PORTRAITS OF RESEARCHERS

[VOLUME 4]

Wallonie

BEWARE FELLOWSHIPS 2 PROGRAMME - JANUARY 2022

Prof. Carine MICHIELS, vice-rector for research
(University of Namur)

FOREWORD

Founded in 1831, anchored in the Walloon capital, the University of Namur aims at excellence in each of its missions, in a very human approach, integrating proximity, solidarity and respect. It is a responsible actor in the construction of a sustainable society at the environmental, social and societal levels.

The University of Namur aims at the development of projects of high quality and is involved in multiple research networks, often interdisciplinary, at the local, regional, federal, European and international levels. Its research aims above all at excellence and maintains the necessary balance between fundamental and oriented research, in the niche sectors that characterize it.

The BEWARE Fellowships programme is co-financed by the COFUND programme of the European Union and the Public Service of Wallonia. It aims at integrating researchers with transnational mobility and international experience in a university / university college of the Wallonia-Brussels Federation, by offering them the possibility to stay in a partner company. It aims to support the transfer of technology and know-how to Walloon companies by increasing the scientific and technological potential of research units associated with universities. This programme allows to reinforce the links between companies and universities in the Walloon Region and opens the doors of research in companies to researchers, usually after a purely academic career.

The BEWARE Academia programme (2014-2019) and the BEWARE Fellowships programme (2020-2025) have given the University of Namur the opportunity to welcome 11 highly qualified researchers from Europe, the Middle East, Asia and Australia. These two programmes have also allowed the University to establish long-lasting and quality collaborations with Walloon companies, mostly SMEs, to promote contacts and the setting up of large-scale projects with these companies, as well as for other teams of the University, to consider the setting up of new projects following the results obtained, and last but not least, to lead to technology transfers to the Walloon economic fabric and to increase its international visibility.

The University of Namur can be proud to have welcome Dr. Tarek BARAKAT, from Lebanon, in the frame of the BEWARE Academia programme. At the end of the project, Dr. BARAKAT developed a technical solution to purify the fumes from wood stoves which is the subject of a patent application. He was awarded the highly prestigious «Marie Sklodowska-Curie Award 2019» in the «*Innovation and Entrepreneurship*» category by the European Commission in Bucharest, Romania, on June 5, 2019. In the same year, he received funding from the Public Service of Wallonia (FIRST Spin-Off programme) to demonstrate the technical validity of his innovation and set up a company specializing in catalytic solutions for air purification. Tarek BARAKAT speaks highly of the Beware programme:

> *It was a great opportunity that allowed me to start my entrepreneurial adventure. One of the strengths of this programme is that it offers joint industry–university projects.*

A good summary of the relevance of this programme.

Alexandra LACROIX and Pierre DEMOITIÉ
BEWARE Programme Managers

INTRODUCTION

In September 2018, SPW Research submitted its third proposal for co-funding under the European Commission's Marie SKŁODOWSKA-CURIE Actions.

And for the third time, a grant was awarded to SPW Research to offer 65 mandates to qualified researchers wishing to bolster the scientific and economic potential of Wallonia.

The «BEWARE2 Fellowships» programme offers companies the opportunity to work in partnership with universities, university colleges and research centres by accommodating these researchers from all over the world.

This was a great initiative that was welcomed (and supported) by all.

Unfortunately, due to the global health crisis, the expected number of researchers has not been reached. We are confident that we will catch up during future calls.

In the meantime, through the following pages you will be able to discover the research of the first post-doctoral fellows with diverse backgrounds who have sometimes come from very far away and who have opted for a mixed career in our region.

LIÈGE université

MODEL CALIBRATION AND SENSITIVITY ANALYSIS

MK Engineering

- Professional support
- Case studies

6 CRITERIA OF THERMAL COMFORT

PHASE 1

FOCUS ON 2 CRITERIA

1. Air Temperature
2. Mean radiant temperature
3. Air speed
4. Humidity
5. Metabolism
6. Clothing

CLIMATE CHANGE SENSITIVE DISCOMFORT INDEX

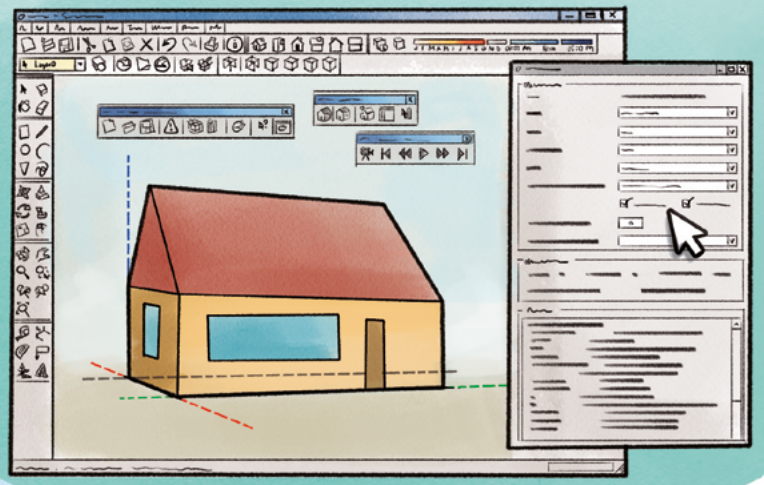
THERMAL DISCOMFORT

$= (T_{A(°C)} + RH_{(\%)})$

SBD LAB

PHASE 2

DesignBuilder



PHASE 3

FRAMEWORK, PROTOCOL AND MONITORING KIT

Recommendations for more RESILIENT BUILDING DESIGN

DEEPAK **AMARIPADATH**

COUNTRY OF ORIGIN	INDIA
COUNTRY AT TIME OF SUBMISSION	FRANCE
DURATION	36 MONTHS
PROMOTERS	
UNIVERSITY OF LIÈGE (PROF. SHADY ATTIA) | **WWW.UEE.ULIEGE.BE**	
MK ENGINEERING (MICHEL KOWALSKI) | **WWW.MKENGINEERING.BE/FR**	

TOWARDS MORE ENERGY-EFFICIENT BUILDINGS?

Originally from a small town in southern India, Deepak Amaripadath studied at the Tampere University of Technology in Finland, specialising in smart grids. «*Leaving your country and going far away is always a wrench*, explains the researcher, *but I wanted to explore the world and what it has to offer, so the Finnish offer appealed to me.*»

After his time in Scandinavia, Deepak completed his Ph.D. in France, at the University Bourgogne Franche-Comté. «*I received a Marie Skłodowska-Curie Actions Innovative Training Network (ITN) grant in association with the Laboratoire National de Métrologie et d'Essais, in Trappes, east of Paris*» he continues. This experience led him to work with various research units, such as Électricité de France, the University of Technology of Belfort-Montbéliard, and the Federal Institute of Metrology in Berne, «*the place where Switzerland is most accurate*.»

He took away a lot from his time in France: «*Participating in many international conferences, training events, seminars, and workshops allowed me to create a vast network of academic and industrial contacts in various fields*.» In addition, «*I was also able to develop a whole range of skills, including preparation of research proposals.*»

Living in Liège since April 2021, Deepak is now working on a research project that focuses on the development of overheating indicator and calculation method for Walloon buildings. «*Here at the University of Liège, working with an international team, I enjoy myself immensely, and working with the project's partner company is excellent.*»

As is well known, overheating in buildings is expected to be more intense and prolonged due to the current rate of climate change. The need for resilient building design is crucial and therefore it is essential that we invest in low carbon cooling technologies and sustainable solutions. «*There is a growing opportunity for building designers to improve the comfort and resilience of our building stock*» says the field hockey fan.

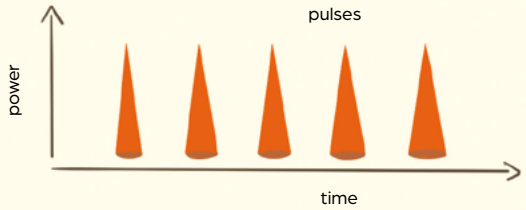
As soon as the project is completed, he plans to become an independent researcher.

THE **SURCHAUFFE** PROJECT AIMS TO :

- strengthen the technical capacity of design offices to estimate thermal comfort in commercial and residential buildings ;
- avoid overheating and develop the integration of low carbon cooling technologies in new and existing buildings ;
- transferring state-of-the-art scientific expertise on advanced building energy modelling from academia to industry. The project aims to strengthen MK Engineering's market leadership as a value-added construction services consultant.

The main objective of the research is to create a modelling framework and protocol with low input data uncertainty and high-risk assessment capability.

