *What Means Life?*
17.00 – 17.30	Talk 24	Pierre Madl/Maricela Yip: *Biophotonics and Information, Matter and Energy – a Non-Linear World-View*
17.30 – 18.00	Talk 25	Dietmar Payrhuber: *Information Alters Matter*

19.00 - Conference Dinner (by the local organizer committee)

Everyone is Welcome

Enjoy an extraordinary music performance by Doris Kirschofer

Saturday, July 8, 2006

MORNING Chair: Jesper Hoffmeyer

Evolution, Development and Sign Functions

09.00 – 09.30	Talk 27	Eugenio Andrade: *A Semiotic Analysis of the Interface Between Evolutionary and Developmental Processes*
09.30 – 10.00	Talk 28	Marcella Faria: *Signal Transduction Codes and Cell Fate*
10.00 – 10.30	Talk 29	Randy L. Jirtle: *Nutrition, Epigenetics and Disease Susceptibility*
10.30 – 11.00		**Coffee Break**
11.00 – 11.30	Talk 30	Mario Gimona: *Protein Linguistics – A Grammar for Modular Protein Assembly?*
11.30 – 12.00	Talk 31	Yair Neumann: *The Polisemy of the Sign: A Quantum Computing Perspective*
12.00 – 12.30	Talk 32	John Pickering: *Affordances of Signs*

AFTERNOON Chair: Marcella Faria

Biosemiotics and Mind Models

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15.00 – 15.30	Talk 34	Jesper Hoffmeyer: *The Awakening of Species: Grades of Consciousness*
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16.00 – 16.30	Talk 35	Mette Miriam Rakel Böll: *The Evolution of Consciousness*
16.30 – 17.00	Talk 36	Robert Logan: *Propagating Organization and the Extended Mind Model of the Origin of Language and Culture*
17.00 – 17.30	Talk 37	Rainer E. Zimmermann: *Topological Aspects of Biosemiotics*

17.30 – 19.15 **DISCUSSION**

Titles of the Communications of the PROGRAMME

Stacey Elizabeth **AKE**, *From Semiotics to Biosemiotics: The Insurrection of Life*

Eugenio **ANDRADE**, *A Semiotic Analysis of the Interface Between evolutionary and Developmental Processes*

Argyris **ARNELLOS**, Martien **BRANDS**, Thomas **SPYROU**, John **DARZENTAS**, *A Biosemiotic Analysis of Serotonin's Complex Functionality*

Marcello **BARBIERI**, *The Origin and Evolution of Semiosis*

Gèrard **BATTAIL**, *Impact of Information Theory on the Fundamentals of Genetics*

Mette Miriam Rakel **BÖLL**, *The Evolution of Consciousness*

Sergey **CHEBANOV**, *The Current Situation in Modern Biosemiotics*

Assen I. **DIMITROV**, *How Could Nature Turn into a Manufacture?*

Marcella **FARIA**, *Signal Transduction Codes and Cell Fate*

Almo **FARINA**, Davide **MORRI**, Silvia **SCOZZAFAVA**, *The Eco-field Hypothesis and the Human Use of Resources in Cultural Landscapes*

Donald **FAVAREAU**, *How To Make Peirce's Ideas Clear*

Mario **GIMONA**, *Protein Linguistics – a Grammar for Modular Protein Assembly?*

Peter **HARRIES-JONES**, *Editing Biosemiotics in Wikipedia*

Jesper **HOFFMEYER**, *The Awakening of Species: Grades of Consciousness*

Randy L. **JIRTLE**, *Nutrition, Epigenetics and Disease Susceptibility*

Kalevi **KULL**, *Methods of Biosemiotics*

Alfred **LANG**, *A-dualistic Generative Semiotic*

Robert **LOGAN**, *Propagating Organization and the Extended Mind Model of the Origin of Language and Culture*

Hellmut **LÖCKENHOFF**, *Integrative Biosemiotics: A Trandisciplinary Systemic Approach*

Pierre **MADL**, Maricela **YIP**, *Biophotonics and Information, Matter and Energy - a Non-Linear World-View*

Paolo **MANZELLI**, *What means Life ?*

Timo **MARAN**, *Structural and Semiotic Aspects of Biological Mimicry*

Toshiyuki **NAKAJIMA,** *Evolution of life in the global network of genetic exchange: sexuality and the universal genetic code*

Yair **NEUMANN**, *The Polysemy of the Sign: A Quantum Computing Perspective*

Seán O **NUALLAIN**, *Genome and natural language; how far can the analogy be extended?*

Dietmar **PAYRHUBER**, Michael **FRASS**, Pierre **MADL**, *Information Alters Matter*

John **PICKERING**, *Affordances of Signs*

Joao **QUEIROZ**, Charbel **EL-HANI**, *Towards a multi-level approach to the Emergence of Meaning Processes in Living Systems*

Wolfgang **REITBERGER**, Christoph **OBERMAIER**, Bernd **PLODERER**, Manfred **TSCHELIGI**, *"From Ant Hills to Ambient Intelligence: Cues for Signaling, Coordination and Persuasion"*

Ingolf A. **SCHMID-TANNWALD**, Johannes **HUBER**, *Human Life: an "Endless Semiosis" through Different Human Sign-Systems*

Adam **SKIBINSKI**, *Meaning' as an Aspect of the living : What Does 'Meaning' Mean in Biosemiotic Perspective?*

Cornelius **STECKNER**, *Peirce's 'sop to the Cerberus' and the Biosemiotic Self as the Interpretant of Object and Sign - an Experimental Approach*.

Konrad **TALMONT-KAMINSKI**, *Active Externalism and Biosemantics*

Tommi **VEHKAVAARA**, *Meaning of Life*

Guenther **WITZANY**, *Applied Biosemiotics: Fungal Communication*

Maricela **YIP**, Pierre **MADL**, *The Light of Life – Biophotonics*

Rainer E. **ZIMMERMANN**, *Topological Aspects of Biosemiotics*

ABSTRACTS

of the

PRE-PROGRAMME

Neurobiological Communication In Plants: From Molecules To Plant Synapses

Frantisek Baluska
Institute of Cellular and Molecular Botany,
University of Bonn, Kirschallee 1, D-53115 Bonn, Germany;
baluska@uni-bonn.de

ABSTRACT - All principal metabolic biochemical pathways are conserved in animal and plant cells. Besides this, plants have been shown to be identical to animals from several other rather unexpected perspectives. For their reproduction, plants use identical sexual processes based on fusing sperm cells and oocytes. Next, plants attacked by pathogens develop immunity using processes and mechanisms corresponding to those operating in animals. Last but not least, both animals and plants use the same molecules and pathways to drive their circadian rhythms. Currently, owing to the critical mass of new data which has accumulated, plant science has reached a cross-roads culminating in the emergence of plant neurobiology as the most recent area of plant sciences. Plants perform complex information processing and use not only action potentials but also synaptic modes of cell-cell communication. Thus, the term 'plant neurobiology' appears to be justified. In fact, the word neuron was taken by animal neurobiologists from Greek where the original meaning of this word is vegetal fibre. Applying a 'neurobiological' perspective to illustrate how the plant tissues and the plant body are organized, several surprises emerge. Firstly, root apices are specialized not only for the uptake of nutrients but they also seem to support neuronal-like activities based on plant synapses. These synapses transport auxin via synaptic processes, suggesting that auxin is plant-specific neurotransmitter. Altogether, root apices emerge as command centres and represent the anterior pole of the plant body. In accordance with this perspective, shoot apices act as the posterior pole. They are specialized for sexual reproduction and the excretion of metabolic products via hydatodes, trichomes, and stomata. Next, vascular elements allow the rapid spread of hydraulic signals and classical action potentials, resembling nerves. As plants are capable of learning and they take decisions about their future activities according to the actual environmental conditions, it is obvious that they possess a complex apparatus for the storage and processing of information.

KEYWORDS: Communication, Plants, Neurobiology, Signaling, synapses

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Baluska F, Hlavacka A, Samaj J, Palme K, Robinson DG, Matoh T, McCurdy DW, Menzel D, Volkmann D (2002) F-actin-dependent endocytosis of cell wall pectins in meristematic root cells: insights from brefeldin A-induced compartments. Plant Physiol 130: 422-431.
Baluska F, Samaj J, Menzel D (2003) Polar transport of auxin: carrier-mediated flux across the plasma membrane or neurotransmitter-like secretion? Trends Cell Biol 13: 282-285.
Baluska F, Volkmann D, Menzel D (2005) Plant synapses: actin-based adhesion domains for cell-to-cell communication. Trends Plant Sci 10: 106-111.
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Samaj J, Read ND, Volkmann D, Menzel D, Baluska F (2005) The endocytic network in plants. Trends Cell Biol 15: 425-433.
Samaj J, Baluska F, Menzel D (2005b) Endocytosis in Plants. Springer Verlag

L-systems and other Symbolic Means of Representing Morphogenetic Events in Plants

Peter W. Barlow[1] & **Jacqueline Lück**[2]
[1]School of Biological Sciences, University of Bristol, Bristol BS8 1UG, UK
[2] Chemin du Val d'Arenc, 83330 Le Beausset, France
P.W.Barlow@bristol.ac.uk
jlck@club-internet.fr

ABSTRACT - As cells, organs and organisms grow and develop, they pass through a succession states recognized as proceeding from the two 'pillars' of living organization – metabolism and morphology. A transition from one state to another is facilitated by the perception of, and response to, some signal which is either generated from within or received from an external source.
Can development be described in symbolic form, such as via an algorithm, whose elements on the one hand have counterparts within, say, a cellular society, and on the other hand enable an observer to make retrospective inferences, and even future predictions, about cellular behaviour? L-systems offer one possible means of extracting the 'living' algorithm which is already embedded within an organism. Based on an initial set of states (w0) and a set of state transitions, L-systems have proved useful descriptors of development, especially where cellular elements are concerned. State transitions operate at the edges (or walls) of the cell, and each state may relate to some time-dependent property of an edge. In double-wall (dw) L-systems the state of one wall corresponds with the state of an adjoining wall. We shall present examples where, using dwL-systems, we have interpreted cellular autoreproduction at the generative centres of shoots and roots apices and related them to organ branching events.
A further concern is the semiotic context of 'living' algorithms. We examined the behaviour of the vascular cambium and the tissue derived from it in the context of a gradient (itself a biosemiotic signal) of a presumed chemical morphogen. The gradient provides a direction to the pathway of differentiation. From the two systems of algorithm-determined division system and morphogenic gradient was derived a structured tissue composed of different anatomical cell types and functional metabolic states.

KEYWORDS - Autoreproduction, Branching, Gradient, L-systems, Meristem

Do Systems Biology and Biosemiotics have Anything to Tell each Other?

