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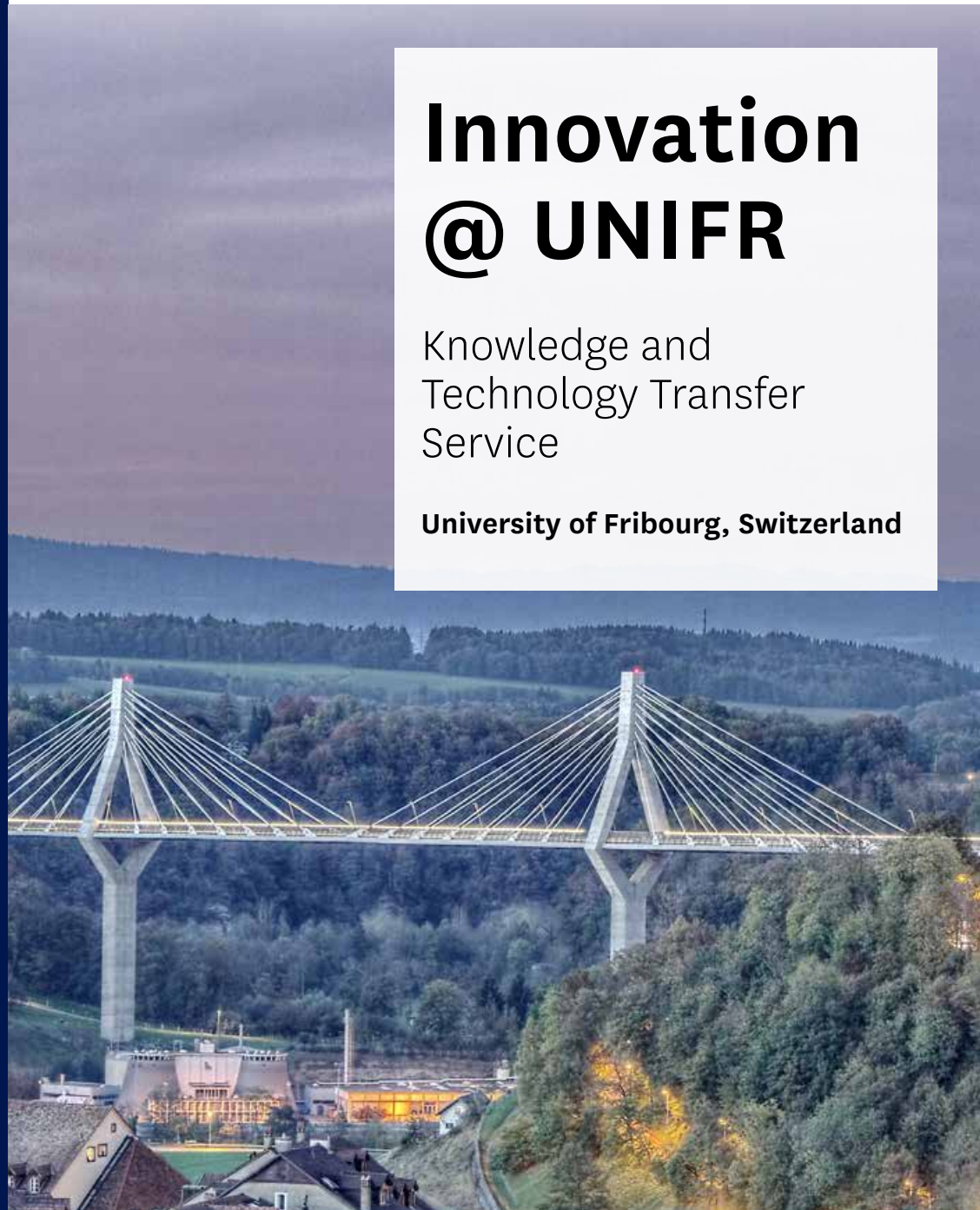
UNIVERSITÄT FREIBURG

Innovation @ UNIFR

Knowledge and Technology Transfer Service

University of Fribourg, Switzerland



Innovation @ UNIFR

Knowledge and Technology
Transfer Service
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Examples

