Evo Devo Universe 2008

First International Conference on the Evolution and Development of the Universe
Dussane Room, Ecole Normale Supérieure, 8-9 October 2008

8 October – EDU 2008 Program

8:30am Conference Start. Intro and Welcome (10 mins)

- **Scale Relativity and Fractal Space-Time: Theory and Applications**, *Laurent Nottale* (50 mins)
- **Does Species Evolution Follow Scale Laws ? An Application of Scale Relativity Theory to Fossil Living Beings**, *Jean Chaline* (30 mins)
- **The Role of Energy Conservation and Vacuum Energy in the Evolution of the Universe**, *Jan Greben* (30 mins)

Coffee Break 1 (10:30am to 11am)

- **Foundations of Physics**, *Tom Gehrels* (30 mins)

Panel Q&A - Scale Relativity and Cosmic Evolution and Development (20 mins)

- **Complex-Dynamic Cosmology and Emergent World Structure**, *Andrei Kirilyuk* (30 mins)
- **Complexity and Evolution**, *Börje Ekstig* (30 mins)

Hosted Lunch (1pm-2pm)

- **Complexity and Energy Density in Big History**, *Fred Spier* (30 mins)

Panel Q&A - Cosmos and Complexity (20 mins)

- **Application of Quantum Darwinism to Cosmic Inflation**, *Nicolas Lori, Alex Blin* (30 mins)
- **Quantum Mechanics and Environment-Induced Superselection Rules**, *Thomas Durt* (30 mins)
- **An Algorithmic Information Theory Approach to the Emergence of Order Using Simple Replication Models**, *Sean Devine* (30 mins)

Panel Q&A - Quantum and Information Theory (20 mins)

Coffee Break 2 (5pm to 5:30pm)

SIG EVENTS (5:30-6:50pm)

- **Laurent Nottale and Jean Chaline** will run a **T-SIG**. Topic: **Scale Relativity: Theory and Applications** (Dussane Room)
- **Tom Gehrels** will run a **C-SIG (Cosmology and Astrophysics)**. Topic: **Can the Origin of Matter and Physics be Explained by an Evolutionary Multiverse?** (SIG Room A).
- **Nicolas Lori** will run an **M-SIG (Mind Sciences)**. Topic: **Darwinian Models in Neurosciences.** (SIG Room B).

OPEN SPACE (7-7:50pm)

- **Fred Spier** will run an Open Space Discussion. Topic: **Complexity and Energy Density in Big History** (Dussane Room).

NO-HOST DINNER AND CONVERSATION
8:30pm, Le Pot de Terre, 22 rue du Pot de Fer, a restaurant a brief walk from ENS.

8:30am Start. EDU Research Community Intro (10 min)

- **Computational and Biological Analogies for Understanding the Fine-Tuning of Parameters in Physics**, *Clément Vidal* (30 mins)
- **The String Landscape as Genetic Alphabet: The Subtle Virtues of a Non-Unique Cosmic Code**, *James N. Gardner* (30 mins)
- **Evo Devo Universe? A Framework for Speculations on Cosmic Culture**, *John Smart* (30 mins)
- **The Meaning of Life in a Developing Universe**, *John Stewart* (30 mins)

Coffee Break 1 (10:40am to 11am)

- **Towards a Hierarchical Definition of Life, the Organism, and Death**, *Gerard Jagers op Akkerhuis* (30 mins)

Panel Q&A - Evo, Devo and Intelligence (35 mins)

- **Are Particles Self-Organized Systems?**, *Vladimir Manasson* (40 mins)

Hosted Lunch (1pm-2pm)

- **Universal Evolutionary Hierarchy: A Unified Network Approach**, *Peter Winiwarter* (30 mins)
  Panel Q&A - Self Organization and Networks (20 mins)
- **Integration as a Fundamental Process in Cosmic Evolution and Science Development**, *Kris Roose* (30 mins)
- **Information Organization and Knowledge Evolution: The Case of Pharmaceutical Innovations**, *Carl Henning Reschke* (30 mins)