ULTRA-SHORT PULSED LASER

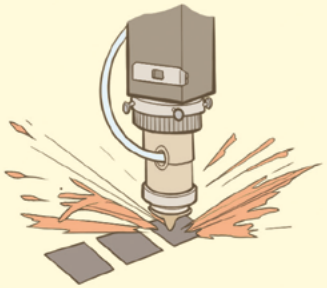


Energy is contained in a shorter time
then the peak power is higher

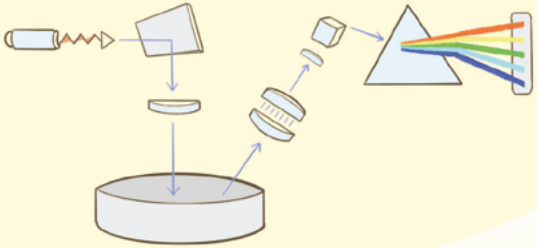
USES

MICROSCOPY

INDUSTRY :
MICRO-MACHINING

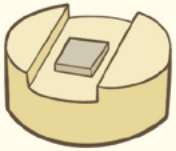


SPECTROSCOPY



Usually, pulsed are generated via a
SEmiconducteur Saturable-Absorber Mirror

SESAM



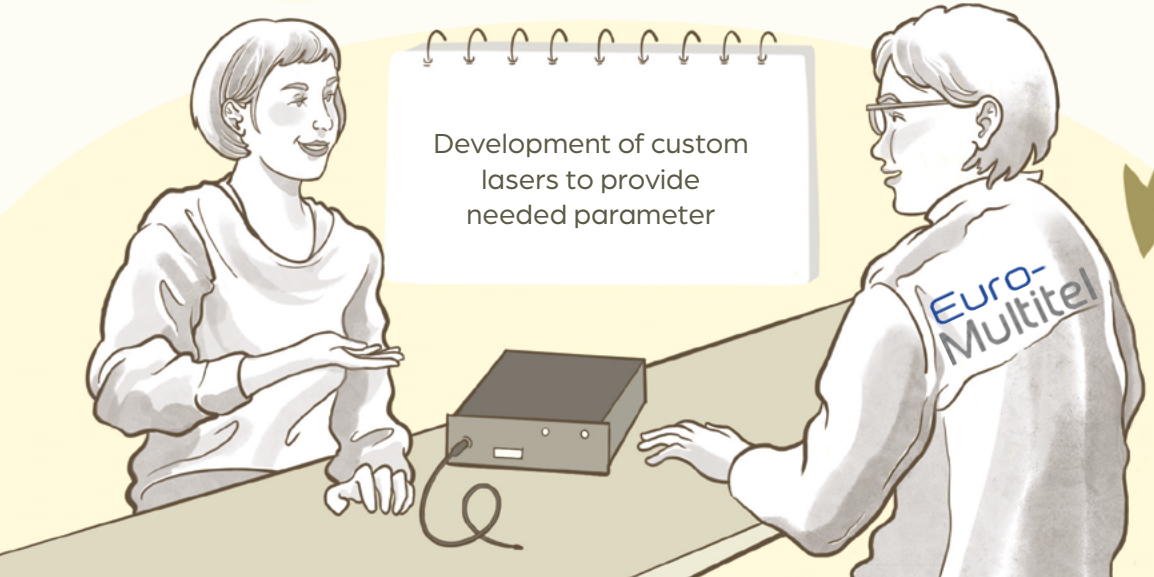
LIMIT : short lifetime
→ Difficult to integrated it for medical and industrial uses

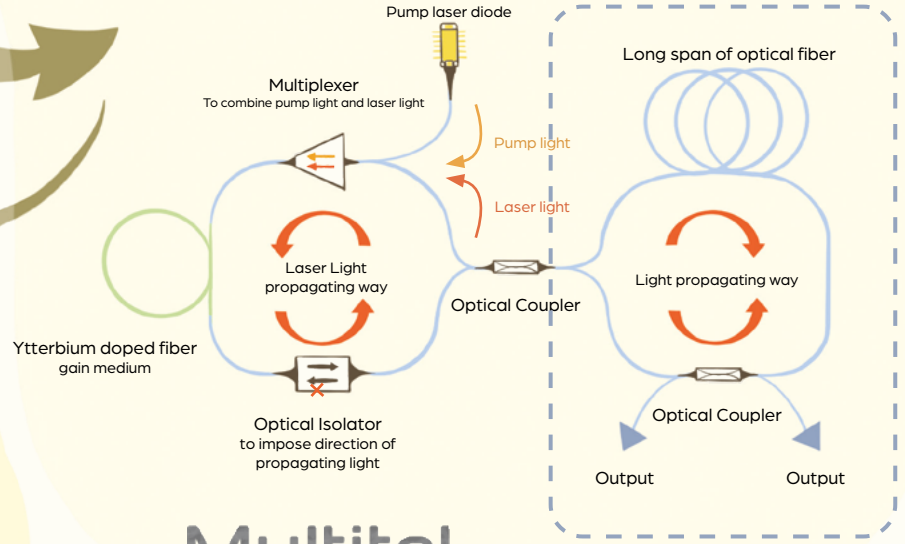
ALTERNATIVE TO SESAM

→ Based on electro-optic effect also called Kerr effect

$$\Delta n = \lambda K E^2$$

λ = Light wavelength
K = Kerr constant
E = Electric field amplitude





Multitel
INNOVATION CENTRE

Sagnac interferometer
Ultra-fast optical switch based on Kerr effect

SIMON **BOIVINET**

COUNTRY OF ORIGIN	FRANCE
COUNTRY AT TIME OF SUBMISSION	FRANCE
DURATION	36 MONTHS
PROMOTERS ▾	
MULTITEL (DR YVES HERNANDEZ) | **WWW.MULTITEL.BE**	
EURO-MULTITEL (DOMINIQUE DERESTIAT) | **WWW.EUROMULTITEL.BE**	

ULTRAFAST LASERS WITHOUT "SESAM": THE SESAME?

After his bachelor's degree in physics from the University of Bordeaux in 2009, Simon Boivinet moved to northern France where he graduated a master's degree in «lasers and applications» at the University of Lille, finishing with a PhD from the University of Mons and Multitel, in 2016. His thesis led to different laser demonstrators and the development of digital tools for simulating and modelling ultra-short fiber lasers. «*At the end of my PhD,* says Dr Boivinet, *I was hired as a product development engineer in Copenhagen for a year and a half before returning to Bordeaux to work at Alphanov, a renowned research centre, for two years.*» There, he has made significant contributions to the development of three new products and wrote and filed two patents related to them.

In early 2020, his knowledge of the research ecosystem in Wallonia led him to apply for a BEWARE mandate. The aim was to set up the laser activity in EURO-MULTITEL via the CLARA project and then to continue the development of these products. At EURO-MULTITEL, there are currently two industrial projects related to photonics, one on interrogators for fiber optic sensors and the other on the development of a laser decoating system. Dr Boivinet is working on this second project.

The researcher also would like to be trained in the field of biophotonics and microscopy. «*This is a fast growing field requiring lasers similar to those developed in the framework of the project. The knowledge would give me a better understanding of the issues related to microscopy and biomedical imaging and allow me to identify business opportunities,*» he says. It should be noted that Multitel already works in this field through various European projects such as MARS, CARMEN and PHARE.

THE **CLARA** PROJECT

The main objective of the CLARA project is to develop high performance reliable fiber laser sources emitting femtosecond and picosecond light pulses.

Usually, to build this kind of laser sources, a SESAM (SEmiconductor Saturable Absorber Mirror) is inserted in the laser cavity. This element is much more fragile than the other components. As a consequence, the robustness of the laser sources has been reduced limiting thus their possible use in an industrial environment. Moreover, since this component has to be used at low optical power, it limits the overall power emitted by the laser.

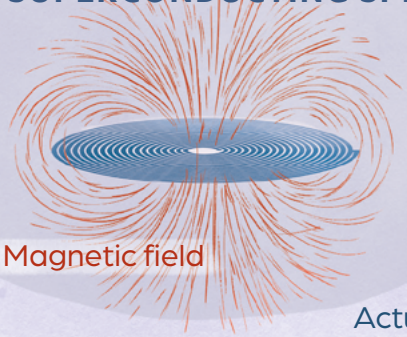
The aim of this project is to replace SESAM by the use of non-linear optical techniques in fiber lasers to generate high energy pulses and obtaining a stable and robust ultra-short pulsed 24/7 laser operation.

OUR GOAL

UCLouvain

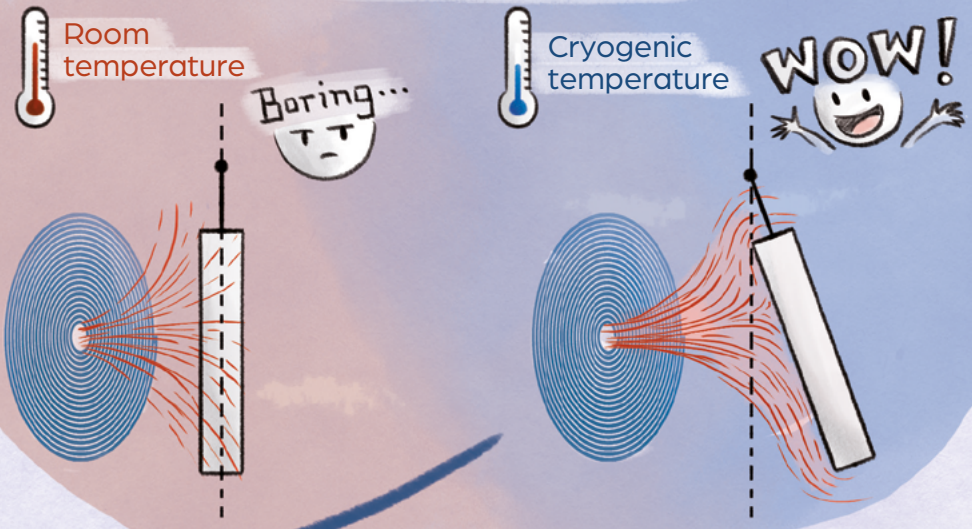
ICS

CREATE A THIN FILM SUPERCONDUCTING SPIRAL

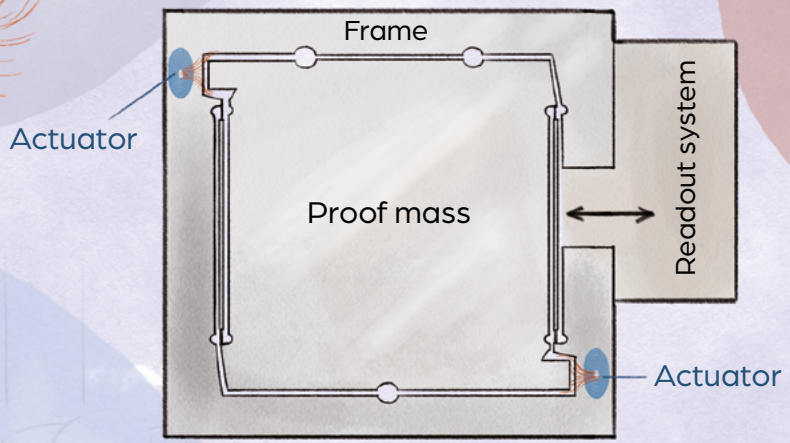


WHY ?