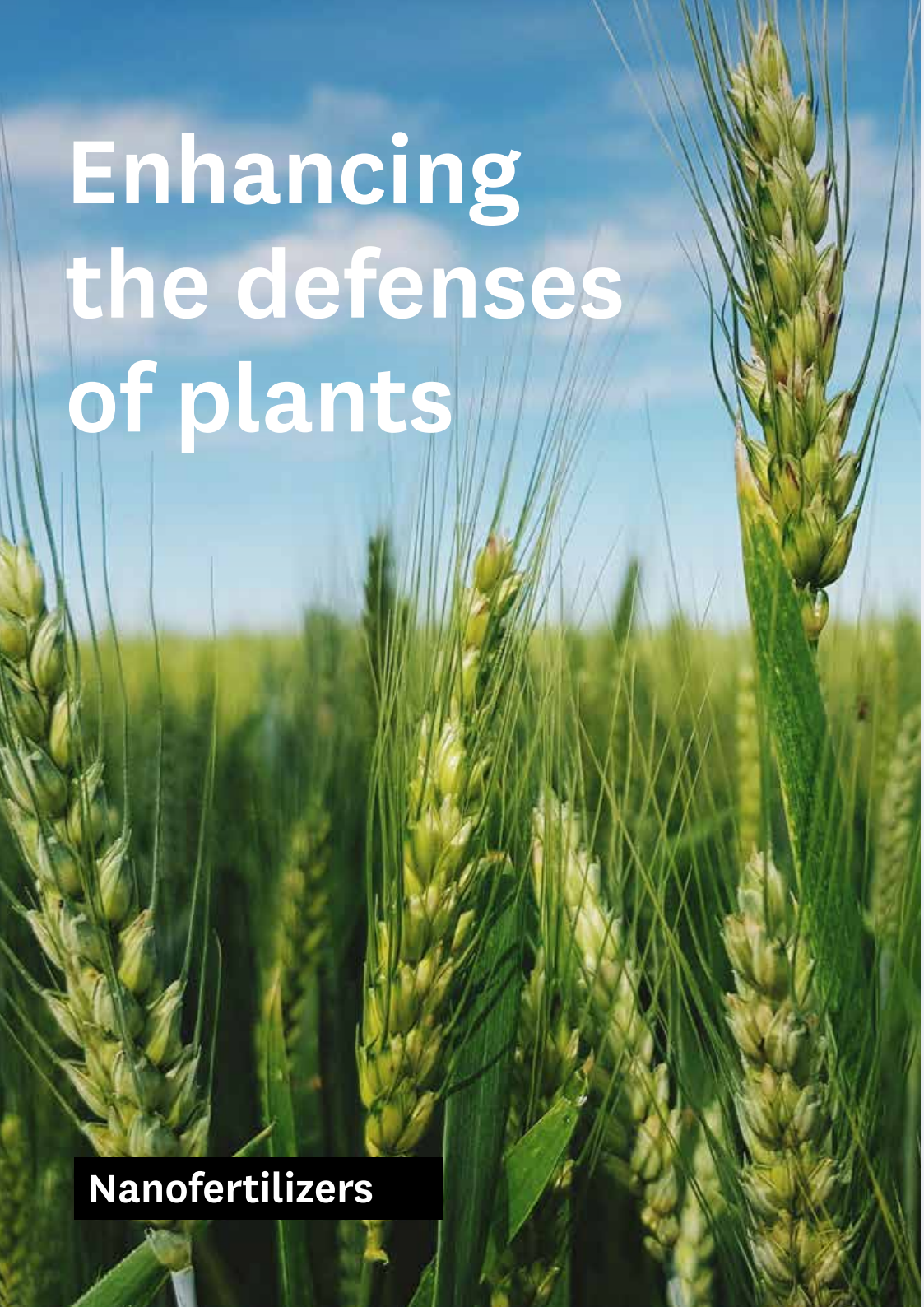
UNIFR researchers collaborate with academia and industry and are successful in applying for innovation funds, like the Swiss Innovation Agency Innosuisse, the BRIDGE program, or Eurostars. The University provides support in the application process and by protecting the intellectual property.

Support

The Knowledge and Technology Transfer (KTT) Service helps to transform research results into benefits for society. Be it through a start-up or a collaboration with an established company, the KTT Service supports you in understanding and forging a path, as well as with the drafting, negotiation and approval of research contracts and patent applications. The KTT Service manages all the intellectual property of UNIFR.

Funding

The KTT Service supports you in setting up collaborations with industrial partners by identifying funding and by providing and negotiating the appropriate agreements. Collaborations can be directly financed by the industrial partners or co-financed with funds from Innosuisse.



Enhancing the defenses of plants

Nanofertilizers

WHAT IS THIS ABOUT?

We have developed a patented, environmentally benign fertilizer based on silica. Our nanofertilizer enhances the defense of plants and makes them more resistant to disease, water, and drought stress. It can also be used as a delivery system for other ingredients.

WHAT'S THE INNOVATION?

The nanofertilizer reliably delivers beneficial orthosilicic acid to seeds and plants, thereby strengthening the plant through a variety of mechanisms. At the same time, the nanofertilizer can deliver other ingredients (including pesticides), reducing the amount of the ingredient needed for plant protection. The nanofertilizer degrades tracelessly in the environment.

WHAT ARE OUR PLANS?

We have scaled-up this technology with Innosuisse funding. Negotiations are in progress with some companies interested in licensing or supporting a start-up. If funding becomes available, we will partner with distributors, run screenings with more different crop plants, pathogens, and active ingredients, and register the product for sales on the market.

WHO WE ARE?

Dr. Fabienne Schwab is a Senior Scientist and trained Environmental Chemist (ETH Zurich) with a track record in environmental nanotechnology and plant science. She has conceived, developed, and patented the nanofertilizer, developed a business concept, and published the research in Nature Nanotechnology.

The scale-up partners are Prof. Roger Marti and Oliver Erni at HEFR (chemical engineering), and Prof. Bernhard Streit at BFH-HAFL (field trials). The project is also backed by the research group BioNanomaterials headed by Prof. Barbara Rothen-Rutishauser and Prof. Alke Fink at the AMI.

