

DYNAMICS OF CODING MATTER AND THE ORIGIN OF LIFE (DYCOMAT)

One of the main challenging problems in evolutionary molecular biology is understanding the mechanisms that led to the emergence of chemical digital coding from inanimate matter. While recent advances, such as the identification of fougérite as a putative coding material have been made, there are currently no reasonable theoretical models describing this transition. The primary objective of this interdisciplinary workshop is to bring together scientists from the fields of physics, mathematics, biology, and computer sciences to address two key questions central to the present COST action:

- The possible characterization of living matter (encoding matter) versus inanimate (non-encoding) matter in terms of their ability to carry an adequate program compatible with life, written in a realistic language.
- Exploration of the specific role of dynamics in encoding matter and possible phase transitions between non-encoding and encoding states of matter at the origin of life.

The Workshop will contribute to the integration of Dynamical System concepts on the interrelation between coding and decoding along the flux of biological information and related aspects on the theories of the origin of life. Moreover, will favor the development and exchange of knowhow, integration, training, and promotion of specific collaborations in the modelling of genomic information. The anticipated outcome of this activity will serve as an integrative synthesis, interweaving the research threads developed in the Bolzano and Porto Conferences and Workshops. In doing so, it will consolidate the findings related to the application of the dynamical systems approach in understanding the fundamentals of the flow of genetic information. The spirit of DYCOMAT is to actively promote collaboration among its participants. In this regard, the organization intends not to be a mere sequence of informative talks but mainly to foster effective collaborative working tables to address the specific objectives of DYNALIFE.

SCIENTIFIC COMMITTEE

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DYNALIFE

Dynamics of Coding Matter and the Origin of Life (DYCOMAT)



14-15 March 2024

Universidad de las Islas Baleares

Mallorca, Spain

THURSDAY, 14 MARCH

8:45	REGISTRATION	13:05 – 13:25	Theo Zacharis Facilitating Knowledge Exchange and Collaboration: The Role of Dissemination and Communication in the DYCOMAT Workshop
9:15	OPENING	13:25 – 15:00	LUNCH BREAK + POSTERS
9:30 – 10:15	Michael Russel The fougérite mineral: The object trouvé capable of order-for-order conversions at life's emergence	15:00 – 15:20	Martín E. García Encoding many-particle dynamics in biological systems: exemplified on synaptic vesicles, Amyloid β and the spike proteins of SARS-CoV-2
10:15 – 10:35	Julyan H. E. Cartwright Beyond crystals: the dialectic of materials and information.	15:20 – 15:40	Nevena Ilieva Viruses and information flow: developing strategies for targeted antiviral therapies
10:35 – 10:55	Silvia Holler Geologically empowered protocell formation	15:40 – 16:00	Claudia Arbeitman Non-canonical allosteric mechanisms in the regulation of protein-kinase A: simulations and theory approach
10:55 – 11:15	Jerzy Gorecki Chemical computing without logic gates.	16:00 – 16:20	Atle M. Bones From genome selection, mutagenesis, gene modification and genome editing to synthetic biology.
11:15 – 11:45	COFFEE BREAK	16:20 – 16:40	Andrej Novak Fixed-Point Framework for Quasilinear Systems of Ordinary Differential Equations: Nonlinear Strategies in Optimizing Cytotoxic Drug Administration
11:45 – 12:05	Steen Rasmussen Catalysis and information, metabolic rates, and covalent bonds	16:40 – 17:00	COFFEE BREAK
12:05 – 12:25	Ádám Kun How to define what is heredity and what is not in the origin of life	17:00 – 17:20	Pablo Rojas Inference of dynamical systems features from trajectory dynamics
12:25 – 12:45	Luis Mandel Formal languages and grammars		
12:45 – 13:05	Diego Luis González Can dynamical systems theory contribute to fill the gap between inanimate materials and coding-directed chemical reactions leading to the genetic code?		

17:20 – 17:40	Stella Logotheti Using a theoretical physics framework to characterize nullomers and their role in organismal and tumor evolution
17:40 – 18:10	Iván Marqués Campillo Genomic sequences, fractals and the ambiguity of nullomers.
18:10 – 19:00	Simone Giannerini A probabilistic framework for nullomers and absent sequences: some reflections
20:00	SOCIAL DINNER

FRIDAY, 15 MARCH

9:00	REGISTRATION
9:30 – 11:00	Moderator: Oreste Piro Working table: From fougérite to the genetic code.
11:00 – 11:30	COFFEE BREAK + POSTERS
11:30 – 13:30	Moderator: Simone Giannerini Working table: Nullomers, dynamics, languages and complexity in genomes.
13:30 – 15:00	LUNCH BREAK + POSTERS
15:00 – 17:00	Moderators: Julyan H. E. Cartwright & Pablo Rojas Working table: Summary of specific proposals and conformation of corresponding collaborative groups.
17:00	CLOSING AND REFRESHMENTS

ABOUT DYNALIFE

In the mid-twentieth century two new scientific disciplines emerged forcefully: molecular biology and information-communication theory. At the beginning cross-fertilization was so deep that the term genetic code was universally accepted for describing the meaning of triplets of mRNA (codons) as amino acids. However, today, such synergy has not taken advantage of the vertiginous advances in the two disciplines and presents more challenges than answers. These challenges are not only of great theoretical relevance but also represent unavoidable milestones for next generation biology: from personalized genetic therapy and diagnosis, to artificial life, to the production of biologically active proteins. Moreover, the matter is intimately connected to a paradigm shift needed in theoretical biology, pioneered long time ago in Europe, and that requires combined contributions from disciplines well outside the biological realm. The use of information as a conceptual metaphor needs to be turned into quantitative and predictive models that can be tested empirically and integrated in a unified view. The successful achievement of these tasks requires a wide multidisciplinary approach, and Europe is uniquely placed to construct a world leading network to address such an endeavor. The aim of this Action is to connect involved research groups throughout Europe into a strong network that promotes innovative and high-impact multi and inter-disciplinary research and, at the same time, to develop a strong dissemination activity aimed at breaking the communication barriers between disciplines, at forming young researchers, and at bringing the field closer to a broad general audience.

COST (European Cooperation in Science and Technology) is a funding agency for re-search and innovation networks. Our Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.