TO PUSH AGAINST OTHER SUPERCONDUCTORS

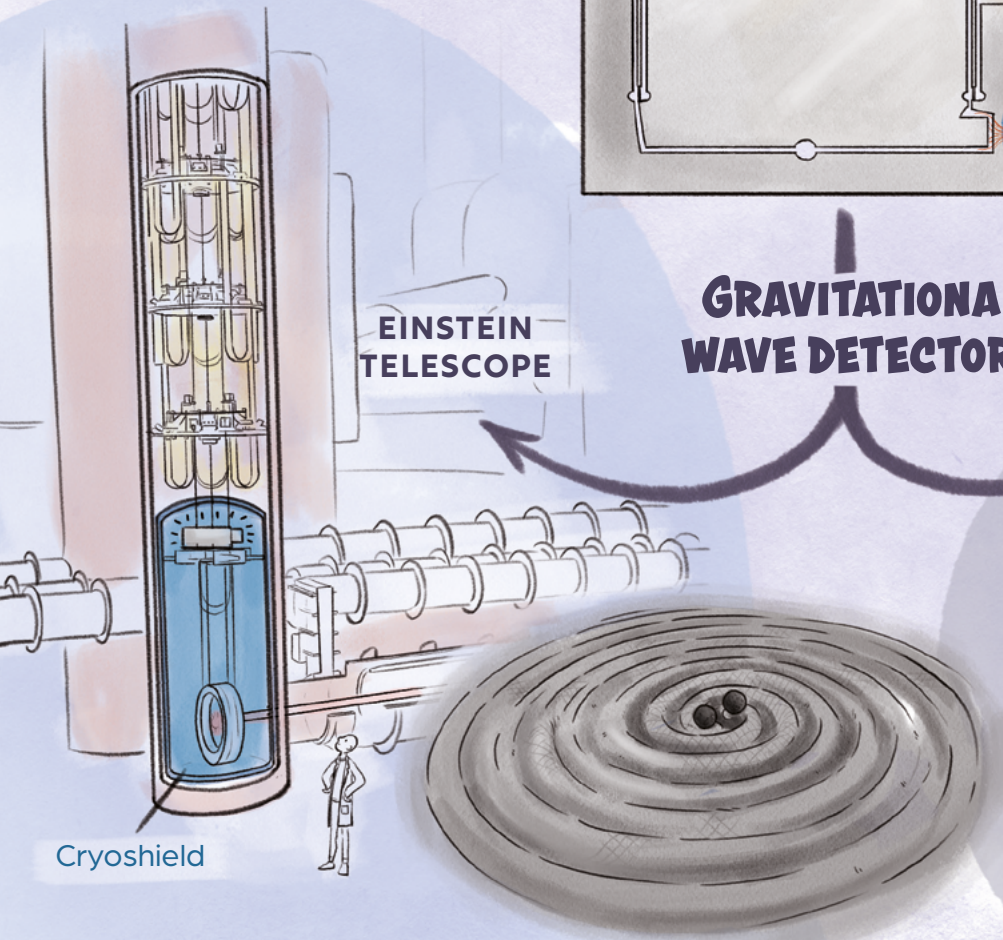


INERTIAL SENSOR

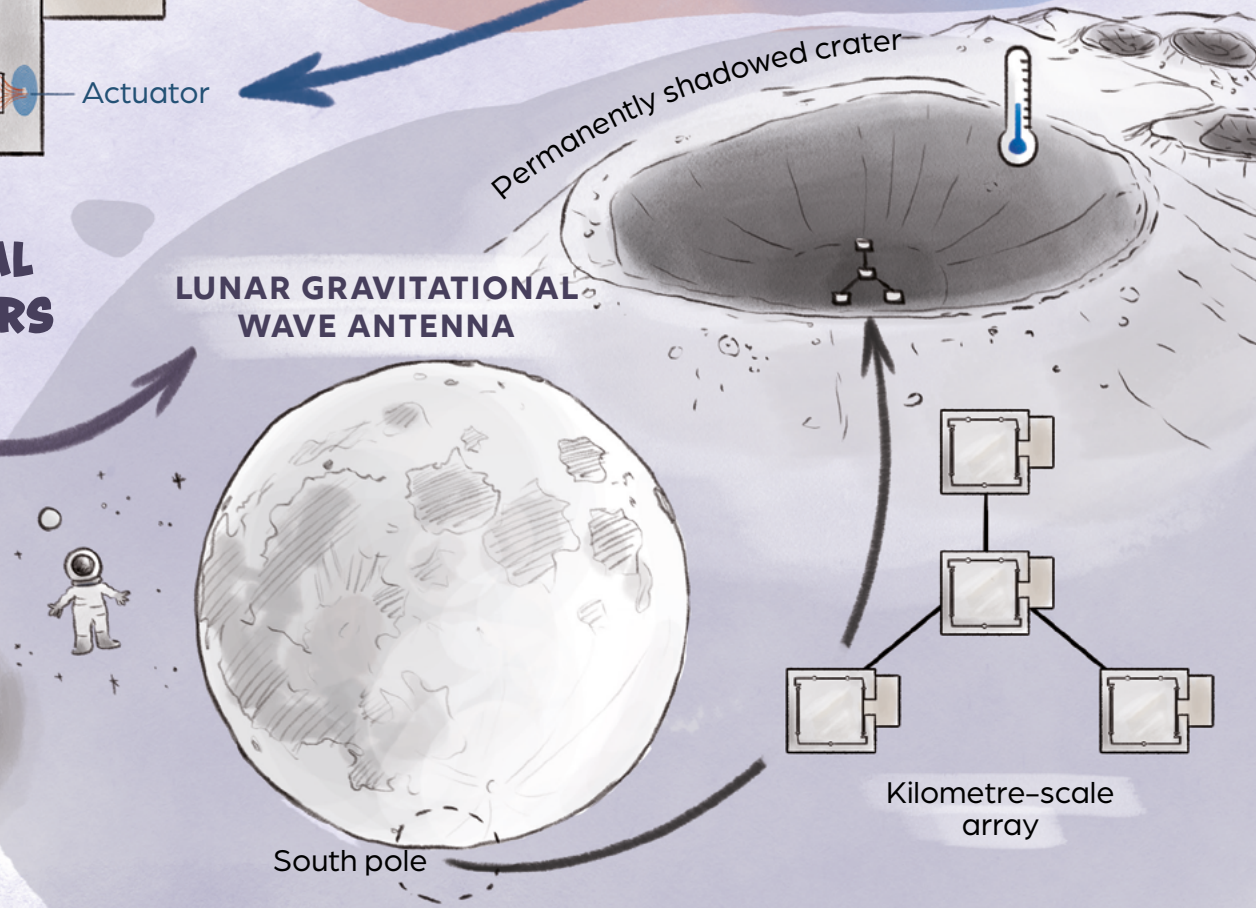


GRAVITATIONAL WAVE DETECTORS

EINSTEIN TELESCOPE



LUNAR GRAVITATIONAL WAVE ANTENNA



ELVIS **CAMILO FERREIRA**

COUNTRY OF ORIGIN	BRAZIL
COUNTRY AT TIME OF SUBMISSION	BRAZIL
DURATION	24 MONTHS
PROMOTERS ▾	
UCL (DR. JORIS V. VAN HEIJNINGEN) | **HTTPS://UCLOUVAIN.BE/EN/RESEARCH-INSTITUTES/IRMP/CP3**	
ICS (PROF. STÉPHANE LUCAS) | **WWW.INCOSOL4U.COM**	

Follow him

HIS BLOG

FAR BEYOND THE STARS

After a master's degree and a thesis in astrophysics at the National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*) in São José dos Campos, Brazil, Dr Elvis CAMILO FERREIRA began his career as a scientific editor before teaching at the Federal Institute of Education, Science and Technology of São Paulo.

You are fascinated by the Universe...

ECF – *That's an understatement. I'm immensely interested in all of it. And the core of my research is to develop instruments, including gravitational wave detectors. In particular, I developed the parametric transducers for the Mario SCHENBERG detector, named in honour of one of the most famous Brazilian physicists, known for his work on the formation of supernovas, in order to improve their sensitivity. I also worked on different instruments related to interferometric detectors: this includes studies from the design to the testing of the whole system under very low pressures in a vacuum chamber.*

During your stay in Belgium, you will also work on the famous Einstein Telescope.

ECF – *Indeed, this telescope could be built on the border between Belgium, the Netherlands and Germany [note: Wallonia has already (co)financed a lot of research in this respect]. ET, as it is called, is an ambitious project that will explore the Universe through gravitational waves and help answer open questions in fundamental physics and cosmology. The Einstein Telescope will explore the physics of black holes in detail and future high statistics studies of gravitational waves will further revolutionise physics, astrophysics and cosmology. It is also important to know that this telescope will detect thousands of neutron star mergers per year, thus improving our understanding of the behaviour of nuclear matter under extreme conditions of density and pressure that cannot be produced in any laboratory.*

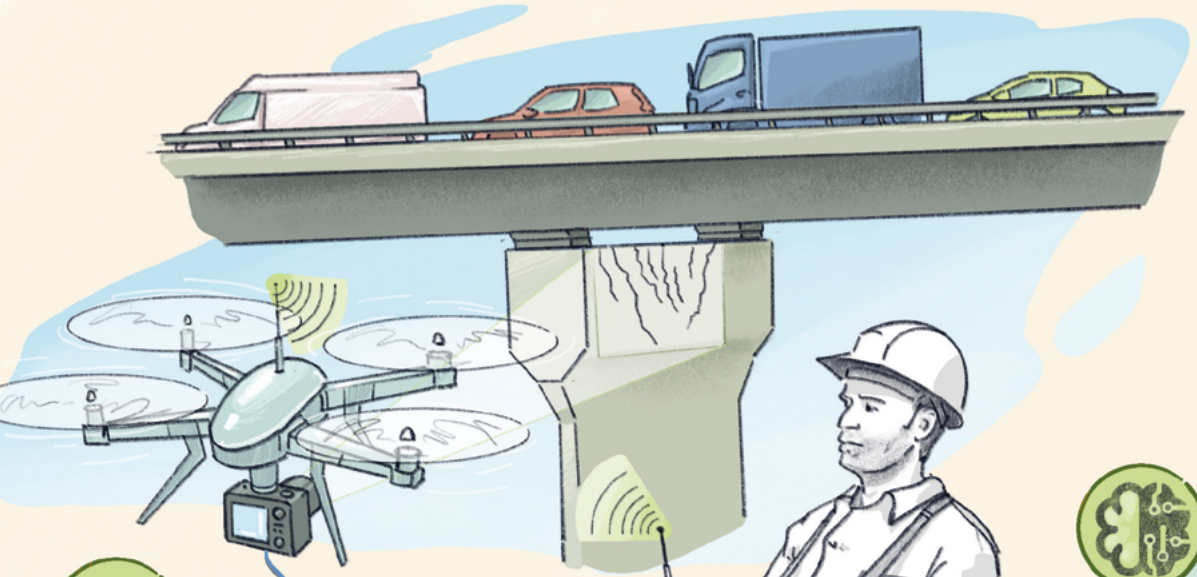
And you also have a penchant for popularising science !