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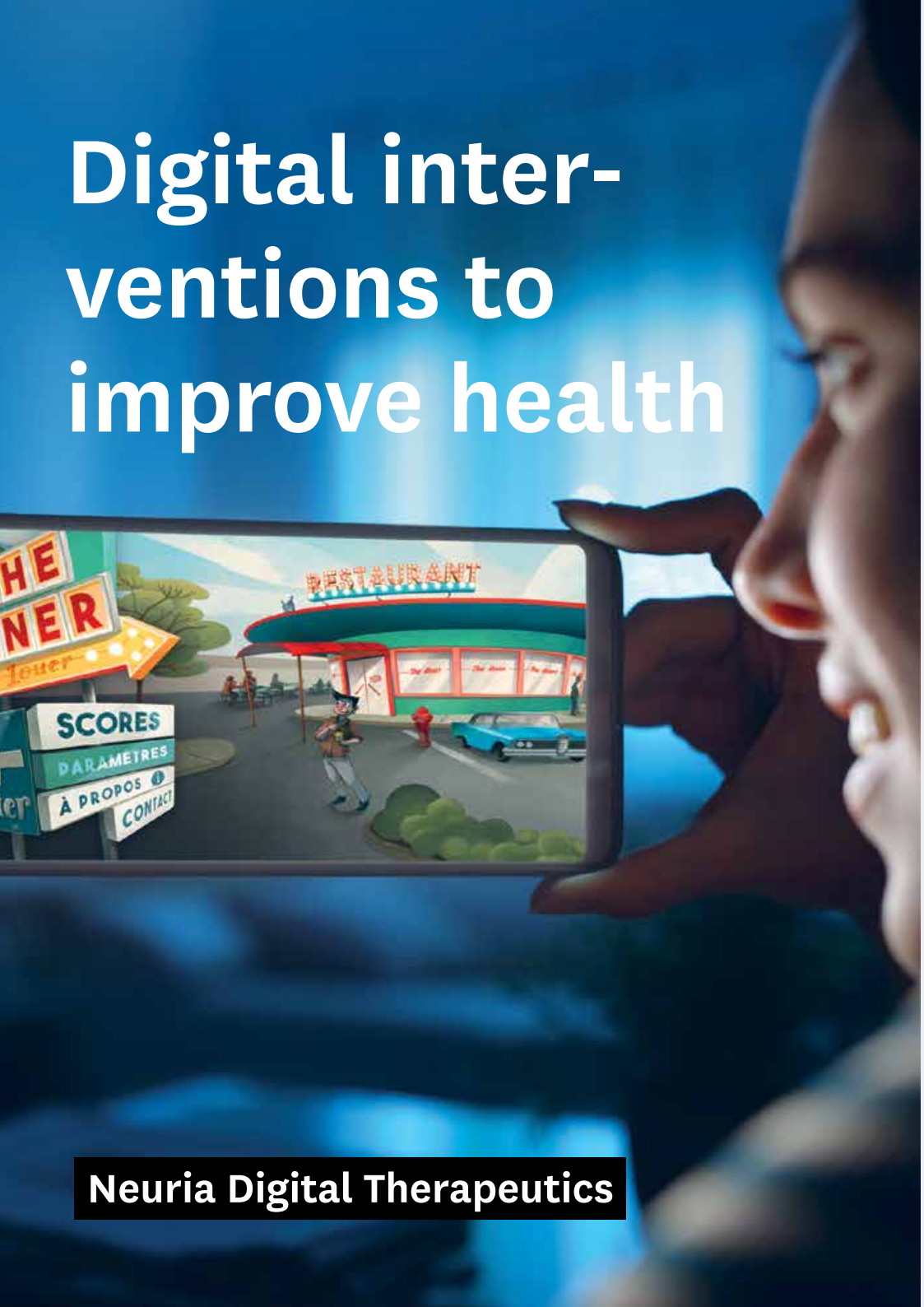
DEPARTMENT: Adolphe Merkle Institute, BioNanomaterials

Digital interventions to improve health



Neuria Digital Therapeutics

WHAT IS THIS ABOUT?

We propose digital interventions to improve health by reducing unhealthy food consumption behaviors. We design professional-level videogames that incorporate new, patented, brain training mechanisms of action allowing to reduce how much individuals like and want attractive but unhealthy food items.

WHAT'S THE INNOVATION?

In contrast to conventional effortful dieting approaches based on maintaining self-control, our interventions improve eating habits without even being aware of it. In our digital interventions, the game rules inducing the targeted brain changes are controlled by a patented human-machine interface, itself embedded in enjoyable videogames.

WHAT ARE OUR PLANS?

We first plan to propose our technology to insurances, to reduce overweight and related health costs. Additionally, we aim at providers of conventional dieting programs to potentialize their interventions. As second step, we will develop new modules focusing on smoking cessation and alcohol consumption. Educational modules will also be added to target younger populations.

WHO WE ARE?

We are a complementary team of five young co-founders, with backgrounds in neurosciences, psychology, programming, and arts. As a spinoff of the Neurology laboratory of the Medicine Section of the University of Fribourg, our core value is to improve populations health at a large scale, with evidence-based digital therapeutics interventions. We are committed to provide high-quality swiss-made software and services. We are supported by FriUp since 2021 and the Swiss Game Center.

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DEPARTMENT: Medicine Section, Faculty of Sciences and Medicine,
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The Digital Cooperative

Handling user data for the future

WHAT IS THIS ABOUT?

We aim to create a concept and implement a Minimum Viable Product to incentivize user to share their personal data with a company. We would like to do so by providing virtual shares of the business to those contributing to it with their data. There is almost an unlimited number of use cases but we expect the creation of a digital twin of traffic flows as being a good one to start with.

WHAT'S THE INNOVATION?

Current approaches using customer data (e.g. google maps) do not incentivize users to share their data. The importance for companies to gather qualitative data might be a key supplement in smaller scale business models, as the ones expected to be present in the relatively small Swiss market. We plan to provide this incentive by providing virtual shares of the business model to those contributing to it with their data.