Panel Q&A - Social Evo Devo (20 mins)

Coffee Break 2 (4:30pm to 5pm)

SIG EVENTS (5pm-6:20pm)

- **Clement Vidal and John Smart** will run a **Community SIG**. Topic: **The EDU Community: How Can we Advance our Interdisciplinary Research?** (Dussane Room)

OPEN SPACE (6:30-7:20pm)

- **John Smart** will run an Open Space Discussion. Topic: '**STEM Compression': A universal developmental process? How to test?** (SIG Room A).

7:30pm-7:40pm, Conference Close, FOS EDU Special Issue Overview (10 mins).

NO-HOST DINNER AND CONVERSATION

8:30pm, Le Pot de Terre, 22 rue du Pot de Fer, a restaurant a brief walk from ENS.

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Speaker Abstracts - *In Presentation Order*

Scale Relativity and Fractal Space-Time: Theory and Applications

Laurent Nottale, Directeur de Recherche, CNRS Meudon, France

In the first part of this contribution, we review the development of the theory of scale relativity and its geometric framework constructed in terms of a fractal and nondifferentiable continuous space-time. This theory leads (i) to a generalization of possible physically relevant fractal laws, written as partial differential equation acting in the space of scales, and (ii) to a new geometric foundation of quantum mechanics and gauge field theories and their possible generalisations.

In the second part, we discuss some examples of application of the theory to various sciences, in particular in cases when the theoretical predictions have been validated by new or updated observational and experimental data. This includes predictions in physics and cosmology (value of the QCD coupling and of the cosmological constant), to astrophysics and gravitational structure formation (distances of extrasolar planets to their stars, of Kuiper belt small planets, value of solar and solar-like star cycles), to sciences of life (log-periodic law for species punctuated evolution, human development and society evolution), to Earth sciences (log-periodic deceleration of the rate of California earthquakes and of Sichuan earthquake replicas, critical law for the arctic sea ice extent) and tentative applications to systems biology.

Does Species Evolution Follow Scale Laws ? First App. of Scale Relativity Theory to Fossil Living-Beings

Jean Chaline, Emeritus Director in CNRS, CNRS Dijon, France

We have demonstrated, using the Cantor dust method, that the statistical distribution of appearance and disappearance of rodents species (Arvicolid rodent radiation in Europe) follows power laws strengthening the evidence for a fractal structure set. Self-similar laws have been used as model for the description of a huge number of biological systems. With Nottale we have shown that log-periodic behaviors of acceleration or deceleration can be applied to branching macroevolution, to the time sequences of major evolutionary leaps (global life tree, sauropod and theropod dinosaurs postural structures, North American fossil equids, rodents, primates and echinoderms clades and human ontogeny). The Scale-Relativity Theory has others biological applications from linear with fractal behavior to non-linear and from classical mechanics to quantum mechanics.

The Role of Energy Conservation and Vacuum Energy in the Evolution of the Universe

Jan Greben, Principal Scientist, CSIR Pretoria, South Africa

We discuss a new theory of the universe in which the vacuum energy is of classical origin and dominates the energy content of the universe. As usual the Einstein equations determine the simple metric of this universe, however, the scale factor is controlled by total energy conservation in contrast to the practice in the Robertson-Walker formulation. This theory naturally leads to an explanation for the Big Bang and is not plagued by the horizon and cosmological constant problem. It naturally accommodates the notion of dark energy, and proposes a possible explanation for dark matter. It leads to a dual description of the universe: on the one hand one can describe the universe in terms of the original Einstein coordinates in which the universe is expanding, on the other hand one can describe it in terms of co-moving time and spatial coordinates in which the universe looks stationary and the lifetime of the universe appears constant (a new type of relativity property or scale invariance).

