XXI CONFERENCE OF THE INTERNATIONAL SOCIETY FOR BIOLOGICAL CALORIMETRY ISBC 2022

June 8–10, 2022
Vilnius, Lithuania

ABSTRACT BOOK

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WELCOME

On behalf of the Conference Organizing Committee I would like to welcome you to the XXI Conference of the International Society for Biological Calorimetry.

We are delighted to welcome you in Vilnius, capital of Lithuania, and hope that you will enjoy both the scientific sessions and the cultural and social program.

Prof. Daumantas Matulis

Conference Chair
Director, Life Sciences Center
Vilnius University

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PROGRAM

JUNE 8, 2022 | Wednesday

09:00–17:00	Registration & Hospitality desk
	SESSION 1 Moderator: Daumantas Matulis
11:00–11:10	Opening remarks *Daumantas Matulis* | Conference Chair
11:10–11:40	Using Isothermal Microcalorimetry to Determine the Stability of Whey Protein Bars *Jason Kenealey* | Brigham Young University, USA
11:40–12:10	Differential Scanning Calorimetry – A Complimentary Approach For Biomedical Studies *Nichola Garbett* | University of Louisville, USA
12:10–12:40	Advances in Biofilm Detection and Monitoring Using Calorimetry, and The Push Towards Clinical Diagnostics Applications *Magnus Jansson* | Symcel AB, Sweden
12:40–14:00	Lunch
	SESSION 2 Moderator: Lars Wadsö
14:00–14:30	Intrinsic Thermodynamics of Protein-ligand Binding by Isothermal Titration Calorimetry for Drug Design *Daumantas Matulis* | Vilniaus University, Lithuania
14:30–15:00	Physical Bioenergetics of Biological Systems *Václav Bočan* | Max Planck Institute of Molecular Cell Biology and Genetics, Germany
15:00–15:30	The Intrinsic Thermodynamic Parameters of Carbonic Anhydrase II and Acetazolamide Interaction *Eglė Vitkūnaitė* | Vilnius University, Lithuania
15:30–17:00	Coffee break and Poster session
17:15–19:00	Vilnius city tour
19:00–22:00	Get-together dinner at Burbulis wine bar

PROGRAM

JUNE 9, 2022 | Thursday

08:30–16:00	Registration & Hospitality desk
	SESSION 3 Moderator: Olivier Braissant
09:00–09:30	The Activity of Wood Decaying Fungi Measured by Isothermal Calorimetry *Lars Wadsö* | Lund University, Sweden
09:30–10:00	What Relationship Between Heat Generation by Living Organisms, by Heat Engines and by the Human Brain? *Urs von Stockar* | Swiss Federal Institute of Technology, Switzerland
10:00–10:30	Differences in Infectivity and Pathogenicity Between Delta and Omicron Strains of SARS-CoV-2 Can Be Explained by Gibbs Energies of Binding and Growth *Marko Popovic* | Technical University of Munich, Germany
10:30–11:00	Coffee break
	SESSION 4 Moderator: Urs von Stockar
11:00–11:30	Isothermal Microcalorimetry and the Development of Antimicrobial Orthopedic Implants and Dental Aligners *Olivier Braissant* | University of Basel, Switzerland
11:30–12:00	Biocalorimetry – An Early Warning Tool for the Detection of Legionella Pneumophila in Drinking Water *Christian Fricke* | University of Koblenz-Landau, Germany
12:00–12:30	Calorimetric Heat Waves to Study the Soil Sensitivity to Temperature *Nieves Barros* | University of Santiago de Compostela, Spain
12:30–14:00	Lunch
14:00–15:00	Poster session
15:00–16:00	ISBC meeting
16:20–22:00	Social program: excursion to Trakai and Conference dinner in Apvalaus Stalo Klubas restaurant in Trakai

PROGRAM

JUNE 10, 2022 | Friday

09:00–12:00	Registration & Hospitality desk
	SESSION 5 Moderator: Jason Kenealey
09:30–10:00	Isothermal Titration Calorimetry For The Analysis of the Kinetics and Completeness of Enzymatic Polyethylene Terephthalate (PET) Nanoplastic Degradation *Thomas Mascow* | Helmholtz-Centre for Environmental Research – UFZ, Germany
10:00–10:30	A Calorimetric Study of Interactions in the Systems of Charged Surfactants and Ionic Poly(amino acid)s *Vytautas Petrauskas* | Vilnius University, Lithuania
10:30–11:00	Coffee break
	SESSION 6 Moderator: Thomas Mascow
11:00–11:30	Conserved Patterns of Heat Release From Cultured Microorganisms Reveal Simple Growth–Metabolism Relations *Karim Fahmy* | HZDR, Institute of Resource Ecology and TU, Germany
11:30–12:00	Isothermal Calorimetry and Complementary Methods to Understand Nucleotide-Based Second Messenger Action on Proteins *Gert Bange* | Philipps University Marburg, Germany
12:30–12:40	Closing remarks *Daumantas Matulis* | Conference Chair

