ENGINEERED LIVING MATERIALS

at InnoRenew CoE

2025

Project portfolio

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ELM HUB

The ELM HUB at InnoRenew CoE brings together research projects and people exploring how biology and materials science can create sustainable innovations for the built environment.

InnoRenew CoE, established in 2017, is a research center dedicated to renewable materials and sustainable construction. It is a part of the Andrej Marušič Institute (IAM) at the University of Primorska, strengthening international collaborations and interdisciplinary research.

Located in Izola, on the Slovenian coast, the Center is housed in a state-of-the-art building designed as a showcase of sustainable architecture. The facility integrates laboratories, offices, and collaborative spaces to foster cutting-edge research and innovation.

InnoRenew CoE building in Izola, Slovenia

Within this environment, the ELM Hub develops projects that address European and global challenges from environmental remediation to innovative construction solutions.

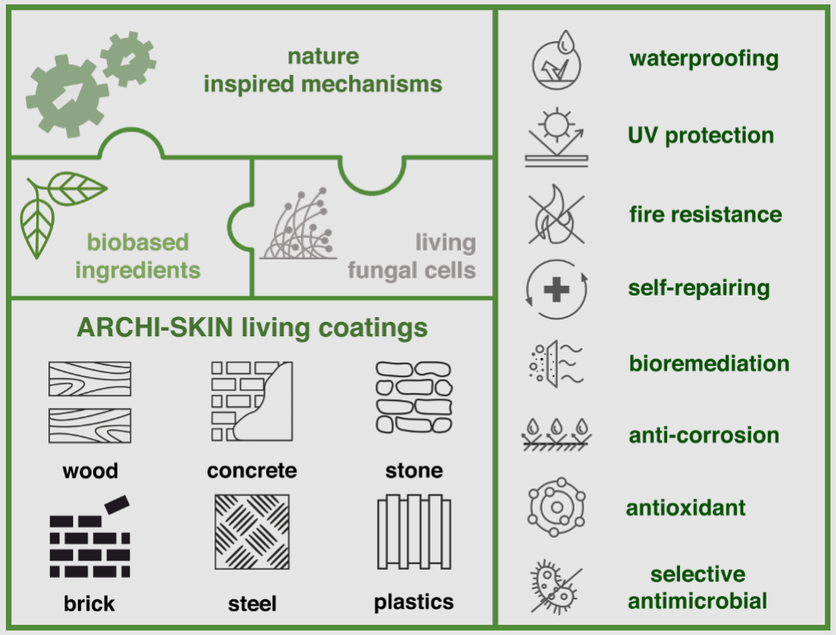
Living innovation

Engineered Living Materials (ELMs) combine biology, materials science, and design to create adaptive, sustainable solutions. Through prestigious European projects such as ERC ARCHI-SKIN and EIC Pathfinder REMEDY, InnoRenew CoE contributes to Horizon Europe's priorities for innovation aligned with the European Green Deal.

ARCHI-SKIN

Bioinspired living skin for architecture

Nature-inspired mechanisms for multifunctional surfaces



ARCHI-SKIN develops a bioinspired living skin - a protective coating made from fungal biofilms that integrates into architectural surfaces.

ARCHI-SKIN

The project develops protective coatings made from fungal biofilm and bio-based ingredients, capable of adapting to their environment and extending the service life of construction materials. These coatings are designed to deliver multifunctional properties, including UV and fire resistance, waterproofing, antioxidant activity, and selective antimicrobial actions.

