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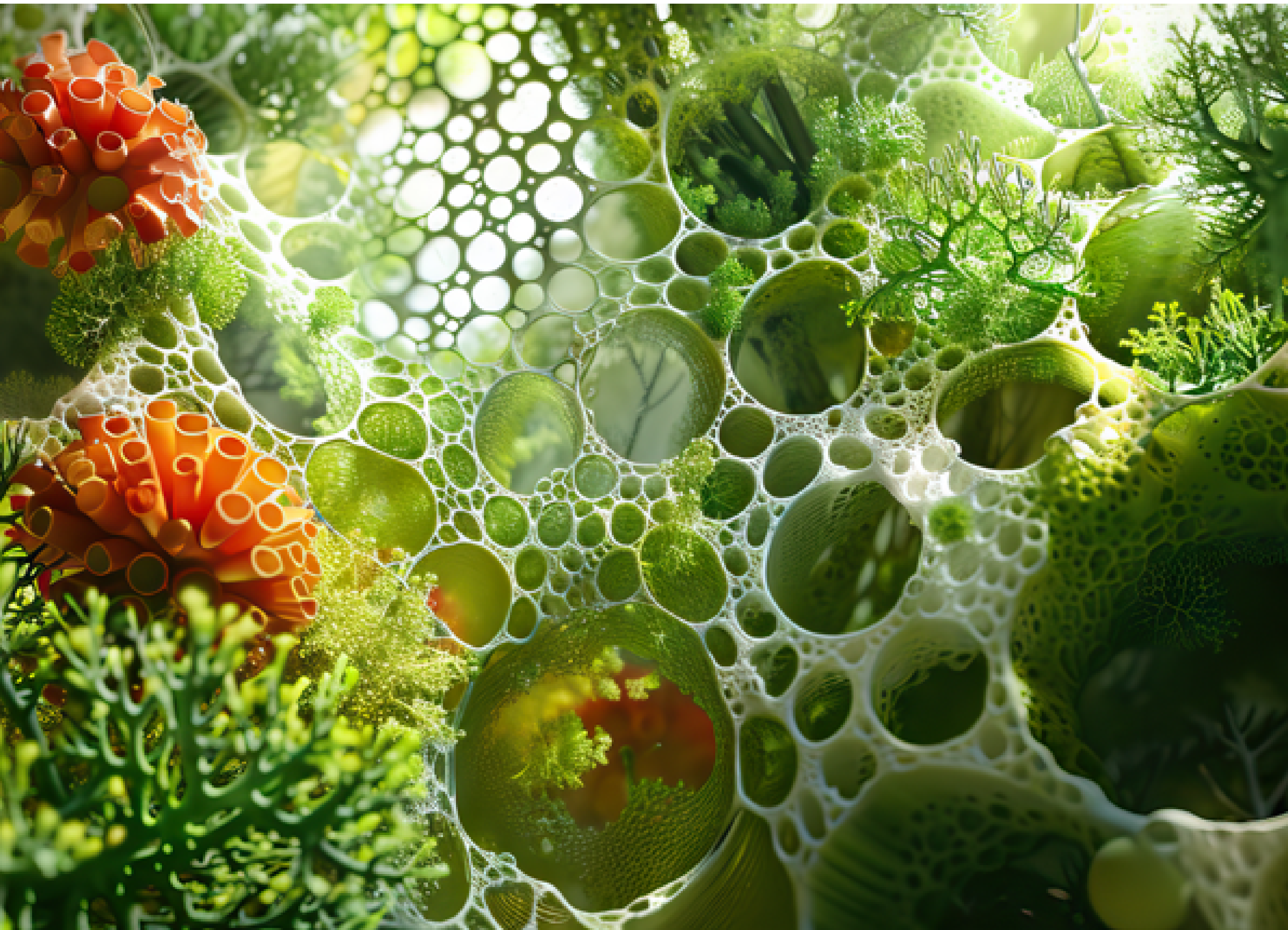
European Innovation Council

ENGINEERED LIVING MATERIALS

PATHFINDER PORTFOLIO



ENGINEERED LIVING MATERIALS

PATHFINDER PORTFOLIO

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EIC Pathfinder portfolio strategic plans

WHY EIC STRATEGICALLY FOCUSES ON PORTFOLIO RATHER THAN ONLY INDIVIDUAL PROJECT/ COMPANIES?

Because the vision to achieve strategic technological autonomy for Europe in selected/targeted areas in the medium/long run, would require coordinated action at portfolio rather than individual project level to capture opportunities and tackle challenges in technology, regulatory and exploitation.