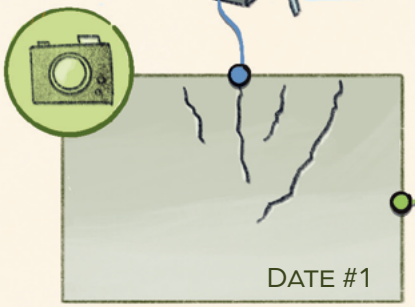
ECF – *Yes, this is another of my interests. I regularly publish articles on my blog (although I should be more active). I believe that research conducted by universities or the industrial world and its results must be made more accessible. This is part of general knowledge.*

THE **SUNRISE** PROJECT

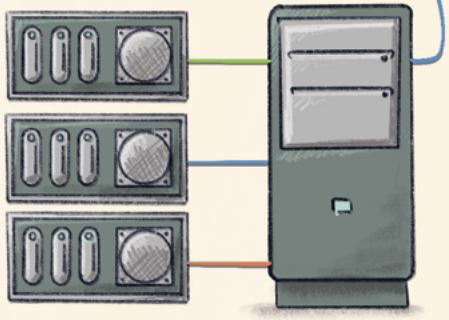
Since 2015, it has been possible to detect gravitational waves (GW) and because of them in particular, to study black holes, for example. The next generation of detectors, which will be built at the end of this decade, will make it possible to go back to the Big Bang. The Einstein Telescope is the future European project for a gravitational wave detector.

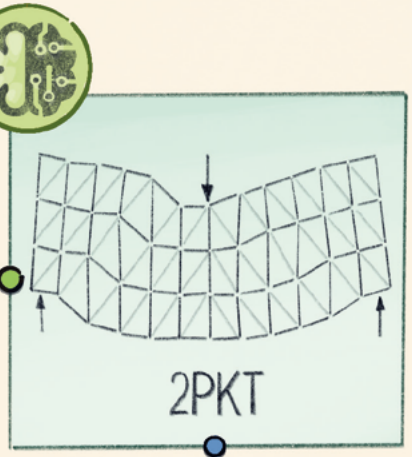
At low frequencies, one of the most critical noise sources is thermal noise. This can be reduced by using very low-loss materials and operating at cryogenic temperatures. A lot of research and development work is needed, especially in terms of the cryogenic operation of the main mirrors and their suspensions (suspensions are a long chain of mechanical filters that are designed to decouple their motion from the Earth's omnipresent vibrations, which are about a factor of 100 billion stronger than gravitational wave signals). For the control of the most critical final cryogenic part, new actuators and inertial sensors are required. The SUNRISE project aims to develop this actuator which will be a superconducting thin film spiral pancake coil.

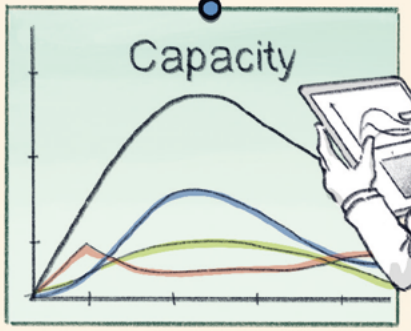




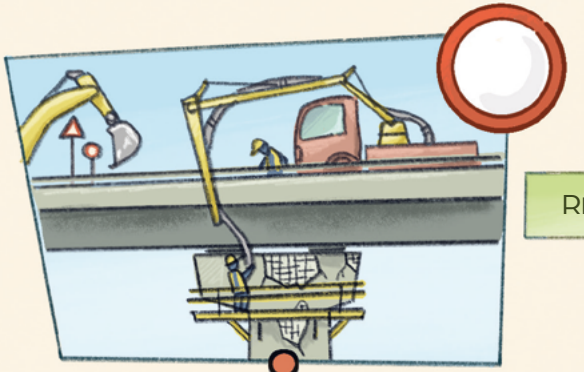
DRONE USED TO MAKE ACCURATE, REPEATABLE AND NON-DISRUPTIVE MEASUREMENTS



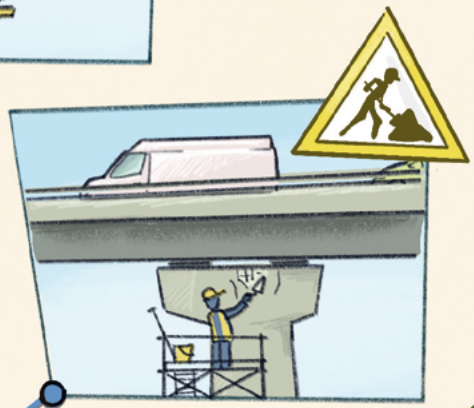


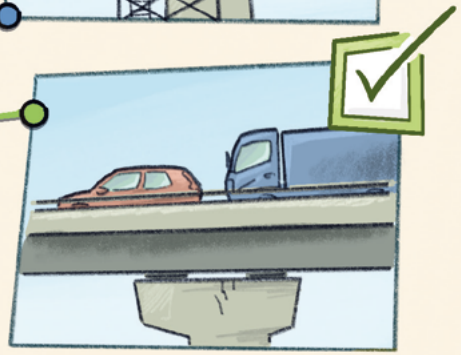


A.I. CODED TO TRACK THE EVOLUTION OF CRACKS IN STRUCTURES



REHABILITATION





ADVANCED MODELS CREATED TO ASSESS THE POTENTIAL DANGER

QUALITICS

LIÈGE université

MAHMOUD **EISSA**

COUNTRY OF ORIGIN	EGYPT
COUNTRY AT TIME OF SUBMISSION	EGYPT
DURATION	36 MONTHS
PROMOTERS ▾	
UNIVERSITY OF LIÈGE (PROF. BOYAN MIHAYLOV) | **WWW.UEE.ULIEGE.BE**	
QUALITICS (DIMITRI MARTINOT) | **WWW.QUALITICS.EU**	

MONITORING THE AGE OF OUR BRIDGES USING DRONES

After obtaining his master degree in civil engineering from Cairo University, Egypt, and writing a thesis on the rehabilitation of masonry buildings using carbon fiber reinforced polymers, Mahmoud Eissa headed to Japan to achieve his doctoral thesis at The University of Tokyo. «*It's true that the change can seem sudden because of the significant cultural differences between these two countries, especially in terms of social life,* he recalls, *but it was worth it because this university was ranked as a Top 20 academic institution in 2016.*»

Dr Eissa spent three years in Japan. «*I put a lot of effort into finishing my work on time and learning new technologies.*» And continues: «*At the University of Tokyo, I developed an artificial intelligence (AI) model for predicting the service life of the reinforced concrete decks of road bridges based on site-inspected damage, i.e., bottom surface cracks and top surface stagnant water*.» This research has been published in several scientific journals. Additionally, the researcher also had research collaboration with Yokohama National University and Taisei Corporation to develop an AI model for crack detection.

After his thesis, Dr Eissa returned to Egypt, and more specifically to the Concrete Research Laboratory of Cairo University, where, in addition to giving lectures, he was involved in supervising master's students, and he contributed to static and dynamic testing of bridges in Egypt.

«*After about two years, I found out about the BEWARE programme on the website of academicpositions.com. I didn't hesitate for a second because I absolutely wanted to do a post-doctorate in the field of infrastructure assessment in Europe as the AISTRUCT2 project, in partnership with the University of Liège and the industrial partner, Qualitics.*»

His integration into the city of Liège went smoothly thanks to the university's Euraxess office, «*except for the difficulties due to the pandemic. Also, the Egyptian community is not very large here, but luckily, I was able to meet Prof Shady Attia, who is a BEWARE project participator* (see p. 7). *»*

THE **AISTRUCT2** PROJECT

Much of the road infrastructure was built in the 1970s and 80s. As a result, over the next decade, a number of bridges will reach the critical age of 50 years, which typically results in significant corrosion and deterioration.

According to the Public Service of Wallonia, about 13% of the bridges in Wallonia are already suffering from serious deterioration, while the resources to renovate them are limited.

It is therefore increasingly necessary to develop modern digital technologies for detailed, accurate, rapid and non-disruptive inspection and assessment of ageing infrastructure to inform timely, sustainable and cost-effective interventions. This is the aim of the AISTRUCT2 project, which proposes this particular approach: combining state-of-the-art digital technologies for accurate crack measurements with advanced mechanical models by bringing together the company's drone and AI-related technologies and the university's concrete structure specialists.

GOAL :
DETECT AUTOIMMUNE DISEASES

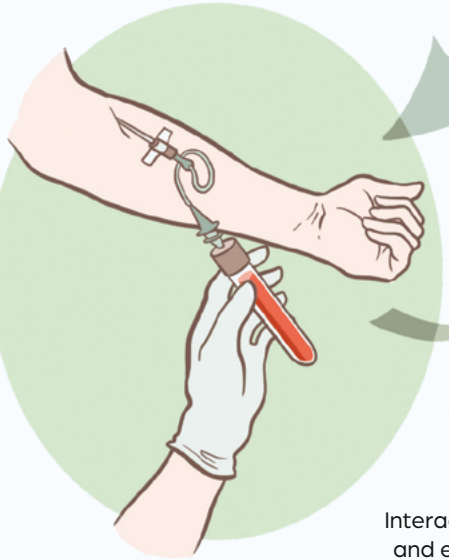
CURRENT METHOD :
D-TEK DETECTION

SYSTEMIC SCLERODERMA
SHARP'S SYNDROME

SJÖGREN'S SYNDROME

LUPUS

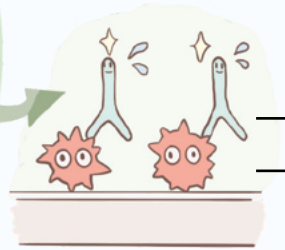
NEW METHOD :
DEVELOPING A MULTI-CHANNEL SURFACE PLASMON RESONANCE BIOSENSING INSTRUMENT



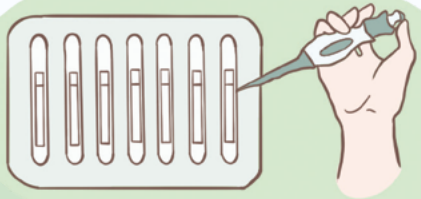
D-tek

Multitel
INNOVATION CENTRE

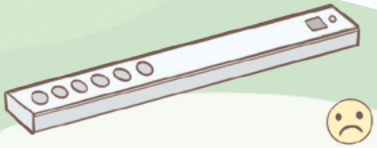
SAMPLING



Interactions between substrates and enzymes produce a colour change!