WHAT ARE OUR PLANS?

Jointly with Swisscom, BBV AG and the city of Lucerne, we are currently developing the concept for the «Digital Cooperative» The project is Innosuisse funded and is expected to end with a minimum viable product. In case of a successful test results, we are planning to roll-out across whole Switzerland.

WHO WE ARE?

The project involves five parties: University of Fribourg and University of Lucerne are doing the integrative design research work. Swisscom provides the infrastructure and is an important implementation partner in case of a swiss-wide rollout. BBV is responsible for user testing and any potential software development. And City of Lucerne provides know-how and the playing field for the tests. Also, we would like to thank Innosuisse for the funding!

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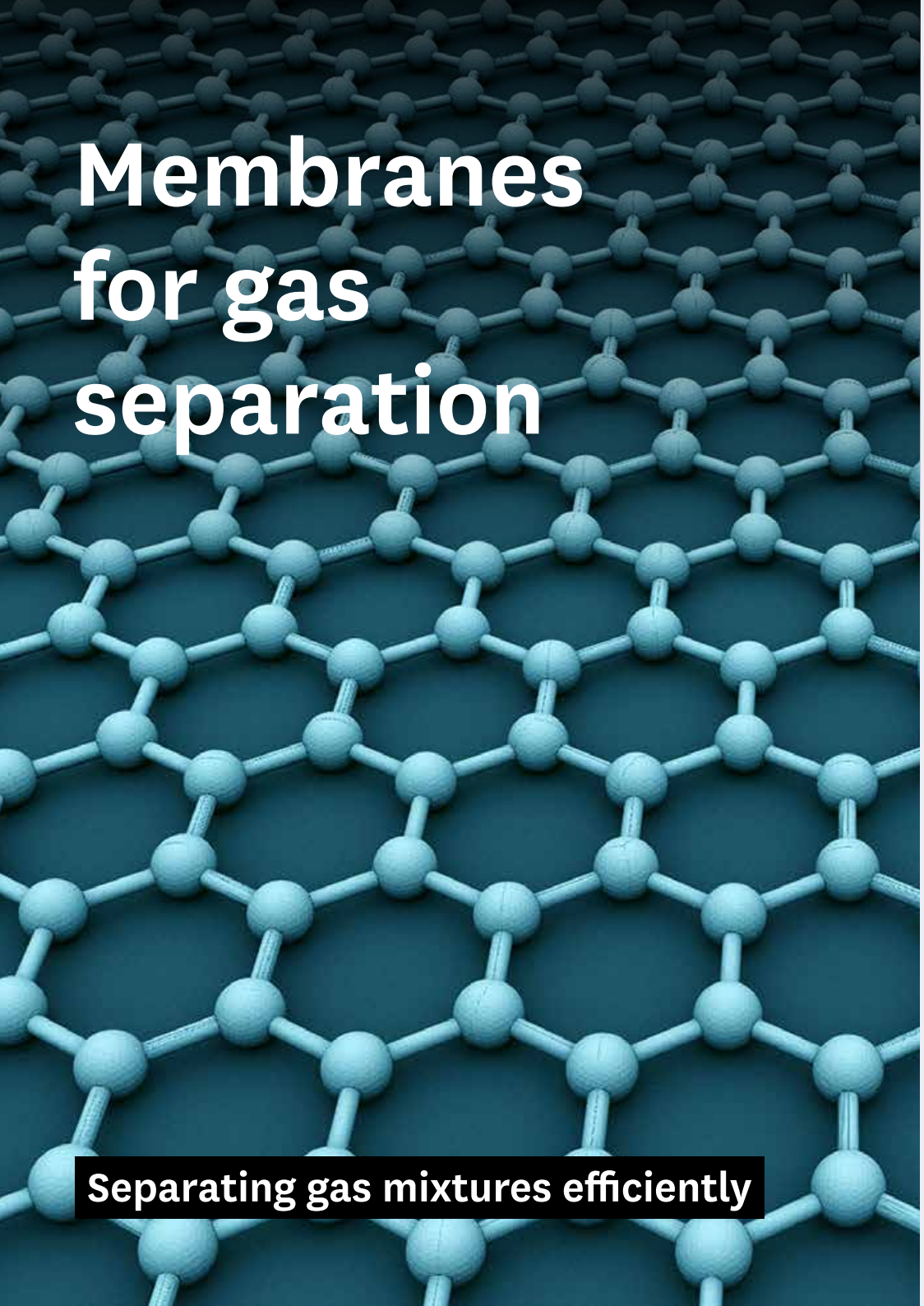
DEPARTMENT: Department of Informatics



Membranes for gas separation

Separating gas mixtures efficiently

WHAT IS THIS ABOUT?

We have developed graphene-based membranes that allow separating gas mixtures. Our first prototype allows separating hydrogen from helium at room temperature and with 100% helium purity. Our membranes can be adapted for any gas.

WHAT'S THE INNOVATION?

Traditionally, helium/hydrogen separation is achieved either by burning hydrogen and subsequent cryogenic cooling or using membranes at elevated temperatures (400–600 °C). These processes are highly energy intensive and bear the risk of helium contamination. Our patented technology (Patent application: PCT/EP2021/087114) reduces the energy needs for this process at least 100 times and reduces the size requirements for the membranes.

WHAT ARE OUR PLANS?

Our plan is to develop a membrane unit for helium/hydrogen separation that can operate for weeks without intervention. For this, we need to develop a scalable fabrication of the membranes. Once we optimized this step, we will establish a start-up company and start field tests with industrial partners.

