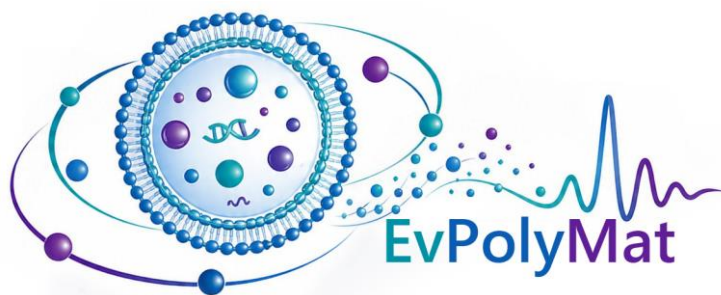


EvPolyMat 2026

**Conference on Extracellular Vesicles Studies
for Disease Diagnosis**

Insights on EVs and Polymeric Materials
for Emerging Applications

Program & book of abstract
Iași, Romania | 1–2 October 2026



CONFERENCE ON EXTRACELLULAR VESICLES STUDIES FOR DISEASE DIAGNOSIS

Insights on EVs and Polymeric Materials
for Emerging Applications
(*EvPolyMat*)

Program & Book of Abstracts

ICMPP – Petru Poni Institute of Macromolecular Chemistry
Iasi, Romania, October 1-2, 2026
<https://www.icmpp.ro/evpolymat>



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

Organized by



ACADEMIA ROMÂNĂ

Partners



Estonian University
of Life Sciences



Sponsors



Laboratorium
Together. A Step Forward™



MDPI – BEST PRESENTATION AWARD



CHAIRPERSONS of EvPolyMat 2026

Dr. Mihai BREBU and Dr. Elena STOLERU

ORGANIZING BOARD

Program

- Dr. Mihai BREBU
- Dr. Elena STOLERU

Editorial

- Dr. Elena BUTNARU
- Catalin BUZDUGAN – IT support

Executive

- Dr. Bogdana SIMIONESCU
- Dr. Raluca DUMITRIU
- Dr. Daniela PAMFIL
- Dr. Elena BUTNARU
- Dr. Narcisa MARANGOCI
- Dr. Mirela ZALTARIOV
- Dr. Florica DOROFTEI

SCIENTIFIC COMMITTEE

- Dr. Wai-Leng LEE
- Dr. Suranga KODITHUWAKKU
- Dr. Carmenza SPADAFORA
- Dr. Radu IONESCU
- Dr. Irina MATEI
- Dr. Siong Fong SIM



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026



Welcome to the
CONFERENCE ON EXTRACELLULAR VESICLES STUDIES
FOR DISEASE DIAGNOSIS
Insights on EVs and Polymeric Materials for Emerging Applications
EvPolyMat 2026

It is our pleasure to invite you to the *Conference on Extracellular Vesicles Studies for Disease Diagnosis - Insights on EVs and Polymeric Materials for Emerging Applications - (EvPolyMat)* which will be held at “Petru Poni” Institute of Macromolecular Chemistry, Iasi, in October 1-2, 2026, as part of the “Analysis of the volatile organic compounds emitted by extracellular vesicles for disease diagnosis” (Volatevs) HORIZON-MSCA-2021-SE-01-01: 101086360 project.

This conference aims to combine the experience gained from the EU research project on volatile organic compounds emitted by extracellular vesicles (Ev) as an innovative approach for disease diagnosis, with the expertise of “Petru Poni” Institute on polymeric (Poly) materials (Mat) for biomedical applications.

The event will foster discussion on cutting-edge technologies, experimental approaches, and translational potential in this rapidly evolving field. We also intend to offer a possibility for researchers, clinicians, and interdisciplinary experts to explore emerging advances in the study of extracellular vesicles (EVs) and their applications in disease diagnosis, pushing forward and shaping the future of EVs in medical science in Romania and abroad.

Ultimately, the conference seeks to advance understanding of extracellular vesicles and promote the development of innovative, minimally invasive diagnostics tools that may improve early detection and disease management.

We thank you for joining us for inspiring discussions during our conference!

Dr. Mihai BREBU and Dr. Elena STOLERU
Conference chairs of EvPolyMat 2026

PROGRAM (OUTLINE)

THURSDAY • 1 OCTOBER			FRIDAY • 2 OCTOBER		
08 ⁰⁰ – 09 ⁰⁰	Registration		Session 5		
09 ⁰⁰ – 09 ⁰⁵	Welcome message Valeria Harabagiu		09 ⁰⁰ – 09 ³⁰	IL7	Suranga Kodithuwakku
09 ⁰⁵ – 09 ¹⁵	Guest of Honour’s Remark H.E. Mrs. Nineta Bărbulescu		09 ³⁰ – 09 ⁴⁵	OC11	Monika Nomm
09 ¹⁵ – 09 ³⁰	Horizon Europe context Radu Ionescu		09 ⁴⁵ – 10 ⁰⁰	OC12	Radu Ionescu
Session 1			10 ⁰⁰ – 10 ¹⁵	OC13	Nyuk Ling Ma
09 ³⁰ – 10 ⁰⁰	IL1	Wai Leng Lee	10 ¹⁵ – 10 ³⁰	OC14	Dulmini Sapugahawatte
10 ⁰⁰ – 10 ³⁰	IL2	Mariana Pinteala			
10 ³⁰ – 11 ⁰⁰ Coffee break & poster session			10 ³⁰ – 11 ⁰⁰ Coffee break		
Session 2			Session 6		
11 ⁰⁰ – 11 ³⁰	IL3	Carmenza Spadafora	11 ⁰⁰ – 11 ³⁰	IL8	Oxana Klementieva
11 ³⁰ – 12 ⁰⁰	IL4	Laura Patras	11 ³⁰ – 12 ⁰⁰	IL9	Siong Fong Sim
12 ⁰⁰ – 12 ¹⁵	OC01	Alina Fudulu	12 ⁰⁰ – 12 ¹⁵	OC15	Rosamaria Capuano
12 ¹⁵ – 12 ³⁰	OC02	Stefan Mihai Dragan	12 ¹⁵ – 12 ³⁰	OC16	Matilde Messina
			12 ³⁰ – 12 ⁴⁵	OC17	Abhigyan Sengupta
12 ³⁰ – 14 ⁰⁰ Lunch & networking			12 ⁴⁵ – 13 ⁰⁰ Closing remarks		
Session 3			14 ⁰⁰ – 17 ⁰⁰ VOLATEVS Project Meeting		
14 ⁰⁰ – 14 ³⁰	IL5	Luminita Labusca			
14 ³⁰ – 14 ⁴⁵	OC03	Leonard Atanase			
14 ⁴⁵ – 15 ⁰⁰	OC04	Razvan Ghiarasim			
15 ⁰⁰ – 15 ¹⁵	OC05	Miruna Nemecz			
15 ¹⁵ – 15 ³⁰	OC06	Andreea Lazar			
15 ³⁰ – 16 ⁰⁰ Coffee break & poster session					
Session 4					
16 ⁰⁰ – 16 ³⁰	IL6	Laura Dinu			
16 ³⁰ – 16 ⁴⁵	RoSEV	Irina Matei			
16 ⁴⁵ – 17 ⁰⁰	OC07	Paula Pasca			
17 ⁰⁰ – 17 ¹⁵	OC08	Madalina Lixandru			
17 ¹⁵ – 17 ³⁰	OC09	James Parry			
17 ³⁰ – 17 ⁴⁵	OC10	Cristian Peptu			
19 ³⁰ Conference dinner					

Poster presentations	
P1	Ana Clara Aprotosoie
P2	Dragos-Ioan Olariu
P3	Raluca Petronela Dumitriu
P4	Ioana A. Duceac
P5	Federico Cortese
P6	Cornelia Vasile
P7	Cristina- Eliza Brunchi
P8	Claudia-Maria Simionescu



Detailed SCIENTIFIC PROGRAM

THURSDAY • 1 OCTOBER 2026

ICMPP Conference Hall

08:00 – 09:00 **Registration of Participants**

Welcome and Guest of Honour's Remark

09:00 – 09:05	Welcome message Valeria Harabagiu Director of "Petru Poni" Institute of Macromolecular Chemistry
09:05 – 09:15	Guest of Honour's Remark - Science Diplomacy H.E. Mrs. Nineta Barbulescu Ambassador of Romania to Malaysia and Brunei Darussalam
09:15 – 09:30	Horizon Europe context Radu Ionescu Estonian University of Life Sciences, Tartu, Estonia

Session 1 OPENING FRONTIERS IN EV RESEARCH

Chair person: Elena Stoleru

09:30 – 10:00	IL1. Next-generation extracellular vesicle diagnostics: harnessing advanced biomaterials, artificial intelligence, and global standards Wai Leng Lee Monash University, Kuala Lumpur, Malaysia
10:00 – 10:30	IL2. Extracellular vesicles as emerging therapeutic and drug-delivery platforms Mariana Pinteala "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

10:30 – 11:00 Coffee break and poster session

Session 2 DISEASE MECHANISMS AND BIOMARKER DISCOVERY

Chair person: Suranga Kodithuwakku

11:00 – 11:30	IL3. Extracellular vesicles in infectious diseases: lessons of intercommunication from the malaria parasite Carmenza Spadafora INDICASAT-AIP, Panama
11:30 – 12:00	IL4. Extracellular vesicles in cancer and beyond: from intercellular communication to therapeutic innovation Laura Patras Babes-Bolyai University, Cluj-Napoca, Romania
12:00 – 12:15	OC01. Isolation and source-specific characterization of extracellular vesicles from cervical cancer cell lines and urine samples for non-invasive biomarker discovery Alina Fudulu "Ștefan S. Nicolau" Institute of Virology, Bucharest, Romania
12:15 – 12:30	OC02. Development and characterization of curcumin-loaded extracellular vesicles from activated dendritic cells as an adjuvant to anti-PD-L1 immunotherapy in a three-dimensional melanoma model Stefan Mihai Dragan "Babeș-Bolyai" University, Cluj-Napoca, Romania

12:30 – 14:00 Lunch

Session 3 EV THERAPEUTICS AND REGENERATIVE MEDICINE

Chair person: Laura Dinu

- | | |
|---------------|--|
| 14:00 – 14:30 | IL5. Extracellular vesicles in musculoskeletal disease: cell-free regenerative tools between biological promise and translational reality
Luminita Labusca
Emergency County Hospital "Saint Spiridon", Iasi, Romania |
| 14:30 – 14:45 | OC03. Functionalized liposomal nanovesicles for targeted drug delivery
Leonard Atanase
Apollonia University, Iasi, Romania |
| 14:45 – 15:00 | OC04 Influence of soy phosphatidylcholine on microfluidically prepared DOPE/CHEMS liposomes for pH-responsive doxorubicin delivery
Razvan Ghiarasim
"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania |
| 15:00 – 15:15 | OC05. Microvesicle-derived and circulating microRNA signatures in diabetic dyslipidemia: biomarker potential of miR-218, miR-132, miR-143, miR-21, miR-122, and miR-155
Miruna Nemecz
"Nicolae Simionescu" Institute of Cellular Biology and Pathology, Bucharest, Romania |
| 15:15 – 15:30 | OC06. Exploring the role of exosome-derived microRNAs in the development and progression of cutaneous malignant melanoma with implications for diagnosis and treatment
Andreea Lazar
University of Bucharest, Bucharest, Romania |

15:30 – 16:00 Coffee break and poster session

Session 4 PLANT, MICROBIOME AND CROSS-SPECIES EVs

Chair person: Wai Leng Lee

- | | |
|---------------|---|
| 16:00 – 16:30 | IL6. Plant-derived extracellular vesicles as emerging modulators of the gut microbiome
Laura Dinu
University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania |
| 16:30 – 16:45 | RoSEV. Romanian Society for Extracellular Vesicles - aims & opportunities
Irina Matei
Weill Cornell Medicine, USA |
| 16:45 – 17:00 | OC07. Extracellular vesicles as mediators of the gut–kidney axis in cats with chronic kidney disease: emerging roles and therapeutic potential
Paula Pasca
Iasi University of Life Sciences, Iasi, Romania |
| 17:00 – 17:15 | OC08. Extracellular vesicles at the feed–gut–AMR axis: priming poultry resilience through immunomodulatory nutrition
Madalina Lixandru
Estonian University of Life Sciences, Tartu, Estonia |
| 17:15 – 17:30 | OC09. The next generation of exosome characterization: meet Leprechaun
James Parry
Unchained Labs, USA |
| 17:30 – 17:45 | OC10. Cyclodextrins at biological and synthetic vesicle interfaces: from membrane modulation to supramolecular engineering
Cristian Peptu
"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania |

Poster session

10:30 – 11:00 and 15:30 – 16:00

P1	Plant-derived extracellular vesicles: recent advancements on their biological properties and medicinal use Ana Clara Aprotosoae "Grigore T. Popa" University of Medicine and Pharmacy, Iasi, Romania
P2	SERS analysis of milk-derived extracellular vesicles using gold plasmonic substrates Dragos-Ioan Olariu "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
P3	Isolation and infrared spectroscopy analysis of extracellular vesicles from mouse neuroblastoma cell lines exposed to oxidative stress Raluca Petronela Dumitriu "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
P4	Development of liposome-polymer hybrid materials based on dynamically crosslinked polysaccharides Ioana A. Duceac "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
P5	Polymer-coated quartz microbalance array for discriminating VOCs and ammonia Federico Cortese University of Rome Tor Vergata, Rome, Italy
P6	Recent insights into the research on applications of the (bio)active additives Cornelia Vasile "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
P7	New polysaccharide-based crosslinked hydrogels: Molecular architecture and applications Cristina- Eliza Brunchi "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
P8	Ultrasound assisted preparation of magnetic chitosan beads to improve removal of pollutants from water Claudia-Maria Simionescu National University of Science and Technology POLITEHNICA Bucharest, Bucharest, Romania

Conference dinner

19:30 – 22:00

FRIDAY • 2 OCTOBER 2026

ICMPP Conference Hall

Session 5 VETERINARY EVs AND MOLECULAR DIAGNOSTICS

Chair person: Siong Fong Sim

09:00 – 09:30	IL7. Extracellular vesicles in veterinary molecular diagnostics Suranga Kodithuwakku Estonian University of Life Sciences, Tartu, Estonia
09:30 – 09:45	OC11. Integrating seminal plasma extracellular vesicles to improve male reproductive outcomes Monika Nomm Estonian University of Life Sciences, Tartu, Estonia
09:45 – 10:00	OC12. Comparative study of the volatile patterns released by bull seminal plasma and extracellular vesicles Radu Ionescu Estonian University of Life Sciences, Tartu, Estonia
10:00 – 10:15	OC13. Environmental drivers of microbiota–host communication Nyuk Ling Ma Universiti Malaysia Terengganu, Malaysia
10:15 – 10:30	OC14. Multi-pathogen bacterial extracellular vesicles as novel biomarkers for early, AI-assisted detection of subclinical bovine mastitis Dulmini Sapugahawatte Estonian University of Life Sciences, Tartu, Estonia

10:30 – 11:00 Coffee break

Session 6 EV CHARACTERIZATION, VOLATOLOMICS AND SENSING

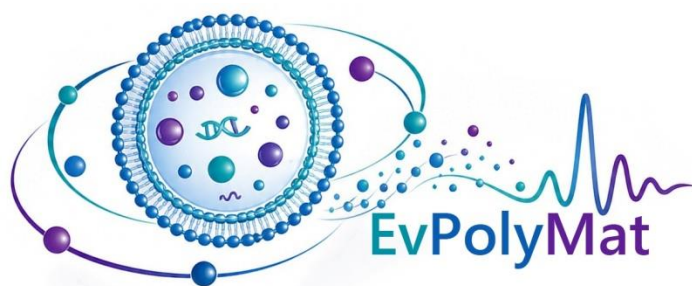
Chair person: Mihai Brebu

11:00 – 11:30	IL8. Label-free infrared microspectroscopy of extracellular vesicles and pathological protein assemblies Oxana Klementieva Lund University, Sweden
11:30 – 12:00	IL9. Analysis of chromatographic and spectral signals of extracellular vesicles Siong Fong Sim Universiti Malaysia Sarawak, Malaysia
12:00 – 12:15	OC15. Volatolomic analysis of extracellular vesicles extracted from cultured cells Rosamaria Capuano University of Rome Tor Vergata, Rome, Italy
12:15 – 12:30	OC16. A multimodal sensor approach to prostate cancer detection through urinary extracellular vesicles Matilde Messina University of Rome Tor Vergata, Rome, Italy
12:30 – 12:45	OC17. FFF-MALS-DLS as a modern orthogonal platform for extracellular vesicle subpopulation discovery and diagnostic characterization Abhigyan Sengupta Waters, USA

12:45 Closing remarks

14:00 - 17:00 VOLATEVS Project Meeting — project partners

INVITED SPEAKERS' BIOGRAPHIES





"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

Her Excellency Mrs. Nineta Bărbulescu

Ambassador of Romania to Malaysia and Brunei Darussalam,

SPECIAL REMARKS

Remarks on Science Diplomacy

Ambassador Nineta Bărbulescu is a seasoned Romanian career diplomat with 34 years experience in diplomacy, security policy and export controls. First female appointed in 2021 as Ambassador Extraordinary and Plenipotentiary of Romania to Malaysia and to Brunei Darussalam (non resident), she previously served as Ambassador to Australia (2013 – 2020) with concurrent accreditations to New Zealand and as the first Romanian Ambassador to 7 Pacific island states. A Bucharest university graduate Magna cum Laude in Public International Law in 1992, she rose through senior leadership roles at Romania's Ministry of Foreign Affairs, including Director General for Export Controls, Head of OSCE/Non-Proliferation and Human Rights Divisions and State Secretary responsible for export controls and chemical weapons convention implementation. Internationally, she has led Romanian delegations to major non-proliferation forums, served as Vice-President of the 2010 NPT Review Conference, and held senior roles with the OPCW, Hague Code of Conduct and the Arms Trade Treaty conference. Honoured by the Romanian President with the National Distinction for Merit (Knight) and by the Romanian Orthodox Episcopate, she is also an active artist with a dozen of participation to art exhibitions in Malaysia, lecturer and published author and committed to cultural diplomacy and diaspora engagement in Asia.