John Collier
School of Philosophy and Ethics
University of KwaZulu-Natal, Durban 4041, South Africa
collierj@ukzn.ac.za

ABSTRACT - Biosemiotics is basically the study of signs, communication and information in living organisms, but it is also a synthetic interdisciplinary program that investigates the role of semiotics in biological function and evolution (Sharov 1992, Hoffmeyer 1997). The latter program takes semiosis to be an emergent phenomenon of living systems that contributes to and enhances functionality while both evolving and contributing to evolution. Systems Biology is a recent discipline that has developed mostly after 2000 from the study of gene and protein networks involved in cell signaling, metabolism and larger biological structures like organelles, cells, organs and organisms, etc. Robert Rosen's work (e.g., Rosen 1991) stands above most of this more recent work with its theoretical study of mechanisms and function in integrated living systems, especially his account of mathematical modeling. Currently, much of systems biology is focused on connections at the level of molecular processes to form networks, and draws heavily on genomics and proteomics. Although there is a general acceptance that reductive methods are of limited value in understanding biological systems, much of current systems biology is still primarily "bottom-up" and *synthetic*. This is in contrast to Biosemiotics, which begins with a presumably emergent phenomenon. This suggests that Biosemiotics may well be helpful in showing how systems biology can move beyond synthetic methods (which are compatible with reduction and mechanism) to models that Rosen calls *analytic*. On the other side, work in Systems Biology can help to ground Biosemiotics, and also help to establish which subsystems and aspects of systems can be understood mechanically without needing to postulate semiosis or other emergent processes. I will discuss these two issues from a theoretical perspective, with some examples.

KEYWORDS - Autonomy, Anticipation, Functionality, Mechanism, Nonreducibility

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Evolution and Mechanisms of Mixed Analog / Digital Information Processing in Living Cells

Albert Duschl
University of Salzburg, Department of Molecular Biology
Hellbrunner Str. 34, 5020 Salzburg, Austria
albert.duschl@sbg.ac.at

ABSTRACT - Cells and organisms can be seen as biological computers, who receive information, process them, and initiate reactions according to the results. Darwinian selection has rewarded the development of suitable input systems (e.g. receptors, sensory organs) and reaction facilities (e.g. enzymes, organs), but the information processing has equally been the subject to intense evolutionary pressure. Living organisms are descendents of earlier life forms who, quite literally, were able to "make sense" of their environment.

In multicellular organisms, relevant information from the environment concern extrinsic forces, like presence of nutrients, toxins, or light, as well as information derived from other cells, which are necessary for the integrated activity of the body as a whole. The analysis of signal transduction mechanisms used within cells allows to deduce which factors have supported survival in the past. Speculations about why some mechanisms exist, and even more interestingly, why seemingly practical mechanisms are not used, can shed light on the biological evolution of information processing.

One key problem for cellular biocomputing is an inherent dichotomy of life: Many processes in life are analog and require analog computing, but nevertheless there are digital decisions in life as well. In particular, many analog signaling mechanisms are feeding into decision making facilities which lead to digital responses. Examples for such interactions between analog and digital information processing mechanisms within living cells will be discussed.

KEYWORDS - Evolution, Signal transduction, Analog computing, Digital computing

Animal Sensing, Acting and Knowing: Bridging the Relations Between Brains, Bodies and World

Donald Favareau
University Scholars Programme
National University of Singapore
favareau@gmail.com

ABSTRACT - If "semiosis" is thought to be essentially the mind-dependant, human achievement accomplished through the act of "thought," then certainly an undertaking calling itself "biosemiotics" will not be able to tell us anything scientifically verifiable whatsoever about animals, cells, brains, or biological systems *per se*. This, then, is one of the first possible misconceptions that one has to clear away when beginning to speak about biosemiotics to an audience unfamiliar with its premises: "semiosis" in its first instance and definitional essence is *not* about "thought" but about "relations" – and, in particular, about those relations that *must* obtain between an organism and its sensations of, and actions upon, the world in which it is embedded and in which it must survive. In this talk, I will introduce the Peircean hierarchy of *iconic, indexical and symbolic* relations underlying the abilities of animals to detect, categorize, and act appropriately upon the world (and, in at least one possibly unique case, which is our own, to reason about such phenomena itself through the semiotic prosthesis that is language). I will then discuss how one of the main streams in the biosemiotic project applies such an analysis to the study of animal perceptual worlds, and offer my own proposal regarding how these same conceptual tools may help us more precisely delineate how such a knowledge-generating hierarchy of sign relations may be physically instantiated in the complex dynamic network of sign-processing interaction taking place in the human brain.

KEYWORDS – Icon, Index, Symbol, Peirce, Brains.

Biosemiotics, Bioinformatics and Responsibility. Ambivalence of the Effects of the Deciphering of the Human Genome on Society and Science

Klaus Fuchs-Kittowski

The deciphering of the Human Genome is one of the greatest achievements of modern science in our days. The genetic code shows, however, the importance of semiosis in evolution. Biosemiotics as the study of signs, communication and information in living organisms has very much in common with bioinformatics, in particular, also the responsibility for the ambivalent effects of their results on science and society.

In ten theses, the scientific and social challenges and the ethical problems are discussed. First important epistemological and methodological problems of modern biology: the limits of Laplace´s Demon and whether or not there is a genetic determinism. Scientific and social challenges arise with tailored medicaments, the high costs of the new medicine and the handling of genetic data. Decisive ethical questions are, for instance, whether the fertilised egg has the right to human dignity? Should the preimplantation diagnostic remain totally forbidden in the German society, while after consulting abortion of a twelve-week old foetus is allowed? Which genetically engineered interventions make sense from the viewpoint of medicine, and which should be fundamentally rejected? Further more, we discuss the possibility that the human genome project and the considerations accompanying it may initiate new varieties of eugenics and racism.

The reduction of man and the living organism on the computer – as syntactical information processor – becomes a deciding methodological and ethical problem too.
Living systems have a dissipative structure, they exist far from equilibrium, manifesting organization insofar they can incoporate free energy and unload degraded by-product. Living systems are semiotic systems: they respond to their surroundings in selective ways specified by there own organization. Living systems, as organized (functional) systems are processing information, but as self-organizing (actional) systems they have also the creative power to generate new structures and functions and thus new properties, new signs and meanings, new information during their evolution.

Genetic Information is not to identify with the DNA-structure, its syntactic carrier. By the unreflected view of ontogenesis the ontogenetic process is seen as fully determined by the genome, there is only an information transformation from the genome to the adult organism. From a semiotic view of ontogenesis, the genome is seen as a set of signs, to be interpreted by the different, interacting structures. It is well known that semiotics has since long called for the semantic or pragmatic aspects of information to be taken into account. and not only the syntactic, because the computer is merely a bit-processing machine. Information should not be identified with a structure which is already existing, i.e. genetic information not with DNA structure. Its explicit and implicit semantic content becomes evident only by interacting with further structures. To leave the role of the concrete cells and tissues out of our understanding of development process, not to see processes of information generation in the ontogenetic process is a very common position. A semiotic view of information is a prerequisite for an understanding of the process of information generation in the process of self-organization of living systems.

Signal - Sign - Word

Transdisciplinary Remarks on the Field Of Research called (Bio-) semiotics

Erich Hamberger
University of Salzburg, Department of Communication Science
Rudolfskai 42, A-5020 Salzburg
erich.hamberger@sbg.ac.at

ABSTRACT - Cognition is always cognition of relation(s). Against this background, I focus on semiotics - especially *bio*semiotics - from a *relational* point of view. The initial point of the considerations are the related terms *signal, sign* and *word.*
All three items stand – similarly – as "word-*signs*", verbal expressions for communication-/information *process* phenomena, described as *transduction*, *transmission*, *signaling*; the special meaning depends on the different context, in which they are used.

According to this fact *bio*semiotics – as a specific cognition concept in life sciences – should be shown by relating it to a mechanistic impact of signal transduction on the one hand and human communication - as a high complex form of (word-) interaction, which is based not only on the ability to speak, to use symbols and to tell messages but to *have* the word - on the other hand.
The transdisciplinary remarks should help to look for the range as well as the limits of the field of research called bio-semiotics.

KEYWORDS - Cognition, Human Communication, Signal, Sign, Word, Biosemiotics, Epigenetics, Transdisciplinarity.

Gregory Bateson as a Precursor for Biosemiotics

Jesper Hoffmeyer
University of Copenhagen
Department of Biological Chemistry
Solvgade 83 H, 1307 Kobenhavn K, Denmark
jhoffmeyer@mail.dk

ABSTRACT -Gregory Bateson's ideas hit a strange blind spot in western thinking. On the one hand, we have a scientific approach to the study of life that takes for granted that natural laws exhaustively explain all of reality. On the other hand, we have a humanistic approach to which human intentionality, conscience or "first person experiences" remain central and which maintains that the core of these phenomena evades description in terms of natural laws. Thinkers of the latter opinion often take the poverty of the scientific world view vis a vis these aspects of the world to imply that a religious or spiritual position is necessary. Conversely, and symmetrically, adherents of the scientific world view routinely suspects religious or spiritual motives behind any criticism of the scientific world view.
None of these mainstream views seems much inclined to consider that a third possibility exists, a position that sees human mind as a particular instantiation of a nature that is in a deep sense itself minded. A view, in other words, which holds that neither human mind nor nature at large is reducible to deterministic natural laws. According to this third position, the position taken by Bateson and before him by Charles S. Peirce - let us term it the bioanthropological position - nature is not the mindless kind of thing the natural sciences have stubbornly tried to reduce it to and there is therefore no reason why human mind should not be seen as a naturalistic phenomenon in no particular need of religious or spiritual explanation. The paper will discuss this bioanthropological position as an important precursor for biosemiotics

KEYWORDS - Gregory Bateson, Semiotic causation, Semiosphere, Interpretance, Mind

Biological Consequences of Divergent Evolution of M6P/IGF2R Imprinting

Randy L. Jirtle
Duke University Medical Center
Department of Radiation Oncology, Durham, NC
jirtle@radonc.duke.edu

ABSTRACT - The M6P/IGF2R (Mannose 6-Phosphate/Insulin-like Growth Factor 2 Receptor) encodes for a 275 kDa monomeric multifunctional transmembrane binding receptor that lacks intrinsic tyrosine kinase activity. Thus, the mitogenic effects of IGF2 are mediated through the IGF1R and the insulin receptor isoform A, not the M6P/IGF2R. High affinity binding sites for phosphomannosyl glycoproteins, IGF2 and retinoic acid, and independent lower affinity binding sites for plasminogen and uPAR (urokinase-type plasminogen activator receptor) are contained in the large extracellular portion of the M6P/IGF2R [1]. Consequently, this multifunctional tumor suppressor affects normal growth and development by trafficking lysosomal enzymes from the trans-Golgi network to the lysosomes, regulating the extracellular bioavailability of growth factors such as TGFß and IGF2, and facilitating neurotransmitter release [1].

The M6P/IGF2R is also imprinted with preferential suppression of the paternal allele occurring about 180 million years ago in a common ancestor to marsupials and eutherian mammals [2]. Thus, imprinting at this locus evolved in mammals with the advent of viviparity. We have now shown that the opossum M6P/IGF2R is imprinted not only in peripheral tissues, but also in the brain. In contrast, the M6P/IGF2R is biallelically expressed in the brains of eutherian mammals such as mice and humans, an effect that appears to be neuron-specific [3]. In the Euarchonta clade of mammals which includes humans, M6P/IGF2R imprinting is also lost in peripheral tissues [4].