DETECTION



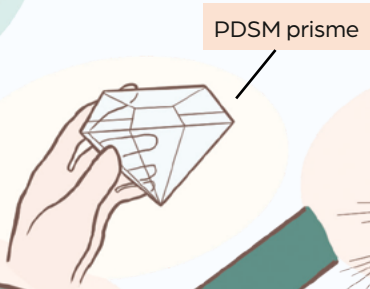
→ 2 hours test
→ high cost
→ detects only one disease

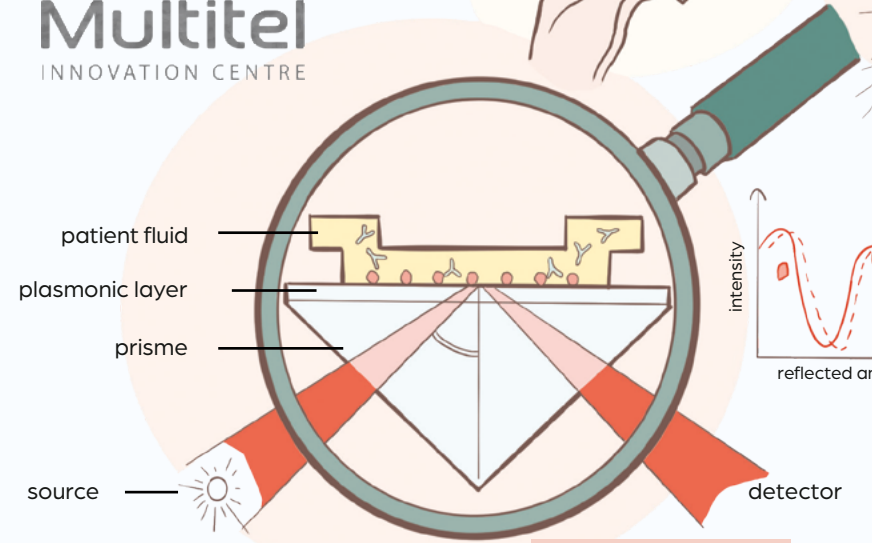
SPR KIT

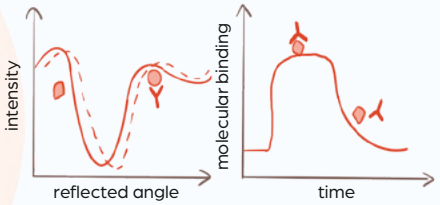
→ quick tests (+/- 20 minutes) directly made in the medical room

→ less expensive (+/- 5000 € for 12 markers)

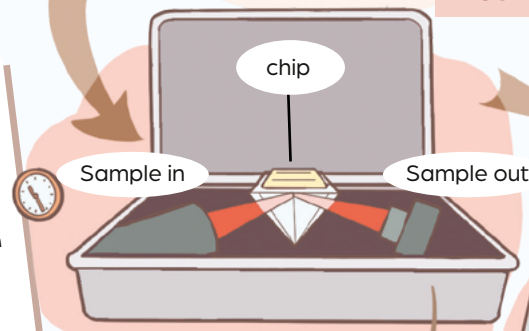
→ easy to carry



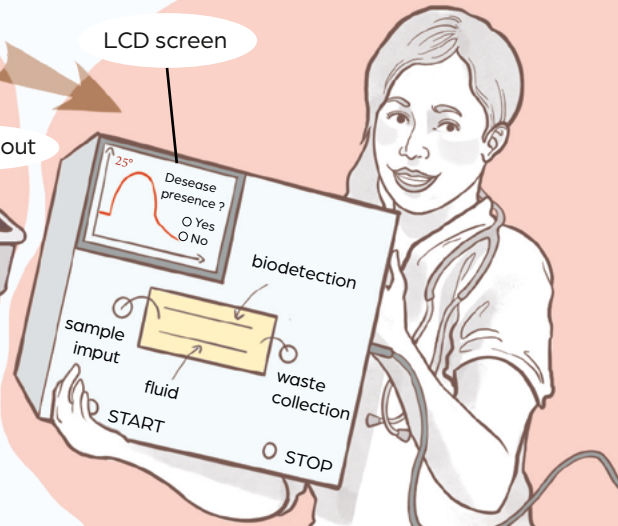




BIOSENSING TOOL



Camera image for 12 channel plasmonic sensor



SIVARAMAKHRISNAN **GANESAN**

COUNTRY OF ORIGIN	INDIA
COUNTRY AT TIME OF SUBMISSION	FRANCE
DURATION	36 MONTHS
PROMOTERS ▾	
MULTITEL (DR FABIAN DORTU) | **WWW.MULTITEL.BE**	
D-TEK (NICOLAS BODART) | **WWW.D-TEK.BE**	

FASTER DETECTION OF AUTOIMMUNE DISEASES

After graduating as an electronics and communication engineer from Veltech University in Chennai, Sivaramakrishnan Ganesan completed his master's in Molecular nano and biophotonics for two years at the École normale supérieure in Paris-Saclay, as part of an Erasmus Mundus scholarship, before beginning his doctorate at the Institut d'électronique de microélectronique et de nanotechnologie, a research institute of the universities of Lille and Valenciennes, the French National Centre for Scientific Research and the Institut supérieur d'électronique et du numérique. «*During my Ph.D.,* explains the researcher, *I worked on the development of an optical biosensor based on the surface plasmon resonance, the SMARTBIOSENSE cross-border project, between Belgium and France, supported by the European Union. Because of its multidisciplinary nature, this project allowed me to discuss and share my views with researchers from different fields of research.*»

This project is particularly relevant to current events because of the coronavirus situation, «*the existence of a biosensor could have reduced the number of deaths through early detection and, in fact, limited the panic effect within the population.*» Today, Dr Ganesan wants to continue in this vein: «*I want to develop this instrument further to make it more innovative. Together with MULTITEL and D-Tek, a specialist in in-vitro diagnostics, we will develop a portable optical biosensor with a very low detection limit and highly sensitive, the functionality of which could even be extended to other types of biosensing than the one currently used by D-tek.*»

But Dr Ganesan has a wealth of resources and remains eager to learn. «*During my BEWARE mandate, I will take part in the MULTITEL training sessions on the design and development of complex optical systems, optical modelling, C++ programming on embedded Linux systems and electronics for controlling optoelectronic devices,*» stresses the researcher.

During his PhD, Siva Ganesan taught at the University of Lille for three years. «*I would like to extend this teaching experience at a university in Belgium.*» If he has the time!

THE **SPRAIDDLAB** PROJECT

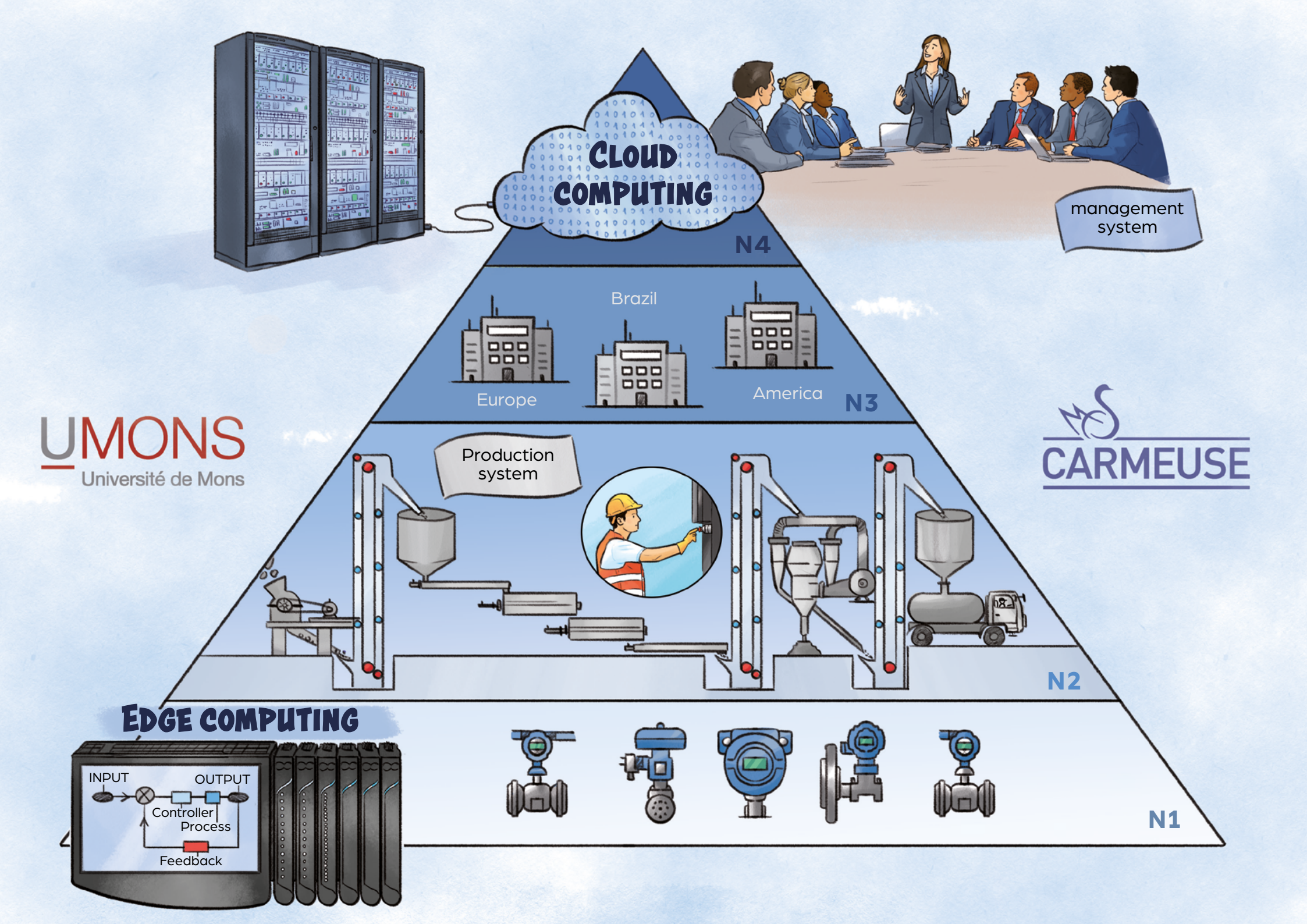
Autoimmune diseases are caused by an inappropriate immune response against the body's own components, resulting in chronic inflammation, tissue destruction and/or organ failure. In order to diagnose and characterise these diseases, laboratories routinely use enzyme-immunoassay multiplexed diagnostic kits (which can simultaneously identify several autoantibodies).