Dr. Wai-Leng Lee

Monash University, Kuala Lumpur, Malaysia

INVITED LECTURE 1

Next-generation extracellular vesicle diagnostics: harnessing advanced biomaterials, artificial intelligence, and global standards

Dr. Lee Wai-Leng Lee is specialized in the integration of extracellular vesicle (EV) research and artificial intelligence for advanced cancer diagnostics. Driven by a translational approach, her work leverages machine learning to develop high-accuracy classifiers while collaborating with material scientists to optimize EV isolation workflows. A strong advocate for global research standards, she actively champion international MISEV guidelines to ensure scientific reproducibility and rigor. Beyond the lab, Dr. Lee drives cross-border collaboration and equity as a leading figure in the Malaysian Society for Extracellular Vesicles (MySEV).

Dr. Mariana Pinteala

"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

INVITED LECTURE 2

Extracellular vesicles as emerging therapeutic and drug-delivery platforms

Dr. Mariana Pinteala studied chemical engineering and received her PhD at "Gheorghe Asachi" Technical University, Iasi, Romania, in 1995. She has been active in "Petru Poni" Institute of Macromolecular Chemistry since 1987 and from 2010 is the Head of the "IntelCenter" integrated into institute (www.intelcentru.ro). She has published more than 200 papers, 1 book and 12 book chapters. The scientific and managerial activities include the successful coordination of two EU projects, 8 former national projects and 4 bilateral projects, as well as the participation to a former NSF grant and others. In addition she has implemented the IntelCentre infrastructure project based on EU Structural Funds. The research interests are focused on the development of polymer-based biomaterials, supramolecular assemblies of hydrophobic and hydrophylic (co)polymers; pseudo- and polyrotaxanes, (co)polymers containing cyclodextrins, and more recently on biomedical-oriented nanotechnologies (non-viral vectors for gene and drug delivery systems; nanoparticles based on metal and metal oxides for tumors imaging and therapy; development of fullerene, cyclodextrin, and polymer derivatives for medical applications; design of cyclodextrin inclusion complexes with different drugs as potential drug delivery systems).

Dr. Carmenza Spadafora

Instituto de Investigaciones Científicas y Servicios de Alta Tecnología de Panamá
(INDICASAT-AIP)

INVITED LECTURE 3

Extracellular vesicles in infectious diseases: Lessons of intercommunication from the malaria parasite

Dr. Carmenza Spadafora got her undergraduate degree in Biochemistry at Eastern Michigan University and her Ph.D from the University of Granada, Spain. She held a postdoc position at the University of Central Florida before moving to the Walter Reed Army Institute of Research in Maryland. She is now the Coordinator of the Center of Cellular and Molecular Biology of Diseases at the Institute of Scientific Research and High Technology Services (INDICASAT AIP) in Panama. Her group studies communication signals through extracellular vesicles in *P. falciparum*, screens for natural and synthetic compounds as antiparasitic agents, and investigates the biophysics of the malaria parasite. She is a Distinguished Investigator in Panama's National Research System and was chosen by 3M as one of the 25 Women of Science in Latin America.

Dr. Laura Patras

Babeş-Bolyai University, Cluj-Napoca, Romania

INVITED LECTURE 4

Extracellular vesicles in cancer and beyond: from intercellular communication to therapeutic innovation

Dr. Laura Pastras is a Lecturer at the Faculty of Biology and Geology, Babeş-Bolyai University (UBB), Cluj-Napoca, and a member of the Nanomedicine Research Group within the same institution. She obtained her PhD from UBB and trained in extracellular vesicle (EV) research at University Medical Center Utrecht and as a visiting postdoctoral fellow at Weill Cornell Medicine. Her research focuses on EV-mediated tumor-immune communication, tumor progression, and therapeutic response, integrating molecular biology, advanced microscopy, flow cytometry, proteomics, glycobiology, and in vivo tumor models.

Dr. Luminița Lăbușcă

"Saint Spiridon" Emergency County Hospital Iasi Romania

INVITED LECTURE 5

Extracellular vesicles in musculoskeletal disease: cell-free regenerative tools between biological promise and translational reality

Dr. Luminița Lăbușcă is an orthopedic and trauma surgeon and senior researcher working at the interface between musculoskeletal medicine, regenerative biology, nanobiomaterials, and translational biomedical technologies. Affiliations include the Emergency County Hospital "Sf. Spiridon" Iași and the National Institute of Research and Development for Technical Physics, Iași. Research interests focus on musculoskeletal regeneration, stem cells, extracellular vesicles, magnetic nanomaterials, nanosensors, and biomaterial-based strategies for tissue repair. Dr. Labusca is a founding member of REGENERO, the Romanian Regenerative Medicine Association, and has authored peer-reviewed publications and books in orthopedics, medical ethics, stem cell biology, and regenerative medicine.

Dr. Laura Dinu

University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania

INVITED LECTURE 6

Plant-derived extracellular vesicles as emerging modulators of the gut microbiome

Dr. Laura Dinu is a Lecturer at the Faculty of Biotechnologies, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania. Her research spans the interface of microbiome research, food safety, and emerging technologies in order to develop sustainable nutraceuticals and functional foods. Recently, her work focuses on the applications of the extracellular vesicles (EVs) in diagnostic and therapy, especially the potential of plant-derived EVs to shape the composition and metabolic functions of the human gut microbiota and through different mechanisms positively affect the overall health. She has authored and co-authored scientific publications and books in the fields of medical microbiology, biotechnology, and food safety and is actively involved in national and EU-funded research projects.

Dr. Suranga Kodithuwakku

Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences (Eesti Maaülikool), Tartu, Estonia

INVITED LECTURE 7

Extracellular vesicles in veterinary molecular diagnostics

Dr. Suranga Kodithuwakku is a Senior Research Fellow in Molecular Physiology and Medicine at the Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences (EMU), Estonia. His main research interests are molecular diagnostics, understanding host-pathogen interactions, extracellular vesicles in physiology and diseases, and applications of integrative omics in One Health related issues.

Dr. Oxana Klementieva

Lund University

INVITED LECTURE 8

Label-free infrared microspectroscopy of extracellular vesicles and pathological protein assemblies

Dr. Oxana Klementieva is Associate Professor in Molecular Imaging and Principal Investigator of the Medical Microspectroscopy Lab at Lund University. She directs MjölIR, Sweden's national biomicrospectroscopy platform at MAX IV Laboratory, and is a visiting scholar at the Abrams Research Center on Neurogenomics at Northwestern University. Her research develops advanced vibrational and multimodal imaging methods, including OPTIR and AFM-IR, to investigate amyloid structure, polymorphism and interactions with the cellular microenvironment in Alzheimer's and other neurodegenerative diseases.

Dr. Siong Fong Sim

University of Malaysia, Sarawak, Malaysia

INVITED LECTURE 9

Analysis of chromatographic and spectral signals of extracellular vesicles

Dr. Sim Siong Fong received her PhD in Chemometrics from the University of Bristol, UK. She obtained her BSc in Resource Chemistry and MSc in Organic Chemistry from Universiti Malaysia Sarawak (UNIMAS). Her research interests focus on data mining and the analysis of large datasets in environmental and analytical chemistry. She has extensive experience analysing diverse datasets spanning biological, archaeological, environmental, and instrumental applications.

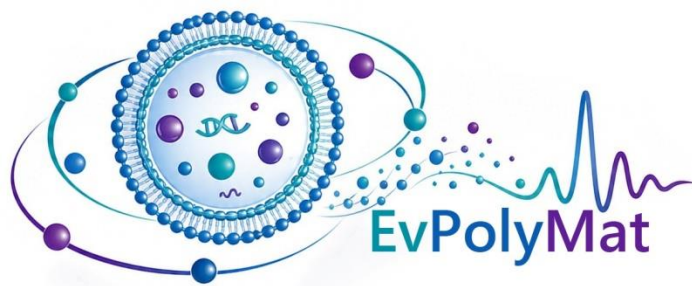


"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

OPENING FRONTIERS IN EV RESEARCH



NEXT-GENERATION EXTRACELLULAR VESICLE DIAGNOSTICS: HARNESSING ADVANCED BIOMATERIALS, ARTIFICIAL INTELLIGENCE, AND GLOBAL STANDARDS

WAI-LENG LEE

*School of Science, Monash University Malaysia, 47500 Bandar Sunway, Selangor Darul
Ehsan, Malaysia
lee.wai.leng@monash.edu*

Extracellular vesicles (EVs) have emerged as pivotal biomarkers in liquid biopsies, offering unprecedented insights into disease states, particularly oncology. However, translating EV research from bench to bedside requires overcoming significant bottlenecks in isolation efficiency and diagnostic accuracy: challenges that are uniquely positioned to be solved by advanced polymeric materials. This presentation bridges the gap between material science and clinical utility, highlighting the critical demand for next-generation polymers to optimize EV isolation and characterization. The recent progress of AI-assisted, EV-based cancer classifier developed in my laboratory will be presented, demonstrating how machine learning algorithms can analyze vesicle profiles to achieve high-accuracy diagnostic outcomes when supported by robust isolation workflows. Furthermore, transitioning these innovations into robust clinical tools necessitates strict adherence to rigorous global frameworks, specifically the Minimal Information for Studies of Extracellular Vesicles (MISEV) guidelines. Finally, this talk emphasizes that technical advancement must coexist with global academic citizenship. By sharing insights from the development and trajectory of the Malaysian Society for Extracellular Vesicles (MySEV), we illustrate how cross-border networks and regional societies drive equity, knowledge exchange, and collaborative research to address global healthcare challenges.

Keywords: extracellular vesicles (EVs), AI cancer classifier, machine learning, MISEV guidelines, MySEV

References:

- [1] K.- Y. Su et al., *Spectrochim. Acta A Mol. Biomol. Spectrosc.*, 127891 (2026).
- [2] K.- Y. Su et al., *Sci. Rep.*, 15, 15945 (2025).
- [3] L.- W. Wong et al., *Health Technol.*, 15, 563-576 (2025).
- [4] J. A. Welsh et al., *J. Extracell. Vesicles.*, 13, e12404 (2024).

EXTRACELLULAR VESICLES AS EMERGING THERAPEUTIC AND DRUG-DELIVERY PLATFORMS

MARIANA PINTEALA

"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
pinteala@icmpp.ro

Extracellular vesicles (EVs) are membrane-bound particles released by cells into the extracellular environment. EVs can be biological instruments applicable in cancer therapy, regenerative medicine, immunotherapy, and the intercellular transport of nucleic acids and pharmaceuticals [1]. Various types of vesicles constitute EVs. Exosomes originate via the endosomal pathway, whereas microvesicles are generated directly from the plasma membrane [2,3]. The phrase "extracellular vesicles" is commonly employed unless their distinct endosomal origin has been experimentally validated, as the creation of isolated vesicles is sometimes challenging to establish [4]. EVs are increasingly being investigated as cell-free therapeutics and biological delivery systems. In contrast to conventional synthetic nanoparticles and other non-viral vectors, they exhibit favorable biocompatibility, low toxicity and immunogenicity, protection of biological therapeutics, and natural interactions with receiver cells. However, their biological variety, fluctuating cargo composition, poor production yield, and complex manufacturing and quality-control requirements remain significant challenges [1,5]. Also, their therapeutic efficacy can be enhanced by modifying their surfaces with targeted ligands or polymers that maintain stability [6]. These approaches may enhance targeted delivery, cellular absorption, circulation duration, and therapeutic efficacy. Nevertheless, standardized isolation, characterization, potency assessment, large-scale production, and clinical validation are essential for broader therapeutic application [4].

Keywords: exosomes, therapeutics, delivery systems

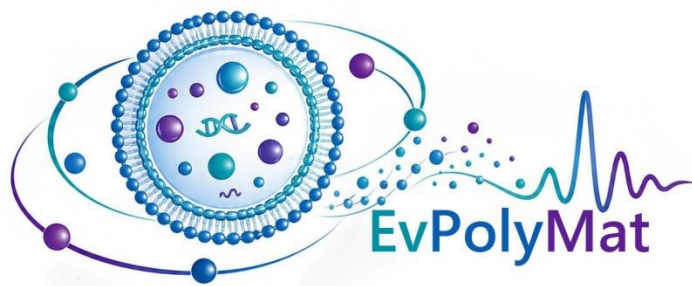
References:

- [1] L. Cheng and A.F. Hill., *Nat. Rev. Drug Discov.*, 21, 379-399 (2022).
- [2] R. Kalluri and V. S. LeBleu., *Science*, 367, 6478 (2020).
- [3] G. van Niel et al., *Nat. Rev. Mol. Cell Biol.*, 19, 213-228 (2018).
- [4] J. A. Welsh et al., *J. Extracell. Vesicles.*, 13, e12404 (2024).
- [5] I. K. Herrmann et al., *Nat. Nanotechnol.*, 16, 748-759 (2021).
- [6] A. H. Mohammadi et al., *BioDrugs.*, 37, 353-374 (2023).



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

DISEASE MECHANISM AND BIOMARKER DISCOVERY



EXTRACELLULAR VESICLES IN INFECTIOUS DISEASES: LESSONS OF INTERCOMMUNICATION FROM THE MALARIA PARASITE

CARMENZA SPADAFORA

*Instituto de Investigaciones Científicas y Servicios de Alta Tecnología de Panamá
(INDICASAT-AIP)
carmenzaspadafora@gmail.com*

Extracellular vesicles (EVs) have emerged as pivotal mediators of intercellular and interkingdom communication in infectious diseases, transporting complex biomolecular cargo—including functional enzymes, regulatory RNAs, and structural proteins—between pathogens, host cells, and vector species. Studies in *Plasmodium falciparum* malaria demonstrate how intracellular parasites leverage EVs as dynamic communication networks to regulate population density, modulate host immune responses, and signal developmental transitions such as gametocytogenesis. Beyond parasite self-regulation, circulating host- and parasite-derived EVs carry distinct proteomic and genomic signatures that reflect the parasite's needs. Harnessing the molecular fingerprints of EV cargo offers a compelling paradigm for understanding host-pathogen crosstalk and developing precision diagnostics.