In this study, we used the M6p/Igf2r floxed mouse that we produced [5] to determine if monoallelic expression of M6p/Igf2r in the brain affects cognitive ability. We demonstrated that M6p/Igf2r haploin sufficiency results in a male-specific impairment in cognitive function as measured with an eight-arm radial maze win-shift task. Moreover, inheritance of a nonsynonymous polymorphism in the human M6P/IGF2R that reduces the ability of the receptor to bind IGF2 is also strongly associated with reduced IQ in males, but not in females. These findings suggest the intriguing possibility that M6p/Igf2r loss of imprinting in the brain of an ancestor common to eutherians may have provided early placental mammals with a cognitive edge. (Supported by NIH grants CA25951, ES08823 and ES13053)

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Diversification: Biosemiotic Approach

Kalevi Kull
University of Tartu, Department of Semiotics,
Tiigi Str. 78, 50410 Tartu, Estonia
kalevi@ut.ee

ABSTRACT

0. Semiotics can be defined as the study of qualitative diversity.

1. Biosemiotic studies of some examples of diversification (biological speciation on the basis of the recognition concept of species; Baldwinian specialization; somatic differentiation; immunological learning) have given a useful framework for understanding and description of the analogous phenomena in many semiotic systems.

2. Biological species, like any communicative category or identity, is not, strictly speaking, physically real. However, biological species as self-defining communicative identities are semiotically real, whereas they are different from higher-level biological taxa (genera, families, orders, classes, phyla, kingdoms) which are not self-defining. Thus, diversity of communicative identities, and its dynamics – divergence and fusion of identities – comprises a typical semiotic (and particularly biosemiotic) problem.

3. Large variety of semiotic selves, or communicative identities, or categories, can be seen as behaving in analogous ways due to their similar semiotic nature: these include, for instance, biological species, social groups, perceptual categories, etc. Consequently, it will also be reasonable to apply the same or similar models for description of dynamics of all these communicative identities. Such general models include, particularly, allopatric and sympatric categorisation, coexistence of categories, fusion of categories, distinction between self and other. Similarity of the phenomena also includes two basic forms of diversification – evolutionary (diachronic, vertical) and ecological (synchronic, horizontal).

4. Categorization requires space – the communicative substrate – provided either by populations, or brain tissue, or society, etc.

5. Since, for instance, (a) making distinctions, and (b) speciation, are based on the analogous mechanism, it provides us a possibility to make use of understanding of some biological phenomena for further re-interpretation of several psychical, social, and cultural phenomena – and vice versa.

KEYWORDS - Biodiversity, Speciation, Differentiation, Categorization

Towards a more Comprehensive Scientific Model of Man

Ingolf A. Schmid- Tannwald

Faculty of Medicine. Ludwig- Maximilians- University Munich – Hospital for Women, Großhadern. Marchioninistr. 15, 81377 Munich, Germany

ingolf.schmid-tannwald@med.uni-muenchen.de

ABSTRACT - The biological *and* social uniqueness of every human being, its capacity to produce unique biological *and* to constitute individual as well as micro- and macro-social realities and to hand them down, discerns human beings and animals (plants).
In order to describe these qualities of human life, a more comprehensive scientific model of man is needed, than a mere biological one. At least biological, social and psychological realities (aspects) have to be integrated.
Different scientific realities, however, are enclosed in special languages (sign-systems, codes) that are separated by language boundaries. In order to overcome them and to succeed in describing exemplarily the diversity of the phenomenon "life" and the interdependence of its different realities (we can realize in real-time), the sign-systems have to be brought down to a common denominator (meta-language).

Adopting semiotics and systems theory, the model of man presented here is hierarchically structured. On different levels it contains biological, psychological and social realities of importance for the living body. The subsystems are linked by horizontal and vertical sign- processes, whereas physical signals ("perturbations") originating in the surroundings are interpreted by means of circular sign-processes.

> The constitution of interpersonal realities by relations work in everyday life ("Lebenswelt"), i.e. the adaptation of the individual codes by intensive communicative processes, is represented exemplarily by the interconnection of circular sign-processes ("Situationskreise") of two different systems. Thus a hetero-sexual supra-system comes into existence with new qualities, e.g. the capacity to produce bio-psycho-social offspring.

This model of man methodologically stands open for the integration of further scientific subsystems and might influence the handling of human life, e.g. of the human embryo in medical or juridical science and practice.

KEYWORDS - Scientific model, Man, Interpersonal reality, Semiotics, Systems theory

The Agents of Genomic Creativity

Günther Witzany
telos - Philosophische Praxis
Vogelsangstr. 18c, A-5111-Buermoos
witzany@sbg.at

ABSTRACT - When we read the vocabulary of modern molecular biology, genetics and genomics, we may have the impression of being in a special seminar on current biosemiotics or biolinguistics. We speak about:

- *Protein-enzymes induced sequence editing* and use terms like replication, recombination, transcription, translation, splicing and self-splicing, RNA-editing, transfer sequences and the involved sequence editing tools such as numerous recombinases**,** endonucleases**,** exonucleases**,** polymerases**,** reductases**,** synthases;

- *Non-coding higher-order regulatory functions* found in formerly (misinterpreted) "junk"-DNA and use terms like: chromatin formating**,** histone modification**,** repetitive elements such as long terminal repeats**,** short interspersed elements**,** long interspersed elements**;**

- *Non-coding higher-order regulatory tools: microRNAs* which are competent in cosuppression, suppression of transposition, position effect variegation, start-stop signals, RNA interference, imprinting, chromosomal methylation, transvection**,** transcriptional and post-transcriptional gene silencing.

Contrary to the mechanistic neo-Darwinian paradigm of the 20th century, with its assumption that the evolution of these elements was the result of (chance) mutations and selection, new reports suggest that agents with genome-editing competences have existed since the very beginning of life. Few examples will demonstrate their enormous genomic creativity.

KEYWORDS - Natural genome-editing: Techniques, Tools, Origin

ABSTRACTS

of the

PROGRAMME

From Semiotics to Biosemiotics: The Insurrection of Life

Stacey Elizabeth Ake
Department of English and Philosophy
5044 MacAlister Hall, Drexel University
Philadelphia, PA 19104 USA
sea29@drexel.edu

ABSTRACT - A sign is something which stands for another thing to a mind. To its existence as such three things are requisite. On the first place, it must have characters which shall enable us to distinguish it from other objects. In the second place, it must be affected in some way by the object which it signified or at least something about it must vary as a consequence of a real causation with some variation of its object. *1873 - MS 380 - Of logic as a study of signs, Charles Sanders Peirce.*

The above quote is one conception of the role that a sign plays in causation. For Peirce, this was not a mere heuristic of how this system of signification functioned. Rather, for Peirce, his theory of semiotics was actually a presentation of how such signs worked in their environments. From this idea, I would like to elucidate a theory of how that which we consider lifeless may have evolved into that which we call "alive".

While such an undertaking seems far-fetched, it is one that biologists, among others, encounter all the time. The most classic example is that of a virus, which outside a biological and living environment is essentially lifeless and dead.

But each movement of "switching on" also changes the parameters from the original state to a novel state. This change can be so drastic as to alter completely the actual possibilities of future semiotic interactions. This alteration of "initial states" is a process concomitant with semiosis and, as a biological process, plays a role in evolution. Thus, I would like to outline what I think are the steps in this process which blends continuity and discontinuity into an integral and functional whole.

KEYWORDS **-** Continuity, Discontinuity, Life, Evolution, Biology

A Semiotic Analysis of the Interface between Evolutionary and Developmental Processes

Eugenio Andrade
Universidad Nacional de Colombia, Department of Biology
Bogotá, D.C. Colombia
leandradep@unal.edu.co

ABSTRACT - It is argued that a new evolutionary synthesis must integrate developmental and behavioral biology with genetics and molecular biology. However, mainstream researchers committed to the idea that evolutionary variations are reduced to prior random genetic mutations and on the other hand, that the environment plays a deterministic role, ignore empirical observations and experimental data that are interpreted by means of dynamical models like Waddington's epigenetic landscapes, Kaneko's interaction-induced phenotype differentiation and Newman's environmental induction of shapes. These three models share the idea that epigenetic mechanisms are the generative causal agents of living forms and that genetic modifications may get fixed after a combination of environmental, behavioral and developmental changes have taken place. Developmental System Theory (DST) and Evolutionary Developmental Biology (EDB) rightly address these problems by attempting to bridge the gap between the modifications of individual behavior and development in interaction with environmental factors at local scale, with branching evolution of populations and species at a global scale.

The accomplishment of this task will make evident general characteristics of the existent, such as the continuity manifested in Peirce's semiotic architecture that recognizes an internal reality in both local and non-local domains in contrast with classical ontology that limits itself to externalities. In this paper the idea of continuum as it is expressed in Peirce's six modes or relations, (*Firstness as Firstness*, *Secondness as Secondness*, *Secondness as Firstness*, *Thirdness as Firstness*, *Thirdness as Secondness* and *Thirdness as Thirdness*), will be explained and applied to a conceptualization of living beings as Evolving Developing Agents (EDA). The material constitution and physical organization of these agents is found at the interface between internal/external, local/non-local, present/past domains. As EDAs are permanently linked to *Thirdness*, they make choices in order to cope with environmental uncertainties. These choices make real latent propensities, condition their future states and open up new potentialities.

KEYWORDS - Evolution, Development, Agency, Peirce, Darwin.

A Biosemiotic Analysis of Serotonin's Complex Functionality

Argyris Arnellos[1], **Martien Brands**[2], **Thomas Spyrou**[1], **John Darzentas**[1]
[1]University of Aegean
Department of Product and Systems Design Engineering
84100, Syros, Greece
{arar, tsp, idarz}@aegean.gr
[2]University of Liverpool, Division of Primary Care
mbrands@planet.nl, brands@liverpool.ac.uk

ABSTRACT - Part of the adaptation capability and evolution of living systems includes the importance of individual history and of the relevant phenomena that condition the behaviour of cells and organisms. Such complex processes and their relevant properties lead to the development of complex memory structures which are informed so as to prepare the organism for a future confrontation with the same or similar stimulus. Serotonin (5-HT) is one key neurotransmitter which engages in such complex self-organizing processes and it functions both in the nervous and in the immune system. Specifically, the presynaptic cell releases serotonin through secretion and it is then reabsorbed by the postsynaptic cell through a specific 5-HT receptor by activation of adenyl cyclase activity. This production is regulated by a negative feedback of the serotonin on the presynaptic cell release activity. Similarly, the 'immune synapse' is the context in which the interaction between serotonin and dendritic cells occurs in immune response. Dendritic cells are maturated by sequestration and thereafter secretion of serotonin, which then in its turn informs naive T-lymphocytes to proliferate into activated T memory cells. So far, due to a purely mechanistic treatment of the respective functionality, the informative capacity of serotonin has not been verified and the respective consequences cannot be identified. The central question is "Whether *serotonin is a mediator"*. To better understand this complex functionality and to identify the main agents involved as well as the representational processes that these agents are engaged in, a biosemiotic analysis of serotonin's interactions is attempted. Specifically, the recent work of (Queiroz and El-Hani, in press) regarding the emergence of semiosis in complex semiotic systems will be used in order to develop a semiotic analysis of the mechanisms and the functionality arising in aspects of adaptation and sensitivity regarding the formation of T-cell memory and the serotonin neuronal feedback mechanisms. We believe that such an analysis would provide us with better insights regarding inquiries such as whether there is specific information in T-cells through serotonin and could these meaning processes be influenced by specific serially diluted and agitated (SDA) forms of substances (such as used in homeopathic medicines) and on which property (degree of specificity or magnitude) does the effect of recognition and interpretation of the biological signal depend on.

KEYWORDS - Serotonin, Information, Representational processes, Peircean semiotics, Self-organization.