ORAL PRESENTATIONS

DIFFERENCES IN INFECTIVITY AND PATHOGENICITY BETWEEN DELTA AND OMICRON STRAINS OF SARS-COV-2 CAN BE EXPLAINED BY GIBBS ENERGIES OF BINDING AND GROWTH

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During the COVID-19 pandemic, biothermodynamics has given its contribution to characterization of viruses and research on energetics of processes performed by viruses [1-4]. Thermodynamic properties represent the driving force for processes performed by viruses and hence are an important element in predictive mechanistic models of virus-host interactions [2,3]. In this research, empirical formulas have been reported of the Delta and Omicron strains of SARS-CoV-2. The empirical formula of the Delta strain virion was found to be $CH_{1.6383}O_{0.2844}N_{0.2294}P_{0.0064}S_{0.0042}$. The empirical formula of the Omicron strain virion was found to be $CH_{1.6404}O_{0.2842}N_{0.2299}P_{0.0064}S_{0.0038}$. Based on the empirical formulas, standard thermodynamic properties of formation and growth have been calculated and reported for the Delta and Omicron strains. Moreover, standard thermodynamic properties of binding have been reported for Wild type (Hu-1), Alpha, Beta, Gamma, Delta and Omicron strains. For all the strains, binding phenomenological coefficients and antigen-receptor (SGP-ACE2) binding rates have been determined and compared, which are proportional to infectivity. The results show that infectivity of the Omicron strain is 50% greater than that of the Delta strain. The increased infectivity was explained in this paper using Gibbs energy of binding. However, no indications exist for decreased pathogenicity of the Omicron strain. Pathogenicity is proportional to the virus multiplication rate, while Gibbs energies of multiplication are very similar for the Delta and Omicron strains. Thus, multiplication rate and pathogenicity are similar for the Delta and Omicron strains. The lower number of severe cases caused by the Omicron strain can be explained by increased number of immunized people. Immunization does not influence the possibility of occurrence of infection, but influences the rate of immune response, which is much more efficient in immunized people. This leads to prevention of more severe Omicron infection cases.

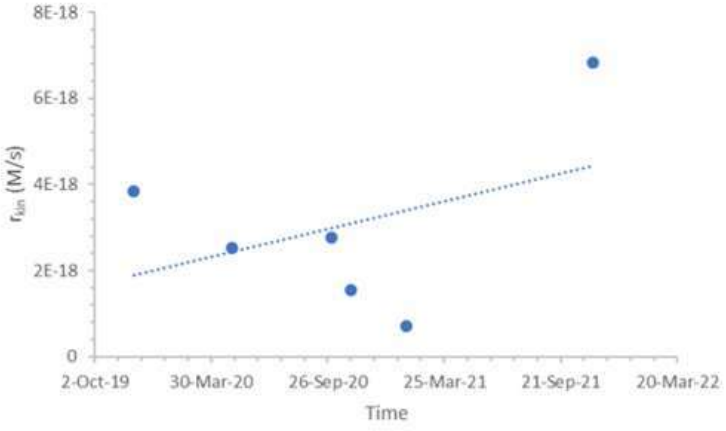

Figure 1. Binding rates of SARS-CoV-2 strains as a function of time.

[1] M. Popovic, M. Popovic, Strain Wars: Competitive interactions between SARS-CoV-2 strains are explained by Gibbs energy of antigen-receptor binding, *Microbial Risk Analysis* (2022) https://doi.org/10.1016/j.mran.2022.100202
[2] P. Gale, Using thermodynamic equilibrium models to predict the effect of antiviral agents on infectivity: Theoretical application to SARS-CoV-2 and other viruses, *Micr. Risk An.* (2021)https://doi.org/10.1016/j.mran.2021.100198
[3] M. Popovic, M. Minceva, Thermodynamic insight into viral infections 2: empirical formulas, molecular compositions and thermodynamic properties of SARS, MERS and SARS-CoV-2 (COVID-19) viruses, *Heliyon 6*, E04943, (2020).
[4] B. Şimşek, M. Özilgen, F. Ş. Utku, How much energy is stored in SARS-CoV-2 and its structural elements?, *Energy Storage* e298 (2021). https://doi.org/10.1002/est2.298