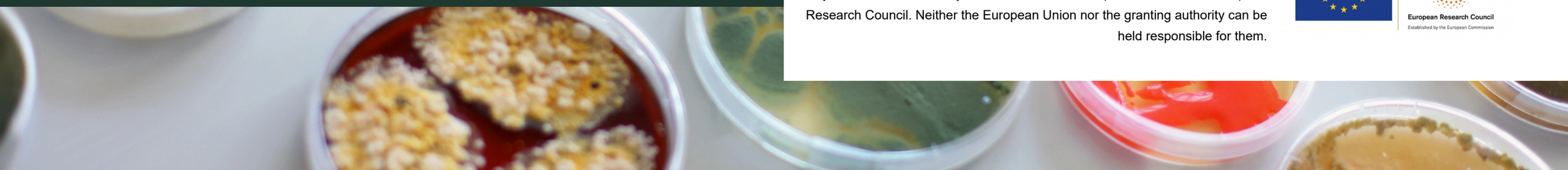
By adapting living fungal systems to materials such as wood, concrete, stone, and metals, ARCHI-SKIN demonstrates how Engineered Living Materials can move from laboratory research into practical architectural applications. This approach establishes new pathways for resilient, sustainable, and environmentally responsive buildings.

Scan the QR code for more details

Project Number: 101044468
Funding: European Research Council
Budget: 1,999,000.00 EUR
Coordinator: University of Primorska (Slovenia)
Duration: 2022 - 2027
PI: Anna Sandak, PhD

The project has received funding from the European Union (ERC, ARCHI-SKIN, #101044468). Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Council. Neither the European Union nor the granting authority can be held responsible for them.

European Research Council
Established by the European Commission



Archibiome tattoo for resistant, responsive, and resilient cities

REMEDY

REMEDY introduces a breakthrough approach to architectural design through the concept of an archibiome tattoo.

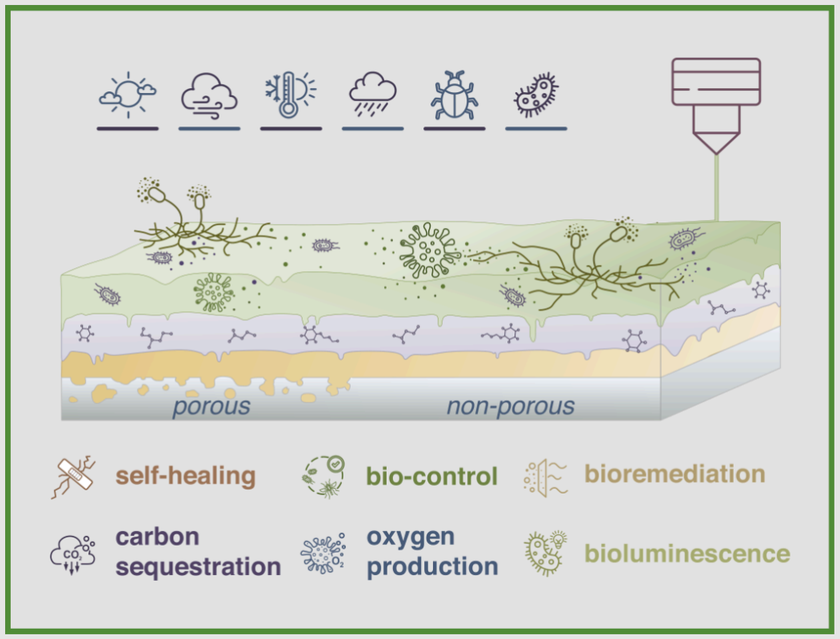
REMEDY
BUILDING TOMORROW WITH LIVING ARCHITECTURE

By combining microbiology, materials science, and synthetic biology the project develops living microbial inks. These inks, integrated into decorative and functional coatings, enhance building performance, support environmental remediation, and contribute to healthier urban spaces.

Through REMEDY, Engineered Living Materials advance beyond research to real-world architectural use, driving innovation in sustainable and responsive construction while pioneering new biofabrication processes that transform scientific knowledge into architectural solutions for both new and existing buildings.

REMEDY is a part of the portfolio of projects funded under the Engineered Living Materials Pathfinder Challenge by the European Innovation Council, started in November 2022. Its participation in this portfolio is further supported by the booster project PATH2ELMS, providing additional resources for dissemination and collaboration.