Keywords: plasmodium falciparum, inter-communication, immune response

EXTRACELLULAR VESICLES IN CANCER AND BEYOND: FROM INTERCELLULAR COMMUNICATION TO THERAPEUTIC INNOVATION

LAURA PĂTRAS¹, ȘTEFAN DRĂGAN¹, VALENTIN F. RAUCA¹, DORU PAUL², IRINA R. MATEI³, DAVID LYDEN³, ALINA SESĂRMAN⁴, MANUELA BANCIU⁴

¹*Faculty of Biology and Geology, "Babes-Bolyai" University, Cluj-Napoca, Romania*

²*Meyer Cancer Center, Weill Cornell Medicine, New York, NY, USA*

³*Department of Medicine, Weill Cornell Medicine, New York, NY, USA*

⁴*Faculty of Medical and Health Sciences, "Babes-Bolyai" University, Cluj-Napoca, Romania*
laura.patras@ubbcluj.ro

Extracellular vesicles (EVs) are key mediators of intercellular communication, transferring molecular information between tumors and their local and systemic environments. Our research explores their dual role as mediators of tumor adaptation and immune modulation and as nanoplatforms for therapeutic intervention. Systemically, tumor-derived EVs promote metastatic progression by reprogramming distant tissues and establishing inflammatory and immunosuppressive pre-metastatic niches, while their surface composition can influence organ-specific targeting and metastatic organotropism. Our initial studies investigated how tumor-derived EVs influence therapeutic responses within the tumor microenvironment. EVs released by doxorubicin-exposed cancer cells altered the response of recipient cancer cells and macrophages to chemotherapy, linking EV-mediated communication with adaptive responses to treatment [1]. This concept was subsequently translated into an EV-based drug-delivery strategy in melanoma, in which PEG-stabilized tumor EVs were engineered to carry doxorubicin and displayed enhanced antitumor efficacy compared with liposomal drug delivery [2]. Extending this work toward adaptive immunity, we identified EV-associated CD147/BSG as a determinant of tumor outcome, demonstrating that tumor EVs can reprogram antitumor immune responses and that EV-mediated immune education can enhance the efficacy of immune-checkpoint blockade. More recently, activated, antigen-pulsed dendritic cell EVs promoted early CD8⁺ T-cell activation and displayed proteomic signatures linked to antigen processing and immune regulation. Curcumin loading further enhanced selected activation-associated responses, supporting engineered immune-cell EVs as cell-free adjuvants for cancer immunotherapy. Beyond oncology, our EV proteomics expertise was extended to human spaceflight, contributing to the characterization of EV-associated molecular adaptations in astronauts from the SpaceX Inspiration4 mission and their integration with multi-omics datasets [3]. Together, these studies position EVs at the interface between tumor progression, pre-metastatic niche formation, adaptive immunity and therapeutic response. Our current work seeks to define how EV molecular identity, particularly surface glycosylation, governs immune-cell recognition, tissue targeting and functional responses, with the long-term goal of rationally engineering EV-based strategies to potentiate existing cancer immunotherapies.

Keywords: extracellular vesicles, tumor microenvironment, adaptive immunity, cancer immunotherapy, EV engineering

References:

[1] L. Patras et al., *Int J Mol Sci.*, 21, 5951 (2020).

[2] L. Patras et al., *Cancer Biol Ther.*, 23, 1-16 (2022).

[3] N. Houerbi et al., *Nat Commun.*, 15, 4862 (2024).

ISOLATION AND SOURCE-SPECIFIC CHARACTERIZATION OF EXTRACELLULAR VESICLES FROM CERVICAL CANCER CELL LINES AND URINE SAMPLES FOR NON-INVASIVE BIOMARKER DISCOVERY

**ALINA FUDULU¹, IULIA VIRGINIA CONSTANTIN (IANCU)¹,
DENISA LAURA DRAGU², ADRIAN ALBULESCU^{1,3}, MIRELA
IACOB¹, ANCA BOTEZATU¹**

¹Molecular Virology Department, Stefan S. Nicolau Institute of Virology, Romanian Academy, 030304 Bucharest, Romania

²Department of Cellular and Molecular Pathology, Stefan S. Nicolau Institute of Virology, Romanian Academy, 030304 Bucharest, Romania

³Pharmacology Department, National Institute for Chemical Pharmaceutical Research and Development, 031299 Bucharest, Romania
alina.fudulu@virology.ro; aly.fudulu29@gmail.com

Background: Despite advances in prevention and treatment, cervical cancer remains a significant global challenge, particularly when treatment resistance emerges in advanced disease. Increasing evidence highlights extracellular vesicles (EVs) as important drivers of tumor progression and resistance [1]. The aim of this study was to optimize the isolation and characterization of EVs from two cervical cancer HPV positive cell lines, HeLa and CaSki, as well as from urine samples, supporting the development of non-invasive EV-based biomarker approaches. **Materials and methods:** Cell culture supernatants were processed to remove cells, cellular debris, and larger extracellular vesicles prior to exosome isolation. Samples were first centrifuged at 800 ×g for 10 min to pellet intact cells. The resulting supernatant was subsequently centrifuged at 10,000 × g for 30 min to eliminate cellular debris, apoptotic bodies, and larger microvesicles. Exosomes were then isolated from the clarified supernatant by ultracentrifugation at 120,000 ×g for 1.5 h. Following ultracentrifugation, EVs were characterized on the Leprechaun platform using a single-particle fluorescence assay based on the capture of the exosomal tetraspanins CD9, CD63, and CD81. Tetraspanin expression was assessed to evaluate the presence and quality of the isolated vesicles. **Results:** Among the two cervical cancer cell lines, CaSki yielded the lowest EV concentration. CD9 was the most highly expressed tetraspanin marker in both HeLa and CaSki-derived EVs. In addition, EVs from both cell lines exhibited the highest mean particle size among the tetraspanin-positive populations. In the urine samples, EV concentration and average particle size were comparable between them. CD63 was the most abundant tetraspanin marker, while CD9-positive and CD63-positive EVs represented the most frequently captured single-positive particle populations. **Conclusion:** The optimized workflow enabled successful isolation and characterization of EVs from cervical cancer cell lines and urine samples. Single-particle analysis allowed rapid assessment of EV size, concentration, phenotype, and marker co-localization with minimal hands-on time and automated processing. Differences in EV profiles between sources highlight the importance of source-specific characterization and support urine as a promising non-invasive source for biomarker studies.

Keywords: extracellular vesicles, cervical cancer, urinary samples, cell culture

References:

[1] V. R. Minciocchi et al., *Semin Cell Dev Biol.*, 40, 41-51 (2015).

DEVELOPMENT AND CHARACTERIZATION OF CURCUMIN-LOADED EXTRACELLULAR VESICLES FROM ACTIVATED DENDRITIC CELLS AS AN ADJUVANT TO ANTI-PD-L1 IMMUNOTHERAPY IN A THREE-DIMENSIONAL MELANOMA MODEL

STEFAN MIHAI DRAGAN¹, LAURA PATRAS², MARTA-SZILVIA MESZAROS², VALENTIN FLORIAN RAUCA², OVIDIU ILIE PAVEL¹, CRISTIAN V. A. MUNTEANU³, RALUCA BORLAN⁴, MONICA FOCSAN⁴, LOREDANA SAVEANU⁵, MANUELA BANCIU⁶, ALINA SESARMAN⁶

¹Nanomedicine group, Doctoral School in Integrative Biology, Faculty of Biology and Geology, "Babes-Bolyai" University, Cluj-Napoca, Romania

²Nanomedicine group, Department of Molecular Biology and Biotechnology, Center of Systems Biology, Biodiversity and Bioresources, Faculty of Biology and Geology, "Babes-Bolyai" University, Cluj-Napoca, Romania

³Department of Bioinformatics & Structural Biochemistry Institute of Biochemistry of the Romanian Academy (IBRA) 296, Bucharest, Romania

⁴Nanobiophotonics Center, Interdisciplinary Research Institute in Bio-Nano-Sciences and Faculty of Physics, Babes-Bolyai University, Cluj-Napoca, Romania

⁵Université Paris-Cité, Faculté de Médecine X Bichat, Centre de Recherche sur l'Inflammation, U1149 INSERM, Paris, France

⁶Nanomedicine group, Department of Medical and Health Sciences, Faculty of Medical and Health Sciences, "Babes-Bolyai" University, Cluj-Napoca, Romania
stefan.dragan@ubbcluj.ro

Melanoma is an aggressive skin cancer characterized by high metastatic potential and immune evasion. Although PD-1/PD-L1 blockade can restore CD8⁺ T-cell function, therapeutic resistance remains common, highlighting the need for improved immunotherapeutic strategies. We developed a combinatorial approach using curcumin-loaded extracellular vesicles (EV-CURC) derived from TRP-2-pulsed, CpG-ODN-activated dendritic cells together with anti-PD-L1 blockade. Evs were isolated by ultrafiltration coupled with size-exclusion chromatography, characterized, and passively loaded with curcumin. Therapeutic activity was evaluated in three-dimensional melanoma spheroids comprising B16.F10 melanoma cells, DC2.4 dendritic cells, and CD8⁺ T lymphocytes. Combination treatment reduced spheroid viability by approximately 50% after 48 h ($p < 0.0001$), decreased spheroid volume two-fold ($p < 0.01$), and increased Granzyme B secretion ($p = 0.022$). EV-mediated delivery also increased intracellular curcumin uptake approximately threefold compared with free curcumin. These findings support EV-CURC combined with PD-L1 blockade as a promising strategy integrating drug delivery with enhanced anti-tumor immunity.

Keywords: melanoma, extracellular vesicles, spheroid model

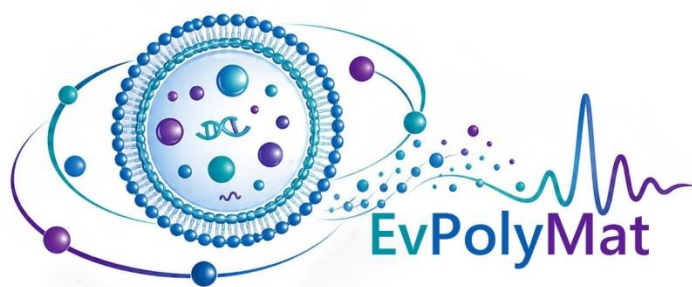
Acknowledgements:

This work was funded from UEFISCDI project PN-III-P1-1_1-TE-2021-0366 „Targeted therapy for the treatment of melanoma based on co-administration of anti-PD-L1 antibodies and curcumin-loaded extracellular vesicles“ (Alina Sesarman), and the France 2030 investment plan through InFibrex grant. (ANR-18-IDEX-0001)



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

EV THERAPEUTICS AND REGENERATIVE MEDICINE



EXTRACELLULAR VESICLES IN MUSCULOSKELETAL DISEASE: CELL-FREE REGENERATIVE TOOLS BETWEEN BIOLOGICAL PROMISE AND TRANSLATIONAL REALITY

LUMINITA LABUSCA^{1,2}

¹*Emergency County Hospital "Saint Spiridon", Iasi, Romania*

²*National Institute of Research and Development for Technical Physics, Iasi, Romania*
drlluminita@yahoo.com

Extracellular vesicles (Evs) are membrane-bound particles released by cells and increasingly recognized as mediators of intercellular communication through the transfer of proteins, lipids, metabolites and nucleic acids. In musculoskeletal disease, Evs are being explored both as candidate biomarkers for detecting inflammation, senescence, matrix remodeling, and as therapeutic tools within regenerative medicine. Particular interest has focused on mesenchymal stromal cell-derived Evs, which may reproduce part of the paracrine activity previously attributed to cell therapy, immunomodulation, attenuation of catabolic signaling, support of angiogenesis, extracellular matrix homeostasis. Compared with living cell products, EV-based approaches may offer practical and biological advantages, including lower risk of uncontrolled engraftment or differentiation, easier storage and handling, potential for standardized dosing, reduced immunogenic concerns and compatibility with polymeric or hydrogel-based delivery systems. These features are relevant in musculoskeletal diseases such as osteoarthritis, tendon and ligament injury, bone repair, intervertebral disc degeneration and muscle atrophy, where the therapeutic target is often a complex, mechanically loaded tissue microenvironment. However, EV therapy is not a simplified version of cell therapy. Major challenges remain in nomenclature, source-cell selection, culture conditions, isolation and purification, cargo heterogeneity, potency assays, biodistribution, residence time after local injection, dose definition and batch reproducibility. Preclinical models also require careful interpretation, since small-animal injury or chemically induced degeneration models may overestimate efficacy and fail to reproduce chronic human disease. Clinical translation remains early: first human studies support feasibility and short-term safety, but robust evidence of disease modification is still lacking. Therefore, the future of EV-based regenerative therapy will depend on rigorous characterization, mechanism-linked potency testing, clinically relevant translational models, rational delivery platforms and endpoint-driven translational design, with realistic outcome measures capable of distinguishing biological activity from true clinical benefit.

Keywords: extracellular vesicles, musculoskeletal regeneration, osteoarthritis, cell-free therapy, translational medicine

References:

- [1] J. A. Welsh et al., *J. Extracell. Vesicles*, 13, e12404 (2024).
- [2] N. S. Bolandnazar et al., *BMC Musculoskelet. Disord.*, 25, 856 (2024).

FUNCTIONALIZED LIPOSOMAL NANOVESICLES FOR TARGETED DRUG DELIVERY

LEONARD I. ATANASE^{1,2}, DELIA M. RATA², ANCA N. CADINOIU²

¹*Faculty of Medicine, Apollonia University of Iasi, Romania*

²*Academy of Romanian Scientists, Bucharest, Romania*

leonard.atanase@yahoo.com

Liposomes represent versatile and biocompatible nanovesicles with considerable potential for the targeted delivery of therapeutic agents. Their surface can be engineered with specific biological ligands to improve cellular recognition, internalization, and therapeutic efficacy while reducing nonspecific interactions with healthy tissues. In this context, the present work explores two complementary approaches based on functionalized liposomal systems designed for targeted therapy of difficult-to-treat pathological conditions. The first approach focused on the development of cationic liposomes coated with carboxymethyl chitosan (CMCS) functionalized with two peptides, Tet1 and TAT, for the targeted delivery of dexamethasone phosphate in inner ear disorders. Tet1 was incorporated to promote recognition of specific inner ear cells, while TAT was used to enhance cellular penetration. Successful functionalization was confirmed by infrared spectroscopy. The obtained liposomes exhibited mean diameters ranging from 167 to 198 nm for uncoated formulations and from 179 to 202 nm following CMCS coating, while TEM analysis confirmed their spherical and unilamellar morphology. The CMCS coating modulated dexamethasone phosphate release, while the formulations demonstrated good hemocompatibility and limited cytotoxicity toward normal V79-4 cells. The second approach addressed targeted therapy of basal cell carcinoma using liposomes functionalized with the DNA AS1411 aptamer and loaded with 5-fluorouracil [2]. Aptamer conjugation increased the hydrodynamic diameter and modified the surface charge of the liposomes, confirming successful surface functionalization. In vitro release studies using Franz diffusion cells demonstrated a reduction in the cumulative release of 5-fluorouracil, attributed to the additional steric barrier provided by the aptamer layer. Moreover, biological studies demonstrated improved targeting capability and therapeutic performance of the functionalized liposomes toward basal cell carcinoma cells compared with non-functionalized systems. Overall, these results highlight the potential of ligand-functionalized liposomes as adaptable nanovesicles, in which peptides and aptamers can be selected according to the biological target. Such surface-engineered vesicles offer promising opportunities to improve drug localization, cellular uptake, controlled release, and therapeutic selectivity in both inflammatory and oncological applications.

Keywords: liposomes, DNA aptamer, peptides, targeted drug delivery

References:

- [1] L. Iftode et al., *Int. J. Mol. Sci.*, 26, 922, (2025).
- [2] A. N. Cadinoiu et al., *Polymers*, 11, 1515, (2019).

INFLUENCE OF SOY PHOSPHATIDYLCHOLINE CONTENT ON MICROFLUIDICALLY PREPARED DOPE/CHEMS LIPOSOMES FOR PH-RESPONSIVE DOXORUBICIN DELIVERY

RAZVAN GHIARASIM¹, ALEXANDRU ROTARU¹, MARIANA PINTEALA¹

¹*Centre of Advanced Research in Bionanoconjugates and Biopolymers, "Petru Poni" Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley, 700487 Iasi, Romania*

ghiarasim.razvan@icmpp.ro

Lipid composition is an important consideration in the development of pH-responsive liposomes, and DOPE/CHEMS-based systems have been investigated for enhanced drug release under acidic conditions [1]. Microfluidic mixing offers adjustable processing conditions for liposome assembly and can be combined with tangential flow filtration for downstream purification [2,3]. This study examines the influence of soy phosphatidylcholine (Soy PC) content on the physicochemical properties and drug-release behaviour of microfluidically prepared DOPE/CHEMS liposomes.