WHY EIC IS IMPLEMENTING PROACTIVE PORTFOLIO MANAGEMENT?

For the Engineered Living Materials (ELMs) portfolio to be productive, the Programme Manager for Health & Biotech designed and developed a Strategy Plan (SP) together with representatives from the portfolio projects as well as oversee the implementation of portfolio activities set in the SP.

WHAT WOULD INCREASE THE CHANCES FOR SUCCESS OF A GIVEN PORTFOLIO?

The way the projects are selected to establish the portfolio. If the projects are selected based on common research interests (shared component), it is more likely that they would also share common innovation and business objectives and want to collaborate on mutual benefit basis, to collectively bring these into fruition.

REMEDY

ARCHIBIOME TATTOO FOR RESISTANT, RESPONSIVE, AND RESILIENT CITIES

The demand for green solutions and the increasing strain on the construction sector caused by climate change and frequent natural or human-made disasters have underscored the need for novel approaches. In light of this, the EU-funded REMEDY project will introduce a groundbreaking technology: the archibiome tattoo. This will combine high-resolution decorative designs with advanced functionalisation for both existing and new buildings. Utilising cutting-edge research in microbiology and synthetic biology, the project will develop fabrication processes for personalised architectural designs. These designs will incorporate engineered microbial consortia to enhance resistance to pathogenic microorganisms, support oxygen production, enable bioremediation, and facilitate carbon sequestration, fostering resilience and sustainability.

REMEDY
BUILDING TOMORROW WITH LIVING ARCHITECTURE

Start date
01.02.2025

End date
31.01.2029

EU Contribution:
EUR 2 998 122,50

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BIOACTION

BACTERIA BIOFILM AS BIO-FACTORY FOR TISSUE REGENERATION

Implant-associated infections, especially those caused by biofilm-forming bacteria, pose a significant challenge, often leading to implant failure and prolonged patient suffering. Traditional treatments are limited and ineffective, unable to address the complexities of biofilm persistence. The need for innovative solutions is clear. The EIC-funded BIOACTION project aims to turn this challenge into an opportunity by developing bio-hydrogel-based implants that transform biofilm-associated bacterial activity a resource for tissue regeneration. Using engineered liposomes and phages, BIOACTION enables programmable protein production to promote cell recruitment and tissue healing. Combining biomaterials, synthetic biology, and medicine, BIOACTION will create injectable materials and coatings for periodontal and bone infection treatments, setting a new benchmark in regenerative medicine.

Bioaction

Start date
01.04.2023

End date
31.03.2027

EU Contribution:
EUR 2 903 862,50

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ISOS

ISOS-IMPLANTABLE ECOSYSTEMS OF GENETICALLY MODIFIED BACTERIA FOR THE PERSONALIZED TREATMENT OF PATIENTS WITH CHRONIC DISEASES

Chronic diseases, demanding lengthy treatments, often push patients into inconvenience and discomfort. Repetitive intrusions of therapies for conditions like age-related macular degeneration, inflammatory bowel diseases or cancer not only disrupt lives but also risk side effects. The EIC-funded ISOS project aims to revolutionise healthcare with a pioneering biomedical solution. By seamlessly integrating genetically engineered bacteria into a biomaterial-based bioreactor, ISOS presents a visionary approach to in situ, on-demand fabrication and auto-renewed delivery of therapeutic compounds based on dynamic variation of pathological signals. In silico simulations allow modelling interactions between bacteria, biomolecules, cells, and tissues/organs, and define optimal microbiota ecosystems to treat the pathology with the best efficacy. The ISOS initiative holds the promise of transforming prolonged treatments into personalised, efficient, and minimally invasive healthcare experiences.