From concept to function: integrating living inks for resilient architecture



European Innovation Council
Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101185862. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.

Project Number: 101185862
Funding: Horizon Europe, EIC Pathfinder
Budget: 3.348.107,17 EUR
Coordinator: University of Primorska (Slovenia)
Duration: 2025 - 2029
Leader: Anna Sandak, PhD
Partners: University of Ljubljana (Slovenia), Technische Universitaet Graz (Austria), TIGER Coatings (Austria), Xylotrade B. V. (Netherlands), Qres Technologies s.r.o. (Slovakia)

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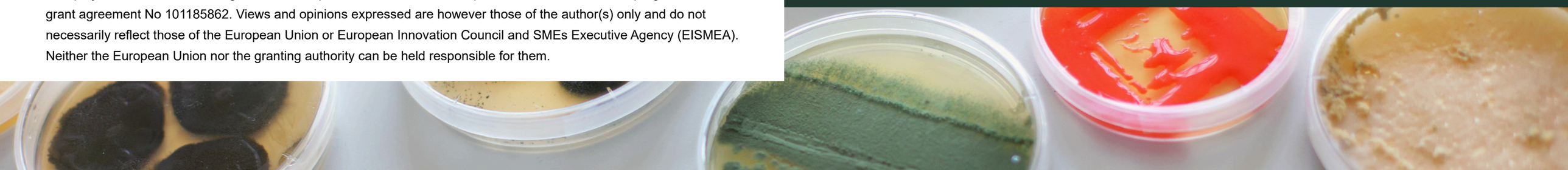


Joint research

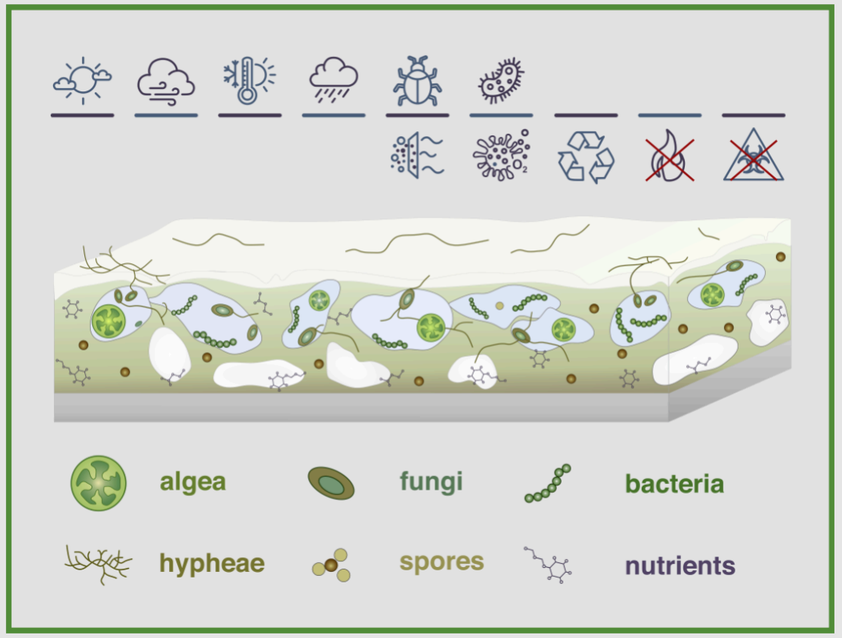
InnoRenew CoE participates in a cross-border research project that connects partners in Slovenia and Poland. This collaboration strengthens expertise across institutions and creates tailored solutions with long-term societal impact.

Hybrid Living Material on bio-based composite scaffold

LIVEMAT

LIVEMAT advances bio-based composites by integrating living cells into structural scaffolds for resilient architecture.