The paper describes the evolution of this universe. It starts out in a classical state with perfect symmetry and zero entropy. Due to the vacuum metric the effective energy density is infinite at the beginning, but diminishes rapidly. Once it reaches the Planck energy density of elementary particles, the formation of particles can commence. Due to the quantum nature of creation and annihilation processes inhomogeneities appear in the matter distributions and residual proton (neutron) and electron densities result. Hence, quantum uncertainty plays an essential role in the creation of a diversified complex universe with increasing entropy. It thus seems that quantum fluctuations play a similar role in cosmology as random mutations do in biology.

The Foundation of Physics

Tom Gehrels, Professor, University of Arizona, Tucson, AZ, United States

This paper first overviews our universe by using Max Planck's natural measurement units for length, mass, time and derived units, *i.e.* the Planck domain. The domain has quantum, relativity, gravity, and atomic physics in unified operation. Unexpected discoveries are thereby made, of a finite mass for our primordial universe and of an exponentially increasing hierarchy of other universes. The hierarchy operates as a trial-and-error evolutionary system, on cosmological time scales, whereby universes survive only when they are nearly flat (near critical mass, such that they do not collapse, or expand too fast). The foundation of our physics lies in that multiverse - the universes have the physics of the Planck domain.

If the theory holds up to further scrutiny, it will show that the unified physics of the Planck domain has an interpretation without anthropic notions and without counter-intuitive results such as parallel universes. Predictions and future work appear throughout the paper and they are assembled at the end.

Complex-Dynamic Cosmology and Emergent World Structure

Andrei Kirilyuk, Dr., Institute of Metal Physics, Kiev, Ukraine

Universe structure emerges in the unreduced, complex-dynamic interaction process with the simplest initial configuration (two attracting homogeneous media). The unreduced interaction analysis avoiding any perturbative model gives intrinsically creative cosmology describing the real, explicitly emerging world structure with dynamic randomness on each scale. Without imposing any postulates or additional entities, we obtain physically real, three-dimensional space, irreversibly flowing time, elementary particles with their detailed structure and intrinsic properties, causally complete and unified version of quantum and relativistic behaviour, origin and number of naturally unified interaction forces, classical behaviour emergence in a closed system and true quantum chaos. Major problems of usual cosmology and astrophysics are solved in this extended approach, including those of quantum cosmology and gravity, entropy growth and time arrow, "hierarchy" of elementary particles (Planckian unit values), "anthropic" difficulties, Big Bang contradictions, and "missing" ("dark") mass and energy. Universality of the proposed theory is expressed by the symmetry (conservation) of complexity providing the unified, irregular, but exact (never "broken") Order of the World that underlies all universe structures, phenomena and laws.

Complexity and Evolution: A New Way of Shaping the Tree of Life

Börje Ekstig, Assistant Professor, Uppsala University, Uppsala, Sweden

In the present paper I suggest a model of life implying human culture to form a continuous extension of organic evolution. The model supports the widespread notion of an accelerating pace of organic and cultural change and suggests acceleration to be seen as a process in time against the level of complexity.

The model has led to the construction a new shape of the Tree of Life depicting complexity versus time, and I discuss the seemingly contradictory observations that each separate species by and large shows relatively minute evolutionary changes whereas life as a whole displays a universal increase of complexity. According to this view the human species is unique amongst all other living creatures in as much as it has reached the highest level of complexity.

How Big History Works: Energy Flows and the Rise and Demise of Complexity

Fred Spier, Senior Lecturer in Big History, University of Amsterdam, Netherlands Amsterdam, Netherlands

In this article, I advance an explanatory scheme for all of history from the beginning of the Universe until life on Earth today (big history). My scheme is based on the ways in which energy levels as well as matter and energy flows have made possible both the rise and demise of complexity in all its forms.