ISOS

Start date
01.12.2023

End date
31.11.2026

EU Contribution:
EUR 2 433 300,00

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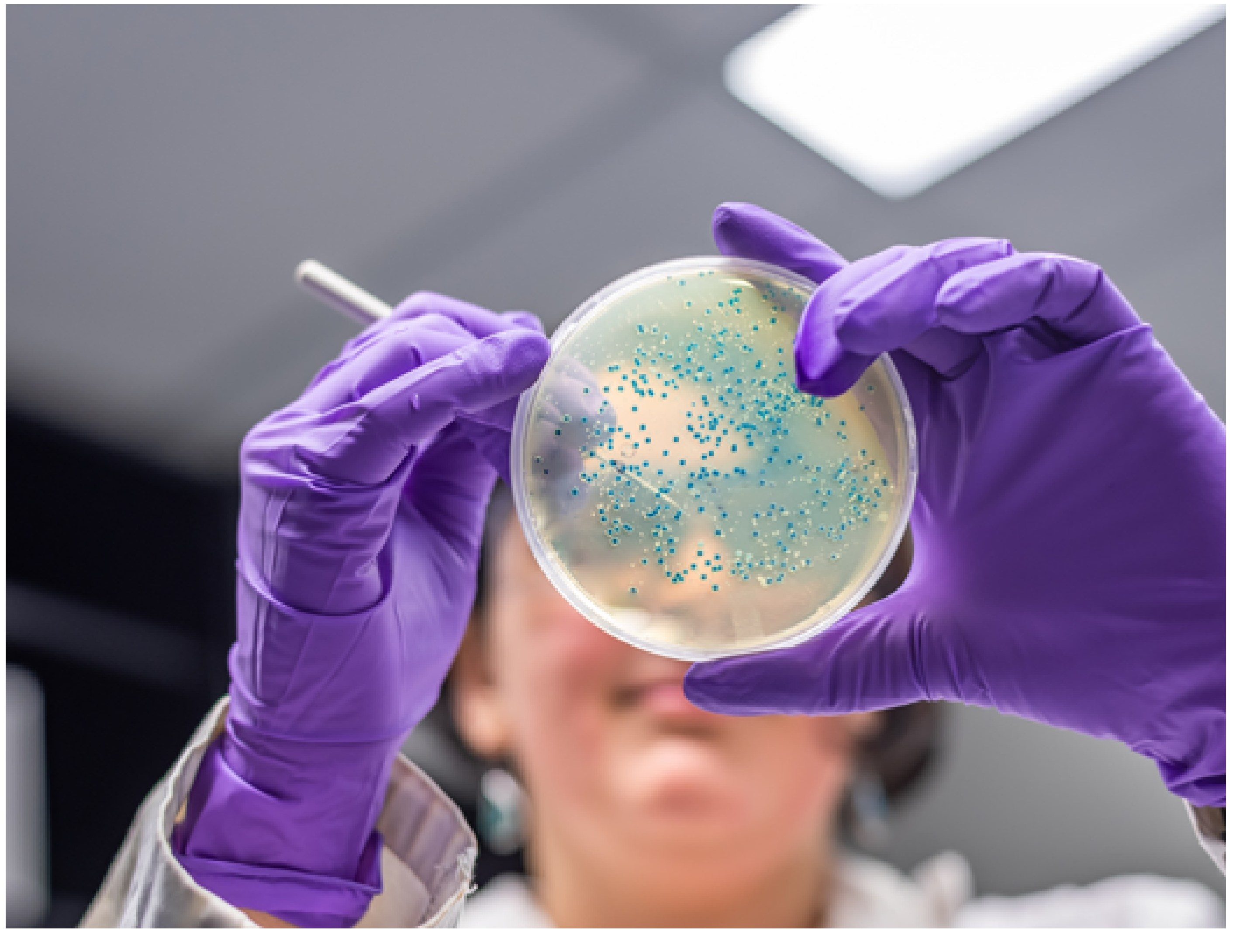

BIOROBOT-MINIHEART

ENGINEERING A LIVING HUMAN MINI-HEART AND A SWIMMING BIO-ROBOT

Making our own hearts is just a heartbeat away, literally. Engineers are joining forces with biologists to make biological heart-robots. The EU-funded BioRobot-MiniHeart project is developing a vascularised beating mini-heart. In parallel, the team is creating a self-propulsion swimming bio-robot that is made by assembling human cardiac cells into 3D tissue structures. To do this, they used sacrificial molding and high-resolution 3D bioprinting. The mini-heart and the bio-robot will provide scientists with a more realistic human cardiac model in vitro and an appropriate tool to assess cardiotoxicants' presence in the environment. This innovation is expected to help speed up development of heart disease cures.

Bio-robot Mini-heart

Start date
01.11.2022

End date
31.10.2027

EU Contribution:
EUR 3 981 196,00

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FUNGATERIA

ENLISTING SYNTHETIC FUNGAL-BACTERIAL CONSORTIA TO PRODUCE MULTI-CELLULAR MYCELIUM-BASED ELMS WITH COMPUTATIONAL CAPABILITY

Engineered living materials (ELMs) are composed of living cells endowing them with unique properties and functions. ELMs have received great attention in the materials science field due to their tuneability and potential for sustainable production. Funded by the European Innovation Council, the Fungateria project aims to generate an innovative portfolio of ELMs that combine fungi with bacteria. Materials based on fungi are most commonly produced by growing the vegetative part of mushroom – the mycelium – on different organic substrates. The mycelium will be combined with bacteria that serve as a chassis for sensor-containing genetic circuits. The resultant ELMs will exhibit advanced functionalities and inducible degradation when no longer needed.

