DYNALIFE

Nonlinear Dynamics of the Biological Information Flow (NODBIF)

A Thematic Workshop of

CA21169 COST Action DYNALIFE

Co-located with NOMA2024

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 research 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.

ABOUT NODBIF Nonlinear Dynamics of the Biological Information Flow; A Thematic Workshop of CA21169 COST Action DYNALIFE Co-located with NOMA2024. During the first year of DYNALIFE researchers involved have achieved considerable progress on setting the basis of the dynamical systems interpretation of many aspects of the biological information flows essential to life. NODBIF-DYNALIFE, will be a thematic workshop concentrated in the consolidation of this interpretation on the solid bases of the dynamical system theory. NODBIF takes advantage of the timely occurrence of the 2024 edition of the workshop NOMA (Nonlinear maps and their applications) as an excellent opportunity to put also in interaction the DYNALIFE community with the experts specialized in the general field of dynamics and its applications. For such purpose, the organizers of NODBIF and NOMA have agreed to coordinate the programs of both meetings in such a way to optimize the interaction between the corresponding participants. The spirit of NODBIF 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.

18 – 19 January 2024

Universidade do Porto

Porto, Portugal

COST Action
CA21169

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THURSDAY, 18 JANUARY 2024

09:00 – 09:20   **REGISTRATION**

09:20 – 09:30   **OPENING**

09:30 – 09:45   **Clara Grácio**
Hyperbolic geometry of biological space

09:45 – 10:00   **Rafayel Petrosyan**
Similar patterns in cell mass time series data and their links to intracellular processes

10:00 – 10:15   **Oreste Piro**
Breaking the circadian dogma: Sustained oscillations in single activation-repression loops with spatial segregation and diffusive transport

10:15 – 10:30   **Ozlem Defterli**
Mathematical Modelling of Complex Regulatory Systems via Advanced Regression Tools

10:30 – 10:45   **Slobodan Zdravkovich**
Stability analysis of solutions in the helicoidal Peyrard-Bishop model of DNA molecule

10:45 – 11:00   **Michel Planat**
From Fricke-Painlevé VI surfaces to the dynamics of gene expression

11:00 – 11:30   **COFFEE BREAK**

11:30 – 11:45   **Ozgur Yildirim**
On the weak solution of nonlinear sine Gordon system corresponding to DNA dynamics

11:45 – 12:00   **İbrahim Işık**
Modelling Molecule Propagation in 2D Cell Populations on Agar Plates: Insights for Efficient Gene Regulation of Biological Experiments

12:00 – 12:15   **Rui J. Oliveira**
Enhancement of geophysical data using mathematical transformations

12:15 – 12:30   **Rosário D. Laureano**
Nonlinear differential equation with delay: searching for complexity in the human pupillary light reflex

12:30 – 12:45   **Julyan Cartwright**
Life emerged when physics and chemistry transformed geology into biology

12:45 – 13:00   **DISCUSSIONS**

13:00 – 14:30   **LUNCH BREAK**

14:30 – 14:45   **Diego L. González**
Biological void is highly structured: a dynamical systems approach to absent genomic sequences (nullomers)

14:45 – 15:00   **Iván Marqués Campillo**
Genomic sequences, fractals and the ambiguity of nullomers

15:00 – 15:45   **Discussions and working tables planning**

15:45 – 16:00   **COFFEE BREAK**

JOINT NOMA–NODBIF SOCIAL EVENTS:

16:30 – 17:30   **PORTO WINE CELLAR VISIT**

17:30   **BOAT TRIP AND DINNER**

FRIDAY, 19 JANUARY 2024

09:15 – 09:30   **REGISTRATION**

09:30 – 11:00   **INTERACTION WITH THE NOMA PROGRAM**

09:30 – 11:00   **WORKING TABLES**

09:30 – 10:15   **Jorge Zubelli**
Diffusion maps and a data-driven algorithm for gradient estimation on manifolds (Joint keynote for NOMA and NODBIF)

10:15 – 11:00   **Diego L. González**
Modelling of complex biological systems: the dynamical systems paradigm (Joint keynote for NOMA and NODBIF)

11:00 – 11:30   **COFFEE BREAK**

11:30 – 13:00   **INTERACTION WITH THE NOMA PROGRAM**

11:30 – 13:00   **WORKING TABLES**

11:30 – 11:45   **Sara Fernandes**
Coupling and stabilization (Joint talk for NOMA and NODBIF

12:45 – 12:30   **Julyan Cartwright**
A coupled map lattice model with excitable dynamics and its applications to crystal growth, to the formation of mother of pearl in molluscs, and to the building of brood combs by stingless bees. (Joint keynote for NOMA and NODBIF)

13:00 – 14:30   **LUNCH BREAK**

14:30 – 16:00   **INTERACTION WITH THE NOMA PROGRAM**

14:30 – 16:00   **WORKING TABLES**

16:00   **CLOSING AND REFRESHMENTS**

SCIENTIFIC COMMITTEE
Clara Gracio (University of Évora)
Oreste Piro (University of the Balearic Islands)
Diego Luis Gonzalez (CNR-IMM Bologna)
Julyan Cartwright (CSIC-IACT Granada)
Simone Giannerini (University of Bologna)

ORGANIZING COMMITTEE
Clara Gracio (University of Évora)
Sara Fernandes (University of Évora)
Oreste Piro (University of the Balearic Islands)