There are multiple limitations with this technique:

- a lack of reproducibility of the reaction medium (nitrocellulose)
- the need to use reagents (secondary antibody, substrate, wash buffer) which lengthen the test duration (minimum 1 hour for the test) and have a significant environmental impact (biological waste, plastic bottles)

Photonic sensors on microfluidic and label-free chips can be used to circumvent these limitations.

The objective of the SPRAIDDLAB project is therefore to develop a portable- easy to use biosensing instrument to detect autoimmune diseases.


CLOUD COMPUTING
management system
N4
Brazil
Europe
America
N3
Production system
N2
EDGE COMPUTING
INPUT
OUTPUT
Controller
Process
Feedback
N1
UMONS
Université de Mons
CARMEUSE

CAMILLO **GARCIA**

COUNTRY OF ORIGIN	COLOMBIA
COUNTRY AT TIME OF SUBMISSION	COLOMBIA
DURATION	36 MONTHS
PROMOTERS ▾	
UNIVERSITY OF MONS (PROF. ALAIN VANDE WOUWER) | **WWW.AUTOM.FPMS.AC.BE**	
TECFORLIME (THOMAS ABBATE) | **WWW.TECFORLIME.COM**	

AI CONTROL: THE FUTURE OF LIME PRODUCTION

Camilo GARCIA graduated as an electrical engineer from the *Andes University in Bogotá*, Colombia. From 2010 to 2014, he worked as a Project Manager for a service company, for the President of *Banco Agrario de Colombia* and even as an auditor at E&Y. In 2015, he embarked on a PhD at *Universidad Nacional de Colombia* (UNAL).

There's a long history between you and the University of Mons !

CG – *Indeed, I have always loved to learn and study and after a professional career in the private sector, where I was not very happy, I decided to start a PhD in the field of automatic control at UNAL which is the country's main academic institution. It turned out that this was a cotutelle PhD with the University of Mons where I spent one of the three years that the thesis lasted.*

During these years, I developed algorithms that would efficiently compute an approximation of the Koopman operator and its spectrum allowing the representation of a nonlinear system by a linear system providing information on the dynamic behaviour.

Then, one day, I received an email from the Belgian Embassy in Bogotá and that's how I found out about the BEWARE programme !

The interest of this programme also lies in the collaboration with a company.

CG – *Yes, because besides the fact that career opportunities in the field of research and innovation as we know them here, do not yet exist in Colombia, I will have the opportunity to gain field experience because TECforLime's IIoT (Industrial Internet of things) solutions are already implemented and tested in actual operation. I will also spend time with the process engineers at the Carmeuse factories, which will give me a better understanding of the limitations and requirements of real operations, both on a human and technical level.*

And, fittingly, you can benefit from the practical support of Carmeuse ...

CG – *Exactly. The GPS (Grow, Perform and Succeed) programme developed within the company gives me access to the internal training platform which covers both technical subjects (kiln operation, product specifications, etc.) and general skills (legal aspects, communication, presentation, sales, etc.).*

THE **RAISELIME** PROJECT

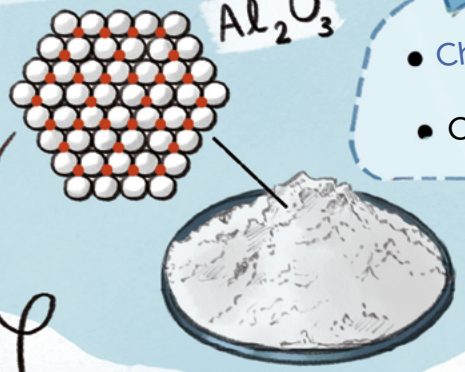
The RAISELIME project is part of this context of digitalisation with the commitment to exploit the potential offered by IIoT technology, edge computing and machine learning tools available on cloud platforms to the full, in order to develop advanced control algorithms for lime kilns.

The project has two objectives :

- the implementation of artificial intelligence and machine learning techniques deployed in a cloud-based hierarchical control structure for the supervision and control of a lime kiln network
- the optimisation of the efficiency of Parallel Flow Regenerative lime kilns, including intensifying production processes, reducing energy consumption, improving quality and respecting environmental constraints.

ALUMINA

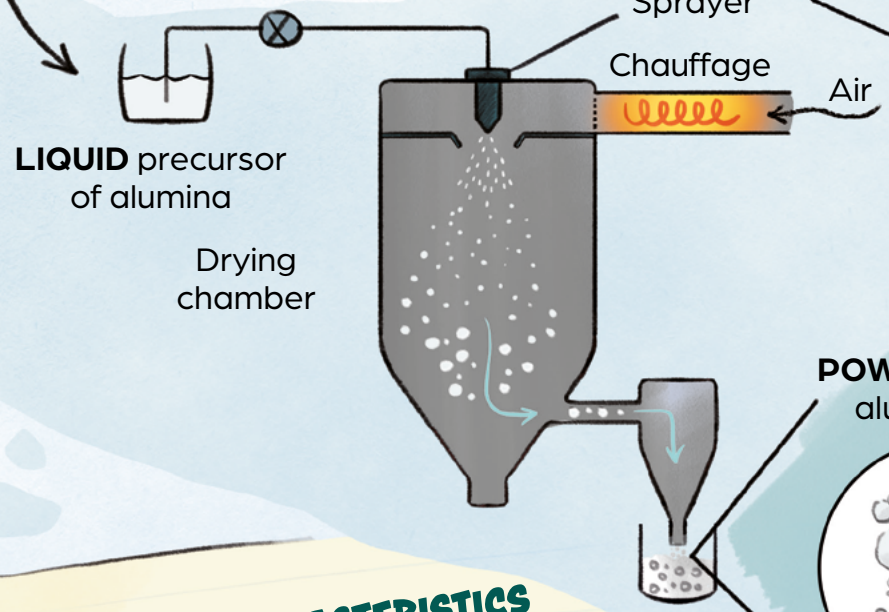
Al_2O_3



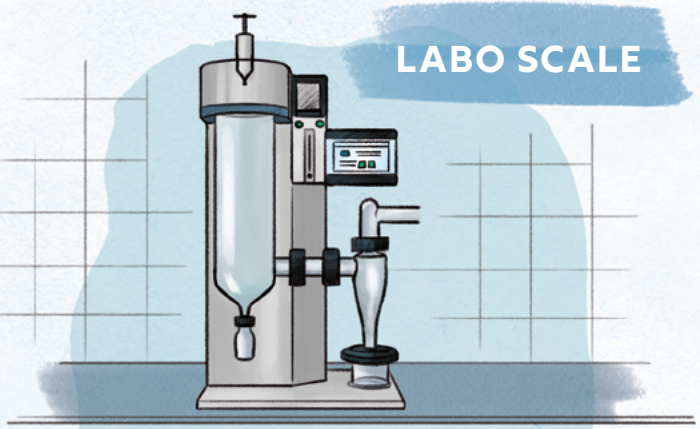
USES

- Chemical catalyst
- Orthopaedic items

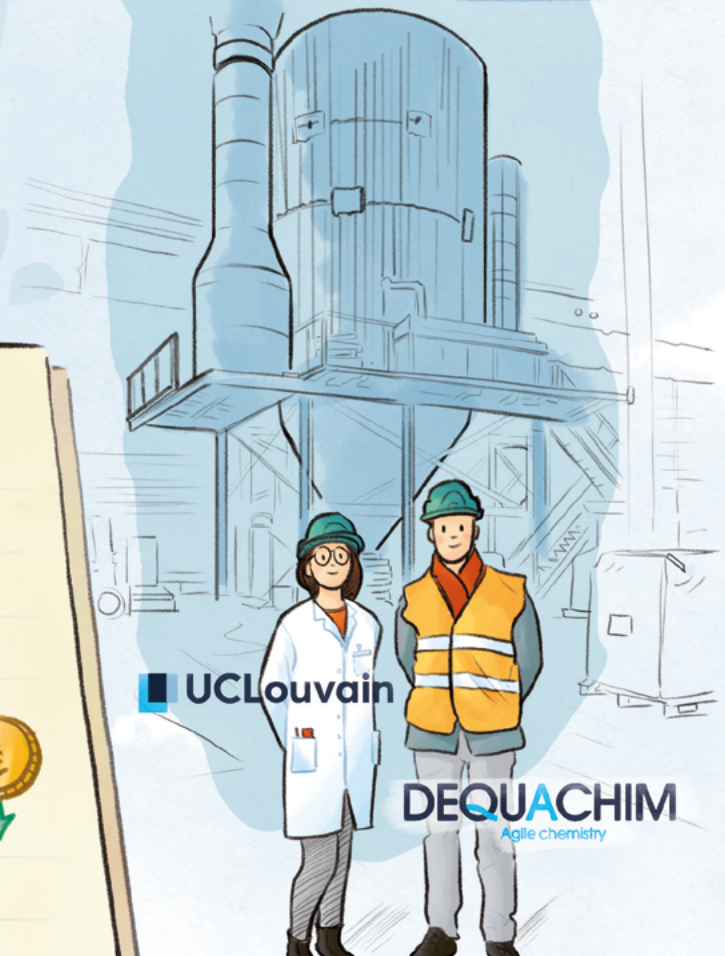
ATOMIZATION



LABO SCALE

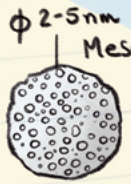


INDUSTRIAL SCALE



EXPECTED CHARACTERISTICS

1. High specific surface area and open porosity



2. Different crystal forms

3. Morphology

4. Highest purity

5. Boosting the catalytic potential of alumina powders by inserting of active elements

6. Low production cost and environmental impact

NADIA **GHOLAMPOUR**

COUNTRY OF ORIGIN	IRAN
COUNTRY AT TIME OF SUBMISSION	CHINA
DURATION	36 MONTHS
PROMOTERS ▾	
UCL (PROF. DAMIEN DEBECKER) | **WWW.DAMIENDEBECKER.COM**	
DEQUENNE CHIMIE (DR MAKHLOUF AMOURA) | **WWW.DEQUENNECHIMIE.BE**	

IN WALLONIA THANKS TO GHENT UNIVERSITY !