WHO WE ARE?

I am Timur Ashirov, Ph.D. candidate at University of Fribourg, Department of Chemistry. I have developed this project under guidance of Prof. Ali Coskun. The results of this project were published in one of the highly prestigious materials science and chemistry journal, Chem and was also highlighted as a front cover for the September 2021 issue. To protect our invention, we filed an international patent application and submitted a BRIDGE proof of concept grant application.

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DEPARTMENT: Department of Chemistry

Impossible Materials

Replacing harmful white pigments with cellulose

WHAT IS THIS ABOUT?

Nowadays, white materials are present everywhere. Examples range from food, pharma, cosmetics, printing, paint, paper to coating industries. Current white enhancers are often metal-based, non-degrading materials and have recently raised serious health and environmental concerns leading to an EU wide ban.

WHAT'S THE INNOVATION?

We have developed a process to extract cellulose that can be used as white pigments or opacifiers. Cellulose is widely available, biocompatible and easy to process. Our patented, brilliantly white pigments from cellulose can be scaled with industry-proven processes and are safe to humans.

WHAT ARE OUR PLANS?

Currently we characterize our material properties, scale the production from milligram to kilogram scale in collaboration with HEIA. We are funded by Innosuisse and BRIDGE. In the future we want to start a company in Switzerland. Initially the spinout company will be selling cellulose-based white pigments to health sensitive industries, focusing on food, pharma and personal care, where biocompatibility drives buying decision, and will thereafter expand into mass-market segments.

WHO WE ARE?

Our technology has been developed by cellulose expert Prof. Silvia Vignolini at the University of Cambridge and was taken towards an innovation project by Dr. Lukas Schertel. He moved to the UNIFR through an SNSF BRIDGE project in the group of Prof. Frank Scheffold, an expert in optical materials. The team further includes a cellulose chemist and a chemical engineer.

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DEPARTMENT: Department of Physics

A blood test for breast cancer detection and monitoring

Exploiting the inflammatory response of the body to detect cancer

WHAT IS THIS ABOUT?

Breast cancer is the most frequent cause of cancer-related mortality in women. Nowadays, detection relies on mammography screening, which, however, has major limitations. Furthermore, no test to monitor patients after therapy and actively detect metastasis development is available. This lack leads to overtreatment, and loss of time to adapt therapy with negative consequences for patients, physicians, and the health system. To fill these gaps, we propose a first-in-class blood test for the early detection of breast cancer and active monitoring after treatment.

WHAT'S THE INNOVATION?

Our test exploits patient's systemic immune/inflammatory response to the tumor. The response is detected by monitoring changes in protein and gene expression the white blood cells (leukocytes). This strategy permits to create a test that is more sensitive and specific, compared to traditional tumor-derived biomarkers.

WHAT ARE OUR PLANS?

At UNIFR, we are conducting a clinical validation study (funded by ISREC foundation and Innosuisse) in collaboration with CHUV, HFR, HNe, and two more centers. A diagnostic algorithm is under development. We plan to start a company to develop and commercialize the test.

WHO WE ARE?

Project team members are: Curzio Rüegg, MD, UniFR, with 25+ years experience in translational cancer research and biomarker discovery, cofounder of 2 Start-Ups; Sarah Cattin, MSci, UniFR, with 10+ years experience in cellular and molecular analytics; Marie Betrand, MA in finances, UniFR, 5+ years experience in StartUps, business strategy and Frederic Fer, MSci biostatistician, informatician with 10+ years experience in bio- marker discovery, algorythm development and artificial intelligence.

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DEPARTMENT: Department of Oncology, Microbiology, Immunology

Innovative antibacterial coatings

Preventing infections and ensuring a fast recovery

WHAT IS THIS ABOUT?

Despite modern advances in medical devices, implant-associated bacterial infections remain a significant issue for some patients and are costly for society. While these bacterial infections are difficult to diagnose and treat due to bacterial biofilm formation and antibiotic resistance, our innovative antimicrobial coatings can prevent infections over months to ensure a healthy and fast recovery.

WHAT'S THE INNOVATION?

We developed antimicrobial coatings based on silver-filled inorganic nanocapsules and mesoporous capsules made of biocompatible silica, ceria, or titanium dioxide. After being tested in vitro and in vivo, silver release activities from capsules show that they can prevent infections of staphylococci strains during the healing phase and last for mid-to long-term use. Our biocompatible coatings can be adapted for different antimicrobial metals.

WHAT ARE OUR PLANS?

Financed by different Innosuisse, SNSF, and NCCR grants, we plan to fine-tune our active antibacterial coatings and upscale them with long-term performances. In collaboration with industrial partners, we plan to implement our technology for orthopedic, dental, and cardiovascular medical devices.

WHO WE ARE?

The team is composed of Prof. Katharina M. Fromm and senior and junior scientists with chemists, biochemists, and biology backgrounds. Prof. Fromm is internationally known for her work in bioinorganic chemistry of silver, silver compounds, and nanoparticles and their application as antimicrobial materials.

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DEPARTMENT: Department of Chemistry

Luminescent sensor for wine cork taint detection

High-sensitive TCA detection

WHAT IS THIS ABOUT?