Four lipid compositions were investigated: a DOPE/CHEMS control at a 60:40 molar ratio and three Soy PC/DOPE/CHEMS formulations at molar ratios of 25:45:30, 50:30:20 and 75:15:10. This series increased the Soy PC fraction while maintaining a constant DOPE:CHEMS molar ratio. Each composition was prepared in unloaded and doxorubicin (DOX)-loaded forms. Liposomes were assembled by microfluidic mixing of organic and aqueous phases, with DOX incorporated through passive loading. The resulting dispersions were purified by tangential flow filtration to remove residual solvent and non-encapsulated drug. Dynamic light scattering was used to determine the hydrodynamic diameter and polydispersity index. Doxorubicin release was investigated at different pH values to assess the release behaviour of the four lipid compositions.

The comparative design examines how replacing part of the DOPE/CHEMS mixture with Soy PC affects liposome characteristics and how DOX incorporation modifies these properties within each composition. The release studies further assess the relationship between Soy PC content and pH-dependent drug release. Together, these investigations evaluate lipid composition as a formulation parameter for the development of microfluidically prepared liposomal doxorubicin carriers.

Keywords: microfluidics, pH-responsive liposomes, soy phosphatidylcholine, doxorubicin, tangential flow filtration.

References:

- [1] G. M. Demirbolat et al., Sci. Rep., 15, 36349 (2025).
- [2] G. Buttitta et al., Int. J. Pharm., 662, 124460 (2024).
- [3] A. Mirkani et al., Langmuir, 41, 3503–3515 (2025).

MICROVESICLE-DERIVED AND CIRCULATING MICRORNA SIGNATURES IN DIABETIC DYSLIPIDEMIA: BIOMARKER POTENTIAL OF MIR-218, MIR-132, MIR-143, MIR-21, MIR-122, AND MIR-155

MIRUNA NEMECZ¹, DIANA SIMONA STEFAN², ALINA CONSTANTIN¹, GABRIELA TANKO¹, NICOLETA ALEXANDRU-MOISE¹, CRISTIAN GUJA², ADRIANA GEORGESCU¹

¹*Institute of Cellular Biology and Pathology 'Nicolae Simionescu' of the Romanian Academy, Bucharest, Romania*

²*National Institute for Diabetes, Nutrition and Metabolic Disease 'Prof. Dr. Nicolae Constantin Paulescu', Bucharest, Romania*
miruna.nemecz@icbp.ro

Circulating microRNAs (miRNAs), carried by microvesicles (MVs), have various physiological and pathological functions. Due to their role in post-transcriptional regulation of gene expression, they are considered markers for many diseases, including diabetes and dyslipidemia. Our goal was to identify common miRNAs in MVs and plasma that could predict the progression of diabetic dyslipidemia. For this purpose, plasma from 63 participants in the study (17 type 2 diabetic patients, 17 patients with type 2 diabetes and dyslipidemia, 14 patients with dyslipidemia alone, and 15 clinically healthy persons with no diabetes or dyslipidemia) was used to analyze circulating cytokines, MVs, miRNAs, and MV-associated miRNAs. The results revealed three miRNAs, miR-218, miR-132, and miR-143, that were found to be significantly overexpressed in circulating MVs and plasma from diabetic patients with dyslipidemia. These miRNAs exhibited significant correlations with key plasma markers representative of this pathology. Thus, miR-218 in MVs/plasma was negatively correlated with erythrocyte MV levels. Plasma-miR-132 was positively associated with MV-miR-132 and negatively associated with uric acid and erythrocyte plasma levels. Plasma-miR-143 was negatively associated with creatinine levels and diastolic blood pressure. Additionally, three miRNAs common to MV and plasma—namely, miR-21, miR-122, and miR-155—were found to be down- and up-regulated, respectively, in diabetic dyslipidemia. Also, MV-miR-21 was positively associated with plasma cholesterol levels, while plasma-miR-21 was positively associated with TNF- α plasma levels. MV-miR-122 was negatively associated with LDL-c levels, while plasma-miR-122 was positively associated with creatinine and diastolic blood pressure, as well as negatively associated with MV-miR-126 levels. MV-miR-155 was positively associated with cholesterol and total MV levels, while negatively associated with HDL-c levels. Plasma-miR-155 was positively associated with IL-1 β plasma levels and total MV levels, while negatively associated with MV-miR-223 levels. In conclusion, the following miRNAs have been identified as potential biomarkers for diabetic dyslipidemia: miR-218, miR-132, miR-143, miR-21, miR-122, and miR-155. These findings offer new insights into the molecular biomarkers associated with diabetic dyslipidemia and could have significant consequences for treating patients with this pathology.

Keywords: diabetic dyslipidemia, microvesicles, microRNAs

Acknowledgements:

This work was supported by a grant of the Ministry of Education and Research, CCCDI-UEFISCDI, project no. PN-IV-P6-6.1-CoEx-2024-0029, financing contract no. 10CoEx/2.03.2026, within PNC DI IV, and by the Romanian Academy.

EXPLORING THE ROLE OF EXOSOME-DERIVED MICRORNAS IN THE DEVELOPMENT AND PROGRESSION OF CUTANEOUS MALIGNANT MELANOMA WITH IMPLICATIONS FOR DIAGNOSIS AND TREATMENT

**ANDREEA-DANIELA LAZAR (POPA)¹, LEA SLEIMAN¹,
ALEXANDRA MOCANU-DOBRANICI¹, SORINA DINESCU^{1,2}**

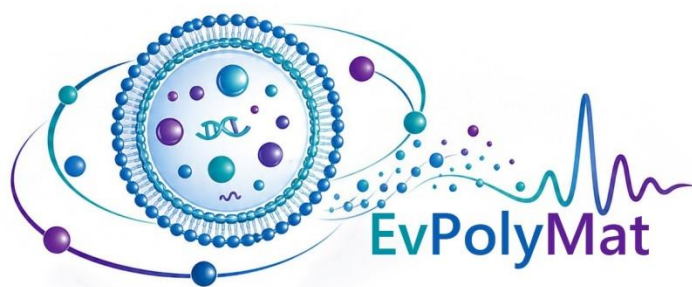
¹*Department of Biochemistry and Molecular Biology, University of Bucharest, Bucharest, Romania*

²*Research Institute of the University of Bucharest - ICUB, Bucharest, Romania
andreea.lazar@bio.unibuc.ro*

Cutaneous malignant melanoma is an aggressive type of cancer, with high mortality and poor prognosis. The incidence is increasing yearly and current therapeutic options remain insufficient. Understanding the mechanisms underlying melanoma progression is essential for proper diagnosis and development of efficient treatment. Recently, exosomes as essential intercellular messengers, with their microRNA (miRNA) cargo, have been of particular interest, as they can modulate the tumor microenvironment and regulate the expression of a wide range of target genes, potentially playing a significant role in cancer invasion and metastasis. In this context, the purpose of our study was to investigate the expression of exosome-derived miRNAs involved in the progression of primary melanoma to metastatic cancer. Therefore, expression profiling of 84 miRNA molecules was performed on exosomes isolated from the culture media of tumor cell lines originated from primary and metastatic melanoma (lymph node and brain), using qPCR array. Results revealed the overexpression of oncogenic miRNAs and underexpression of miRNAs with tumor suppressing function, between the different stages of melanoma, some being reported for the first time in this study (oncomiR-95, oncomiR-652-3p and the suppressors miR-28-3p, miR-34c-5p, miR-98, miR-139-5p, miR-184), which show potential as circulating biomarkers for monitoring and prognosis. Potential targets for the miRNAs of interest were highlighted through bioinformatic analysis, including EGFR, NRAS and VEGFA, important markers involved in several signaling pathways that contribute to cell proliferation and survival. In conclusion, delivery of miRNAs through exosomes can mediate the progression of melanoma, and continuous exploration could lead to improved diagnosis and development of efficient targeted therapy.

Keywords: melanoma, exosomes, microRNAs, tumor microenvironment

PLANT, MICROBIOME AND CROSS-SPECIES EVs



PLANT-DERIVED EXTRACELLULAR VESICLES AS EMERGING MODULATORS OF THE GUT MICROBIOME

LAURA-DORINA DINU¹, EMANUEL VAMANU¹, ELEONORA CALZONI², CARLA EMILIANI²

¹*Faculty of Biotechnologies, University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania*

²*Department of Chemistry, Biology and Biotechnology, University of Perugia, Perugia, Italy*
laura.dinu@biotehnologii.usamv.ro

In recent years, plant-derived extracellular vesicles (PDEVs) have emerged as a promising class of natural nanovesicles capable of mediating interkingdom communication between plants, microorganisms, and mammalian hosts. Accumulating evidence indicates that PDEVs can modulate the composition and metabolic activity of the gut microbiota through the delivery of bioactive cargo, including microRNAs, lipids, proteins, and phytochemicals [1]. These vesicles exhibit remarkable stability within the gastrointestinal tract and can selectively interact with microbial communities, findings that make them an innovative tool for microbiota-targeted interventions [2]. Therefore, we investigated the role of *Rosa canina* EVs and mushroom-derived EVs (*Boletus edulis* and *Pleurotus eryngii*) in shaping human intestinal microbiota composition using *in vitro* gastrointestinal simulation. The results have proved the ability of *Rosa canina* EVs to minimize antibiotic-induced perturbation in gut microbiota [3], while mushroom-derived EVs promoted microbial balance and contributed to intestinal homeostasis, particularly under dysbiotic conditions (cardiovascular disease and type II diabetes mellitus). Overall, plant-derived extracellular vesicles represent a rapidly expanding field of research with considerable potential for the development of next-generation microbiome-based therapeutics. Advancing our understanding about PDEVs mechanisms of action will be essential for translating experimental findings into nutritional applications, while exploring personalized approaches based on individual microbiome profiles.

Keywords: plant-derived extracellular vesicles, gut microbiota, microbiome-based therapeutics

References:

- [1] E. Calzoni et al., *Processes*, 12, 2938 (2024).
- [2] J. Zhang et al., *J. Transl. Med.*, 22, 1059 (2024).
- [3] G. Cusumano et al., *Pharmaceuticals*, 18, 1672 (2025).

ROMANIAN SOCIETY FOR EXTRACELLULAR VESICLES (RoSEV)

– AIMS AND OPPORTUNITIES –

IRINA MATEI

*Weill Cornell Medicine, Department of Pediatrics, Drukier Institute for Children's Health,
Meyer Cancer Center
NY, NY USA
irm2224@med.cornell.edu*

Extracellular vesicles (EV) are heterogeneous nano-vesicles bound by a bilipid membrane that are released into the extracellular space by every living organism (except viruses) and cell. Initially described and dismissed as "garbage dumpsters" of cells, they have now been shown to carry diverse, active biological cargo (DNA, RNA, protein, metabolites, lipids, etc) and to function in short and especially long-range intercellular communication. Interest and involvement in EV research grew exponentially over the past two decades, with topics of interest expanding from biology to bioengineering, biomarker research and theranostics. Critical moments in the expansion of EV research were represented by the establishment of the International Society for Extracellular Vesicles (ISEV) in 2011, and the publication of the Society's journal, The Journal of Extracellular Vesicles (JEV), in 2012 by Wiley. Together, ISEV and JEV periodically publish updated consensus guidelines for EV research, in the form of the MISEV (Minimal Information for the Study of Extracellular Vesicles). ISEV provides a forum for knowledge exchange, through annual conferences, summer schools, technical and special topic conferences, as well as organizing Task Forces, Intersociety Working Groups, Special Interest Groups. Critical to achieving the global reach of ISEV is the Global EV Network, which aims to: 1) provide recognition and visibility to EV-focused local, national, or regional societies, centers, and networks, and 2) organize EV-focused entities within ISEV and to establish alliances with societies interested in EVs. Over the past decade, there has been a growing interest in establishing and performing EV research in laboratories at various institutions across Romania and the last 2-3 years have crystallized the idea that the establishment of a Romanian Society for Extracellular Vesicles would help Romanian EV researchers across the country network and collaborate, sharing resources and ideas. Moreover, it would provide opportunities for interactions with other European EV societies, especially those from neighbouring countries, as well as opportunities to integrate into the Global EV Network. This presentation is aimed at raising awareness and interest in the Romanian Society for Extracellular Vesicles (RoSEV), and identify laboratories and researchers interested in participating in this endeavour.

Keywords: extracellular vesicles, exosomes, ISEV, ROSEV

Acknowledgements:

Dr. Edit Buzas, ISEV President 2022-2024, Semmelweis University, Hungary
Dr. David Lyden, Weill Cornell Medicine, NY, USA
Dr. Doru Paul, Weill Cornell Medicine, NY, USA
Dr. Laura Patras, Babes-Bolyai, Cluj Napoca, Romania
Dr. Mihai Brebu, Petru Poni Institute of Macromolecular Chemistry, Iasi, Romania

EXTRACELLULAR VESICLES AS MEDIATORS OF THE GUT-KIDNEY AXIS IN CATS WITH CHRONIC KIDNEY DISEASE: EMERGING ROLES AND THERAPEUTIC POTENTIAL

PAULA-MARIA PAȘCA¹, GHEORGHE SOLCAN¹, DRAGOȘ ANIȚĂ¹

¹*Faculty of Veterinary Medicine, Iasi University of Life Sciences, Iasi, Romania*
paula.pasca@iuls.ro

Chronic kidney disease (CKD) is one of the most prevalent and clinically significant pathologies in domestic cats, representing a leading cause of morbidity and mortality in older animals. Although advanced multimodal therapeutic methods are being used, the pathophysiology underlying CKD occurrence and progression in cats remains incompletely understood. Emerging evidence in human and veterinary medicine has highlighted the gut-kidney axis as a bidirectional communication network linking intestinal microbial and epithelial function to renal homeostasis, also being considered a key driver of CKD progression. Within this axis, extracellular vesicles (EVs), have been identified as pivotal intercellular messengers capable of transferring bioactive cargo such as proteins, lipids, and non-coding RNAs between distant organ systems. In CKD, uremic toxin accumulation leads to intestinal dysbiosis and disruption of the intestinal epithelial barrier, promoting the release of gut-derived EVs carrying pro-inflammatory and pro-fibrotic mediators that can exacerbate tubular injury, glomerulosclerosis, and immune dysregulation within the kidney. Conversely, renal-derived EVs modulate gut epithelial integrity and microbiota composition, suggesting a reciprocal signalling loop. In cats specifically, alterations in the gut microbiome, including reductions in short-chain fatty acid-producing taxa and increases in urease-positive bacteria, parallel patterns observed in human CKD, implicating similar EV-mediated pathways. Furthermore, urinary and plasma EVs in feline CKD patients exhibit altered proteomic and miRNA profiles, positioning them as promising non-invasive biomarkers of disease stage and progression. Extracellular vesicles thus represent a previously underappreciated mechanism of gut-kidney communication in feline CKD, with dual potential as diagnostic biomarkers and therapeutic targets. Future research should prioritise species-specific characterization of EV cargo in cats across CKD stages and explore the use of engineered or mesenchymal stem cell-derived EVs as nephroprotective interventions, which may fundamentally reshape diagnostic and therapeutic strategies for CKD in feline patients, being especially useful for patients who have difficulties in accepting long-term oral medication.

Keywords: extracellular vesicles, gut-kidney axis, chronic kidney disease, feline, gut microbiota

References:

- [1] J. S. Lawson et al., *J Small Anim Pract.* 64, 3-11 (2023).
- [2] S. Summers and J. Quimby, *Vet J.* 306, 106181 (2024).
- [3] W. Li et al., *Stem Cell Res Ther.*, 13, 379 (2022).
- [4] P. P. Chen et al., *Theranostics*, 13, 3988-4003 (2023).