Nadia Gholampour obtained her master's degree in chemical sciences in Damghan, a city of 60 000 inhabitants, 270 kilometres northeast of Tehran. For just over four years, she was an assistant at Shiraz University before starting a PhD, from 2013 to 2017, at Wuhan University, in China, at the instigation of Prof Francis Verpoort, also a professor at Ghent University. «*This meeting, which was both unprecedented and very rich, enabled me to initiate my first contacts with European universities,*» explains Dr Gholampour. While waiting to formalise them, she continued her career with a post-doctorate in Shanghai before applying for a BEWARE fellowship.

«*In China, I worked on different types of heterogeneous catalysts, including metal complexes supported by polymers, different types of metal organic networks (MONs) and alumina-based catalysts,*» adds the researcher. «*But, above all, I absolutely wanted to combine an industrial component with my academic career,*» continues the woman who is currently working at the Catholic University of Leuven. «*This is one of the challenges I set myself, with a preference for Europe or the United States, as there is a significant language barrier in Asia for those who do not speak the language on a daily basis.*»

«*I knew Prof Debecker because I have been following his work since 2014 and it was quite natural that I turned to this team.*» Two interviews later, in association with the partner Dr Makhlouf Amoura from Dequenne Chimie, everything having come together, the project could be set up. «*I'm thrilled to be embarking on such an adventure because I know I'll have the opportunity to be exposed to many different aspects of industrial chemistry,*» she says. In addition to her research, Dr Gholampour is also involved in the life of her laboratory, «*one of the best.*»

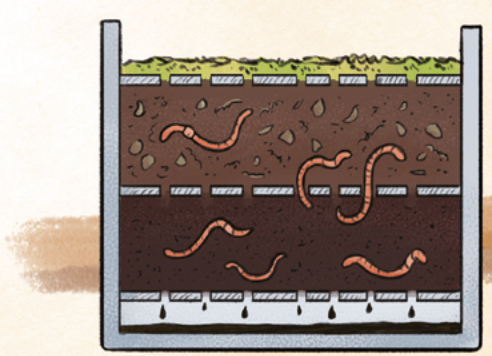
While the research project started at the end of October 2020 and it is still (somewhat) early to look ahead, Dr Gholampour is convinced that this mandate will not only strengthen her chances of obtaining a permanent research position but will also mark her personal life.

THE **SPRAY4ALU** PROJECT

In the context of the transition to a sustainable development model, heterogeneous catalysts specifically dedicated to the development of biosourced molecules need to be developed. In this field, alumina is a catalytic support of great interest.

However, the synthesis of alumina is a complex process.

The objective of the SPRAY4ALU project is to bring high value-added aluminas, dedicated to the manufacture of heterogeneous catalysts to market. These materials will have a competitive advantage in the context of catalyst preparation because they will develop favourable and customisable properties: specific surface area, porosity, crystallinity, primary crystal size and morphology, microparticle size and morphology, purity, doping. The research team will also aim for low production costs and a low environmental impact.



VERMICOMPOSTING

BIO

Circular economy

Liquid extracts

leaf spraying

Composting

Incorporation into the soil

Fertigation

DOES THIS VERMICOMPOST EFFECT ON INSECT PESTS?

UCLouvain

1 REPELLENT EFFECT ON INSECT PESTS

Olfactometer

Aphid

Blanco

Will it avoid the vermicompost ?

Will they focus on the not treated plant ?

2 EFFECT ON PLANT RESPONSE TO PEST ATTACK

Molecular analysis

Plant nutritional status analysis

Effect on life history traits of insect pest

Morpho-physiological measurement

MEY **JERBI**

COUNTRY OF ORIGIN	TUNISIA
COUNTRY AT TIME OF SUBMISSION	TUNISIA
DURATION	36 MONTHS
PROMOTERS ▾	
UCL (PROF. THIERRY HANCE) | **HTTPS://UCLOUVAIN.BE/EN/DIRECTORIES/ENTITIES/ELIV**	
PURVER (GRÉGORY SEMPO) | **WWW.PURVER.COM**	

WORMS AND INSECTS

After a preparatory cycle in biology/geology at the Higher Institute of Agricultural Sciences of Chott Meriem, in Tunisia, Mey JERBI continued her training at the National Agronomic Institute of Tunis where she graduated as an agricultural engineer specialising in plant protection. «I*n 2007*, explains the researcher, *I decided to continue my training with a masters of research in organic and integrated pest management in agriculture, co-directed by the Catholic University of Louvain and INAT.*» The internship at the Earth and Life Institute as part of Prof HANCE's team then paved the way to a PhD in agronomy, still under the co-direction of these two institutions.

Subsequently, from 2015 to 2017, Dr JERBI presented a series of lectures at the Faculty of Pharmacy of Monastir and the Higher Institute of Agricultural Sciences of Chott Meriem. «*In 2019, I had the opportunity to work as a researcher at the Regional Research Centre in Horticulture and Organic Agriculture. This post-doctoral position was funded by the European Union.*» There, her collective research project aimed to develop an effective essential oil-based bioinsecticide, «*which is really topical at the moment.*»

Today, the researcher is involved in a research project on the insecticidal potential of vermicompost in the BEWARE programme: «*I like to forge a link between basic research and the expectations of a private company in order to meet its objectives.*»

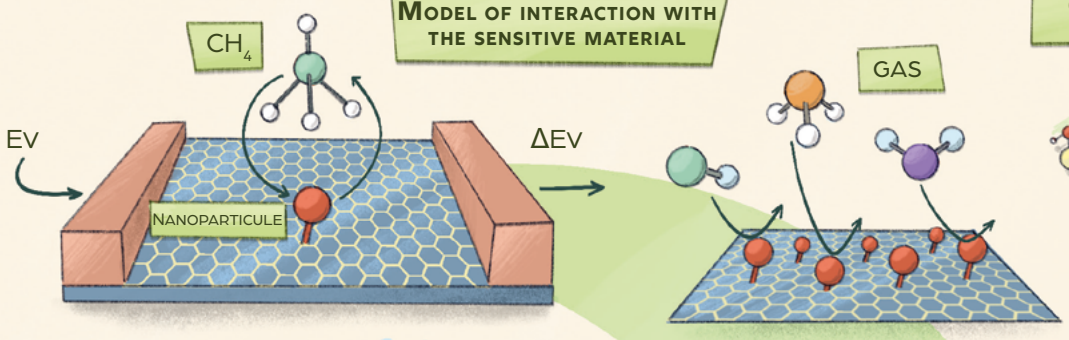
The VERMULSIF project is a truly integrated project between the two partners, the Catholic University of Louvain and PurVer, with a sharing of skills, equipment and a balanced work schedule. «*The relationship with the company is exceptional,*» she continues. Beyond this collaboration, it will also help to consolidate the partners' expertise in the context of the issue of biological protection of crops and their fertilisation and the recovery of green waste.

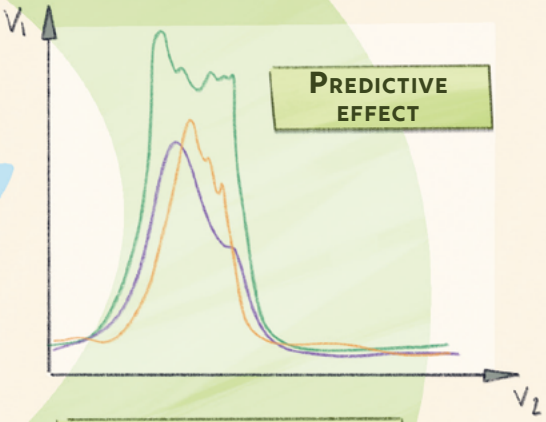
THE **VERMULSIF** PROJECT

The use of organic fertilisation instead of synthetic fertilisers increases crops' natural resistance to their pests. Indeed, thanks to a gradual release of nutrients, the sap contains less nitrogenous derivatives which decreases the plant's attractiveness and, in addition, produces more secondary metabolites, the activity of which repel or even be toxic to insects. These observations offer new possibilities for controlling phytophagous arthropods in crops. Vermicompost and its by-products seem to offer particularly interesting pest control in this sense. Its use also allows cultivation practices to be developed which respect the physicochemical and microbiological characteristics of the soil and consumers' health. The objective of the VERMULSIF project is to improve the quantification of the plant protection activity of vermicompost and understand the mechanisms involved. Firstly, the repellent nature of the vermicompost and its extracts will be tested at different concentrations on a series of phytophagous arthropods representative of the major pests in agriculture. Then, the negative effects on the pests in terms of survival and fecundity (either via an increase in plant resistance or via a direct action on the phytophagous arthropods tested) will be studied.

