Contact

ETH Zürich
Sara Booz
Clausiusstrasse 59, RZ J 7
8092 Zürich
hpm_office@gess.ethz.ch
www.hpm.ethz.ch

Herausgeber	Department of Humanities, Social and Political Sciences Chair of History and Philosophy of Mathematical Sciences and the Turing Centre
Redaktion	Victoria Laszlo
Gestaltung	Hochschulkommunikation, ETH Zürich
Druck	PrintFactory
Auflage	2000

ETH zürich

Symposium

The science of systems and life: alternative philosophies, new mathematics

Date & Time: Friday, 26 October 2018, 10:50 – 16:30

Venue: ETH Zurich, Clausiusstrasse 59, RZ F 21

Organisers:
Prof. Dr. Roy Wagner, HPM, ETH Zurich
PD Dr. Dr. Norman Sieroka, The Turing Centre, ETH Zurich
Association Girolamo Cardano

www.hpm.ethz.ch

D GESS

The Turing Centre

The Girolamo Cardano Association

We are a group of mathematicians who denounce a mathematization of the world oriented towards purely quantitative analyses and reductionism, rather than invention and construction of understanding. The prevailing use of mathematics as a search for “optimal paths” in economy, biology and general human activities supposes a pre-given universe of possibilities and is suitable for control more than for knowledge construction and a common action. Sometimes, researchers even claim that “computer programs” run organisms’ development and animal or human behavior.
We are instead interested in the historical emergence of meaning in changing spaces of possibilities as well as in the production of sense in science and in the personal activity of the researcher. Our current work focuses on historicity, organicity and contextuality of life; on the role of interpretation and meaning in the process of vision; on the importance of interpretation in the applications of mathematics and of a committed analysis of future projections in areas such as finance and ecology.

In 2017, we proposed the creation of the association Girolamo Cardano (1501-1576: inventor of imaginary numbers, first thinker of the transformation of the living in time) that readers are invited to join: http://cardano.visions-des-sciences.eu

Participants and Abstracts

Prof. Dr. Giuseppe Longo

Mathematician, CNRS-Ens,
Paris and Biology Dept.,
Tufts U., Boston

Modeling in natural sciences, following, but going beyond Turing: discrete vs continua, or the necessity of contingency

Turing's Logical Computing Machine grounds its effectiveness and success on the perfect nonsense of its stepwise activity ("desultory" and "Laplacian", says Turing), on the distinction of hardware (the "tape") and software (the "instructions"), and on the one-dimensional coding of digital computations. After World War II, while stressing the practical interest of his "Discrete State Machine", Turing works also on very different physical structures by his 1952 analysis of morphogenesis in "continuous systems". His action/reaction/diffusion systems will pave the way to a new insight into many physical processes in biology. Mainstream molecular biology, instead, is still grounded on vague notions of software and information of a Laplacian nature, enriched by some "noise", against Turing's view and despite Schrödinger's awareness of the deterministic properties of the notion of genetic "code". Darwinian principles and the peculiar nature and role of randomness in biology set the guidelines for new approaches, radically departing from the coded homunculus in the DNA. These are in a similar vein to Turing's morphogenesis and his "falsification", as he says, of the instructional approach to the genesis of biological forms.

Dr. Maël Montévil

Theoretical biology, IRI,
Centre Pompidou

What is a new possibility in theoretical biology?

Biological evolution involves the appearance of new traits, new phenotypes and new processes, but the mathematical understanding of such novelties is still lacking. In this paper, I argue that the notion of a new possibility should and can be a fundamental notion in biology. This idea has been used in several models but it still lacks a proper mathematical, theoretical and epistemological framework. What "new possibility" means should be analyzed carefully, since, as for the notion of probability, a priori and a posteriori points of view cannot be conflated. Moreover, possibilities are virtual and it seems at first sight that adding possibilities by a retrospective theoretical move does not change the state of an object. I will first discuss a positive notion of possibility, which pertains to properties that are properly defined theoretically. This will lead us to a more precise discussion than the set-theoretic language to describe possibilities and enable us to define a robust notion of new possibilities.

Prof. Dr. Alessandro Sarti

Mathematician, CNRS – EHESS,
Paris

The dynamic of heterogenesis and becoming singular

In this talk, we present the notion of "differential heterogenesis". This is a mathematical framework to envisage the singular emergence of distinct forms from a distribution of heterogeneous operators. In opposition to the kind of differential calculus that's usually adopted in mathematical-physical modeling, which tends to assume a homogeneous differential equation applied to an entire homogeneous region, heterogenesis allows differential constraints of qualitatively different kinds in different points of space and in time. These constraints can also change in time, opening the possibility for new kinds of differential dynamics and the emergence of distinct entities and forms. This approach can be applied to the organization of brain connectivity in neuroscience, to the evolution of organisms, to the emergence of expression/content planes in semiotics, and to the dynamics of the multitude (the opposite of an homogenous mass) in political philosophy. This study is inspired by Deleuze and Guattari's concept of differential heterogenesis, roughly stated in "Difference et Repetition" and in "A Thousand Plateaus", and gives it precise mathematical meaning. We translate what the philosophers would describe as "the becoming of forms in terms of actualization of an intensive field of singularities into forms extended in space and time" into a new mathematical approach.

Programme

10:50 – 11:00	Welcome and introduction by Prof. Dr. Roy Wagner and PD Dr. Dr. Norman Sieroka
11:00 – 12:00	**Prof. Dr. Giuseppe Longo** Modeling in natural sciences, following, but going beyond Turing: discrete vs continua, or the necessity of contingency
12:05 – 13:05	**Dr. Maël Montévil** What is a new possibility in theoretical biology?
13:05 – 14:30	Lunch break
14:30 – 15:30	**Prof. Dr. Alessandro Sarti** The dynamic of heterogenesis and becoming singular
15:35 – 16:30	Discussion
16:30	Refreshments