EXTRACELLULAR VESICLES AT THE FEED–GUT–AMR AXIS: PRIMING POULTRY RESILIENCE THROUGH IMMUNOMODULATORY NUTRITION

**LAURA-M. LIXANDRU^{1,2}, DULMINI N. SAPUGAHAWATTE¹,
SURANGA KODITHUWAKKU¹, WAI-LENG LEE³, VIOLETA E.
SIMION^{2,4}**

¹*Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences,
Tartu, Estonia*

²*University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania*

³*School of Science, Monash University Malaysia, Selangor, Malaysia*

⁴*Spiru Haret University, Bucharest, Romania*

laura-madalina.lixandru@emu.ee

Antimicrobial resistance (AMR) dissemination in poultry production is often driven by prevention gaps: fragile gut barriers and dysbiosis, pathogen pressure, as well as limited access to scalable biological alternatives to conventional antibiotics. Extracellular vesicles (EVs) offer a promising bridge between nutrition, immunomodulation, antimicrobial stewardship, and gut-health monitoring. As nanoscale carriers of lipids, proteins, metabolites, nucleic acids and signalling molecules, EVs can influence epithelial, microbial and immune pathways relevant to disease resilience. This presentation outlines an integrated One Health framework for the use of EVs in poultry nutrition and AMR reduction, focusing on five translational applications: (1) EV-enriched feed bioactives from circular agro-industrial substrates; (2) postbiotic extracellular vesicles derived from controlled lactic acid bacteria and yeast fermentation; (3) plant-derived phytosomes with potential antimicrobial and adjunctive activity against multidrug-resistant pathogens; (4) EV-based delivery of bioactive or antimicrobial compounds; and (5) faecal EVs as non-invasive readouts of gut barrier function, microbiome shifts, immune modulation and host–pathogen interaction. Together, these concepts support an integrated feed-gut-resilience model in which EVs are used both as functional bioactives and as non-invasive indicators of biological effect. The proposed workflow moves from circular biomass selection, controlled fermentation, tangential-flow filtration and size-exclusion-based EV enrichment, to cargo characterisation, *in vitro* gut epithelial barrier testing, dose optimisation, and controlled poultry trials measuring performance, welfare, microbiome composition, intestinal barrier integrity, immune modulation, and antimicrobial-use indicators. By positioning EVs both as functional feed components and as biological indicators of response, this approach supports a shift from reactive antimicrobial treatment towards prevention oriented and evidence based poultry health management. EV-centred animal nutrition could help strengthen gut resilience, reduce reliance on prophylactic antibiotics, improve welfare, and create circular value chains aligned with One Health AMR mitigation.

Keywords: extracellular vesicles, antimicrobial resistance, one Health, poultry gut health, postbiotics



THE NEXT GENERATION OF EXOSOME CHARACTERIZATION: MEET LEPRECHAUN

JAMES PARRY

Distribution Manager, Biologics Products, Unchained Labs, USA
james.parry@unchainedlabs.com

Comprehensive characterization of exosomes and other extracellular vesicles (EVs) is critical for advancing biomarker discovery, cell and gene therapy development, and biopharmaceutical quality control. However, conventional analytical techniques often require trade-offs between sensitivity, throughput, and ease of use. Leprechaun™ from Unchained Labs is a next-generation platform designed to overcome these limitations by enabling rapid, comprehensive, and highly reproducible EV characterization. The system simultaneously measures particle size, concentration, and population distribution from minimal sample volumes without complex sample preparation. Its proprietary optical design, combined with a fully automated workflow, delivers fast, operator-independent results while minimizing variability and maximizing data quality. The platform is optimized for high sensitivity across a broad range of extracellular vesicle populations, providing reliable characterization in a single, streamlined analysis. This presentation will introduce the unique capabilities of Leprechaun™, demonstrate how it simplifies EV analysis, and highlight its potential to accelerate research workflows and improve confidence in extracellular vesicle characterization across a wide range of biomedical applications.

Keywords: exosomes, extracellular vesicles, EV characterization, nanoparticle analysis, Leprechaun™

CYCLODEXTRINS AT BIOLOGICAL AND SYNTHETIC VESICLE INTERFACES: FROM MEMBRANE MODULATION TO SUPRAMOLECULAR ENGINEERING

CRISTIAN PEPTU

*"Petru Poni" Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley,
700487 Iasi, Romania
cristian.peptu@icmpp.ro*

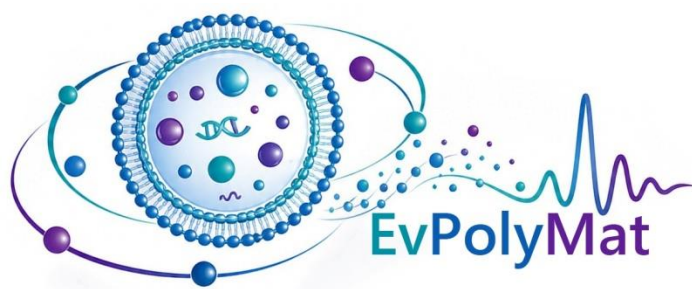
Lipid vesicles, from synthetic liposomes to naturally occurring extracellular vesicles (EVs), are increasingly investigated as carriers for therapeutic agents, biomolecules and diagnostic markers. Cyclodextrins (CDs), well known for their inclusion-complexation ability and tunable chemical structure, can interact with these vesicular systems at several levels, ranging from membrane lipid modulation to supramolecular organization and functional material design. The nature of the CD-vesicle interaction is strongly influenced by cyclodextrin type and substitution. Native, methylated, hydroxypropylated, sulfobutylated and amphiphilic CD derivatives display different affinities toward membrane lipids and cholesterol, affecting membrane organization, permeability and vesicle stability. In synthetic liposomal systems, CDs have been employed to improve drug solubilization and loading, regulate cargo retention and release, and generate drug-in-cyclodextrin-in-liposome formulations. Chemical modification can further transform CDs from soluble complexing agents into amphiphilic or surface-active components capable of membrane insertion, host-guest recognition and supramolecular assembly at the vesicle interface. Related concepts are increasingly being extended to biological vesicles. Cyclodextrins have been used to investigate cholesterol-dependent processes involved in EV formation and cellular uptake, while CD-based supramolecular and porous materials have recently emerged for EV capture, isolation, protection and controlled release. This literature overview discusses cyclodextrin-vesicle interactions from a structure-function perspective, emphasizing how CD substitution and molecular architecture determine their role at synthetic and biological membrane interfaces. The evolution from membrane-modulating agents to engineered supramolecular components highlights the potential of cyclodextrin chemistry in the development of advanced vesicle-based technologies.

Keywords: cyclodextrins; extracellular vesicles; liposomes; supramolecular interactions



"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
October 1-2, 2026

VETERINARY EVs AND MOLECULAR DIAGNOSTICS



Invited Lecture – IL7

Extracellular Vesicles in Veterinary Molecular Diagnostics

SURANGA KODITHUWAKKU



Chair of Veterinary Biomedicine and Food Hygiene
Institute of Veterinary Medicine and Animal Science, Estonian University of Life Science
Tartu 51014, Estonia
suranga@emu.ee

Extracellular vesicles (EVs) are emerging as powerful biological carriers with increasing relevance in molecular diagnostics, particularly because they can be isolated from minimally invasive or non-invasive biological samples such as saliva, urine, blood, milk, and faeces. Since EVs are released by almost all cell types and are naturally enriched with molecular cargo, including proteins, lipids, DNA, mRNA, microRNA, and other non-coding RNAs, they have become an ideal target. Importantly, this cargo reflects the physiological or pathological status of the cells and tissues from which EVs originate. Therefore, EVs provide a unique opportunity to access disease-associated molecular information without the need for invasive tissue biopsies. Our recent works have demonstrated their diagnostic potential across metabolic diseases in cattle, reproductive disorders, infectious diseases and inflammatory conditions. In host–pathogen interactions, EVs carry pathogen-derived molecules, host immune mediators, and tissue-response signatures, making them valuable for detecting early infection and monitoring disease progression. Similarly, gut dysbiosis associated molecular alterations and inflammatory microenvironments changes also can be easily analysed using faecal EVs. As EVs are stable in biofluids and protected by a lipid bilayer, their molecular contents are less prone to degradation compared with freely circulating biomolecules however sensitive enrichment processes are needed to capture the biomarkers in adequate quantities. A major advantage of EV-based diagnostics is their compatibility with repeated sampling. This is especially important for monitoring disease dynamics, treatment response, relapse, or subclinical pathological changes over time. Non-invasive EV sampling also improves patient compliance and is highly relevant in veterinary and One Health settings, where repeated invasive sampling may be impractical or ethically challenging. For example, faecal, salivary, urinary, or reproductive-tract EVs may offer tissue-proximal molecular information while avoiding invasive procedures. Despite their promise, EV-based diagnostics still face technical challenges, including standardisation of EV isolation, purification, characterisation, biomarker validation, assay reproducibility and cost per sample. However, continuous progress in EV technologies, molecular profiling, and digital detection platforms is rapidly improving diagnostic sensitivity and specificity.

Keywords: veterinary diagnostics, EVs, multi-omics , non-invasive sampling, biomarkers

Acknowledgement:

The research works were funded by the European Union through HORIZON 2020 research and innovation program under grant agreement No 857418 "COMBIVET," HORIZON Coordination and Support Actions under grant agreement No 101079349 "OH-Boost," Co-funded by European Union Project 101136346 (EUPAHW) and supported by the Estonian University of Life Sciences base funding projects (P17019VLKM & V240051VLVB)

INTEGRATING SEMINAL PLASMA EXTRACELLULAR VESICLES TO IMPROVE MALE REPRODUCTIVE OUTCOMES

MONIKA NÕMM¹, ANNI VILJASTE-SEERA¹, ÜLLE JAAKMA¹

¹*Chair of Animal Breeding and Biotechnology, Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, Tartu, Estonia
monika.nommm@emu.ee*

Seminal plasma (SP) extracellular vesicles (EVs) play a conserved role in reproductive physiology by modulating sperm function. Understanding and harnessing these vesicle-mediated interactions offers new opportunities to develop regenerative and precision fertility strategies that bridge animal and human reproductive medicine. SP-derived EVs from bulls with high (HF) or low (LF) *in vitro* fertility were isolated via size exclusion chromatography and characterized using nanoparticle tracking analysis. Firstly, EVs from HF bull SP were added to 100 μ L IVF medium in three concentrations (A: 200×10^6 , B: 400×10^6 , C: 600×10^6 EVs mL^{-1} and D: control) and co-cultured with sperm and oocytes for 24 h under mineral oil. Secondly, EVs from LF bull SP were added to the IVF medium in a final concentration of 600×10^6 EVs mL^{-1} . In both experiments, embryo development, morphology, and kinetics scores were assessed on Day 7 (D7) and Day 8 (D8). The statistical analysis was performed using GraphPad Prism 10 software. All data were analyzed with one-way ANOVA followed by Tukey's multiple comparisons test with $P \leq 0.05$. On D7, the highest blastocyst morphological score was recorded in group C (3.0), which was 1.1 points higher than the control group morphological score (1.9). On D8, the difference in blastocyst rates (%) between group C and D was 19.8 ± 2.6 and 9.4 ± 0.9 , respectively, but was insignificant with a $P \geq 0.05$. The morphological score of D8 in group C was the highest (2.35), 0.55 points higher than group D (1.8). For LF bull SP treatment, there were no statistically significant differences between the treatment groups ($P \geq 0.05$). The preliminary results suggest improvement in embryo morphology and blastocyst rates when adding 600×10^6 EVs mL^{-1} SP EVs from known HF bulls to the IVF media of known LF bulls. On the other hand, no differences were observed when adding 600×10^6 EVs mL^{-1} SP EVs from known LF bulls to the IVF media. More research is needed into the cargo components of SP EVs to understand the translational aspects of EV-mediated reproductive modulation across species.

Keywords: seminal plasma extracellular vesicles, *in vitro* fertilization (IVF), bull fertility, embryo development

Acknowledgements:

This research was supported by the Estonian Research Council (PRG1665)

COMPARATIVE STUDY OF THE VOLATILE PATTERNS RELEASED BY BULL SEMINAL PLASMA AND EXTRACELLULAR VESICLES

**RADU IONESCU¹, ANNI VILJASTE-SEERA¹, MONIKA NÕMM¹,
JAFETH CARRASCO², DIONNE LEONG³, ÜLLE JAAKMA¹**

¹*Estonian University of Life Sciences, Tartu, Estonia*

²*Institute for Scientific Research and High Technology Services, Panama City, Panama*

³*Monash University, Kuala Lumpur, Malaysia*

radu@emu.ee

Extracellular vesicles (EVs) derived from bovine seminal plasma (SP) play key roles in modulating sperm function and fertility by transporting bioactive molecules such as lipids, proteins, and RNAs [1]. These EVs influence sperm maturation and immune responses in the female reproductive tract [2]. Volatile organic compounds (VOCs) in SP are emerging as potential modulators of sperm functionality [3].

This study aimed to characterize and compare the volatilomic profiles of SP and SP-derived EVs. GC-MS analysis identified 49 VOCs across SP and EV sample matrices and ambient blanks. Multivariate analysis revealed distinct metabolic signatures between SP and EVs. Filtering for 60% prevalence highlighted 5 core biomarkers, among which SP was characterized by abundant ketones (acetone and 2-butanone), whereas EVs displayed selective enrichment in trichloromethane alongside shared metabolites (ethanol and (2-aziridinyethyl)amine). Supervised classification via PLS-DA and Support Vector Machines demonstrated robust discrimination between SP and EVs with an accuracy of 96%. Electronic nose fingerprinting with a custom made device based on commercial MOS gas sensors increased the classification accuracy to 98% in the concomitant discrimination between SP, EVs and blank air samples, while the discrimination accuracy between the SP and EV samples achieved 100%. These findings demonstrate that SP-EVs harbour a distinct volatile cargo, opening new avenues for non-invasive fertility assessment and understanding male reproductive physiology.

Keywords: Bovine seminal plasma, extracellular vesicles, volatile organic compounds, GC-MS, electronic nose

Acknowledgements:

The study was funded by the Estonian Research Council (PRG 1665) and European Commission (101086360).

References:

- [1]. Xie et al., *Veterinary Sciences*, 12, 585 (2025).
- [2]. S. Paktinat et al., *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 235, 71-76 (2019).
- [3]. V. Longo et al., *Biomedical Physics & Engineering Express*, 5, 015006 (2019).

ENVIRONMENTAL DRIVERS OF MICROBIOTA-HOST COMMUNICATION

NYUK LING MA

Universiti Malaysia Terengganu, Malaysia
nyukling@umt.edu.my

Chronic dietary exposure to low-dose environmental chemicals, including pesticide, heavy metals and pharmaceutical mixtures poses an insidious threat to gastrointestinal integrity and immune homeostasis. Every day, we unintentionally ingest a low-dose cocktail of environmental chemicals, pesticides, and heavy metals. But what happens once they cross the threshold of our digestive tract? Following ingestion to our body, the trillions of microorganisms that inhabit our gastrointestinal tract can interact and alter the chemical structures of their lifetime, bioactivities and biological effects. Our research focuses on how the gut microbiome responds to environmental exposomics. Specifically, we have identified unique plant proteins triggered by pesticide treatments that have the potential to react directly with the host upon consumption. In a parallel study, we demonstrated that chronic, low-dose pesticide exposure, mirroring what we unintentionally consume in our daily diet, induces profound immunotoxicity and localized pathology. This damage is characterized by systemic leukopenia (depleted white blood cells, lymphocytes, and monocytes), elevated serum alkaline phosphatase (ALP), and severe colonic inflammation driven by surging TNF- α and IL-6 levels. These immunological defects converge with structural gut damage, manifested as crypt distortion and goblet cell depletion. Furthermore, we observed severe gut microbiota dysbiosis marked by collapsed alpha diversity, an expansion of pathobiont-containing *Pseudomonadota* and *Bacteroidota*, and a systemic shutdown in community-level carbon substrate utilization. Fortunately, these damaging effects are manageable. This talk will demonstrate how the right gut management and functional foods can reverse this damage.