One important challenge that the Europe wine sector faces is the alteration of wine aroma caused by the well-known 2,4,6 trichloroanisole (TCA) molecules which threatens its competitiveness. By using our luminescent sensor, producers of wines and corks as well as consumers would be able to detect TCA in a fast manner. This technology has higher sensitivity compared to traditionally instrumental gas chromatography techniques, which are expensive, time-consuming and require skilled personnel.

WHAT'S THE INNOVATION?

We have developed functional active mesoporous coordination polymers based on anthracenes chromophores and transition metal ions as efficient luminescent sensors. Their physicochemical properties are tuned by modifying the surface area and the porosity to capture as much as possible TCA and other targeted molecules such as pesticides, explosives, and air pollutants.

WHAT ARE OUR PLANS?

We plan to implement industrial collaborations acting in different fields (Food, Environment, and Medtech) to better develop our luminescent sensor according to industrial needs. We also intend to submit Innosuisse projects for prototyping our smart sensor.

WHO WE ARE?

Prof. Katharina M. Fromm with her seniors and juniors' scientists have developed several inorganic coordination compounds with different applications in different fields. They have published multiples articles and reviews and presented their research at various international conferences.

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DEPARTMENT: Department of Chemistry

Advanced Thermal Imaging for nano-particle detection

NanoLockin

WHAT IS THIS ABOUT?

Nanoparticles are used in a large variety of applications or can occur unintentionally (e.g. environment, industrial production sites). Their characterization and detection are required to establish quality assurance protocols and assess environmental and health risks. Nowadays, these analyses have a high device and operational costs. NanoLockin's technology permits to significantly increase sample analysis throughput, leading to a strong reduction in analytical cost, and can be adapted for different needs depending on the type and occurrence of the nanomaterials.

WHAT'S THE INNOVATION?

Most nanoparticles absorb light and produce heat when subjected to light. We use the lock in thermography, a highly sensitive method for measuring very small temperature differences, to detect the heat produced by nanoparticles. Different nanomaterials can be analyzed by modifying the irradiation wavelength thanks to differences in the thermal signature. Compared to other methods, the handling of our instrument requires no special training or complicated sample preparation, reducing the time dedicated to this operation by at least a factor of 10.

WHAT ARE OUR PLANS?

In a Swiss research project with the University of Fribourg, we develop new applications for our instrument the Caliorsito VIS/NIR and we test our newly developed instrument the Calorsito UV. Furthermore, in a Eurostars Project in collaboration with a German company, we develop a miniaturized version of our instrument for the analysis of environmental particles and process control analysis for the industry. We will also attend several conferences to advertise and sell our instruments.

WHO WE ARE?

NanoLockin is a spin-off from the Bionanomaterials Group of the Adolphe Merkel Institute led by Prof. Alke Fink and Prof. Barbara Rothen-Rutishauser. The company was founded by Dr. Christoph Geers (Managing Director), Dr. Tobias Fink (Software Development), Dr. Gunter Festel (Business Development), and Dr. Mathias Bonmarin (Technical Development). The team is complemented by the collaborators Olivier Schaub (Instrumentation & Control Engineer), Ruggero Botteon (Software Development), Tim Friedrichson (Business Development), and Daniel Fehr (Application Development).

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DEPARTMENT: Adolphe Merkle Institute, BioNanomaterials

Energy-autonomous soft robotic prosthetics

INTEGRATE project

WHAT IS THIS ABOUT?

The use of robotic prosthetic devices is a compelling strategy to reduce loss of mobility and functionality in patients suffering from amputations. Current devices are mostly designed using hard materials that are very different from biological tissues and rely on batteries that need to be continuously recharged. To overcome these limitations, we are striving to develop soft robotic prosthetics that draws on the body's own metabolic energy, no longer requiring an external recharge.

WHAT'S THE INNOVATION?

Our team will target two technological innovations. The first is the development of 3D-printed soft and biocompatible artificial muscles that precisely reproduce human muscles. The second innovation is the creation of an artificial electric organ capable of converting metabolic energy into electricity. Combing these two technologies will allow construction of robotic prosthetic devices that are soft like human muscles and do not need to be recharged.

WHAT ARE OUR PLANS?

We are laying the technological foundations for both the artificial muscles and the artificial electric organ. Our plan is to develop a lab-scale demonstrator within the next four years and subsequently apply for further (public or private) funding to bring the technology to the market.

WHO WE ARE?

The team comprises four research institutions (University of Fribourg, Eindhoven University of Technology, CNRS and University of Roma Tor Vergata) and a research association (Veltha IZV). Dr. Alessandro Ianiro of the Adolphe Merkle Institute (AMI), the scientific coordinator of the consortium, conceived the project with the collaboration of Dr. José Berrocal, Prof. Michael Mayer and Prof. Christoph Weder (all from AMI). The project received €3 million in funding in 2022 from the European Innovation Council under the prestigious Pathfinder program.