Application of Quantum Darwinism to Cosmic Inflation: An Example of the Limits Imposed in Aristotelian Logic by an Information-Based Approach to Gödel's Incompleteness

Nicolas Lori, Researcher, University of Coimbra, Coimbra, Portugal
& Alex Blin, Professor, Universidade de Coimbra, Coimbra, Portugal

Gödel's incompleteness applies to any system with recursively enumerable axioms and rules of inference. Chaitin's approach to Gödel's incompleteness relates the incompleteness to the amount of information contained in the axioms. Zurek's Quantum Darwinism attempts the physical description of the universe using information as one of its major components. The capacity of Quantum Darwinism to describe quantum measurement in great detail without requiring ad-hoc non-unitary evolution makes it a good candidate for describing the transition from quantum to classical. A baby-universe diffusion model of cosmic inflation is analyzed using Quantum Darwinism. In this model cosmic inflation can be approximated as Brownian motion of a quantum field, and quantum Darwinism implies that Brownian motion will make the quantum field decohere. The quantum Darwinism approach to decoherence in the baby-universe cosmic-inflation model yields the decoherence times of the baby-universes. The result is the equation relating the baby-universe's decoherence time with the Hubble parameter.

Quantum Mechanics and Environment-Induced Superselection Rules

Thomas Durt, Postdoc Researcher, TONA, Free University Brussels (VUB), Brussels, Belgium

The term entanglement was first introduced by Schroedinger who described this as the characteristic trait of quantum mechanics, ``the one that enforces its entire departure from classical lines of thought''. Bell's inequalities show that when two systems are prepared in an entangled state, the knowledge of the whole cannot be reduced to the knowledge of the parts, and that to some extent the systems lose their individuality. It is only when their joint wave-function is factorisable that they are separable. So, entanglement reintroduces holism and interdependence at a fundamental level and raises the following question: is it legitimate to believe in the Cartesian paradigm (the whole is the sum of its parts, the description of the whole reduces to the description of its parts), when we know that entangled objects (the majority of quantum systems) are entangled?

In order to solve this apparent contradiction, Zurek and coworkers developed, in the framework of the decoherence approach, the idea that maybe if we think classically, this is because during the evolution, our brain selected in the external (supposedly quantum) world the islands of stability that correspond to the maximal quantum (Shannon-von Neumann) information. These 'classical islands' would correspond to the structures that our brain naturally recognizes and identifies, and this is why the way we think is classical.

An Algorithmic Info. Theory Approach to the Emergence of Order Using Simple Replication Models

Sean Devine, Research Fellow, Victoria University of Wellington, Wellington, New Zealand

This paper applies Algorithmic Information Theory to simple examples of replication processes to illustrate how replicating structures can generate and maintain order in a non equilibrium system. Variation in replicating structures enhances the system's ability to maintain homeostasis in a changing environment by allowing it to evolve to a more restricted region of its state space. Stability is further enhanced when replicating systems develop dependencies, by sharing information or resources. Such systems co-evolve, becoming more independent of the external environment. Nested systems have a hierarchy of dependency but have low algorithmic entropy as they are in principle simpler to describe algorithmically. Nesting of replicating systems offsets the need for increased variety by allowing the structures to increase in organizational complexity with little increase in algorithmic
entropy. Chaitin's d-diameter complexity provides a measure of the level of order in nested replicating systems.

Computational and Biological Analogies for Understanding the Fine-Tuning of Parameters in Physics

Clément Vidal, Research Assistant, ECCO, Free University Brussels (VUB), Brussels, Belgium

In this paper, we explore computational and biological analogies to tackle the fine tuning problem in cosmology. It states that if a number of parameters, both constants in physics and initial parameters in Big Bang models had been slightly different, no life or more generally no complexity would have emerged. We first clarify what it means for a physical constant or initial parameter to be "fine tuned". We review important distinctions such as the *dimensionless* and *dimensionful* physical constants, and the classification of constants proposed by Levy-Leblond. Duff argued that the number and value of *dimensionful* constants is arbitrary and that the most economical choice is to have zero constant. We examine if and how this conclusion can affect the fine-tuning arguments.

