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BOOK OF ABSTRACTS



4th Belgrade Bioinformatics Conference

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FOREWORD

Dear colleagues and friends,

The 4th Belgrade Bioinformatics Conference - BelBi2023, where many high-quality scientific contributions were presented, has just ended. With great thanks to all participants, we now proudly present a book of abstracts that both reflects the scientific abundance and diversity of the conference and serves as a reminder of a memorable event.

Several research institutions, faculties, and scientific societies from Serbia joined forces in organizing this international conference, which covered numerous topics in computational biology, bioinformatics, and biomedical and health informatics. The main goal of BelBi2023 was to foster contact between scientists, both early stage career and senior researchers, allowing them to share experiences and latest advances in their fields. We sincerely hope that BelBi2023 has served as a platform for researchers from around the world to meet, initiate new collaborations, and expand professional contacts, and that all of you would become a part of the growing BelBi community.

We are grateful and proud to have welcomed more than 250 researchers from 21 countries. We have had 28 scientific sessions, consisting of more than 60 lectures (including eight Keynote talks), 47 presented posters, as well as three workshops and one satellite event – COST action. We have also organized seven industry lectures, including the NGS Challenge,

two Meet the Expert Sessions, and one Business Coffee Break where ten start-up companies took part. And finally, the future BIO4 campus was presented and first panel on Serbia's resources for storage and analyses of genetic data was organized.

We would like to thank all the members of the International Advisory Board and the International Program Committee for their efforts and help in making this event a success. We are very grateful to the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, SAIGE project, and UNDP-Serbia for their support. Finally, the Local Organizing Committee is very grateful to all the sponsors of the conference - BGI, Illumina & Elta'90MS, PacBio & East Diagnostics, ThermoFisher Scientific & Vivogen, Huawei, Labena, DSP Chromatography, RNIDS, Telekom Srbija, Alfa Genetics, Kefo and Superlab, hoping that they will stay with us for many years to come.

Looking forward to seeing you again at the 5th Belgrade Bioinformatics Conference.

Belgrade, July 2023

Dr. Valentina Đorđević
& *Dr. Ivana Morić,*
On behalf of BelBi2023
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“What is life?": Open quantum systems approach

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Recently the quantum formalism and methodology started to be applied to modeling of information processing in biosystems, mainly to the process of decision making and psychological behavior (but some applications to microbiology and genetics are considered as well). Since a living system is fundamentally open (an isolated biosystem is dead), the theory of open quantum systems is the most powerful tool for life-modeling. In this presentation, we turn to the famous Schrödinger book “*What is life?*” and reformulate his speculations in terms of this theory. Schrödinger pointed out to order preservation as one of the main distinguishing features of biosystems. Entropy has the tendency to increase (*Second Law of Thermodynamics* for isolated classical systems and dissipation in open classical and quantum systems). Schrödinger emphasized the ability of biosystems to beat this tendency. We demonstrate that systems processing information in the quantum-like way can preserve the order-structure expressed by the quantum (von Neumann or linear) entropy. We emphasize the role of the special class of quantum dynamics and initial states generating *the camel-like graphs for entropy-evolution* in the process of interaction with a new environment E:

- 1) entropy (disorder) increasing in the process of adaptation to the specific features of E;
- 2) entropy decreasing (order increasing) resulting from adaptation;
- 3) the restoration of order or even its increase for limiting steady state. In the latter case the steady state entropy can be even lower than the entropy of the initial state.

Such quantum entropy dynamics is illustrated by graphs obtained via numerical simulation for quantum master equation. For simplicity of modelling we consider only quantum Markov dynamics. But the real dynamics of biosystems' states is non-Markovean.

Keywords: Open quantum systems, biosystems, order stability, entropy dynamics, quantum master equation, adaptation to environment, camel-like shape of entropy



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