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The Origin and Evolution of Semiosis

Marcello Barbieri
Dipartimento di Morfologia ed Embriologia
Via Fossato di Mortara 64, 44100 Ferrara, Italy
brr@unife.it

ABSTRACT - Semiotics, literally, is the study of signs and initially it was thought to be concerned only with the products of culture. Mental phenomena, however, exist also in animals, and cultural semiotics came to be regarded as a special case of biological semiotics, or *biosemiotics*, a science that started by studying semiotic phenomena in animals and then it was gradually extended to other living creatures. Eventually, the discovery of the genetic code suggested that the cell itself has a semiotic structure and the goal of biosemiotics became the idea that all living creatures are semiotic systems. But what is a semiotic system? Today the answers to this question are still provided by the two classical models of cultural semiotics. The model proposed by Saussure, who defined a semiotic system as a duality of "signifier and signified", or "sign and meaning", and the model of Peirce, who pointed out that interpretation is an essential component of semiosis and defined a semiotic system as a trinity of "sign, meaning and interpretant". In 1974 Marcel Florkin argued that "signifier and signified" are equivalent to "genotype and phenotype" and proposed for biosemiotics the dualistic model of Saussure. Thomas Sebeok, on the other hand, underlined that there can be no semiosis without interpretation and adopted the triadic scheme of Peirce first in zoosemiotics, in 1963, and then in the more general field of biosemiotics. A third possibility, however, does exist and was suggested by the theory that the cell is a trinity of genotype, phenotype and ribotype (Barbieri, 1981), where the ribotype is the ribonucleoprotein system of the cell and represents its "codemaker", i.e. the seat of the genetic code. This amounts to saying that the cell contains a "codemaker" but not an "interpreter", because the genetic code does not depend on interpretation. The simplest semiotic system, in other words, is a trinity made of "sign, meaning and code". According to this model, the first semiotic structure that appeared in the history of life was the apparatus of protein synthesis, and the genetic code was the first code, but not the only one. The evolution of semiosis was essentially due to the appearance of other organic codes, especially in eukaryotic cells, and it was these new codes that increased the complexity of the eukaryotes and eventually allowed them to produce semiotic systems capable of interpretation, i.e. *hermeneutic* systems. The model of Peirce and Sebeok, therefore, is still valid but only for hermeneutic systems. The origin of semiosis (the *semiotic threshold*) and the origin of interpretation (the *hermeneutic threshold*) were separated by an extremely long period of evolution, because interpretation is dependent on context, memory and learning, and probably evolved only in multicellular systems. The history of semiosis, in short, was a process that started with context-free codes and produced codes that were more and more context-dependent. Today, our cultural codes are so heavily dependent on context that we can hardly imagine semiosis without interpretation, and yet these are distinct processes and we need to keep them apart if we want to understand their origin and their evolution in the history of life.

KEYWORDS – Semiosis, Sign, Meaning, Codes, Codemakers, Interpretation.

Impact of Information Theory on the Fundamentals of Genetics

Gérard Battail
Ecole nationale superieure des Telecommunications, Paris (retired)
"La Chanatte", Le Guimand, F-26120 Chabeuil, France
gbattail@club-internet.fr

ABSTRACT - Using information-theoretic arguments, we have shown at the 5-th Biosemiotics Gathering that the current paradigm of DNA replication by template copying cannot explain the faithful transmission of genomic information through the ages. It relies indeed on the wrong implicit assumption that conservation is the rule and error, the exception. A model where genomes possess an intrinsic error-correcting ability must be substituted for it. Then genome conservation results from a dynamic process. Assuming this model to hold, information theory then explains many features of the living world and its evolution. The present paper is intended to further investigate implications of this model. A genome can be regenerated only if the cumulated number of errors to be corrected is small enough hence after a short enough time interval, or else it quickly tends to a random sequence of nucleotides. Conservation of a genome thus depends on its error-correcting ability on the one hand, and on the time interval between regenerations on the other hand. These factors are presumably independent so their matching can only result from natural selection. We look at consequences of their possible mismatch suggesting, e.g., that the Cambrian explosion could be explained by too long an interval between regenerations. As regards sexually reproducing animals one may plausibly assume that genome regenerations occur during meiosis. Then some inner clock determines the interval between them. Genome conservation thus implies successive generations, a trivial biological fact. But other mechanisms may be contemplated, e.g., the recent finding in Arabidopsis thaliana of 'non-Mendelian inheritance' [1] could be explained by assuming that, in this species and probably in other plants, the regeneration process is sporadically triggered by some external factor. We also examine consequences of our assumption that several genomic codes appeared successively in time, making up a nested system which conserves an information the better, the older it is.

KEYWORDS - Genome Conservation, Genomic error-correcting Codes, Nested codes, Time interval between regenerations.

The Evolution of Consciousness

Mette Miriam Rakel Böll
University of Copenhagen, Biosemiotic Group
Copenhagen, Denmark
www.industrialethology.com

ABSTRACT - *Canis lupus familiaris* and *Homo sapiens* have co-evolved for approximately 40.000 years. By studying the social behavior of one of these species, we gain knowledge of the other – this works both ways. Departing from my investigations of distributions of feelings in complex social systems in nature, I address the question of consciousness in a similar type of natural setting: the common cultural habitat of man and dog.
In the biosemiotic approach to the evolution of consciousness, c. is a graduated phenomenon widespread in nature. As the shared conscious context generated by man and dog largely depends upon authenticity in the behavioral expressions of both species, "authentic behavior" will be a main focus in my talk.

KEYWORDS - Authentic behavior, Co-evolution of man and dog, Distribution of consciousness.

The Current Situation in Modern Biosemiotics

Sergej Chebanov
Institute of Evolutionary Physiology, St. Petersburg, Russia
chebanov@iephb.nw.ru

ABSTRACT

Rough development of biosemiotics last fifteen years have resulted in washing out of its subject. There are some reasons of such situation:

- Existence different sources of biosemiotics: F. S. Rothschild treats "biosemiotics" as psychiatrist, Ju. S. Stepanov - as semiotician and linguist, Th. Sebeok enters "zoosemiotics" as semiotician; Lotman and Hoffmeyer enter "semiosphere" in different senses.

- The study of a history and prehistory of biosemiotics does not allow unequivocally to draw borders of biosemiotics (it is impossible to answer a question concern or do not concern G. Gamov's or F. Crick's works to biosemiotics, though without their contribution it is impossible to realize modern biosemiotics; debatable questions is one about the relation to biosemiotics the J. von Uexkull's doctrine of Umwelt).

- Some branches of biosemiotics develop as closed areas (endosemiotics are crossed with study of animals' behaviour very seldom).

- Variety of understanding of a subject of semiotics and plurality of its versions (opposition the uni- and bilateralist conception of sign, Peirsian and Saussurian semiotics).

- Humanitarization of a science determining loss of distinction anthropomorphic and not-anthropomorphic ideas (cf. B. Carter's anthropic principle). This circumstance is important especially in the attitude to biosemiotics, because human being is object of study in biosemiotics.

- Development of semiotics of biology as study of semiotic means used in professional activity of the biologists.

- The interest of the ethnographers, anthropologists, linguists etc., and some leaders of "green" movement to semiotics of ideas about plants and animal in different cultures produces a huge flow of the literature which is difficult for separating from biosemiotics and semiotics of biology.

That in these circumstances biosemiotics would keep institutional definiteness, the systematic discussion of structure of biosemiotics as independent branch of knowledge is necessary.

How could Nature turn into a Manufacture?

Assen I. Dimitrov
Institute of Philosophical Research
Bulgarian Academy of Sciences
6, Partiarch Evtimii Blvd. Sofia, 1000, Bulgaria
assendimitrov@yahoo.com

ABSTRACT

I. Propensities and Communication

Consider the difference between the collision of billiard balls and the movements of dancing partners. While the first is an interaction based on the exercise of physical force, the second is a typical manifestation of communicating agents. The dancers never collide, or if they do, it is due to a regrettable failure of their balance. They scarcely interact physically between themselves. They communicate. In other words, they manifest their propensities[1]. Propensities are above all displayed; whereupon they compete, synchronize and reinforce, complement themselves during communication.

II. It will be argued that:

1. Propensities are emergent properties. They emerge within a physical environment, with its characteristic structures and forces, but are irreducible to them.

2. Communication brings life into propensities and they, in turn, turn into the proper subjects of the communication.

3. Propensities are accountable for the distinguishing features of the communication process, e.g. the application of codes.

4. Finally, it will be considered how was it possible for nature to turn into a manufacture?

KEYWORDS - Communication, Propensities, Codes, Manufacture

The involved chains of chemical reactions are hardly relevant to the germane life's dynamics. What do have to be disclosed are the primitive propensities that drive them: the primitive propensities that composed the first live modules; as well as these that underlie present-day cell biochemistry.

[1] In Popper's sense

Signal Transduction Codes and Cell Fate

Marcella Faria
Universidade de São Paulo,
Departamento de Bioquímica, Instituto de Química
Caixa Postal 26077, São Paulo 05513-970, São Paulo, Brazi.
Marcella@iq.usp.br

ABSTRACT - The categorical framework (Körner, 1984) consisting of CELL/SELF/SENSE has been previously proposed (Faria, 2006) as an attempt to classify the levels of organization adopted by living systems. Our working hypothesis is that these categories reflect: (i) an improved comprehension of self-organization and the convergent gain of complexity that are crucial traits of biological systems, (ii) the possibility of a research agenda, which aims the identification of organic codes at the transitions between levels. In our initial works we have investigated the contextual meaning of dsRNAs in each category to illustrate a broader phenomenon: the acquisition of organic codes by a combination of the two processes that play a role in evolution, natural selection and natural convention (Barbieri, 2003). In the present work we shall use the CELL/SELF/SENSE levels to analyze the progressive complexity of cell fate control and how it is related switches in signal transduction codes.

In metabolism, cell cycle, differentiation, neuronal and immune function the circuitry operating at cell level will proceed by the creation of conventional links between otherwise separated physiological activities, *i.e.* changes in environment composition are progressively coupled to: transcription patterns; transcription and replication patterns; transcription, replication and developmental migration patterns; transcription, replication, developmental and functional migration patterns.
The mediators of signal transduction, the classic second messengers, do not seem to be altered: Calcium, cAMP, Nitric Oxide, phosphorylation cascades, etc. Nevertheless the way they are integrated, the consequences they trigger, change from level to level. We will show that increasing complexity in cell fate controls seems to rely on this progressive coupling of physiological processes by the selection of conventional codes. The notion of physical attractors and its relation to cell fates and states will be introduced to articulate the role of classical signal transduction modes in the making of alternative organic codes. The modular nature of biological tinkering will also be discussed to articulate some molecular evidences of code making.

KEYWORDS – Signal transduction, Cell cycle, Organic codes, Natural conventions, Biosemiotics.