We then explore how two great analogies, computational and biological can give new insights in our problem. As a preliminary study to critically examine the two analogies, we first argue that analogies are useful and fundamental cognitive tools and also point out their possible misuses and abuses. The idea that our universe might be modelled as a computational entity is analysed, and we distinguish between physical laws and initial conditions using Chaitin's algorithmic information theory. Laws represent information about the world which can be shortened by algorithmic compression; whereas initial conditions represent information that cannot be so compressed. On the other hand, if the universe is to be likened to an organism, then this biological analogy suggests that the universe is an evolutionary developmental system. Smolin was one of the first cosmologists to introduce such an analogy with his theory of "cosmological natural selection". His theory is compared to the carrying on of the analogy proposing an hereditary mechanism to complete CNS. We discuss how far this extension can be legitimated.

The String Landscape as Genetic Alphabet: The Subtle Virtues of a Non-Unique Cosmic Code

James Gardner, Vice President, Gardner & Gardner, Portland, OR, United States

In his classic reflection on the nature of life—*Life Itself: Its Origin and Nature*—Francis Crick contrasted the genetic code employed by every organism on Earth with the periodic table of chemistry by underscoring the arbitrariness of the former and the ineluctable cosmic universality of the latter. Because it was both inherently random and universally pervasive throughout the terrestrial biosphere, Crick concluded that the genetic code's very ubiquity on planet Earth conveyed a subtle but powerful message about the origin of life: If this appearance of arbitrariness in the genetic code is sustained, we can only conclude . . . that all life on earth arose from one very primitive population which first used it to control the flow of chemical information from the nucleic acid language to the protein language. A quarter of a century after publication of *Life Itself* we continue to marvel at the uncanny degree of terrestrial biochemical unity—a degree of unity greater even than Crick suspected. But, ironically, the presumed universality of the laws and constants of physics (which underlie the periodic table and every other law and principle of interest to chemists) has been called severely into question. The culprit responsible for this disquieting development is string theory—more precisely, the concept of a string theory landscape containing numerous low-energy vacuua that manifest a dizzying array of physical constants and dimensional set-ups, none of which appear to be mathematically favored by the underlying theory.

The physics community has reacted with predictable horror to this messy environmental problem. Physicists, after all, had hoped that string theory (and its successor, M-theory) would, in the end, yield a "brittle" unique solution, dictated by invariant mathematical principles, that would correspond tightly to the parameters of the Standard Model. Thus would the dream of a final theory have been finally realized. That hope has been dashed. Now string theorists, more out of desperation than conviction, have rushed to embrace the weak anthropic principle as the *deus ex machina* that selects our cosmic code from the googolplex of alternatives that lurk in the mathematical recesses of the theory. But is despair and desperation the appropriate response to this development? Or might the very arbitrariness of the cosmic code prevalent in our universe be trying to tell us something important, much as the arbitrariness of the genetic code was saying something important to Crick? The thesis of this paper is that the very arbitrariness of the Standard Model—the bitter pill of non-uniqueness that string theorists have been forced to swallow— possesses a subtle and largely overlooked virtue. This arbitrariness may imbue the Standard Model with the capacity to function as a genuine code—a kind of cosmic DNA—that (1) prescribes a developmental program of cosmic ontogeny and (2) serves as a heredity mechanism in a hypothesized process of cosmological replication.

Evo Devo Universe? A Framework for Speculations on Cosmic Culture

John Smart, President, ASF, Mountain View, CA, United States

The underlying paradigm for cosmology is theoretical physics. In this paper we explore ways this framework might be extended with insights from information and computation studies and evolutionary developmental (evo-devo) biology. We also briefly consider implications of such a framework for cosmic culture. In organic systems, adaptive evolutionary development guides the production of intelligent, ordered and complex structures. In such systems we can distinguish evolutionary processes which are stochastic, creative, and 'divergent,' and developmental processes which produce statistically predictable, robust, conservative, and 'convergent' structures and trajectories.