Keywords: gut microbiota, inflammation, environmental exposomics, metagenomics

MULTI-PATHOGEN BACTERIAL EXTRACELLULAR VESICLES AS NOVEL BIOMARKERS FOR EARLY, AI-ASSISTED DETECTION OF SUBCLINICAL BOVINE MASTITIS

**DULMINI N. SAPUGAHAWATTE¹, LAURA-M. LIXANDRU^{1,2},
CHANAKA PREMATHILAKA¹, WAI-LENG LEE³, MIHAI BREBU⁴,
ELENA STOLERU⁴**

¹*Institute of Veterinary Medicine and Animal Sciences (IVMAS), Estonian University of Life Sciences (EMU), Tartu, Estonia*

²*University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania*

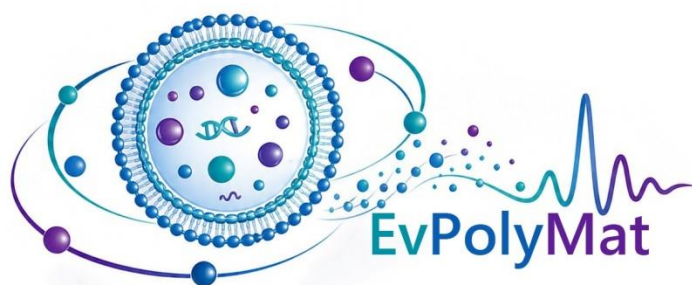
³*School of Science, Monash University Malaysia Selangor, Malaysia*

⁴*"Petru Poni" Institute of Macromolecular Chemistry, Physical Chemistry of Polymers Department, 700487 Iasi, Romania
dulmini.nanayakkara@emu.ee*

Subclinical mastitis is the most economically damaging form of bovine mastitis, causing no visible signs while silently reducing milk yield and quality and driving the overuse of broad-spectrum antibiotics, a major contributor to antimicrobial resistance (AMR). Conventional tools such as somatic cell counting and strip cup testing lack the sensitivity to flag infection before it becomes established, and current diagnostics cannot distinguish between the more than 130 causative pathogens. All bacteria, including the dominant mastitis pathogens *Streptococcus agalactiae*, *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumoniae*, release nanoscale extracellular vesicles (EVs) carrying pathogen-specific surface proteins, virulence factors, lipopolysaccharides and nucleic acids, detectable in biofluids well before clinical symptoms emerge. We propose the MastiVEC concept, which translates the bacterial-EV diagnostic paradigm, already validated in human biofluids for cancer and infectious disease, into a multi-pathogen, milk-based, AI-integrated platform for the earliest detection of bovine subclinical mastitis. The project will characterise pathogen-specific EV cargo signatures using proteomics and metagenomics, and train machine-learning classifiers to discriminate pathogen-specific EV signatures and flag subclinical infection before somatic cell count thresholds are reached. These biomarker and AI models will be embedded in a microfluidic lab-on-chip device, co-developed with Monash University Malaysia, enabling rapid on-farm EV isolation and pathogen-specific detection directly from raw milk. The integrated platform will be benchmarked against gold-standard microbiology in a prospective field trial in Estonian dairy herds. By enabling pathogen-specific diagnosis at the subclinical stage, MastiVEC aims to support targeted antibiotic stewardship, reduce the dissemination of AMR pathogens into the food chain, and demonstrate a generalisable model for EV-based early disease detection in veterinary and One Health applications.

Keywords: bacterial extracellular vesicles, subclinical mastitis, biomarker discovery, AI/machine learning diagnostics, lab-on-chip

EV CHARACTERIZATION, VOLATOLOMICS AND SENSING



LABEL-FREE INFRARED MICROSCOPY OF EXTRACELLULAR VESICLES AND PATHOLOGICAL PROTEIN ASSEMBLIES

OXANA KLEMENTIEVA

Faculty of Medicine, Lund University – Lund, Sweden

oxana.klementieva@med.lu.se

Extracellular vesicles, including exosomes (50–150 nm in diameter), play a crucial role in cell-to-cell communication and the propagation of pathological proteins in neurodegenerative disorders. However, their nanoscale dimensions present a major analytical challenge for conventional Fourier-transform infrared (μ -FTIR) microspectroscopy due to the optical diffraction limit ($\sim 5\text{--}10\ \mu\text{m}$). This talk highlights recent developments in high-resolution vibrational techniques, focusing on the application of scattering-type scanning near-field optical microscopy (s-SNOM) and nano-FTIR for exosome characterization. With a spatial resolution of $\sim 20\text{--}25\ \text{nm}$, s-SNOM bypasses the diffraction limit by utilizing an AFM tip as a local optical probe to measure chemical composition and morphology simultaneously. Using this approach, individual exosomes can be resolved and chemically identified label-free by mapping characteristic infrared absorption bands for proteins ($1656\ \text{cm}^{-1}$) and lipids ($1740\ \text{cm}^{-1}$). Furthermore, s-SNOM enables the discrimination between lipid-rich vesicles and non-vesicular, lipid-free protein aggregates, as well as the assessment of secondary protein structure directly at the single-vesicle level. We discuss key technical considerations, sample preparation strategies, and the potential of infrared nanospectroscopy to investigate the molecular mechanisms of exosome-mediated pathology.

ANALYSIS OF CHROMATOGRAPHIC AND SPECTRAL SIGNALS OF EXTRACELLULAR VESICLES

**SIONG FONG SIM¹, MIHAI BREBU², ELENA STOLERU²,
ROSAMARIA CAPUANO³, CORRADO DI NATALE³, ALEXANDRO
CATINI³, CARMENZA SPADAFORA⁴, OXANA KLEMENTIEVA⁵,
WAI-LENG LEE⁶, RADU IONESCU⁷**

¹Global Futures Transdisciplinary Institute, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

²“Petru Poni” Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley, 700487 Iasi, Romania

³Department of Electronic Engineering, University of Rome Tor Vergata, 00133, Rome, Italy

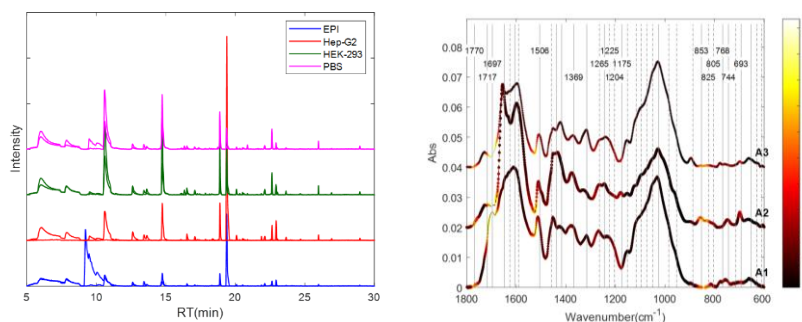
⁴Instituto de Investigaciones Científicas y Servicios de Alta Tecnología (INDICASAT AIP), City of Knowledge, 0843-01103, Panama City, Panama

⁵Department of Experimental Medical Science, Lund University, 22184 Lund, Sweden

⁶School of Science, Monash University Malaysia, Jalan Lagoon Selatan, Subang Jaya 47500, Malaysia

⁷Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, 51006 Tartu, Estonia
sfsim@unimas.my

Signals from extracellular vesicles (EVs) have been investigated using analytical techniques including Gas Chromatography-Mass Spectrometry (GC-S), Fourier Transform Infrared (FTIR) spectroscopy, and electronic nose (e-nose) systems. These techniques are employed to detect volatile organic compounds and molecular signatures associated with EVs. This paper aims to demonstrate the application of chemometric techniques in processing GC-MS, FTIR, and e-nose signals for EV characterization, covering steps from data pre-processing and signal processing to variable selection and classification.



Chromatographic and spectral analysis of EVs signal

Keywords: unsupervised learning, variable selection, peak detection and matching, supervised learning

Acknowledgements:

This work was supported by the European Union’s Horizon Europe research and innovation programme under the Marie Skłodowska-Curie Actions – Staff Exchanges (Grant Agreement 101086360 – VOLATEVS)

VOLATOLOMIC ANALYSIS OF EXTRACELLULAR VESICLES EXTRACTED FROM CULTURED CELLS

**ROSAMARIA CAPUANO¹, SIONG FONG SIM², MOHAMMAD
MEHEDI HASAN^{3,4}, PASCALE V. GUILLOT⁵, CORRADO DI
NATALE^{1,8}, ALEXANDRO CATINI¹, CARMENZA SPADAFORA⁶,
MIHAI BREBU⁷, RADU IONESCU⁴**

¹Department of Electronic Engineering, University of Rome Tor Vergata, Rome, Italy

²Faculty of Resource Science & Technology, Universiti Malaysia Sarawak, Sarawak,
Malaysia

³Department of Regenerative Medicine, State Research Institute Centre for Innovative
Medicine, Vilnius, Lithuania

⁴Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, ,
Tartu, Estonia

⁵University College London, Elizabeth Garrett Anderson Institute for Women's Health,
Research Department of Maternal and Fetal Medicine, Medical School Building, London, UK

⁶Center of Cellular and Molecular Biology of Diseases (CBCMe), Instituto de Investigaciones
Científicas y Servicios de Alta Tecnología (INDICASAT AIP), City of Knowledge, Panama

⁷"Petru Poni" Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley, Iasi,
Romania

⁸Centre for Interdisciplinary Research (CIDR), SRM University-AP, Amaravati, Andhra
Pradesh, India

capuano@ing.uniroma2.it

Extracellular vesicles (EVs) are membrane-bound nanoparticles that mediate intercellular communication by transporting bioactive molecules reflective of the physiological or pathological state of their cells of origin. While metabolomics has been widely used to characterize EV composition, volatilomics remains largely unexplored. Here, we present a complementary volatilomic approach to characterize volatile organic compounds (VOCs) released by EVs isolated from three human cell lines (EPI, Hep-G2, and HEK-293). VOC profiles were analysed using gas chromatography–mass spectrometry (GC-MS), gas chromatography–ion mobility spectrometry (GC-IMS), and a porphyrinoid-based electronic nose. The three analytical platforms consistently revealed distinct, cell type-specific VOC signatures. GC-MS identified characteristic aldehydes associated with oxidative and membrane lipid metabolism, GC-IMS enhanced discrimination through ion mobility profiling, and the electronic nose enabled rapid and reproducible classification. These findings demonstrate that EVs exhibit reproducible volatilomic fingerprints and highlight the potential of VOC analysis for EV characterization, biomarker discovery, non-invasive diagnostics, disease monitoring, and quality control of EV-based therapeutics [1].

Keywords: extracellular vesicles, volatilomics, cell lines

Acknowledgements:

This work was supported by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie actions (grant agreement 101086360), and partially funded by SNI Panama to C.S.

References:

[1] R. Capuano et al., *Talanta*, 307, 129776 (2026).

A MULTIMODAL SENSOR APPROACH TO PROSTATE CANCER DETECTION THROUGH URINARY EXTRACELLULAR VESICLES

MATILDE MESSINA¹, KISHORE PUSHPARAJ¹, ALEXANDRO CATINI¹, VALERIO ALLEGRA¹, ROSAMARIA CAPUANO¹, CHEE WEI ANG², KEN YOON YEONG², LAURA DINES NGAU³, SIONG FONG SIM³, WAI-LENG LEE², CORRADO DI NATALE¹

¹Department of Electronic Engineering, University of Rome Tor Vergata, Rome, Italy

²School of Science, Monash University Sunway Campus, Jalan Lagoon Selatan, Selangor Darul Ehsan, Malaysia

³Faculty of Resource Science & Technology, Universiti Malaysia Sarawak, Sarawak, Malaysia

matilde.messina@alumni.uniroma2.eu

Non-invasive biomarkers are urgently needed to improve the specificity of prostate cancer screening and reduce unnecessary biopsies [1]. Urinary extracellular vesicles (EVs) carry molecular footprints of disease, but identifying the most reliable, high-throughput analytical technique for clinical translation remains a challenge. In this study, we isolated and analyzed urinary EVs from a cohort of 8 confirmed prostate cancer patients and 10 non-cancer controls. We evaluated and compared the diagnostic efficacy of three distinct analytical modalities: Fourier Transform Infrared (FTIR) spectroscopy, an electronic noses (e-noses), and an electronic tongue (e-tongue) system. The used electronic noses is based on an array of 12 Quartz crystal microbalances coated with porphyrinoids [2]. On the other hand, the e-tongue consists of a 12-sensor array based on laser-induced graphene/porphyrinoids, integrated into a 3D-printed mesofluidic cell. FTIR spectroscopic analysis of urinary extracellular vesicles (EVs) proved unsuitable for reliably discriminating prostate cancer patients from non-cancer controls, likely due to the substantial overlap in their biomolecular spectral profiles. In contrast, volatile organic compound profiling performed using the electronic nose system achieved a classification accuracy of approximately 80%, demonstrating good discrimination between the two groups. Comparable performance was obtained with the electronic tongue, whose electrochemical fingerprint successfully distinguished prostate cancer patients from non-cancer controls. Classification performance, assessed by confusion matrix analysis, yielded a true positive rate of 80% for prostate cancer detection. Overall, these findings highlight the strong potential of both gas- and liquid-phase sensing technologies as rapid, high-throughput, and non-invasive tools for prostate cancer screening based on the analysis of urinary extracellular vesicles.

Keywords: prostate cancer, urinary extracellular vesicles, fourier transform infrared (FTIR) spectroscopy, electronic nose, electronic tongue

Acknowledgements:

This work was supported by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie actions (grant agreement 101086360)

References:

- [1] Y. Zeng et al., *Front Cell Dev Biol*, 10, 816698 (2022)
- [2] R. Capuano et al., *Talanta*, 307, 129776 (2026)
- [3] R. Capuano et al., *ACS Sensors*, 10, 7 (2025)

FFF-MALS-DLS AS A MODERN ORTHOGONAL PLATFORM FOR EXTRACELLULAR VESICLE SUBPOPULATION DISCOVERY AND DIAGNOSTIC CHARACTERIZATION

ABHIGYAN SENGUPTA¹

¹Market Application Specialist
abhigyan_sengupta@waters.com

Extracellular vesicles (EVs) are increasingly pursued as circulating biomarkers for non-invasive disease diagnosis, yet their biological heterogeneity has historically been masked by characterization tools that report only bulk, ensemble-averaged properties. Asymmetric-flow field-flow fractionation coupled in-line to multi-angle light scattering and dynamic light scattering (FFF-MALS-DLS) addresses this limitation by first separating an EV sample by hydrodynamic size, then characterizing the geometric and hydrodynamic dimensions of each eluting fraction as it is resolved; because the light scattering and dynamic light scattering detectors are complementary across the accessible size range, this combination can distinguish vesicle subpopulations that bulk or single-detector methods tend to average together or confuse with co-eluting lipoproteins and free protein [1]. This resolving power has previously been used to reveal that a nominally single “exosome” fraction can in fact comprise multiple biophysically and molecularly distinct nanoparticle populations, each with its own conserved identity and cargo signature across most cell lines [2]. In an independent clinical application, the same fractionation-and-scattering approach was reported to distinguish urinary exosome size profiles between prostate cancer patients and healthy controls, suggesting that subpopulation-resolved characterization itself can serve as a diagnostic feature once separation is properly achieved [3]. Extending the platform with an electrical field-flow channel further enables surface charge to be assessed as a function of size for each fraction, adding a further label-free, orthogonal dimension of relevance to EV behavior in diagnostic and delivery contexts. Taken together, the accumulated body of work using FFF-MALS-DLS across EV isolation, sizing, structural, and surface-charge studies supports its positioning as a modern, high-resolution orthogonal technique for translating EV subpopulation biology into robust diagnostic and quality-control frameworks.

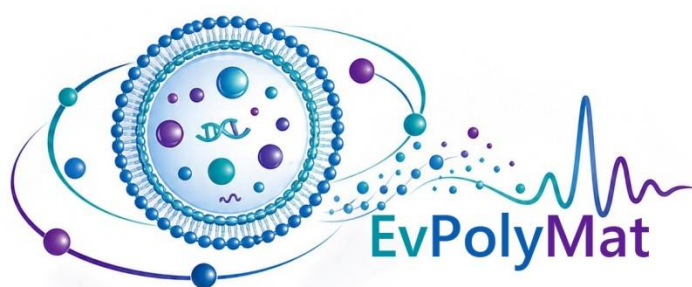
Keywords: extracellular vesicles, FFF-MALS-DLS, exosome subpopulations, diagnostic biomarkers, asymmetric-flow field-flow fractionation

References:

- [1] C. Johann, WP2606: *Exosome Characterization with FFF-MALS-DLS*, Waters | Wyatt Technology Corporation, White Paper.
- [2] H. Zhang et al., *Nat. Cell Biol.*, 20, 332–343 (2018).
- [3] J. S. Yang et al., *Anal. Chem.*, 89, 2488–2496 (2017).



POSTERS



PLANT-DERIVED EXTRACELLULAR VESICLES: RECENT ADVANCEMENTS ON THEIR BIOLOGICAL PROPERTIES AND MEDICINAL USE

**MIHAELA LIPOVANU, OANA CIOANCĂ, ADRIANA TRIFAN,
MONICA HÂNCIANU, ANCA MIRON, ANA CLARA APROTOSOAIE**

*Department of Pharmacognosy-Phytotherapy, Faculty of Pharmacy, Grigore T. Popa
University of Medicine and Pharmacy, Iasi, Romania
ana.aprotosoai@umfiasi.ro*

Plant-derived extracellular vesicles (PDEV_s), also named plant-derived nanovesicles or plant exosome-like nanovesicles, are lipid-bound membrane vesicles that are actively secreted by plant cells through vesicle trafficking pathways into the apoplastic space [1,2]. They are vital in the regulation of many significant processes such as intercellular communication, cell wall remodelling, cell proliferation and differentiation and defence against pathogens [3]. PDEVs contain functional biomolecules such as RNAs, proteins, lipids, and metabolites (flavonoids and other phenolics, organosulfur compounds, organic acids, amino acids) [4]. They can interact with mammalian cells and exhibit various biological activities (anti-inflammatory, anticancer, antioxidant, regeneration, gut microbiome regulation and intestinal barrier repair) that offer a range of interesting possible therapeutic uses [3,5]. This paper summarizes recent progress in bioactivity of PDEVs and outlines a foundation for developing reliable PDEVs-based therapeutics. The current challenges are analyzed and the research directions for the clinical application of PDEVs are also discussed.