The Eco-Field Hypothesis and the Human Use of Resources In Cultural Landscapes

Almo Farina, Davide Morri, Silvia Scozzafava
University of Urbino, Institute of Biomathematics
Campus Scientifico "Sogesta", loc. Crocicchia
farina@uniurb.it

ABSTRACT - The traditional study of ecological complexity using an ecosystemic approach suffers from a systematic lack of connection between information and meaning. The eco-field, defined as a spatial configuration that is a carrier of meaning identified in the surrounding environment by organisms during the performance of a specific vital function, seems to be an appropriate paradigm to fill such an epistemological gap.
According to the Peirce's sign convention, the eco-field can be considered as the representamen by which certain functions (the interpretant) are in correspondence with the resources (the objects). In such a way the eco-field becomes the intermediary that is necessary to intercept resources heterogeneously distributed in time and space. All the eco-fields related to the functions performed by an individual species become the perceived landscape.
The eco-field hypothesis shifts the vision of the landscape from a species-invariant component of the environment to a dynamic function-specific perceived context. This approach allows us to investigate the mechanisms that connect information (every energy gradient) with meaning mediated by cognitive semiotic processes. For instance the eco-field hypothesis can be applied to investigate the relationships between land uses, scenery attributes of the landscape and economical drivers. In fact, the landscape can be regarded as the sum of all the eco-fields that make up the interface between human needs and resources.
According to this last hypothesis, the high diversity and the related complexity of the traditional (cultural) landscapes are the result of a semiotic exchange of information between rural culture and resources. It seems reasonable to maintain such relationships by a fine-grained use of the energy and related information in order to preserve such complex valuable landscapes. Today, the huge amount of energy spent in crop-production degrades the complexity of landscapes, reducing the information housed in the neutral-based landscape (*sensu* Farina *et al.* 2005) and consequently limiting its availability to the eco-fields of other organisms.
The recent shift to mass production driven by global market determines a change of eco-field resolution and a shifting in resource use and related scale. When resources are neglected by humans, the related landscapes gradually vanish. The new landscape configurations that replace the traditional ones develop according to the change in functions, eco-fields and resource types. The only way to maintain cultural landscapes is to focus on the eco-fields that generate them, which in turn is the dynamic result of interaction between specific functions and resources.

KEYWORDS - Eco-field, Eco-semiotic, Complexity, Cultural landscape, Meaning

How To Make Peirce's Ideas Clear

Donald Favareau
University Scholars Programme, National University of Singapore
USP ,06-37 10 Kent Ridge Crescent, Singapore 119230
usfdf@nus.edu.sg

ABSTRACT - Having largely failed within his own lifetime in making his own ideas "clear" – in the sense of immediately self-evident, easily understood, and absolutely unmistakable – to either his fellow academics or to the general public, Charles Peirce left behind in his manuscripts an extraordinarily complicated notion of "sign" that is only rivaled in its complexity, perhaps, by his extraordinarily complicated notion of "mind." But the fact that both these small words – much like the word "time" – already have everyday connotations that, while internally incoherent, yet manage to do a lot of useful work in the world as placeholders, should not deter the serious inquirer from attempting the kind of higher-order definitions from which the everyday uses can then be understood as specific cases. Therefore, those of us who feel that Peirce's explanations of these terms are at least pointing us in the right direction as we attempt to develop our own understandings of biosemiotic processes, find that we have to try to make clear for our audiences what it takes Peirce literally thousands of pages to make clear to us. In this short talk, I will attempt to convey at least an initial working understanding of Peirce's notions of "sign" and "mind" in a way that should be quickly understandable to anyone with basic understanding of dynamic systems theory.

KEYWORDS – Peirce, Sign, Representamen, Interpreter, Interpretant, Mind

Protein Linguistics – a Grammar for Modular Protein Assembly?

Mario Gimona
Consorzio Mario Negri Sud, Via Nazionale 8A,
Santa Maria Imbaro, Italy
gimona@negrisud.it

ABSTRACT - The correspondence between biology and linguistics at the level of sequence and lexical inventories, and of structure and syntax, has fuelled attempts to describe genome structure by rules of formal linguistics. The significance of information (or *semantic value*) that is contained within the linear or folded structure of macromolecules, and the hierarchical order and the rules that govern macromolecular organization relate strongly to syntactic structures in human languages. Protein language appears more complex than the genetic code, and the features of protein structures seem to more closely resemble complex languages, which make use of conceptual expression patterns, such as Chinese characters or Egyptian hieroglyphs. Protein regions that fold and function autonomously and also convey their inherent function onto other proteins are generally referred to as “domains” or “modules”. Modules might thus delineate the authentic syntactic units in the protein language albeit it is difficult to generally adopt modular protein domains as “words”, as they already seem to have a higher semantic complexity. If, however, we consider a folded domain as a more complex “phrase” or “clause”, we can more easily accommodate functional plasticity within structurally similar modules that have little conservation at the sequence level. Under such conditions, the semantic value of a protein domain can be modified substantially without changing the length or structure of the clause (its size and basic fold). A key theoretical principle for understanding an unknown language or code is the recognition of syntactic patterns. Are then protein modules a biological “*Rosetta Stone*” that will help us to decipher the first basic rules of grammar in protein linguistics? Here I will discuss how protein linguistic rules might be defined and how compositional semantics could improve our understanding of protein organization and functional plasticity.

KEYWORDS - Protein Linguistics, Compositional semantics

Editing Biosemiotics in 'Wikipedia'

Peter Harries-Jones
York University, Ontario, 24 Highview Crescent,
Toronto, Ontario M6H 2Y2 Canada
peterhj@yorku.ca

ABSTRACT - Wikipedia is a collective electronic encyclopedia. For computer users it is a major utility for understanding 'biosemiotics.' Editing is required not for what the current entries do say, but what they do not say. Existing entries concentrate on the writings of 'the founders,' Jacob von Uexküll and C. S. Peirce. C. S. Peirce presents a highly anthropomorphic account of semiosis based on the relation between human visualization and sign recognition. Von Uexküll's contribution, the functional circle of perception in single organisms, comes close to 19th century vitalism. The anthropomorphism in Peirce account makes translation to other fields of biosemiotic enquiry very difficult indeed, as a recent article in SEED (Peirce translated to molecular biology) demonstrates.* This suggests either a need for plural definitions of 'information,' or thorough revision of the relation Peirce drew between 'habit' and 'recall.' Meanwhile the natural world, the 'semiosphere,' exhibits very different capacities for sensing than that of human beings, and this goes undiscussed. The network of life where difference makes a difference (Bateson) and exhibits complex interconnection both among senses and between organisms is also not discussed. Also unmentioned is the advocacy aspect of biosemiotics, which is not vitalist in the 19th century definition, but contests validity of state and corporate programmes which are counter-life. This paper addresses these themes.

KEYWORDS - Advocacy, Bateson, Peirce, Wikipedia

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The Awakening of Species: Grades of Consciousness

Jesper Hoffmeyer
University of Copenhagen
Department of Biological Chemistry
Solvgade 83 H, 1307 Kobenhavn K, Denmark
jhoffmeyer@mail.dk

ABSTRACT - The way people use the term consciousness varies considerably depending on background and attitude. While most lay people are inclined to ascribe consciousness to mammals and birds or even reptiles and fishes scholars from humanistic disciplines generally reserve the concept for use only in the human species not even according consciousness to the big apes. Biologists, on the other hand, most often reserve the concept consciousness for animals possessing big brains (relative to body weight), such as mammals and perhaps birds. At the same time, however - somewhat contradictionary one might think - mainstream biological theory tacitly implies that animal consciousness could not escape the power of "natural law". Physicists, on the contrary, often seem inclined to ascribe consciousness to the most insignificant living beings such as e.g. bacteria. This is then accompanied by an understanding of consciousness more or less as indeterminism, such as the indeterminacy often postulated to characterize quantum jumps. The implicit idea seems to be, that consciousness and quantum jumps are the only phenomena in the world to escape the destiny of natural law, and that thus, the too phenomena are deeply connected. In this conception even inanimate nature is seen as exhibiting consciousness.
No project aimed at approaching an understanding of the mind-body relation can escape this confusion of "the graded consciousness". The paper initiates an analysis of consciousness as an evolutionary emergent phenomenon exhibited by different species to different degrees. It raises and suggests a biosemiotic answer to the question of what would be the biological function of this much praised property.

KEYWORDS: - Consciousness, Evolution, Emergence, Holistic marker

Nutrition, Epigenetics and Disease Susceptibility

Randy L. Jirtle
Duke University Medical Center
Department of Radiation Oncology, Durham, NC
jirtle@radonc.duke.edu

ABSTRACT - Human epidemiologic and animal data indicate that susceptibility to adult-onset chronic conditions such as cardiovascular disease, diabetes, obesity, and cancer is influenced by persistent adaptations to prenatal and early postnatal nutrition [1]. We have used the viable yellow agouti (A^{vy}) mouse, which harbors a retrotransposon in the Agouti gene, to investigate the importance of maternal nutrition and DNA methylation in determining the susceptibility of offspring to adult diseases. We have shown that maternal dietary supplementation during pregnancy with either methyl donating substances (i.e. folic acid, vitamin B_{12}, choline and betaine) [2] or genistein [3], a phytoestrogen present in soya products, alters coat color of the offspring by increasing CpG methylation of the transposable element within the Agouti gene rather than by gene mutation. Furthermore, these epigenetic changes reduce the risk of A^{vy} offspring from developing obesity - a clear example of nature via nurture. Such epigenetic information can also inherited transgenerationally. Therefore, it is now critically important to determine if similar epigenetically labile genes exist in the human genome, and whether micronutrients are useful in counteracting environmentally-induced deleterious alterations of the epigenome. (Supported by NIH grants CA25951, ES08823 and ES08823)

KEYWORDS **-** Epigenetics, Imprinting, Methylation, tTansposons, Disease susceptibility

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Methods of Biosemiotics

Kalevi Kull
University of Tartu, Department of Semiotics
Tiigi Str. 78, 50410 Tartu, Estonia
kalevi@ut.ee

ABSTRACT - Tommi Vehkavaara has emphasized that the explication of methods may be a central problem in biosemiotics nowadays. Moreover, the study of methodological problems may turn to be crucial in the development of the whole of biosemiotics.

Biosemiotics, in many ways, differs from the more classical fields in semiotics, like for instance semiotics of culture. A particular difference concerns their methods, since the study of sign processes in non-human organisms or inside the organism's body may not have much use from traditional methods of humanities or social sciences. Also, biosemiotic studies often appear in a situation of opposition with the alternative, natural scientific approaches used for studying the living systems.

F. S. Rothshild, who was the first to use the term 'biosemiotic' already in 1961, emphasized the distinction between biosemiotics and biophysics on the basis of the difference of their methods.

Robert Rosen's point of departure in his search for an adequate methodology for the study of living processes uses the opposition of this methodology to the physicalistic methods. Rosen describes mimesis as an alternative to reductionistic method.

Semiotics as basically non-quantitative science would accordingly get much use in a wide and systematic application of qualitative methods. The latter include participant observation, phenomenological description, individual case studies, structural analysis, naturalism, etc. However, a study on the application of qualitative methods as developed in social sciences, is still almost absent in biosemiotics.

Biosemiotics can also be defined as a study of nonconscious semiosis. A study of human nonconscious has an overlap with zoosemiotics, which accordingly means a possibility of wider use of the methods of study of unconscious in biosemiotics. A similar relationship has been brought up by Thure von Uexküll via his concept of endosemiosis.

Thus, semiotic approach would mean an enrichment of the toolbox a biologist is allowed to use.