We will briefly model our universe as an information processing, evolutionary and developmental system, as an 'info evo devo universe' (abbreviated 'evo devo universe' hereafter). Our framework will try to reconcile the majority of unpredictable, evolutionary features of universal emergence with a special subset of potentially statistically predictable and developmental universal trends, including: 1) accelerating advances in universal complexity, a pattern seen over the last half—but not the first half—of the universe's history, 2) increasing spatial and temporal locality of universal complexity development, 3) hierarchical emergence of increasingly matter and energy efficient and matter and energy dense 'substrates' (platforms) for adaptation and computation, 4) the apparent accelerating emergence, on Earth, of increasingly postbiological (technological) systems of physical transformation and computation. We use the phrase 'evo devo' without the hyphen here, to distinguish this speculative philosophy and systems theory from the legitimate science of 'evo-devo' biology, from which we seek insights.

The Meaning of Life in a Developing Universe

John Stewart, Dr., ECCO Melbourne, Victoria, Australia

The evolution of life on Earth has produced an organism that is beginning to model and understand its own evolution and the possible future evolution of life in the universe. These models and associated evidence show that evolution on Earth has a trajectory. The scale over which living processes are organized cooperatively has increased progressively, as has its evolvability.

Recent theoretical advances raise the possibility that this trajectory is itself part of a wider developmental process. According to these theories, the developmental process has been shaped by a larger evolutionary process that involves the reproduction of universes. This evolutionary process has tuned the key parameters of the universe to increase the likelihood that life will emerge and develop to produce outcomes that are successful in the larger process (e.g. a key outcome may be to produce life and intelligence that intentionally reproduces the universe and tunes the parameters of 'offspring' universes).

Theory suggests that when life emerges on a planet, it moves along this trajectory of its own accord. However, at a particular point evolution will continue to advance only if organisms emerge that decide to advance the evolutionary process intentionally. The organisms must be prepared to make this commitment even though the ultimate nature and destination of the process is uncertain, and may forever remain unknown. Organisms that complete this transition to intentional evolution will drive the further development of life and intelligence in the universe. Humanity's increasing understanding of the evolution of life in the universe is rapidly bringing it to the threshold of this major evolutionary transition.

A Hierarchical Definition of Life

Gerard Jagers op Akkerhuis, Sr. Scientist, Wageningen U. and Research Ctr, Wageningen, Netherlands

To some, a virus, a cell and a robot are life. Others consider only cellular beings life. Despite hundreds of definitions, there is no consensus about a system-based definition. This is problematic for the practical and theoretical progress in various disciplines, including exobiology, artificial life, biology and evolution. This paper suggests a way to improve upon this situation. In an earlier paper, I have introduced the 'operator hierarchy', offering a strict complexity ranking of systems, from superstrings to animals with brains. Here I use this hierarchy for defining life, the organism and death, and explore the application of these definitions in practical situations.

The operator hierarchy allows defining life as 'matter with the configuration of an operator, and that possesses an equal, or an even higher complexity than the cellular operator'. Living, then, is synonymous to the dynamics of such systems. I suggest considering as organisms only operators fitting the present definition of life. In this context, its existence as an operator represents the minimum condition defining an organism, construction being more essential than metabolism, growth or reproduction. In the operator hierarchy, closures define complexity levels, for example from pro- to eukaryote and from uni- to multicellular. These closures, allow defining death as 'the loss of an organism's typical closure in the course of an irreversible process of deterioration'. The generality of the operator hierarchy also offers a context for discussing 'life as we do not know it'. The paper ends with a range of practical examples, including viruses, mitochondria, robots, flowers in a vase, prions, etc.

Are Particles Self-Organized Systems?

Vladimir Manasson, Dr., Sierra Nevada Corporation, Irvine, CA, United States

Elementary particles possess quantized values of charge and internal angular momentum or spin. These characteristics do not change when the particles interact with other particles or fields as long as they preserve their entities. Quantum theory does not explain this quantization. It is introduced into the theory a priori. An interacting particle is an open system and thus does not obey conservation laws. However, an open system may create dynamically stable states with unchanged dynamical variables via self-organization. In self-organized systems stability is achieved through the interplay of nonlinearity and dissipation. Can self-organization be responsible for particle formation?