Integrating biology into composite materials



LIVEMAT

By combining biotechnology, materials science, and engineering, the project develops sustainable and reproducible composite materials that host living organisms such as fungi and cyanobacteria. These hybrid systems merge abiotic and cellular components to create structures capable of carbon sequestration, photosynthesis, and bioremediation, while also adapting to changing environmental conditions.

LIVEMAT demonstrates how engineered living composites can move beyond the limitations of conventional construction materials by uniting mechanical performance with biological activity. The project expands the design for adaptive and multifunctional building solutions. This approach highlights the potential of living composites to redefine the future of sustainable architecture.

Project Number: 2023/51/I/ST11/00713 (PL); N2-0380 (SI)
Funding: NCN (PL), ARIS (SI)
Budget: 693.796,00 EUR
Coordinator: Poznan University of Technology (Poland)
Duration: 2025 - 2029
Leader: Mateusz Barczewski, PhD
Partners: University of Primorska (Slovenia), University of Ljubljana (Slovenia)

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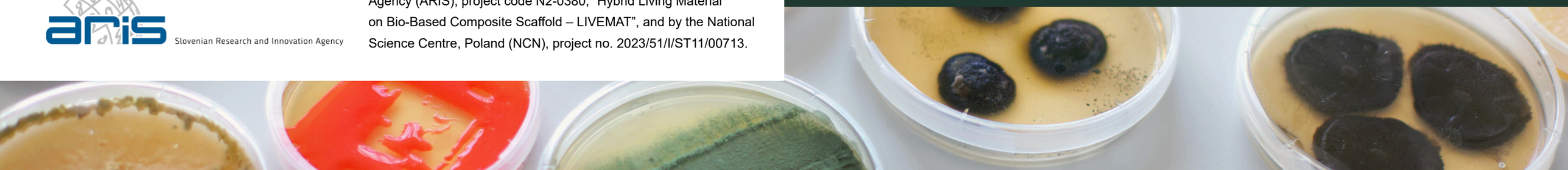
NATIONAL SCIENCE CENTRE POLAND

Slovenian Research and Innovation Agency

This project is supported by the Slovenian Research and Innovation Agency (ARIS), project code N2-0380, “Hybrid Living Material on Bio-Based Composite Scaffold – LIVEMAT”, and by the National Science Centre, Poland (NCN), project no. 2023/51/I/ST11/00713.



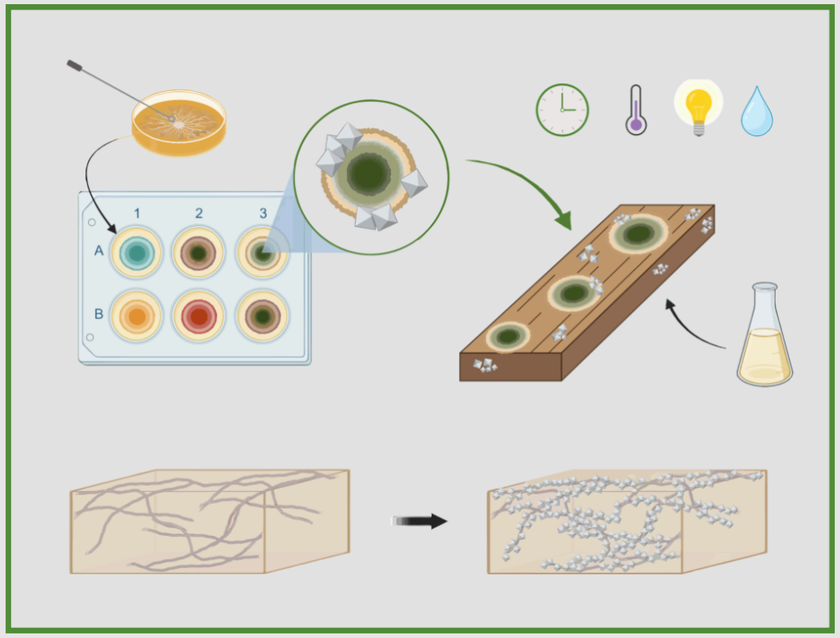
Nurturing Talent

Through individual fellowships and excellence awards, InnoRenew CoE supports researchers in developing their careers and advancing new ideas. These projects highlight independence, creativity, and the personal dimension of scientific progress.
By nurturing talent in this way, we build the foundations for future research directions and long-term impact.