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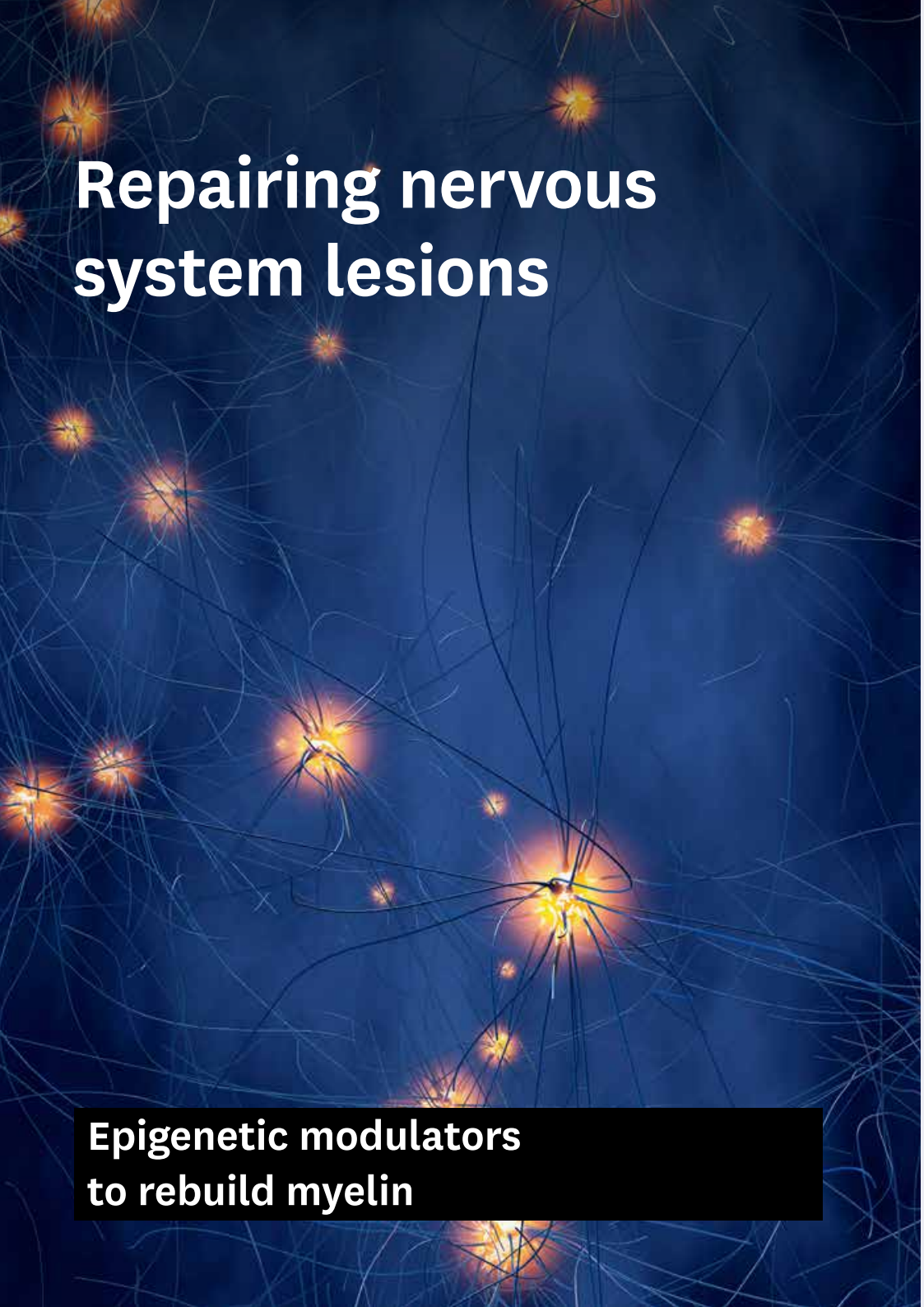
DEPARTMENT: Adolphe Merkle Institute, BioPhysics



Repairing nervous system lesions

Epigenetic modulators to rebuild myelin

WHAT IS THIS ABOUT?

Myelin is essential for nervous system function and protection. In patients suffering from multiple sclerosis (MS), the most frequent degenerative disease of the central nervous system, myelin is progressively lost. There is currently no treatment that helps rebuild myelin. We have identified a treatment that promotes myelin reformation in animal models of multiple sclerosis, Charcot-Marie-Tooth disease (CMT), a large group of peripheral neuropathies, and after a traumatic injuries.

WHAT'S THE INNOVATION?

We found that activators of the epigenetic regulator histone deacetylase 2 (HDAC2) promote myelin reformation in animal models of MS, CMT, and after traumatic injuries. Theophylline is a potent activator of HDAC2 at low dosage. It has been so far used at high dosage as a phosphodiesterase inhibitor for the treatment of lung diseases. Our first remyelinating drug is Theophylline used at a low dosage. We have two main patents for this re-purposed treatment, one currently at the national phase in Europe and the US and a very recent remyelination-specific formulation patent application.

WHAT ARE OUR PLANS?

So far, no drug for remyelination is approved. Our startup will offer a long-sought-after treatment paradigm for MS, CMT, and traumatic injuries. Phase II clinical trial results will be available within 4 years, allowing for an attractive clinical phase III financing round or a lucrative exit strategy for investors. Four additional molecules for axonal regeneration and remyelination should be under patent within 4 years.

WHO WE ARE?

Prof. Claire Jacob and Mr. Thomas Meier will be the founders of the startup. Prof. Jacob was SNSF Professor at the University of Fribourg (Dept. Biology) and is now a Professor in Cellular Neurobiology at the University of Mainz in Germany. Prof. Jacob has received two prestigious Prizes for her research on Epigenetics and nervous system Regeneration and is a recognized expert in the field of remyelination and axonal regrowth. Mr. Meier is the CEO of Bachem, a peptide-manufacturing company, and a pharma industry expert with 28 years of experience.