KEYWORDS - Methodology, Qualitative Methods, Holism, Biophysics

A-dualistic Generative Semiotic

Alfred Lang
University of Bern, Switzerland
Aarestrasse 4e, CH-3037 Zollikofen-Bern
alfred.lang@psy.unibe.ch, http://www.langpapers.net

ABSTRACT - The contribution shall present a conception of semiosis, that is general enough to cover processes of evolution and inter as well as intra-organic and environmental functioning in biotic, psychic, and cultural systems. It is a-dualistic and generative and can cover both input and output branches as well as organism-internal processes of memory formation and use on chromosomal, cerebral and cultural levels. I think it may not have been a good idea to base semiotics upon some "definition of a sign". Peirce has written around 100 of them, obviously never satisfying himself completely. If signs of any kind are to be "interpreted", whatever that may eventually mean, they have to be "made" or "produced" before. A related misconception appears to underlie the notion that a sign should represent something and could vicariously replace it. Rather than start with a definition of the "sign" and rely upon some rather arbitrary notion of "interpretation", I'd prefer to follow chains of effects of anything that does or can have effects of innovation and maintenance upon something else; and whenever physical or chemical explanations are wanting, I may look for a kind of connection that can be called semiotic. Any structure observable or inferable in the above fields of life and what is built thereupon may then preferably be thought of as a semion presenting something to be taken up by another semion which encounter is generating a third structure, and the same happens again and again, all semions becoming part of the chains of being.

KEYWORDS: Semiotic, Generative, A-dualistic, General evolution

Integrative Biosemiotics: A Transdiciplinary Systemic Approach

Hellmut Löckenhoff
Research Consulting Ossietzkkystr.
14 D-71522 Backnang BRD
Loeckenhoff.HellK@t-online.de

ABSTRACT - Biosemiotics is established as a unique approach to understand e.g. life/social systems. Beginning with 'evolutionary semiotics' (Yoshida, 1967) research topics covered the entire path of evolution virtually from the big bang to higher consciousness - eventually hybrids of brain and computer, of mind and software. Any system needs be understood as well by its functions *in situ* as from its evolvement. Accordingly biosemiotics extends to both aspects. Priority is assigned to the evolutional aspects of meaning: to evolution of meaning within general evolution and to the essential role meaning must be ascribed for evolvement.
With deeper understanding, the general concept of evolution is gaining priority even in most non-physical sciences. Well known are e.g. evolutional psychology and evolutionary economics. For a science comprehending as well human (economic) behavior as the 'social physics' of hard systems and mathematical approaches, e.g. economists set on to reconsider the assumptions, the presuppositions concerning inquiry systems, modeling/ simulation and the theory of scientific discovery in general. They contribute but an example for the 'evolution and information turn' of science.
These contexts raise questions relating to the future of biosemiotics as a evolution and information bound discipline. How do biosemiotics contribute to and how are they profiting from close disciplines as biology? How may they be integrated into the body of science as a mode to understand social/societal phenomena and as a social phenomenon in itself ? The transdisciplinary aspect to be discussed is shown closely entwined with the evolutionary approach in general and in particular the emergence of higher consciousness. Systemic inconsistencies will induce consideration of 'The Second Scientific Revolution…- Informatic Turn - (Yoshida 2005) and connected concepts e.g. of Synergy, Complexity, Anticipatory Systems and of Life systems. Reconciliation also sheds light on the potentials and issues open for biosemiotics towards an essentially restructuring science.

KEYWORDS – Biosemiotics, Evolution/Information Turn, Transdisciplinarity,
Theory of Science

Propagating Organization and the Extended Mind Model of the Origin of Language and Culture

Robert K. Logan
University of Toronto, Department of Physics
60 St. George St. - Toronto ON M5S 1A7 - Canada
logan@physics.utoronto.ca

ABSTRACT - An enquiry involving the collaboration of my colleagues Stuart Kauffman, Robert Este, Randy Goebel, David Hobill and Ilya Shmulevich is made into the meaning of information in biological systems and the propagation of organization as exemplified by the vast organization of the co-evolving biosphere. In the propagation of their organization cells carry out a set of interlocked tasks requiring work that achieves a closure whereby the cell literally builds a rough copy of itself. It takes constraints on the release of energy for this work to happen, but it also takes work for the constraints themselves to be built. The new insight being explored here is that the constraints that allow autonomous agents to channel free energy into work are connected to information and the constraints are actually the information and are part of the organization that is propagated. By showing that Darwinian adaptations cannot be reduced to physics and that Darwinian preadaptations cannot be prestated we also show that neither Shannon nor Kolmogorov information apply to the evolution of the biosphere. It is argued that information is a relative notion not an invariant and depends on the nature of the systems being described, hence our definition of instructional or biotic information as constraints on biotic systems. We further show that biotic, but not linguistic, semiosis, is a subcase of information as constraints.

It is shown that the evolution of human language, culture, technology, governance and economies are another example of the propagation of organization. Language emerged as the bifurcation from percept-based thinking to conceptualization as the complexity of hominid existence increased. Language and culture is likened to an organism, a kind of beneficial parasite, a 'nonobligate symbiant' that evolved to be easily learned explaining the emergence of Universal Grammar without invoking Chomsky's language acquisition device. This hypothesis also leads to the notion of Universal Culture.

KEYWORDS - Propagation of organization, Information, Language, Culture

Information, Matter and Energy - a Non-Linear World-View

Pierre Madl[1] & **Maricela Yip**[2]
[1]University of Salzburg, Department of Material Sciences
Div. Physics & Biophysics, Hellbrunner St.34, A-5020, Salzburg, Austria
pierre.madl@sbg.ac.at
[2]University of Salzburg, ICT &S Center
Sigmund-Haffner Gasse 18, A-5020, Salzburg, Austria.
maricela.yip@sbg.ac.at

ABSTRACT - As far as we understand life today, it is the most amazing, even the most wonderful appearance on this planet. Only since exploration of space do we become increasingly aware how the entire architecture of the cosmos seems to be synchronized in a way to make life possible in the first place. Embedded in a series of orders the universe - including Earth - is but a ripple in a vast ocean of energy. This highly inorganic realm seems to be in total opposition with the animated world. However, the highly complex physico-chemical interaction of molecules differs only in its phenomenology not in its principles from the non-animated world. Thus the shift from life to non-life must be gradual, a continuum so to speak. As with the cosmic principle, both the animated and inanimated realms are open, dissipative systems that are far from equilibrium. Both rely on injections of energy, or neg-entropy. Based on these dissipative structures these systems undergo changes, which, at a critical point, completely destroy the previous structure only to give rise to new and different dissipative structures. Two basic features characterize such systems: One is the concept of the bifurcation point, the other is the evasion - but not violation - of the 2nd law of thermodynamics. Being supplied with neg-entropy and thus far-from-equilibrium, such systems seems stable at one instant and unstable the next. At the point of bifurcation, predictability seems to collapse, making any determination of the course of these systems impossible. Open systems seem to choose whichever probability it wishes to activate thereby reorganizing themselves. This attribute of self-organizing systems creates order out of chaos. Since this process occurs in both the animated as well as the in-animated realm, the gap between the in-animate and animate becomes obscured.

KEYWORDS - Neg-entropy, Bifurcation point, Animated and non-animated world, Self-organizing systems.

What Means Life?

Paolo Manzelli
EGOCREANET/OPEN NETWORK FOR NEW SCIENCE, Dept. Chemistry , Scientific Pole , Florence University, via Lastruccia 3 - 50019 Sesto F.no - FIRENZE- Italy.
LRE@UNIFI.IT

Living organism are characterized by their ability to survive and to reproduce itself though the transmission of informational signs. Remembering that DNA is no an auto-reproductive molecule, the above definition need to be extended to the interpretation of any auto-catalytic systems that works by means exchanging chemical signals during the cyclic metabolic transformation on the basis of many organizational levels of the transfer of signals of information. For an example the Nitric Oxide (NO) is a free radical and in-tercellular messenger working as catalytic signaling substance, within a rich spectrum of biological chemistry. In fact Nitric Oxide works giving a catalytic role in signaling and controlling the regulation in normal physiology in various animals and plants metabo-lisms. Therefore NO activity need to be considered as well as an indicator of the best catalytic pathway for the successive biochemical transformations where the chemical information is stored in the new bonding structures. Looking at this and other examples of signaling catalytic properties, it is possible to understand that the difference among autocatalytic chemical self reproductive systems, and biological living systems concerns only the grade of complexity developed in the evolution of signals and information ex-change, especially regarding the protection of communication control of genetic codex. This premise is useful for understanding that the concept of " information" (that means tacking a new form) need to be revised for better understanding how "Biosemiotics" can make an integrating attempt into a coherent theoretical structure of biochemical catalytic transformations, aiming to develop a better understanding of the general question: "WHAT MEANS THE LIFE " explained on the basis of better interpretation of the "cata-lytic sign operations into the self –organized evolution –systems.

KEYWORDS - Sign, Information, Catalysis , Genetic-codex, Life

Structural and Semiotic Aspects of Biological Mimicry

Timo Maran
University of Tartu, Department of Semiotics
Tiigi Str. 78, 50410 Tartu, ESTONIA
timo.maran@ut.ee

ABSTRACT - Biological mimicry can be described as a structure consisting of two senders (a mimic and a model), a receiver, and their communicative interactions. The distinguishing of three participants in mimicry brings along the possibility to explain mimicry from different perspectives as a situation focused on signal-receiver, mimic, model, or human observer. This has been the foundation for many definitions and classifications of mimicry as well as for some semiotic interpretations. The present paper introduces some possibilities for defining and classifying mimicry and shows them being burdened by structural approach. Proceeding from Jakob von Uexküll's 'Theory of meaning', it is possible to question the common understanding that participants in mimicry are specific species. According to "Theory of meaning", mimicry as any other relation between species is *Umwelt*-dependent i.e. it is conditioned by meanings and functions present for an animal. Therefore also mimic and model, as entities that the receiver fails to differentiate, are first entities of meaning in one's *Umwelt* and are not necessarily representatives of some biological species. Uexküllian approach allows us to analyze various examples of abstract and semiabstract resemblances in nature. Based on some examples, the biological notion of 'abstract mimicry' is reinterpreted here as a situation where the object of imitation is an abstract feature with a universal meaning for many different animal receivers. From semiotic point of view, the most common property of mimicry seems to be the receiver's inclination to make a mistake in recognition. This allows describing mimicry as incorporating a specific type of semiotic entity — *ambivalent sign* —, which is understood as an oscillation between one and several signs depending on the actual course of interpretation.

KEYWORDS - Biological mimicry, Mimicry systems, Classifications, Model, Abstract resemblance

Evolution of Life in the Global Network of Genetic Exchange: Sexuality and the Universal Genetic Code

Toshiyuki Nakajima
Ehime University, Department of Biology
Bunkyo-cho 2-5, Matsuama, 790-8577 Ehime, Japan
nakajima@sci.ehime-u.ac.jp

ABSTRACT - Living things on earth reproduces themselves based on genetic information through the common genetic code. The code is shared universally among present-day organisms, although there are some modifications of the common code. Sexuality is also known as universal; analyses based on multilocus linkage equilibrium have shown that even bacteria have a wide range of sexualities ranging from lineages with little or no recombination to others that are almost panmictic. The universality of the genetic code and sexuality in a broad sense suggests a global network of genetic exchanges among organism on earth. Sexual/horizontal transfer of genetic information may be restricted to a limited rage of member species; but, if there is some connection of genetic transfer between relatively isolated groups, the degree of separation between any species decreases to form a small world of the global network of genetic exchange among species on earth. Why are they so universal? In this talk, I focus on the idea that if lineages (or species) in complete isolation from others or those using different genetic code arise in a local ecosystem of species that are connected to the global network of genetic exchange, the former would go extinct by the evolutionary race with a member of this network. For this discussion, I show some data from the experiments of evolutionary competition between two evolving lineages of bacteria that were carried out by us, one of which evolved with genetic exchange with another lineage, and the other evolved in isolation. I will discuss the results from the viewpoint of the above idea and some related evolutionary hypotheses.