Keywords: plant-derived extracellular vesicles, bioactivity, pharmacotherapeutics

References:

- [1] H.Y. Jo et al., *View*, 6, 20240115 (2025).
- [2] F. Alsaïd et al., *Front. Bioeng. Biotechnol.*, 14, 1758558 (2026).
- [3] M. Q. Lian et al., *J. Extracell. Vesicles.*, 11, 12283 (2022).
- [4] O. Urzi et al., *Int. J. Biol. Macromol.*, 22, 5366 (2021).
- [5] S. Hao, et al., *Pharmacol Rep.*, 200, 107062 (2024).

SERS ANALYSIS OF MILK-DERIVED EXTRACELLULAR VESICLES USING GOLD PLASMONIC SUBSTRATES

**DRAGOȘ-IOAN OLARIU^{1,2}, WAI-LENG LEE³, SEPTILA RENATA²,
MAGDALENA AFLORI¹, BRÎNDUȘA DRĂGOI², RAREȘ-IONUȚ
ȘTIUFUIC^{2,4}**

¹*Department of Physics of Polymers and Polymeric Materials, "Petru Poni" Institute of Macromolecular Chemistry, 700487 Iasi, Romania*

²*Nanotechnology Laboratory, TRANSCEND Research Center, Regional Institute of Oncology, 2-4 General Henri Mathias Berthelot Street, 700483 Iasi, Romania*

³*Monash University, Kuala Lumpur, Malaysia*

⁴*Department of Nanobiophysics, MedFuture Research Center for Advanced Medicine, "Iuliu Hatieganu" University of Medicine and Pharmacy, 4-6 Pasteur Street, 400337 Cluj-Napoca, Romania*

olariu.dragos@icmpp.ro

Extracellular vesicles (EVs) are nanosized, lipid bilayer-enclosed particles that carry proteins, lipids and nucleic acids that reflect the physiological state of their cells of origin, making them attractive candidates for liquid-biopsy applications. Surface-enhanced Raman scattering (SERS) provides an ultrasensitive label-free approach for probing the molecular fingerprint of EVs. Reliable SERS analysis depends strongly on EV preparation quality and the physicochemical properties of the plasmonic substrate. Here, milk was used as an abundant and readily accessible source of EVs. EV-enriched fractions were obtained by sequential centrifugation, casein precipitation, tangential flow filtration, and centrifugal concentration (Figure 1). Gold nanoparticles with different surface chemistries were prepared through aqueous reduction routes employing citrate, polyethylene glycol, or polyethylene imine, with pH and temperature adjusted to modulate particle size and surface charge. The interaction of the plasmonic substrates with EVs and their ability to provide SERS enhancement were investigated. The SERS spectrum of milk-derived EVs (Figure 2) showed protein-related bands, including tryptophan ($\sim 753\text{ cm}^{-1}$), phenylalanine ($\sim 998\text{ cm}^{-1}$), tyrosine, and amide III, together with an intense band at 1583 cm^{-1} . CH_2/CH_3 and $=\text{CH}$ stretching bands in the $2850\text{--}3010\text{ cm}^{-1}$ region reflected the lipid-rich EV membrane. The results support the use of SERS for potential applications in EV-based cancer diagnostic.

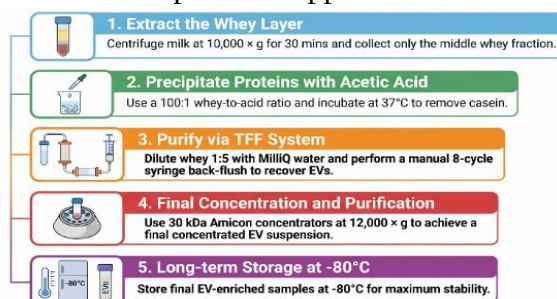


Figure 1: Isolation of Extracellular Vesicles from milk using differential processing & tangential flow filtration

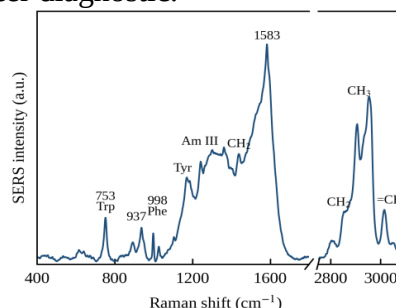


Figure 2: SERS spectrum of milk-derived EVs

Keywords: milk-derived extracellular vesicles, SERS, plasmonic substrates, gold nanoparticles

Acknowledgements:

H2020 ERA Chair ESEI-BioMed (No. 952390) and the Horizon Europe MSCA Staff Exchanges VOLATEVS (No. 101086360)

ISOLATION AND INFRARED SPECTROSCOPY ANALYSIS OF EXTRACELLULAR VESICLES FROM MOUSE NEUROBLASTOMA CELL LINES EXPOSED TO OXIDATIVE STRESS

**RALUCA PETRONELA DUMITRIU¹, EDMUND UI-HANG SIM²,
KAR-YAN SU³, MELANY MORALES⁴, ADELENIS VEGA⁴, OXANA
KLEMENTIEVA³, SIONG FONG SIM², CARMENZA SPADAFORA⁴,
ELENA STOLERU¹, MIHAI BREBU¹**

¹*"Petru Poni" Institute of Macromolecular Chemistry, Physical Chemistry of Polymers
Department, 700487 Iasi, Romania*

²*Universiti Malaysia Sarawak (UNIMAS), Faculty of Resource Science and Technology, Kota
Samarahan, Sarawak, Malaysia*

³*Department of Experimental Medical Science, Lund University, 22184 Lund, Sweden*

⁴*Instituto de Investigaciones Científicas y Servicios de Alta Tecnología (INDICASAT AIP),
City of Knowledge, 0843-01103, Panama City, Panama
rdumi@icmpp.ro*

Current research is moving beyond demonstrating the biological activity of extracellular vesicles (EVs) as key mediators of intercellular communication, toward understanding aspects such as biogenesis, molecular cargo, heterogeneity, quality control [1]. The diversity of EV populations makes their isolation and purification a major challenge. While conventional differential and density-gradient ultracentrifugation remain widely used, other methods (e.g. size-exclusion chromatography, ultrafiltration, tangential-flow filtration) provide alternative or complementary strategies. Since no single method simultaneously maximizes yield, purity, scalability, vesicle integrity and recovery, combined approaches may be a better option. In characterization of the isolated EVs, infrared spectroscopy, particularly Attenuated Total Reflectance Fourier-Transform Infrared (ATR-FTIR) spectroscopy arised as a promising label-free approach for assessing the biochemical composition of EVs with minimal sample preparation [2]. This study aims to develop an optimized strategy for isolation and purification of EVs released by mouse neuroblastoma cells exposed to oxidative stress. Two complementary isolation protocols were designed, both initiated with a common pre-processing step to remove cells, debris, and larger vesicles by differential centrifugation. The first method incorporated ultracentrifugation to pellet EVs based on size and density with good yields, while in the second method size-exclusion chromatography separation was used, in the attempt to enhance integrity and purity. The preliminary results can offer a perspective on the effect of oxidative stress on N2a cells EVs secretion capacity, morphology aspect, cell viability post-treatment, EVs protein concentration and eventually changes in the EVs molecular spectral pattern. An optimized isolation workflow for EVs released into cell culture media coupled with ATR-FTIR analysis offers an attractive strategy for linking EV recovery and purity to their molecular composition associated with culture conditions.

Keywords: neuroblastoma cell lines, extracellular vesicles, isolation, infrared spectroscopy

Acknowledgements:

This work was supported by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie Actions – Staff Exchanges (Grant Agreement 101086360 – VOLATEVS)

References:

- [1] K. Moloudi et al., *Photodiagnosis Photodyn. Ther.*, 58, 105370 (2026).
- [2] K.- Y. Su et al., *Spectrochim. Acta A Mol. Biomol. Spectrosc.*, 127891 (2026).

DEVELOPMENT OF LIPOSOME-POLYMER HYBRID MATERIALS BASED ON DYNAMICALLY CROSSLINKED POLYSACCHARIDES

IOANA A. DUCEAC¹

¹ "Petru Poni" Institute of Macromolecular Chemistry, Grigore Ghica Voda Alley, 41A, Iasi,
Romania
duceac.ioana@icmpp.ro

Dynamic gels have received increasing attention as carriers for various treatment strategies. These polymeric systems are injectable and can be loaded with one or more drugs or encapsulate nanoparticles such as extracellular vesicles for controlled, local delivery. Injectable hydrogels can have in situ gelling, like the photo-crosslinked networks, or they can be thixotropic, with dynamic, reversible bonds, such as the imine or Schiff base bond. [1-3] In this study, it was assumed that the hydrogel may act as a protective depot at an injury or tumor site, preventing the rapid clearance of liposomes (as synthetic models for extracellular vesicles) and releasing them in a controlled, steady manner. Therefore, phosphatidylcholine-based liposomes were prepared by the thin film hydration method and further characterized, with particular focus on stability and spontaneous oxidation. Dynamic hydrogels were investigated separately. First, gellan and alginate were chosen and subjected to selective oxidation by the periodate protocol. Second, hydrogels were prepared using raw or oxidized polysaccharides, which were combined with a water-soluble chitosan derivative. The resulting materials were characterized, and preliminary data support the potential of these hydrogels for further liposome loading and release studies.

Keywords: chitosan, alginate, gellan, oxidation.

References:

- [1] I.A. Duceac, S. Coseri, *Gels*, 2022, 8 (12), 779.
- [2] I.A. Duceac, S. Coseri, *Biotech. Adv.* 2022, 61, 108056.
- [3] I.A. Duceac, M.C. Stanciu, M. Nechifor, F. Tanasa, C.A. Teaca, *Gels*, 2022, 8, 771.

POLYMER-COATED QUARTZ MICROBALANCE ARRAY FOR DISCRIMINATING VOCs AND AMMONIA

FEDERICO CORTESE¹, ROSAMARIA CAPUANO¹, ALEXANDRO CATINI¹, ELENA STOLERU², MIHAI BREBU², CORRADO DI NATALE¹

¹Department of Electronic Engineering, University of Rome Tor Vergata, Rome, Italy

²"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

federico.cortese@alumni.uniroma2.eu

Quartz microbalances (QMBs) are attractive platforms for room temperature gas sensing because they provide real time mass sensitive transduction with simple readout electronics. Their analytical performance strongly depends on the physicochemical properties of the coating, which control sorption, swelling and specific interactions with the analytes [1-3]. In the present work, a QMB array coated with chitosan and polylactic acid layers was investigated for the detection of volatile compounds and ammonia at room temperature. Measurements performed with isopropanol, xylene, pentanol, octane and ammonia showed analyte dependent response patterns over concentration ranges relevant to environmental monitoring. Chitosan electrospinning coatings provided the largest absolute responses, while signal normalization highlighted complementary sensitivities across the array. t-distributed Stochastic Neighbor Embedding (t-SNE) (Figure 1) confirmed that the collective response of the sensors enables discrimination among the tested compounds. The study therefore supports further optimization of the coating set and measurement protocol toward an electronic nose strategy for environmental or process monitoring applications.

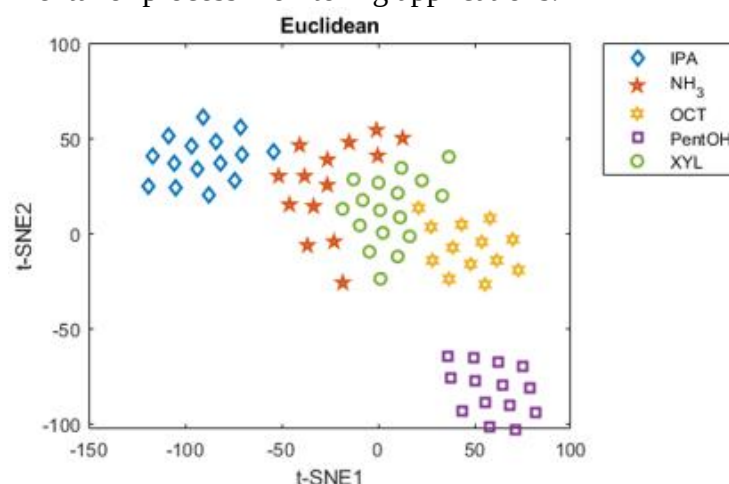


Figure 1: t-SNE of the linear-normalized sensor responses, calculated using Euclidean distance

Keywords: quartz microbalance, polymer coatings, volatile organic compounds, gas sensor array

Acknowledgements:

This work was supported by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie actions (grant agreement 101086360)

References:

- [1] G. Magna et al., *Sensors and Actuators B: Chemical*, 320, 128373 (2020)
- [2] A. Catini et al., *Sensors* 16, 1640 (2016)
- [3] K. Triyana et al., *Electronics* 7, 181 (2018)

RECENT INSIGHTS INTO THE RESEARCH ON APPLICATIONS OF THE (BIO)ACTIVE ADDITIVES

DANIELA PAMFIL, ELENA STOLERU, MIHAI BREBU, RALUCA PETRONELA DUMITRIU, ELENA BUTNARU, CORNELIA VASILE

*"Petru Poni" Institute of Macromolecular Chemistry, Physical Chemistry of Polymers
Department, 41A Grigore Ghica Voda Alley, 700487 Iasi, Romania
cvasile@icmpp.ro*

An exhaustive analysis of the recent progresses (last 5 years) in the research on the applications is presented based on the the fast-developing innovations of the biologically active additives/ingredients, nanosized inorganic, organic and polymeric active additives and extracellular vesicles (EVs) shortly compared in the table below. The active (bioactive), natural additives (plants, plant extracts, essential oils, polysaccharides and proteins) and NPs are used in agriculture, food industry, food packaging, pharmacological and biomedical applications, cosmetics, energy, electronics, environmental applications, etc. due to their activities and biochemical properties.

Comparison of the EVS and Traditional Active Additives (some differences are mentioned)

Differences	Extracellular vesicles (EVs)	Traditional active additives
Structural	Lipid bilayer structure	Single chemical, biological compounds or blend
Delivery	Protects fragile intracellular cargo from enzymatic breakdown in the body	Exposed to extracellular environments, they are prone to rapid clearance or degradation
Formulation	Increasingly integrated into advanced biomaterials (such as bio-instructive injectable hydrogels) for sustained local release	Compatible with standard cosmetic, pharmaceutical, and food supplement delivery. Sometimes without complex bio-compatibility
Biological	Membrane-bound intercellular communicators; Natural targeting and stability	Passive chemical ingredients; Active additives function as isolated chemical compounds
Effectiveness and efficiency	EV signaling: 'bind-and-leave', 'bind-and-stay', and 'bind-and-internalized	Effectiveness and efficiency depend on chemical composition and presence of active components
Cancer	Major role in cancer spread and precision drug delivery	Functional supplement ingredients, bioactive food components, or pharmaceutical excipients/adjuvants, reduce toxicity, or support metabolic health
Standardization, & Quality Control	Highly heterogeneous; defining exact batch potency is a challenge. To standardize purity and particle-to-protein ratios are necessary (ISEV MISEV guidelines)	Chemically well-defined, easily quantified by standard mass percentage, and straightforward to manufacture at scale

EVs are increasingly utilized in deliver targeted therapeutic cargo, reduce inflammation, cosmetics, pharmaceuticals, and nutritional science for their intrinsic ability to cross biological barriers, balance microbiota, etc.

Keywords: bioactive, additives, EVs, applications

References:

- [1] M. B. Schank et al., *Biomedicines* 14, 9495 (2026).
- [2] C. Vasile et al., *Polymers*, 17, 3139, (2025).