MICRO-INSERT

Microbially induced mineralisation of wood for improved fire resistance

From microbial activity to mineralised hybrids: creating wood surfaces with enhances fire resistance and durability.



MICROINSERT explores fungal biomineralisation to transform timber into safer, more resilient construction material.

MICRO-INSERT

The project investigates a bioinspired strategy to improve the safety of timber by using fungi as carriers for mineralisation. Through microbial processes, calcium carbonate is deposited within the wood structure, forming organic-inorganic hybrids that strengthen its performance under fire conditions.

MICROINSERT studies growth parameters, mineral penetration, and the resulting changes in chemical and physical properties. Particular focus is placed on how biomineralised layers influence reaction to fire, durability, and long-term stability of treated wood.

Beyond material innovation, MICROINSERT supports knowledge transfer and training within the Marie Skłodowska-Curie Postdoctoral Fellowship framework, advancing interdisciplinary research on sustainable solutions for safer, renewable building materials.

Scan the QR code for more details

Project Number: 101105772
Funding: Marie Sklodowska-Curie Actions (MSCA)
Budget: 171.399,36 EUR
Coordinator: University of Primorska (Slovenia)
Duration: 2024 - 2027
PI: Karen Butina Ogorolec, PhD
Supervisor: Anna Sandak PhD

The project MICRO-INSERT has received funding from the European Union's Horizon Europe, project number 101105772.

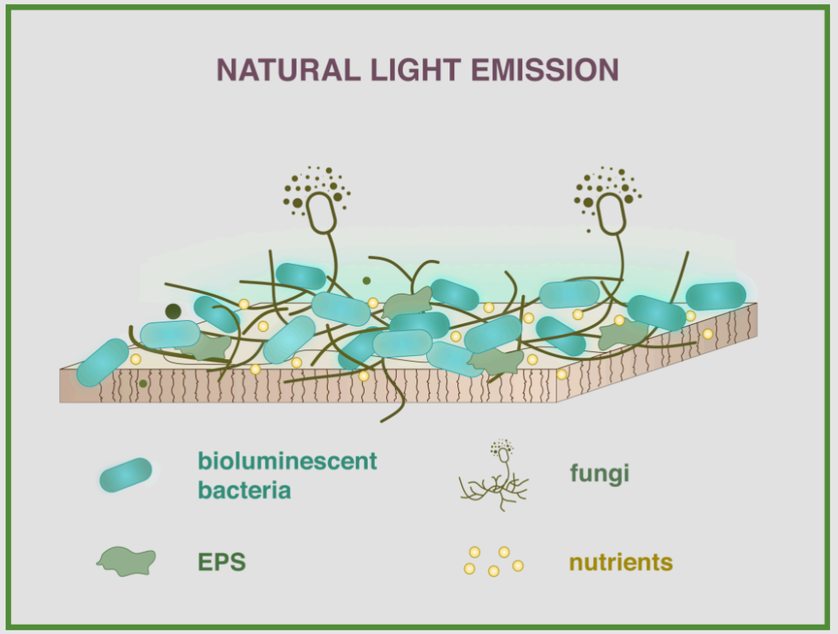
MARIE CURIE ACTIONS

Bioluminescent microbial coating for architectural surfaces

BIOLUMICOAT

BIOLUMICOAT explores the potential of bioluminescence in microbial living coating systems.

Exploring microbiology for luminous surfaces



The project investigates how microorganisms can be harnessed to create coatings that naturally emit light. Rather than relying on conventional illumination, the project envisions bioluminescent surfaces as both functional and aesthetic components of architectural design.