KEYWORDS - Genetic code, Sexuality, Bacteria, Evolution

The Polysemy of the Sign: A Quantum Computing Perspective

Yair Neuman
Ben-Gurion University of the Negev
Office for Interdisciplinary Research, Beer-Sheva, Israel
yneuman@bgu.ac.il

ABSTRACT - A sign, both in natural language and biology, is polysemy capable of having a range of possible meanings in different contexts. In this presentation, I would like to present the thesis that the polysemy of the sign can be interpreted in terms of a *superposition*, here defined as *the paradoxical and simultaneous existence of mutually exclusive values*, before an interaction-in-context determines its value. Moreover, I argue that polysemy is crucial for understanding biological machines as Interactive Machines (IMs) and the way they bridge the gap between the digital and the analogue codes. This argument is presented in several phases. First, I present the interactive nature of living systems and the argument that this interactive behavior cannot be modeled by a Turing Machine. Second, I present the concepts of superposition, interference and the "square root of NOT" and show the counter intuitive work they can do in quantum computing machines. Third, I argue that living systems are interactive systems that compute themselves by turning information, which is expressible in terms of one-dimensional string of discrete units, into meaning. In this context the superposition of the sign is crucial for bridging the gap between the digital and the analogue codes. I conclude by raising some speculations about the relevance of this thesis for explaining the emergence of life from inanimate matter.

KEYWORDS - Polysemy, Quantum computing, Codes, Digital/analogue.

Genome and Natural Language; how far can the Analogy be extended?

Seán O Nualláin
Symbolic systems program, Stanford; visiting scholar, molecular and cell biology, Berkeley
2645 Stuart, Berkeley, Ca 94704, USA
sonual@stanford.edu

ABSTRCT - It is now almost universally accepted that terms like “sign”, “signified”, and “semantics” are appropriate to genetic expression. Moreover, a field called “Biosemiotics” with an associated set of journals has come into being. However, how far can the analogy between genetic expression and natural language production and comprehension actually be pushed? This paper first looks at natural language, the best-known symbol system. It considers the various attempts that have been made formally to characterize human language. First, we broaden the context to consider language as one symbol system among others, including the genetic code. We then look at language through the prism of formal language theory before detailing some of the ingenious and thorough formalisms within the fields of formal and computational linguistics. We consider the layers within natural language itself, and that consideration leads to speculation about the role of context. Finally, we return to our original starting-point of genetic expression, and give a prognosis as to the likely progress of this field, as seen from a linguistic point of view. Barbieri’s paper in this conference makes the point from a semiotics point of view that the distinction between context-independent and context-dependent semantic primitives needs to be emphasized. It may indeed be the case that the HGP, considered thus, has revealed only the low-hanging fruit; context-dependent primitives. Alternatively, it may be useful to consider the HGP’s findings as collocations, or indeed as purely a lexicon. It is obviously vital that genetics learns lessons from the mistakes of another field. Just as the goal of eliciting meaning from parsing of strings of symbols proved infinitely more difficult in natural language than anticipated, so the goal of specifying production of proteins from nucleotide sequences is likely to exercise us for several generations.

KEYWORDS - Context, Natural language, Logical atomism

Information alters Matter

Dietmar Payrhuber,[1] **Michael Frass,**[2] **Pierre Madl**[3]
[1]Medical Practitioner, Eduard Baumgartner-Str. 8, A-5020 Salzburg, Austria
payrhuber@gmx.net
[2]University of Vienna, Department of Medicine
Division of Oncology. Austria
michael.frass@meduniwien.ac.at
[3]University of Salzburg, Department of Material Sciences
Division Physics & Biophysics, Austria
pierre.madl@sbg.ac.at

The focus of our observation is the atom. It has structure (H.P. DÜRR) and therefore represents matter on one hand as well as a psychological theme, an archetype (C.G. JUNG) on the other hand. The history taking is mainly based on the life conflict and the mental constitution of the patient. The mental constitution is partly conscious, partly unconscious and represents the very source of one's disease and indicates a specific remedy. Positioned lower in hierarchical status, local symptoms are included in the overall picture of the disease. Both the psyche and the physical manifestation may be a part of a higher-dimensional reality (D. BOHM). By using this method, potentized remedies show a deep action upon the psychological constellation of the patient and may be capable even to dissolve malignant tissues to restore health. For example, the underlying theme of a pathogenic mother-child relationship may create leukemia and can be cured by a specific salt. A difficult father-son relationship shaped by rivalry may establish a malignant brain tumor, which can be cured by the very same method. These elements / salts are simple in their structure (atoms, molecules) but may represent life-themes which are associated to a given mineral as well as to the patient's life conflict. Indeed, we compare the energized state of the mineral with the mental constitution of the patient, which is similar to a theme, an archetype. The tumor may be suggested as a local symptom as a result of the disturbed life-force (C. BURNETT) and only part of the system. Since elements and minerals are the tiniest and most archaic units, out of which life is made, the potentized forms may represent pristine archetypes, which have profound organizing capacities.

KEYWORDS – Atom, Archetype, Matter and Consciousness, Higher-dimensional reality

Affordances are Signs

John Pickering
Warwick University, Psychology Department
Coventry, UK. CV4 7AL
j.a.pickering@warwick.ac.uk

ABSTRACT - How is the existence of the mental world, particularly reflexive thought, to be accounted for if the real world is only material in motion? Descartes' answer was to add something immaterial to the world. Pierce's answer was different:

> *Thought is not necessarily connected with a brain. It appears in the work of bees, of crystals, and throughout the purely physical world ... But ... there cannot be thought without signs.* C.S Peirce, 1906.

Like Whitehead, Peirce supposed that mental life is not confined to human experience but participates in a universal organic order, mediated by semiotic interaction. In the local conditions of this planet, this order has been stratified into physical, biological and cultural levels.

Semiotic exchange is essential to the emergence, maintenance and evolution of these levels. Physical order, according to Bohm, supports a form of semiosis. Maturana proposes that the autopoietic unity of living beings depends on semiotic transfer. Saussure, Peirce and Jakobson, among many others, show how natural signs of the physical and biological levels have been enhanced by those of human culture .

Cultural artifacts and the practices that go with them are a semiotic system that produces, among many other things, the reflexive form of consciousness that may well be unique to human beings. To fully understand the immense power and productive complexity of this system we need an appropriately powerful theory that can be applied uniformly to physical, biological and cultural phenomena.

This paper will sketch such a theory, based on von Uexküll, Peirce and Brier. The potentially novel component of the theory will be the incorporation of Affordance, a notion central to James Gibson's Ecological Psychology. This was actually first put forward by Koffka, a major figure in Gestalt psychology who, like his contemporary von Uexküll, had a strong preference for organic holism over mechanistic reduction.

KEYWORDS – Affordance, Whitehead, Autopoeisis, Culture, Bohm.

Towards a Multi-level Approach to the Emergence of Meaning Processes in Living Systems

João Queiroz[1,2,4] & **Charbel Niño El-Hani**[2,3,4]
[1]Dept. Computer Engineering and Industrial Automation, FEEC - UNICAMP.
queirozj@dca.fee.unicamp.br
[2]Research Group on History, Philosophy, and Biology Teaching, Institute of Biology,
charbel@ufba.br
[3]Graduate Studies Program in History, Philosophy, and Science Teaching (UFBA/UEFS).
[4]Graduate Studies Program in Ecology and Biomonitoring (UFBA).

ABSTRACT - Any description of the emergence and evolution of different types of meaning processes (semiosis, *sensu* C.S.Peirce) in living systems must be supported by a theoretical framework which makes it possible to understand the nature and dynamics of such processes. Here we propose that the emergence of semiosis of different kinds can be understood as resulting from fundamental interactions in a triadically-organized hierarchical process. To grasp these interactions, we develop a model grounded on Stanley Salthe's hierarchical structuralism. This model can be applied to establish, in a general sense, a set of theoretical constraints for explaining the instantiation of different kinds of meaning processes (iconic, indexical, symbolic) in semiotic systems. We use it to model a semiotic process in the immune system, namely, B-cell activation, in order to offer insights into the heuristic role it can play in the development of explanations for specific semiotic processes.

KEYWORDS - Semiosis, Signs, Emergence, Levels, Hierarchical structuralism, Biological meaning

"From Ant Hills to Ambient Intelligence: Cues for Signaling, Coordination and Persuasion"

Wolfgang Reitberger[1], **Christoph Obermair**[1], **Bernd Ploderer**[1], **Manfred Tscheligi**[1]
[1]University of Salzburg, ICT&S Center
Sigmund-Haffner Gasse 18, A-5020, Salzburg, Austria.
wolfgang.reitberger@sbg.ac.at

ABSTRACT - The main question we are investigating is how Ambient Intelligence (AmI) environments can be designed to support a group to carry out common goal-oriented activities. The aim is to foster more sustainable behaviour with a particular focus on environmental pollution. The approach we are taking in answering this question is inspired by insect colonies, in particular ant and bee colonies. An individual insect can derive information about certain aspects of the global state of its colony by observing and interpreting certain environmental factors and situations (e.g. an individual bee can make inferences about the current food situation in the bee colony based on the length of the queue at the entrance to the hive). Here a group of individuals unconsciously acts as an indicator for another individual, providing information about the current state of their colony. We call these indicators "cues in the environment". They are of an implicit nature because they emerge from the behaviour of individuals which act according to the current global situation of their group. Thus cues in the environment are an unobtrusive but efficient feedback mechanism for signaling certain aspects of the current global state. This helps to accomplish the desirable state of Collective Intelligence (CI) within a group of individuals. We apply the concept of CI to AmI as we have found it works well in biological and social systems. Examples from nature demonstrate the power of CI stimulated by implicit cues in the environment. We use these examples to derive design principles for AmI environments. By applying these design principles to a concrete scenario, we are able to propose ways to help decrease environmental pollution within urban areas.

KEYWORDS – Ambient Intelligence, Collective Intelligence, Cues, Human-Computer Interaction, Technology Design,

Human Life: An "Endless Semiosis" Through Different Human Sign-Systems

Ingolf A. Schmid-Tannwald[1] and **Johannes Huber**[2]
[1] Faculty of Medicine. Ludwig-Maximilians-University – Hospital for Women Großhadern.
[2] Faculty of Philosophy, Munich School of Philosophy S. J.
Marchioninistr. 15, 81377 Munich, Germany
ingolf.schmid-tannwald@med.uni-muenchen.de

ABSTRACT - The individual genome of a sperm and a person represent unique objects in different realities (sign-systems, levels). If a meaning is assigned to the genome by the (epigenetic) interpretant of the oocyte at the cellular level (biology) respectively to the person by the (emotional) interpretant of a partner at the social level and if the oocyte, as well as the person, act as interpreters of a sign, i.e. either by signaling or by instrumental behavior (e.g. active and specific transformation of the paternal genome respectively responding to the partner´ s emotion etc.), the signal and the action itself can be treated as a sign at the same or at another level again, that invites new interpretations and actions of new interpreters in new sign–systems (e.g. ß-HCG production signaling the presence of a pre-implantation embryo respectively sexual response at the organic level) etc. etc. Thus a periodical vertical "stream of signs" (sign-process, semiosis) will result oscillating between the person as a social pole (reality) and the genome as a cellular one characterizing the phenomenon "human life" in the course of generations (horizontal). Life therefore might be regarded as a theoretically "endless semiosis" (Peirce) being pushed forward by interpreting and acting interpreters in innumerable sign-systems since its origin. Descriptions of the phenomenon in different sign-systems (languages, codes), however, crack the phenomenon into separate realities. This may lead to an inadequate handling of human life.