In this paper we develop and analyze a particle model based on qualitative dynamics and the Feigenbaum universality. This model demonstrates that elementary particles can be described as self-organized dynamical systems belonging to a wide class of systems characterized by a hierarchy of period-doubling bifurcations. This semi-qualitative heuristic model gives possible explanations for charge and action quantization, and the origination and interrelation between the strong, weak, and electromagnetic forces, as well as SU(2) symmetry. It also provides a basis for particle taxonomy endorsed by the Standard Model. The key result is the discovery that the Planck constant is intimately related to elementary charge.

Universal Evolutionary Hierarchy: A Unified Network Approach

Peter Winiwarter, Dr., Bordalier Institute, Boursay, France

Hierarchies are ubiquitous. You find them in any science and in any field of research. In fact the hierarchical “vision” of a system is a way to put a *static* order into the view of a complex system. Networks are everywhere. You find them from galaxies to the World Wide Web. Again the networks don't exist, they are only a mental framework to put a *dynamic* order into the view of a complex system. The Universe is a hierarchy – most people agree that it is not a flatland – but it can also be seen as a hierarchy of networks. How to put an order into this complex mess of viewpoints, points of view and world views? This paper attempts to establish an evolutionary hierarchy based on clearly stated criteria. A hierarchy is an ordered set: ordered according to an order criterion. As order criterion for the universal evolutionary hierarchy we propose the time of emergence during evolution as observed by today’s science. By time of emergence we understand the first observation during the process of evolution of a given hierarchical level. Such a nested hierarchy of levels corresponds to the temporal sequence of their emergence.

The number of levels in our hierarchy is arbitrary. For simplicity we choose 24 levels: 12 levels for the astrophysical evolution (deceleration and expansion of the universe from the big bang to the origins of biological life), and 12 levels from the early biosphere to the present of the Internet and Web Services (acceleration of evolution).

Integration as a Fundamental Process in Cosmic Evolution and Science Development

Kris Roose, MD (Psychiatrist), Academy for Integrative Psychology, Ghent, Belgium

In this Review Paper the author presents a description of the procedure of integration, that is encountered as well in nature as in pre-exact science, and that can be applied to develop new hypotheses out of apparently conflicting theories. He then makes an overview of many application fields for this procedure, including creativity, mental health, evolution, communication, social synergy, internet, ethics. This method is also proposed as an alternative for the non applicable exact scientific method for the alpha sciences. He concludes with a short overview of the development of integrative thinking.

Information Organization and Knowledge Evolution: The Case of Innovations in Pharmaceuticals

Henning Carl Reschke, Dr., IMFK, Cologne, Germany (attendance uncertain)

This paper explores how a systemic evolutionary view, which argues that evolution is a knowledge generating process, and conceptually or mathematically related perspectives can contribute to an integrated perspective on the evolution of information organization from inanimate matter to molecules to social systems by linking the latter two domains. If correct, the first domain of inanimate matter should in principle—though not necessarily easily in practical research—be subsumable to the perspective sketched here, particularly as it is the least complex one on a process-level.

The paper uses the illustrative example of punctuation patterns in pharmaceutical innovations as a starting point for discussing a number of theoretical models and perspectives with respect to their suitability for such an integrated perspective. These models, if sufficiently correct representations of the characteristics of and tools for research into evolutionary development processes, should play a role in explaining the molecular makeup of human organisms. Thus they also must find a reflection in the history and characteristics of pharmaceutical research as well as the more general characteristics of knowledge processes. The implied circularity of scientific concepts used for analysis and processes operating in the domain indicates the relativity and reflexivity of knowledge which is seen as expression of evolutionary processes of knowledge growth in the social domain being 'eigenprocesses' of evolutionary development from inanimate matter to the social domain.