This research focuses on selecting and optimising microbial strains for stable light emission, while also investigating the complex interactions at the interface between living microorganisms and non-living substrates. Understanding these dynamics is crucial for creating durable, adaptive coatings that maintain functionality over time.

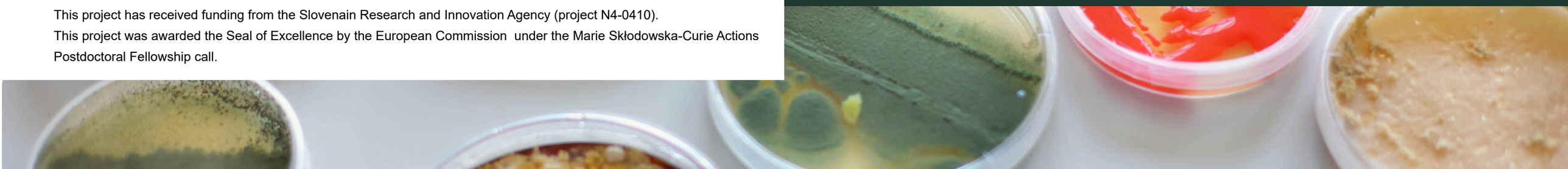
By combining biological activity with architectural functionality, BIOLUMICOAT demonstrates a new way of designing surfaces - coatings that generate light, reduce energy demand and inspire novel approaches to sustainable material design.

Project Number: N2-0410
Funding: ARIS - MSCA-SE
Budget: 153.102,00 EUR
Coordinator: University of Primorska (Slovenia)
Duration: 2025 - 2026
PI: Wojciech Pajerski, PhD
Supervisor: Anna Sandak, PhD

Scan the QR code for more details

Slovenian Research and Innovation Agency

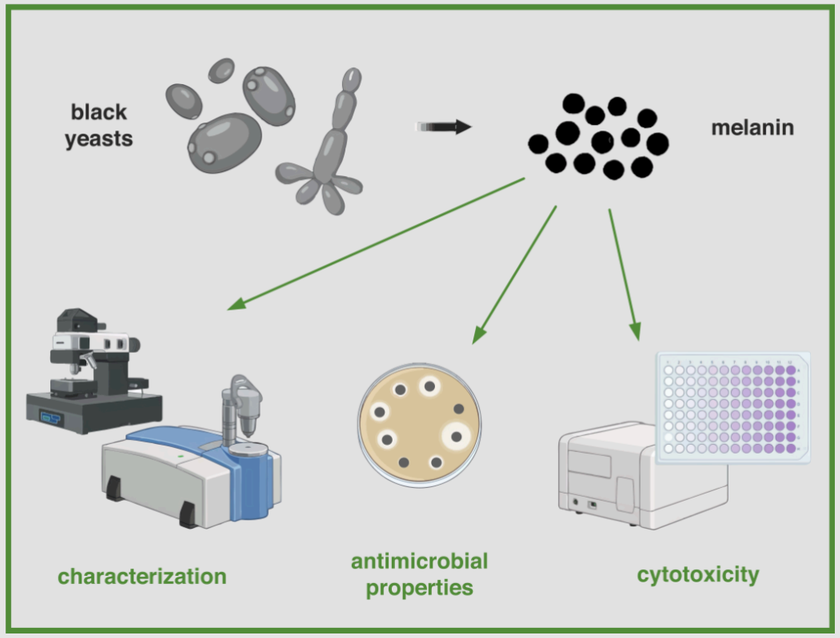
This project has received funding from the Slovenain Research and Innovation Agency (project N4-0410).
This project was awarded the Seal of Excellence by the European Commission under the Marie Skłodowska-Curie Actions Postdoctoral Fellowship call.



FUME

Fungal melanin: enemy or friend? Evaluating its role in human health and antimicrobial properties

Investigating fungal melanin for human safety and engineered living materials.