KEYWORDS - Life, Endless semiosis, Sign-system, Human

'MEANING' AS AN ASPECT OF THE LIVING
What does 'Meaning' Mean in Biosemiotic Perspective?

Adam Skibinski
Warsaw School of Social Psychology
Jasnorzewskiej 5/41, 01-863 Warsaw, Poland
adamskibinski@wp.pl

ABSTRACT – 'Meaning production' processes in the living depend on sign processes, agency, evaluation and interpretation. The shift in logical levels and sign (re)production, i.e. survival by semiotic means (semiotic survival) refers to the Peircean notion that 'to mean' is to 'to stand for something else'. 'Meaning' in minimal biosemiotic sense emerges as sign stability in sign recognition processes in the living. In this perspective 'to mean' can be understood as consequences of Bateson's 'difference that makes difference' for something in some respect. All environments of the living are both physical and semiotic (*Pleroma* and *Creatura*), thus 'meaning' requires the place for sign production in a living entity, from a cell to an organism. 'Meaning' means relational, instant, procedural, emergent activity in relation between semiotic agent and its environment. Self-reflexive 'nature' of signification processes in nature assumes an existence of a comparator, i.e. a sensory organ plus signal processing unit, which can be a whole living entity. Minimal requirements for 'meaning production' in the living: a comparator as a part of the living, a feedback with an environment and difference recognition as a process. *Umwelt* or 'meaning world' in animals as species-specific meaning production feedback loops or Maturana's consensual domain may serve as potential meaning production milieu. 'Meaning production' in humans extends such processes in animals to the level of partial (self)control of digital code in culture and language. 'Meaning production' serves as a central process of adaptation in human niche of culture, only as extension and amplification of 'meaning production' in other animals.

KEYWORDS - Meaning, Semiotic survival, Sign production, Evaluation

Peirce's 'Sop to the Cerberus' and the Biosemiotic Self as the Interpretant of Object and Sign - an Experimental Approach.

Cornelius Steckner
Etruskerstr. 22 D-50996 KÖLN
dr.steckner@gmail.com

ABSTRACT - "I define a sign as an thing which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its interpretant, that the latter is thereby mediately determined by the former. My insertion of "upon a person" is a *sop to Cerberus*, because I despair of making my own broader conception understood." (C.S. Peirce, 1908) The trick with the bribe allowed Peirce there to design a formal system of ten triadic classes of signs in the level of thirdness, which is the main difference to his entry in the "Dictionary of Philosophy and Psychology".

The trick with the bribe in 1908 eliminated the biosemitical aspect behind the triadic construct, which Peirce had pronounced in the presupposed generation of firstness, secondness and thirdness. There still the person had its role as the object and sign related place of interpretation.

This in mind, the focus on the trick now becomes an instrument to switch to the person's role in thirdness related triadic relations. In this case, the triadic relations remain in the background, while the broader concept of the semiotic self is addressed by an experimental approach to the role of the person as the interpretant. The experimental semiotics of the human concept of object size (as a first) then refers to the thirdness-related triades, but the persons own view of size will help to understand the person's role as interpretant of both the object and the sign. The biosemiotic experiments, at the end regain the lost of reference, to open a new view on the person as the interpretant of object and sign to unveil common aspects in the concepts of C. S. Peirce and J. v. Uexküll.

KEYWORDS - C.S.Peirce, Triadic concept, Semiotic self, Interpretant, Biosemiotic experiment, J.v. Uexküll

Active Externalism and Biosemantics

Konrad Talmont-Kaminski
Institute of Philosophy
Marie Curie-Sklodowska University
plac MCS 4, 20-031 Lublin, POLAND
ktalmont@bacon.umcs.lublin.pl

ABSTRACT - Andy Clark and Alan Chalmers in 'The Externalized Mind' criticize Putnam's and Burge's forms of externalism regarding meaning on the grounds that they are passive. The problem is that the external features which on those accounts are responsible for differences in meaning are at the other end of a long causal chain and, therefore, do not play an active role in the present situation. This can be seen in the way that the accounts allow for physically indistinguishable situations in which, none-the-less, the content of beliefs differs. Despite the differences between Millikan's etiological account of function and the accounts Clark and Chalmers criticize it is also possible to show that Millikan's account is affected by a very similar argument. The reason is that the etiological account entails that an organ that is not the end result of a proper (evolutionary) process will not have a function even if it is physically identical with one that does. Though that may seem an unlikely-enough scenario not to be concerned about, the problem is actually quite significant for Millikan. The reason is that, as a naturalist, she is unlikely to want to accept the dualism that threatens due to the mismatch between differences in physical states of events and differences in function.
The solution to Millikan's problem is to provide an account of function where the relevant features are active. A dynamic account of the type needed has been developed by Collier, Bickhard and others. It ties function to the organism's ability to maintain autonomy in its given environment.

KEYWORDS - Etiology, Function, Active externalism, Biosemantics

Meaning for Life

Tommi Vehkavaara
University of Tampere, Department of Mathematics, Statistics, and Philosophy
FI-33014 University of Tampere
tommi.vehkavaara[at]uta.fi

ABSTRACT - The general method of making biosemiotics is to capture and abstract some concepts from humanities and apply them in biological phenomena. The most of such endeavours introduce some vague notion of meaning to biology but usually quite implicitly or intuitively. The current topic is how this could be done more explicitly. A provisional list of the possible starting point intuitions about meaning is following:

- *Emotional meaning*: the sum of the subjective feelings that a sign or other stimulus launches.

- *Logical meaning*: the sum of the logical consequences of a representation.

- *Meaning in Batesonian information*: that difference which is made by another difference.

- Subjective intentional meaning: the conscious intention of the utterer.

- *Communicated meaning*: the content that is encoded in the semantic structure of the utterance (independently on utterer's intentions)

- *Pragmatic meaning 1*: meaning as the actual use of the sign in communicative community

- *Pragmatic meaning 2*: the sum of the true effects of the sign on all of the emotional, reactional, habitual, and conceptual levels.

Their suitability and uses in different wings of biosemiotics are critically analysed. It is argued that it is useless to start with any epiphenomenal conception of meaning. Any 'meaning' can be meaningful only when it is selected freely but not randomly among alternative interpretations or actions, the selection being guided but not completely determined by some normative criteria. Special concern is given to Peircean pragmaticist maxim that defines one concept of logical meaning. It is not directly applicable in biosemiotics, but its extension, *Practical meaning*, in Peircean theoretical ethics, *Practics*, may be. It is studied whether the defined concept of Practical meaning would be applicable in biosemiotics, and if it is, how sufficient concept of meaning it offers to biosemiotics.

KEYWORDS - Biosemiotics, Meaning, Pragmaticism, Normativity, Practics.

Applied Biosemiotics: Fungal Communication

Günther Witzany
telos - Philosophische Praxis
Vogelsangstr. 18c, A-5111-Buermoos
witzany@sbg.at

ABSTRACT - After an era of gene-centered biosemiotics, the advance of the epigenetic perspective has placed the focus on the action-theoretical aspect: semioses in interactions between cells, between organisms of the same or related species and between organisms of different species, families, genera and kingdoms.

Using rule-governed, sign-mediated interactions in fungi as a case study, I show how versatile their communicative competence is and how important this communicative competence was for the evolutionary step from aquatic to terrestrial life-forms. Interestingly, certain semiotic rules of fungal communication are very similar to those of animals, others to those of plants. The correspondence between all three eukaryotic kingdoms from the perspective of a three-leveled biosemiotics is: 1. Context determines the meaning of meta-, inter- and intraorganismic communication. 2. Differences in abiotic and biotic signal perception determine the content arrangement of response behavior.

KEYWORDS - Multilevel fungi-communication, Sign-mediated interactions, Biosemiotics, Context-dependency

The Light of Life – Biophotonics

Yip Maricela[1] & **Madl Pierre**[2]
[1]ICT&S Center, University of Salzburg,
Sigmund-Haffner Gasse 18, A-5020, Salzburg, Austria.
maricela.yip@sbg.ac.at
[2]Department of Material Sciences, Div. Physics & Biophysics,
University of Salzburg, Hellbrunner St.34, A-5020, Salzburg, Austria
pierre.madl@sbg.ac.at

ABSTRACT - Practically all organisms emit light at a steady rate from a few photons per cell per day to several hundred photons per organism per second. The emission of biophotons, as they are called, is somewhat different from well-known cases of bioluminescence. Biophoton emission is universal to living organisms and is not associated with specific organelles. Such emission is strongly correlated with the cell cycle and other functional states of cells and organisms, and responds to many external stimuli or stresses. Biophotons include electromagnetic radiation from extremely low frequencies - well below the visible range - and extend all the way up through microwave and radio frequencies on the other end of the spectrum. Contrary to the common assumption that molecular reactivity is determined by chaotic stimulation of thermal energy, it is the result of a spatio-temporal manifestation of electromagnetic field energy. The coherent property of this biophotonic field is thus an ability, a communicative tool without which the state of each cell both in single cellular as well as multicellular organisms could not be communicated to its surrounding. Coherence in this sense includes also communication processes that are not limited to the immediate proximity, but involves the entire organism. Even the DNA molecule is an excited duplex, or exciplex, in which photons are effectively stored. Biophotons are thus a key tool in inter- and trans-cellular communication processes. Rather than the “struggle for existence” do all organisms contribute in play-like fashion to a truly dynamic interplay of communicative interaction. Hence biophotonic processes along with intra- and inter-specific cooperation are essential features for life to occur in an orderly manner. Any outside interference – including chemical to electromagnetic disturbances – easily hampers these subtle biophotonic communication patterns and results in erratic messages and eventually in the manifestation of diseases.

KEYWORDS - Biophotons, Bioluminescence, Electromagnetic radiation, Microwave

Topological Aspects of Biosemiotics

Rainer E. Zimmermann
IAG Philosophische Grundlagenprobleme, U Kassel /
Clare Hall, UK – Cambridge /
Lehrgebiet Philosophie, FB 13 AW, FH Muenchen,
Lothstr. 34, D – 80335 München
rainer.zimmermann@fhm.edu

ABSTRACT - According to recent work of Bounias and Bonaly (2000), there is a close relationship between the conceptualization of biological life and mathematical conceptualization such that both of them co-depend on each other when discussing preliminary conditions for properties of biosystems. More precisely, such properties can be realized only, if the space of orbits of members of some topological space X by the set of functions governing the interactions of these members is compact and complete. This result has important consequences for the maximization of complementarity in habitat occupation as well as for the reciprocal contributions of sub(eco)systems with respect to their structural mutualism. In this present paper it will be shown what this more technical result means in philosophical terms with a view to the biosemiotic consequences. As this approach fits naturally into the Kassel programme of investigating the relationship between the cognitive perceiving of the world and its communicative modeling (Zimmermann 2004, 2006), it is found that topology as formal nucleus of spatial modeling is more than relevant for the understanding of representing and co-creating the world as it is cognitively perceived and communicated in its design.

KEYWORDS - Topology, Cognition, Design

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