

THE 67<sup>TH</sup> INTERNATIONAL



# OPEN READINGS

CONFERENCE FOR STUDENTS OF PHYSICS AND NATURAL SCIENCES

**BOOK OF  
ABSTRACTS** | **2024**



Vilnius  
University

VILNIUS UNIVERSITY PRESS

Editors:

Martynas Keršys  
Rimantas Naina  
Vincentas Adomaitis  
Emilijus Maskvytis

Cover and Interior Design:

Goda Grybauskaitė

Vilnius University Press  
9 Saulėtekio Av., III Building, LT-10222 Vilnius  
info@leidykla.vu.lt, [www.leidykla.vu.lt/en/](http://www.leidykla.vu.lt/en/)  
[www.knygynas.vu.lt](http://www.knygynas.vu.lt), [www.journals.vu.lt](http://www.journals.vu.lt)

Bibliographic information is available  
on the Lithuanian Integral Library Information System (LIBIS) portal [www.ibiblioteka.lt](http://www.ibiblioteka.lt)  
ISBN 978-609-07-1051-7 (PDF)

© Vilnius University, 2024

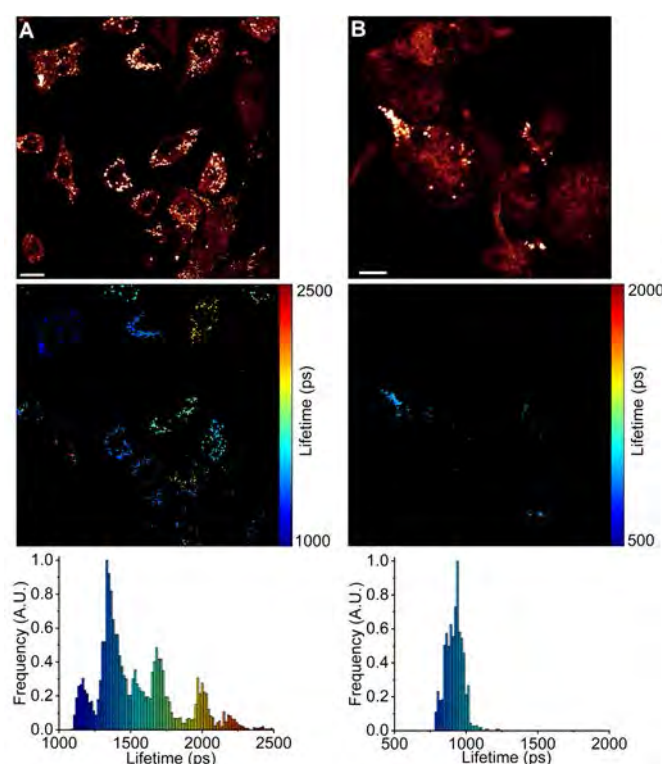
# FLUORESCENT VISCOSITY PROBES AS DIAGNOSTIC TOOLS FOR CANCER DETECTION

Artūras Polita<sup>1</sup>

<sup>1</sup>Vilnius University

[arturas.polita@gmc.vu.lt](mailto:arturas.polita@gmc.vu.lt)

Viscosity is a key characteristic of biological membranes -- it governs the passive diffusion of solutes and affects the lipid raft formation and membrane fluidity. Moreover, viscosity measurements provide a convenient way to observe the compositional changes that take place in biological membranes and organelles, as the efficiency of lipid packaging and the order of lipids have a great influence on the viscosity values of lipid structures.<sup>1</sup> In this work, we explore the viscosity-sensitive dyes, called molecular rotors,<sup>2,3</sup> as diagnostic tools for cancer detection. Through the use of fluorescence lifetime imaging microscopy (FLIM) in combination with organelle-specific BODIPY dyes, whose fluorescence lifetimes increase with increase in microviscosity, we investigate the order of lipids in lysosomes and lipid droplets of cancerous and non-cancerous live cells. Our results demonstrate that lipid droplets in cancerous cells have vastly different lipid packaging efficiencies between different cells in the same culture. In contrast, we show that lipid packaging efficiencies of lipid droplets are uniform in non-malignant cells. Finally, we demonstrate that both lysosomes and lipid droplets in malignant cells possess up to 3 times greater microviscosities compared to non-malignant cells.



**Fig. 1.** FLIM of BODIPY-LD in lipid droplets of human lung cancer A549 cells (A) and human embryonic kidney HEK 293T cells (B). The top panel shows images of fluorescence intensity. FLIM images are shown in the middle panel. The corresponding lifetime histograms are shown in the bottom panel. Scale bars are 10  $\mu$ m.

- 
- [1] A. Polita, M. Stancikaitė, R. Žvirblis, K. Maleckaitė, J. Dodonova-Vaitkūnienė, S. Tumkevičius, A. P. Shivabalan, G. Valinčius, *RSC Adv.*, 2023, 13, 19257-19264.  
 [2] A. Polita, S. Toliautas, R. Žvirblis, A. Vyšniauskas, *Phys. Chem. Chem. Phys.*, 2020, 22, 8296-8303.  
 [3] S. Toliautas, J. Dodonova, A. Žvirblis, I. Čiplies, A. Polita, A. Devižis, S. Tumkevičius, J. Šulskus, A. Vyšniauskas, *Chem. - Eur. J.*, 2019, 25, 10342-10349.