Scan the QR code for more details

Project Number: UP-VGTU-2024-02
Funding: Joint Research Collaborative Seed Grant Program 2024
Budget: 7.000,00 EUR
Coordinator: University of Primorska (Slovenia)
Duration: 2025-2025
PI: Anja Černoša, PhD
Partners: University of Primorska (Slovenia), Vilnius Gediminas Technical University (Lithuania)

FUME explores fungal melanin for safety, resilience, and future bio-based applications.

FUME

FUME investigates the complex role of fungal melanin, a biopolymer produced by many fungi that influences both pathogenicity and material performance. While melanized fungal cells are known to resist immune defenses, their direct impact on human health remains unclear, requiring deeper investigation.

The project focuses on understanding the biochemical properties of fungal melanin and its interactions with human cells, bacteria, and environmental substrates. By linking these insights to the performance of engineered living materials, researchers aim to evaluate melanin's antimicrobial potential alongside its contribution to durability, bioremediation, and resilience.

Through this approach, FUME bridges fundamental microbiology with applied biotechnology. It provides critical knowledge for assessing risks, ensuring safety, and unlocking new opportunities for fungal-based innovations that can serve health, environmental, and material applications.

The project FUME is supported by the Joint Research Collaborative Seed Grant Program between University of Primorska and Vilnius Gediminas Technical University (Grant No: UP -VGTU-2024-02)

About Us

Behind every project are the people who make it possible

The Engineered Living Materials Hub at InnoRenew CoE is developed by a diverse team of researchers, technicians, and students at the University of Primorska. Our work connects biology and materials science to create sustainable solutions for the built environment.

The team brings together expertise in chemistry, biology, architecture, wood science, engineering, computer science, and environmental research. Collaboration across these disciplines enables us to explore new ideas and translate them into practical outcomes for science and society.

The photo shows part of the group working in the laboratory, representing a broader community involved in ELM projects. Researchers contributing to this line include: Anna Sandak, Aleksandar Tošić, Karen Butina-Ogorolec, Wojciech Pajerski, Anja Černoša, Ihab Malat, Ana Gubenšek, Simon Troha, Viviana Gaytan Nuñez, Sasikala Perumal, Evgenija Gagaleska, Stefanija Sekuloska. Not all colleagues are pictured, but each plays a key role in advancing our shared vision.

Together, we aim to push the boundaries of bio-based materials, strengthen cooperation, and inspire future innovations in sustainable construction.

Discover the full InnoRenew CoE Team

Scan the QR code for details

Infrastructure

Every discovery needs the right environment

The InnoRenew CoE laboratories provide dedicated spaces for advancing research on Engineered Living Materials and sustainable construction. They combine expertise ranging from microbiology to advanced material testing and allow researchers to move smoothly between cultivation, experimental work, and prototype development. In total, InnoRenew CoE hosts eight specialized laboratories, providing an optimal research environment that links fundamental studies with real-world applications.

A central role is played by the ELM Laboratory, which focuses on microbial engineering and bio-based innovations for resilient architecture. Complementing this is the Characterization Laboratory, which provides advanced infrastructure for chemical, structural, and microscopic analysis. Together, they create a unique workflow, linking the development of living materials with their comprehensive testing and validation.

By combining state-of-the-art tools with an interdisciplinary approach, these facilities transform research concepts into tangible results. They serve as a foundation for collaboration, training, and innovation, supporting the development of next generation of sustainable and environmentally responsible materials.