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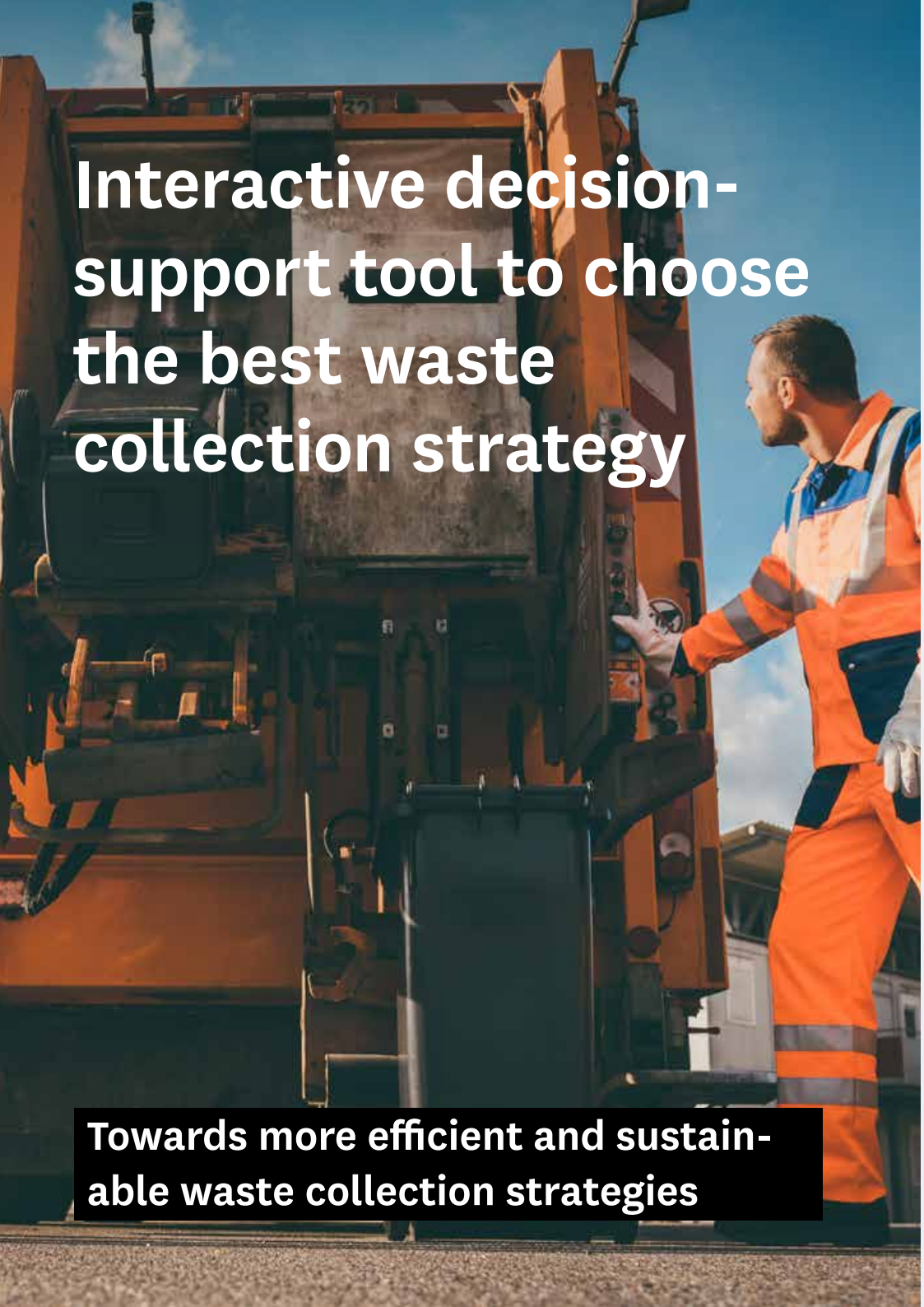
DEPARTMENT: Currently Faculty of Biology, Institute of Developmental Biology and Neurobiology, JGU Mainz, Germany; until March 2019, Department of Biology, University of Fribourg, Switzerland



Interactive decision-support tool to choose the best waste collection strategy

Towards more efficient and sustainable waste collection strategies

WHAT IS THIS ABOUT?

In many Swiss municipalities, a door-to-door collection is often used to gather the non-recoverable waste. This comes with negative effects such as high fuel consumption, emissions and noise. We aim at making the non-recoverable waste collection process more efficient and more sustainable with the development of an interactive decision-support tool that helps municipalities to choose the strategy that best suits their needs.

WHAT'S THE INNOVATION?

To define a new collection strategy, we design and implement algorithms to optimize the related decisions, such as the location of collection points and the routes performed by the collection vehicles. The interactive tool enables municipalities to specify their characteristics (such as the street network and the expected generated waste). Then, it displays several efficiency, sustainability and cost indicators of the various strategies to assist the municipality in choosing one.

WHAT ARE OUR PLANS?

At the end of the project, we expect to have a pilot of the interactive decision-support tool that will be further tested by the partnering company Schwendimann AG (jointly with some municipalities). The innovative waste collection concepts developed by the company will be accommodated in the tool. The idea is then to propose the tool to other municipalities while improving the interface with additional features and refining the backend optimization algorithms.

WHO WE ARE?

This project is funded by Innosuisse and involves three parties. From the University of Fribourg, the Decision Support & Operations Research Group (DS&OR) handles the implementation of the interactive tool and its backend optimization algorithms, and the International Institute of management in technology (iimt) deals with the communication aspects of the tool from an innovation point of view. Schwendimann AG, the implementation partner, is responsible for the development of the innovative collection concepts and practical tests.

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