Fungateria

Start date
01.11.2022

End date
31.10.2026

EU Contribution:
EUR 3 857 067,50

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Bio-HhOST

NEXT GENERATION 3D TISSUE MODELS: BIO-HYBRID HIERARCHICAL ORGANOID-SYNTHETIC TISSUES (BIO-HHOST) COMPRISED OF LIVE AND ARTIFICIAL CELLS

Bio-HhOST will build bio-hybrid materials that comprise living & artificial cells, in dynamic communication, such that artificial cells may influence the proliferation, differentiation and function of living cells. This will be accomplished by producing precision engineered, microscale, liquid and lipid bilayer-based, chemically compartmentalised artificial cells, co-localised with live cells. The artificial cells will contain functional metabolisms, and the ability to respond to chemical stimuli in the environment to release signaling molecules, on demand, to regulate the neighboring living cells, as found in complex biological tissues. These new chemically programmable organoid-synthetic tissues will enable a paradigm shift, in both ability to elucidate and control the complexity of physio-chemical interactions within 3D tissues, and reduce animal use in pharmaceutical R&D.

Bio-HhOST

Start date
01.02.2024

End date
31.01.2027

EU Contribution:
EUR 1 225 468,83

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LoopOfFun

CLOSED-LOOP CONTROL OF FUNGAL MATERIALS

Fungi comprise approximately 100 000 described species to date. The real total is estimated to be in the millions. They are amazing factories, producing numerous bioactive metabolites of therapeutic interest. The EU-funded LoopOfFun project has recognised their potential in yet another innovative area – as part of engineered living materials (ELMs), with open- and closed-loop control of mechanical and structural properties. The project will identify fungi gifted with superior abilities for materials synthesis and harness them for synthetic biology-based programming. The programming will be accomplished via a novel automatic robotised platform that will develop the fungi into ELMs, based on iterative design-build-test-learn cycles. The outcomes will then support rational design of such materials.

LoopOfFun

Start date
01.11.2022

End date
31.10.2027

EU Contribution:
EUR 4 098 438,00

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PRISM-LT

PRINTED SYMBIOTIC MATERIALS AS A DYNAMIC PLATFORM FOR LIVING TISSUES PRODUCTION

The EU-funded PRISM-LT project will use a hybrid living materials concept to create a flexible platform for living tissue manufacturing. The innovative bio-ink will contain stem cells integrated into a supporting matrix with engineered helper bacteria or yeast cells. The bioprinting process will produce a 3D patterned structure where stem cells could be induced to differentiate into different lineages. The directed stimulation of differentiating stem cells will force them to produce lineage-specific metabolites for sensing by the designer helper cells. The helper cells within the platform will then enhance localised lineage commitment to sustain differentiation stability. The project aims to implement this strategy for the development of two symbiotic materials designed for biomedical and food applications, respectively.

PRISM•LT

Start date
01.11.2022

End date
31.10.2027

EU Contribution:
EUR 2 318 811,33

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NEXTSKINS

LIVING THERAPEUTIC AND REGENERATIVE MATERIALS WITH SPECIALISED ADVANCED LAYERS

Compared to conventional materials, biomaterials encountered in living organisms are characterised by specific architecture, organisation and often exhibit multiple functions. Engineered living materials (ELMs) have emerged at the cornerstone of synthetic biology and material science to produce materials with improved functions because of the living organisms within them. Funded by the European Innovation Council, the NextSkins project is inspired by the structure/function of the many layers of skin. Researchers will mimic the specialised skin arrangement to make two engineered living materials: one with a therapeutic function to treat skin diseases and one with a regenerative function to be used as a protective garment in sports.

NEXTSKINS

Start date
01.11.2022

End date
31.10.2027

EU Contribution:
EUR 2 856 441,00

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SUMO

SUPERVISED MORPHOGENESIS IN GASTRULOIDS

Gastruloids are multi-tissue embryonic organoids (miniaturised and simplified versions of an organ) that can replicate mammalian developmental processes, including early organogenesis, in a petri dish. They hold great promise for scientific advancement through their ability to model organs in their earliest recognisable stages. However, current organoids are small and lack the ability to develop their own vascular networks. Focusing on cardiovascular and foregut development, the EU-funded SUMO project applied cutting-edge technologies, including artificial intelligence and bioengineering to develop reproducible and scalable formation of gastruloids with embryo-like morphology that demonstrate an advanced stage of organ development.

SUMO supervised morphogenesis

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01.11.2022

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31.10.2027

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