Discover InnoRenew CoE Laboratories

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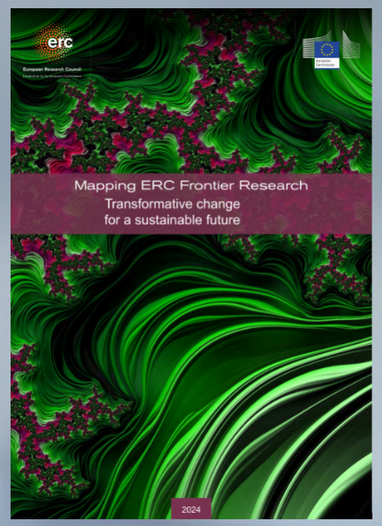
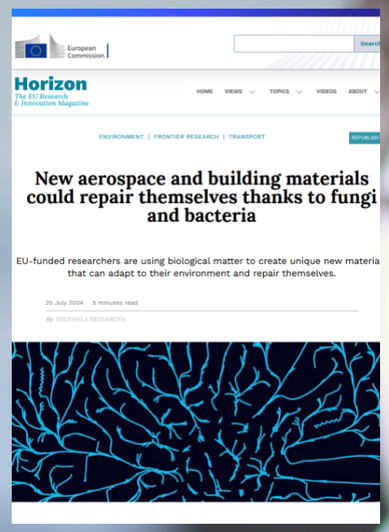
Fot. Miran Kambic





External recognition

InnoRenew CoE and its Engineered Living Materials research have been featured in international reports, EU communications, and the Science4EU campaign of the European Commission.
These mentions underline the visibility and societal relevance of our work, confirming its contribution to sustainable innovation and the European research priorities.

Collaborate with Us

We believe that progress come through collabration

The ELM HUB welcomes partnerships across disciplines and sectors. From joint research proposals to industrial pilots and mobility programs, our team is open to new ideas and collaborations that advance Engineered Living Materials.

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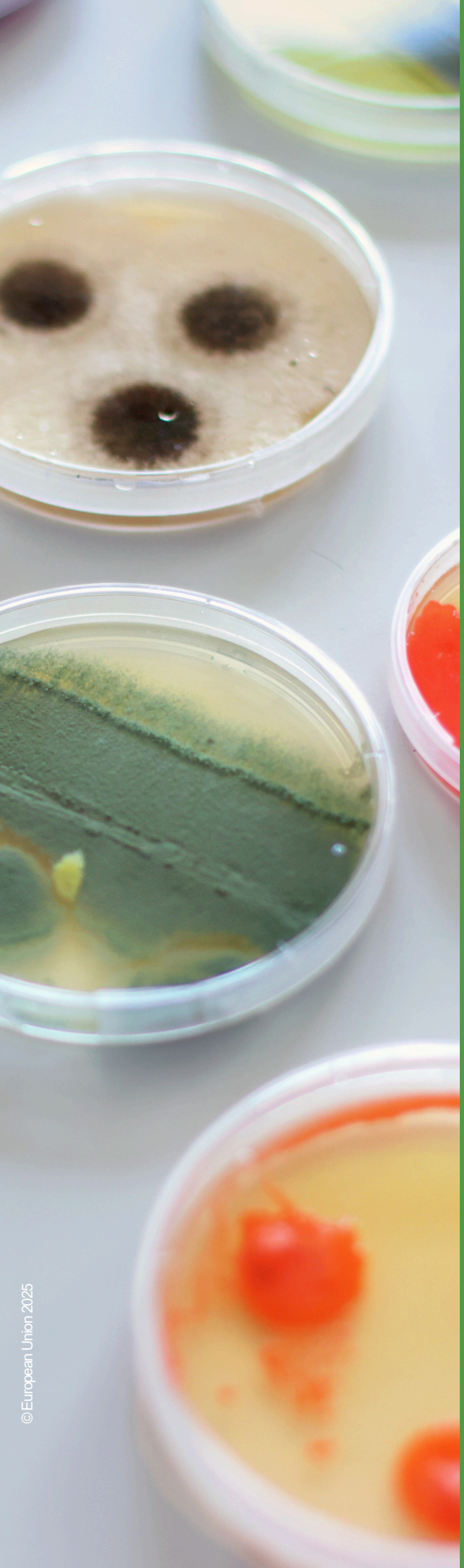

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