NEW POLYSACCHARIDE-BASED CROSSLINKED HYDROGELS: MOLECULAR ARCHITECTURE AND APPLICATIONS

CRISTINA-ELIZA BRUNCHI

“Petru Poni” Institute of Macromolecular Chemistry, 41A Gr. Ghica Voda Alley, 700487,
Iasi ROMANIA

brunchic@icmpp.ro

Hydrogels are versatile materials that are distinguished by a three-dimensional porous architecture able of absorbing and storing a large amount of water/fluids. Polysaccharide-based hydrogels are among the favorites, due to their versatility, biodegradability, and abundance of reactive sites for ion coordination. In this study, new hydrogels based on xanthan gum (XG) and polyvinyl alcohol (PVA) were prepared via citric acid (CA)-mediated cross-linking. The effect of XG/PVA gravimetric ratio and crosslinking on the hydrogels structure was assessed by combining morphological (SEM, swelling capacity) and rheological analysis, at 25 °C. The interconnected macroporous structure of the hydrogels (Figure 1) leads to specific water-swelling and viscoelastic properties. Thus, the swelling capacity S_t increases (from 10.6 to 41.9 g/g) with the XG content in hydrogel composition at the expense of the mechanical stability.

The second aim of this study was to demonstrate the practical utility of hydrogels for environmental remediation using as model two cationic dyes (Methylene Blue (MB) and Nile Blue (NB)). The adsorption capacity of the hydrogels' was evaluated by varying the sorbent dosage and composition, contact time, pH, and initial dye concentration. The hydrogel matrix with high XG content resulted in a maximum adsorption capacity of 403.58 (for MB) and 365.81 (for NB). Analysis of adsorption data with different kinetic and isotherm models revealed that dye adsorption occurs by both physical diffusion and specific binding, with the best fit of the data for the Sips model.

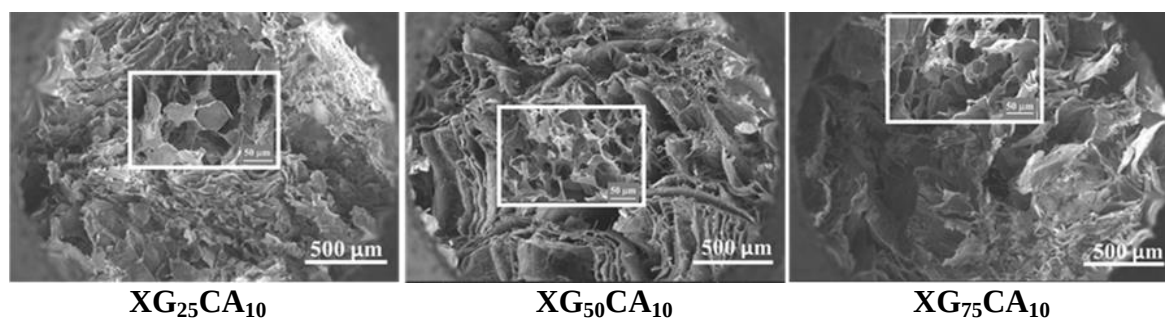


Figure 1. SEM microphotographs of chemically crosslinked XG_aCA_{10} hydrogels at two magnifications

Keywords: Xanthan Gum, Polyvinyl alcohol, Citric acid, Hydrogel, Dye sorbents

ULTRASOUND ASSISTED PREPARATION OF MAGNETIC CHITOSAN BEADS TO IMPROVE REMOVAL OF POLLUTANTS FROM WATER

CLAUDIA-MARIA SIMONESCU^{1,2,3}, ELISA GABRIELA BROASCĂ (DUMBRAVĂ)^{1,4}, AHMED MALEK DJABALLAH³, NICU SCĂRIȘOREANU⁴, LAVINIA BALAN³, IOAN CĂLINESCU¹

¹National University of Science and Technology POLITEHNICA Bucharest, Faculty of Chemical Engineering and Biotechnology, Gheorghe Polizu 1-7, Bucharest, Romania

²LE STUDIUM RESEARCH PROFESSOR, Loire Valley Institute for Advanced Studies, Orléans & Tours, France

³CEMHTI-Conditions Extrêmes et Matériaux : Haute Température et Irradiation (UPR3079 CNRS), Orléans, France

⁴National Institute for Laser, Plasma and Radiation Physics, 409 Atomistilor, 077125 Magurele, Romania
claudia.simonescu@upb.ro

Chitosan (CS) and its derivatives are intensely used to remediate organic and inorganic pollutants from wastewater due to their abundance, availability, low cost, biodegradability, biocompatibility, nontoxicity, and high adsorption capacity [1]. However, they present some drawbacks, as insufficient mechanical properties, low surface area, low porosity, poor acid stability, and low thermal resistance [2]. To improve its remediation performance, CS is modified before to be applied in the pollutant's removal [3]. Ultrasound-assisted (USs) method using BANDELIN SONOREX (Frequency: 35 kHz; Power: 60/240 W) ultrasonic bath has been applied to prepare core-shell Fe₃O₄@Chitosan beads for inorganic and organic pollutants remediation. For comparison purposes, the Fe₃O₄@Chitosan beads have been obtained in the absence of USs. X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) revealed the crystalline phases and functional groups of the beads. Scanning electron microscopy (SEM) images demonstrate a distinctively wrinkled and hierarchical surface structure of beads due to the encapsulation of chitosan matrix into the Fe₃O₄ cores. Pb(II), Cd(II) and diclofenac have been remediate using Fe₃O₄@Chitosan beads in optimum remediation conditions experimentally determined. The results demonstrated that US induced cavitation in aqueous media creates water hydrolysis reactive radicals and hot-spots that enhance the local conditions for preparing beads with the controlled characteristics and faster than traditional colloidal synthesis.

Keywords: magnetic chitosan, ultrasounds, pollutants removal, pollutants photodegradation

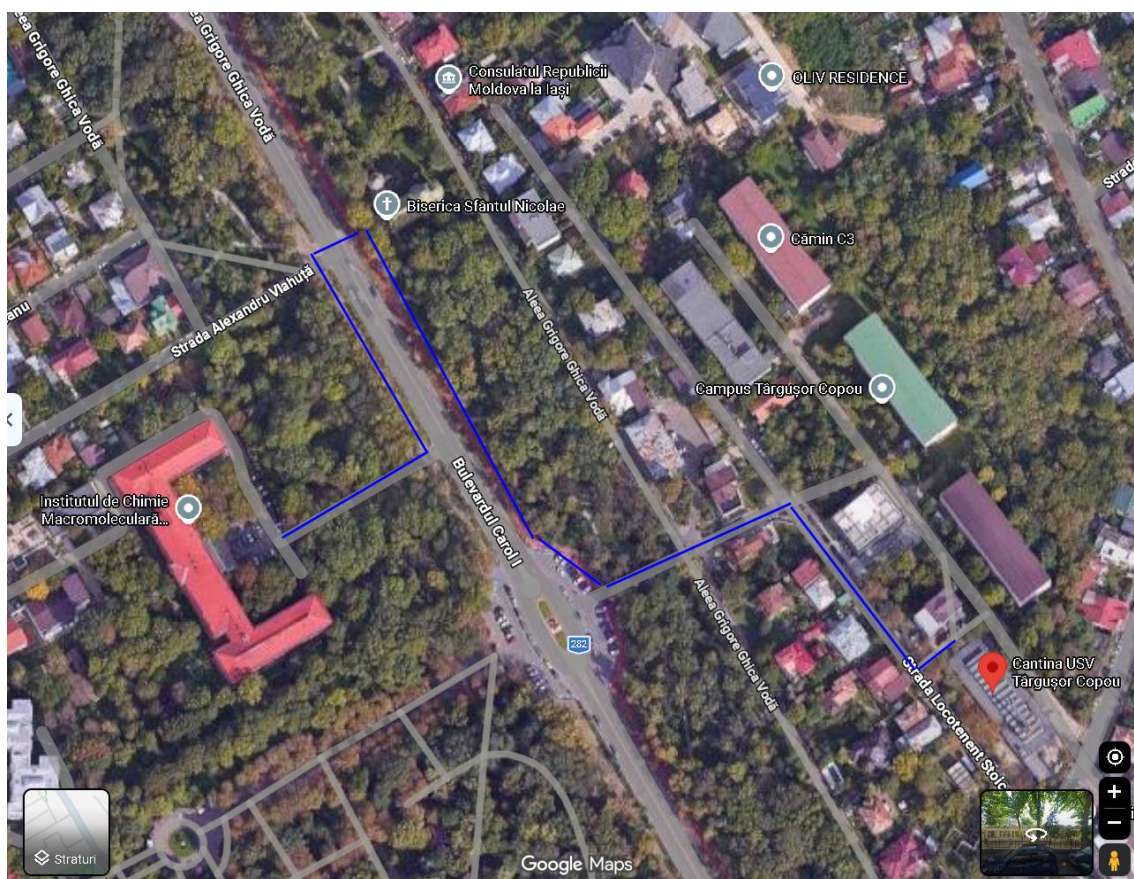
Acknowledgements:

The authors acknowledge the support of LE STUDIUM Loire Valley Institute for Advanced Studies, and CEMHTI-CNRS Orléans, France under the LE STUDIUM RESEARCH PROFESSORSHIP and the European Union Horizon Europe Research and Innovation program for funding this research under the project NANOEMCA (Grant Agreement No: 101235833 —HORIZON TMA MSCA Staff Exchanges).

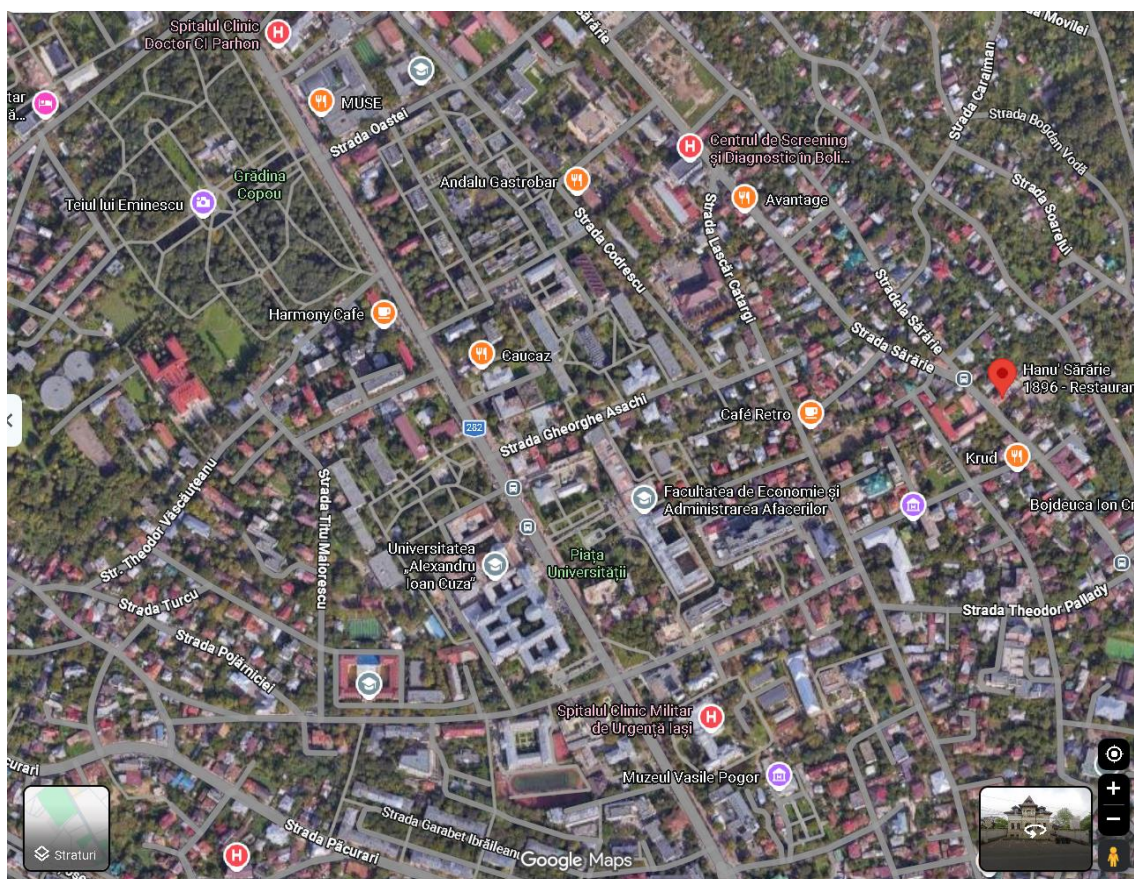
References:

- [1] M. Vakili et al., *Polymers* 11, 1701 (2019).
- [2] C. M. Simonescu et al., *Colloids Surf. A: Physicochem. Eng. Asp.* 682, 132906 (2024).

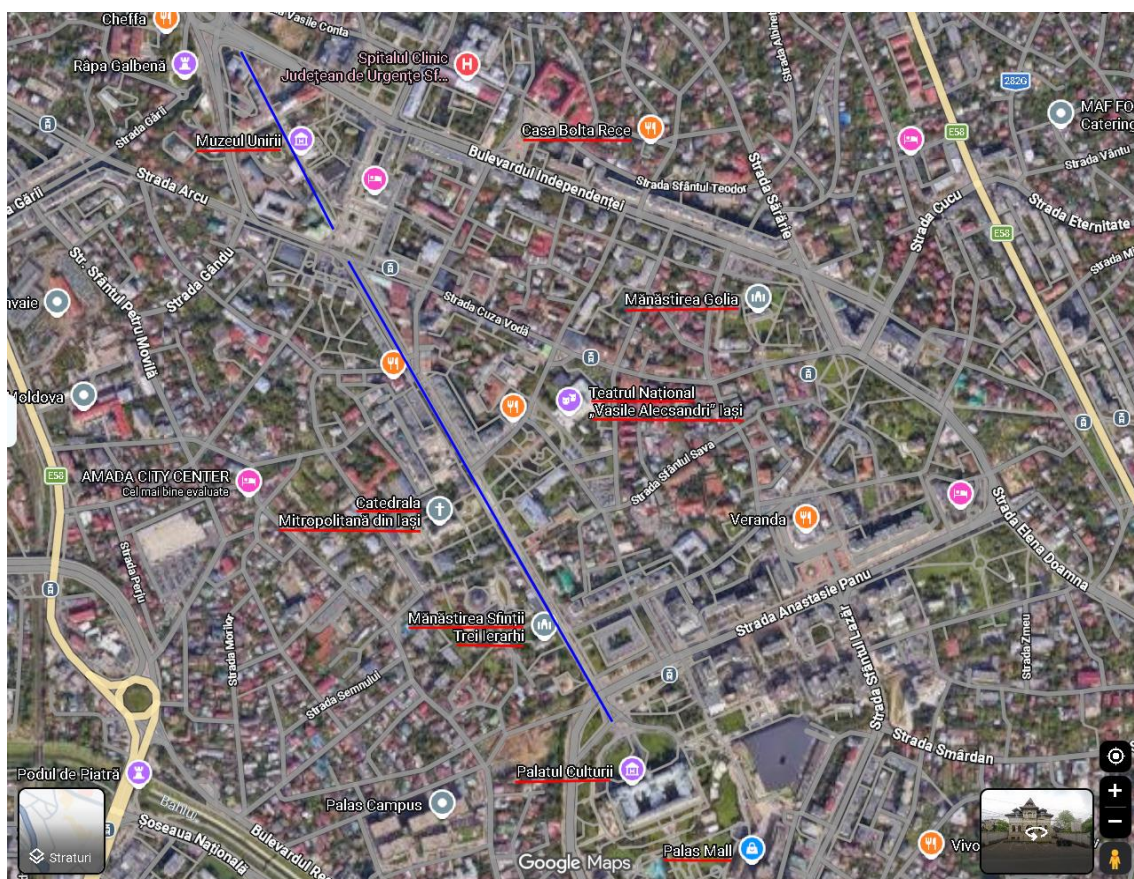
ORIENTATION



Lunch: Thursday October 1, 12.30 – 14.00: Cantina USV Târgușor Copou – 10 min walk



Conference dinner: Thursday October 1, 19.30 – 22.00: Hanul Sărărie 1896, Strada Sărărie 144



Places to see in Iasi:

- Lăpuşneanu Street, Stefan cel Mare Blvd.: enjoy the atmosphere of pedestrian streets;
- Unirii Square: the main gathering place for celebration the unification of Romanian provinces; historical building of Grand Hotel Traian (built in 1882 by Gustave Eiffel); Statue of Al. I Cuza (first ruler of modern Romania);
- Orthodox Mitropolitan Cathedral (relics of Saint Parascheva), Catholic Cathedral, "Trei Ierarhi" Monastery (1637 -1639 - famous stone embroidery), Golia Monastery and its entrance tower (16th century): important religious centres;
- National Theatre, Palace of Culture: cultural places;
- Palace Mall – shopping centre;
- Casa Bolta Rece: traditional atmosphere and food.

We hope you have good memories from Iasi and EvPolyMat conference!