Simulation

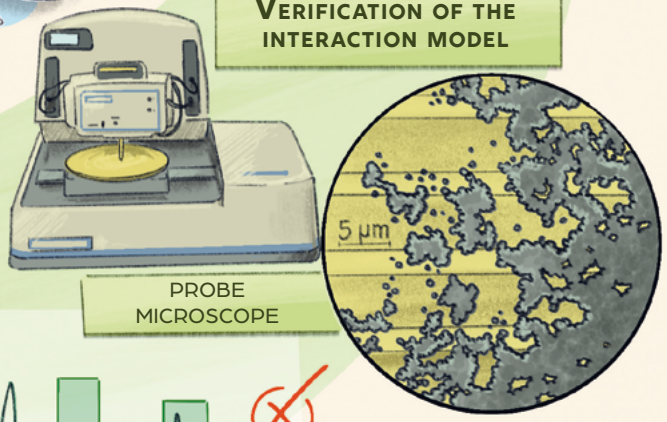
Model of interaction with the sensitive material



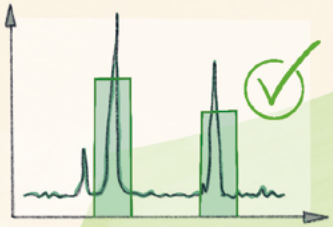


Predictive effect

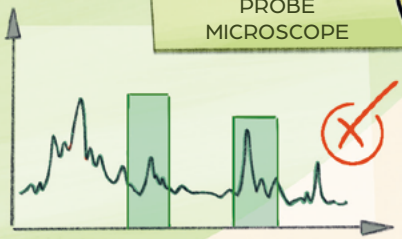
Verification of the interaction model



PROBE MICROSCOPE

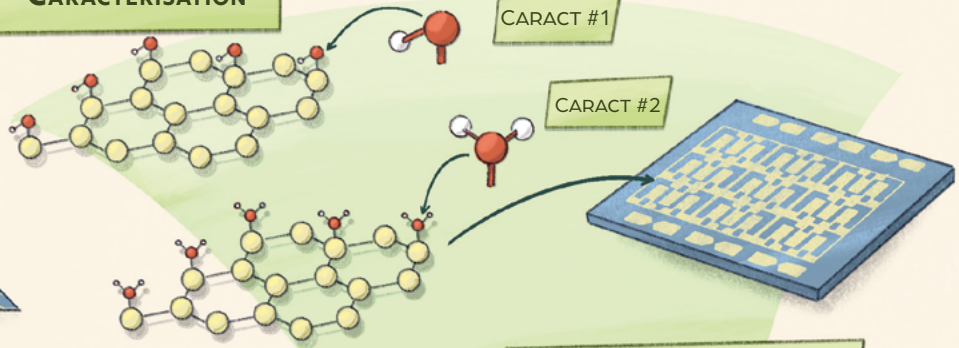


Model validation

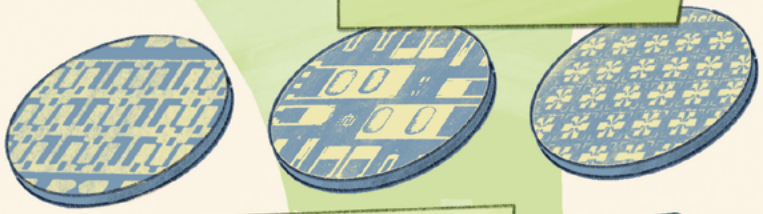


Formulation

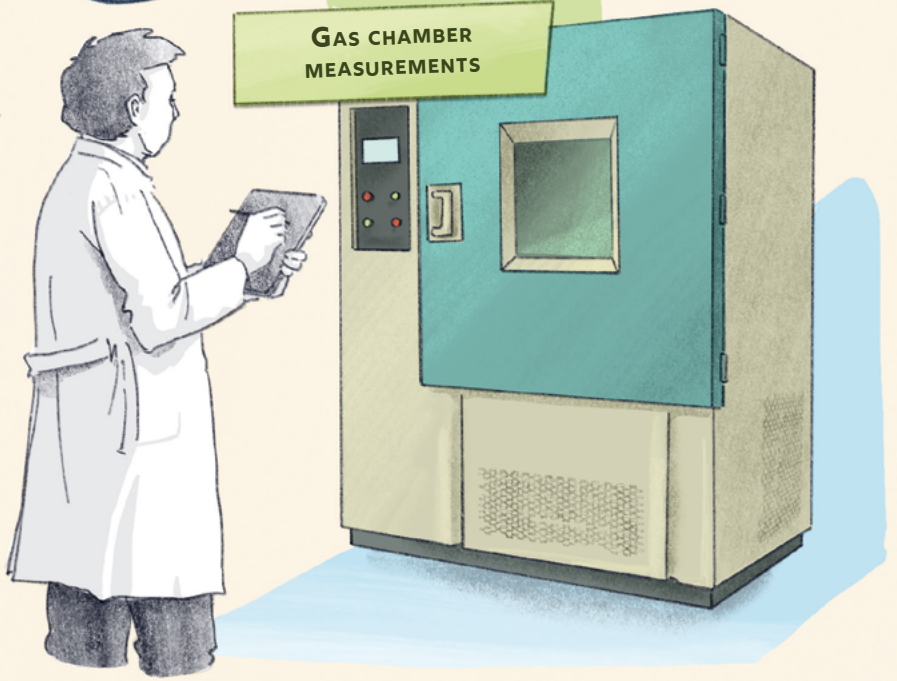
Caracterisation



Création de pouces sensibles



Gas chamber measurements



FERNANDO **MASSA**

COUNTRY OF ORIGIN	BRAZIL
COUNTRY AT TIME OF SUBMISSION	BRAZIL
DURATION	24 MONTHS
PROMOTERS ▾	
UCL (PROF. BENOIT HACKENS) | **HTTPS://UCLOUVAIN.BE/EN/RESEARCH-INSTITUTES/IMCN**	
VOCSENS (YANN DANLÉE) | **WWW.VOCSENS.COM**	

«I WANTED TO USE MY EXPERIENCE FOR RESEARCH»

After a master's degree in physics at the University of Sao Paulo, Fernando MASSA embarked on a doctoral thesis at the same faculty under the supervision of Prof Alain-André QUIVY, himself a doctor of the Université libre de Bruxelles...

However, it was at the Catholic University of Louvain in 2012 that he spent time as part of his research and then again in 2020, as a guest professor. But was in fact at the University of Rio de Janeiro where Dr MASSA taught various courses. «*It was a lot of work,*» he says. «*And truth be told, I wanted to use my experience to go into research, specifically in the field of applied physics.*»

And then, as it happens, thanks to an email sent by his university announcing the existence of the BEWARE programme, the researcher reconnected with his Louvain-based colleague. «*We work on common themes and are quite complementary: everything was in place to submit a project in partnership with the company.*» And he adds: «*I was very impressed with the research environment, the infrastructure, the state-of-the-art instruments and the talented and highly qualified people I was able to meet.*»

And a few hours later, the foundations of the project had been laid...

«*I arrived in Belgium without any major problems, except for a three-week delay,*» the Brazilian researcher observes. A precondition however, and despite the difficulties related to the health crisis, the presence of his wife so that he could thrive in both his private and professional life.

Dr MASSA has been involved in the ASPCIN project since April 2021. «*I am very excited about it,* he concludes, *especially since I intend to assist and support the co-sponsor in integrating technological innovation into the company's strategy to access new markets and implement organisational changes.*»

THE **ASPCIN** PROJECT

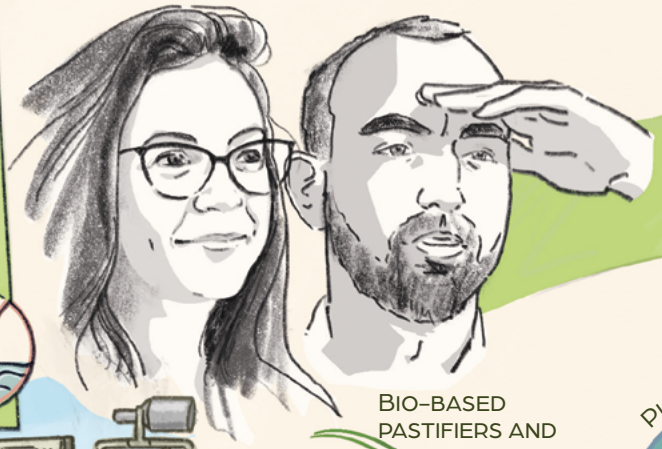
The ASPCIN project focuses on developing simulation and optimisation tools for nanostructures applied to sensitive materials specific to target gases as well as to the formulation and characterisation of these nanocomposites. The project is structured around the following two research components:

- the first part focuses on writing a model describing the interaction of specific gas molecules with the sensitive material (this model will predict the effect of adsorbed molecules on the transport properties; the model's robustness will be validated by comparing the outputs with the measurements of the transport properties at the local scale using advanced local probe microscopy techniques)
- the sensitive material (functionalised nanostructured carbon) designed for the selective detection of specific gases will be synthesized and measured in a gas chamber (the main target gas is methane; however, further developments are planned for the measurement of other gases (e.g. CO, CO2, SO_2, NO_2 and NH_3).

Our goals

Reducing the use of petrol-based plastics

Reducing the plastic pollution



A 100% biodegradable product

Packaging application

Edible ?

Compostable

Solvable

Food

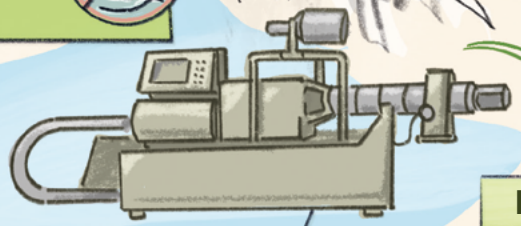
Healthy

Medical

Chemical ?

and more !

Bio-based pastifiers and additives

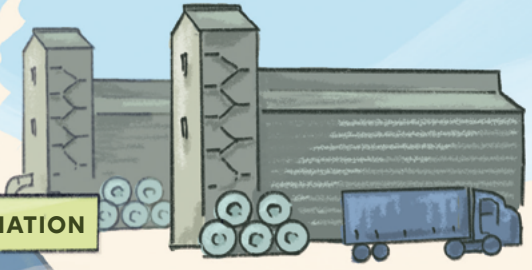


Toxic solvent free and green process

Lamination

Plastic pellets

Transformation



Co-produced starch

Plastic film

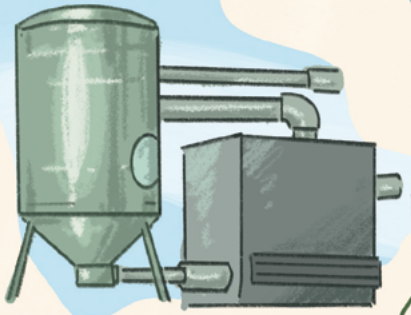
Final Product

100% biodegradable and biobased plastic film

UMONS Université de Mons SMPC

cosucra

PolyPea



Extraction

Uses

Food proteins

Pea plants

Biodegradable

Biomass

SERENA MARIA **TORCASIO**

COUNTRY OF ORIGIN	ITALY
COUNTRY AT TIME OF SUBMISSION	ITALY
DURATION	36 MONTHS
PROMOTERS ▾	
UNIVERSITY OF MONS (PROF. JEAN-MARIE RAQUEZ) | **WWW.UMONS.BE**	
COSUCRA (HEIDI JACOBS) ET POLYPEA (GILLES CRAHAY) | **WWW.COSUCRA.COM** ET **WWW.POLYPEA.BE**	

WHY NOT A PLANT-BASED PLASTIC ?

«*During my PhD in chemistry I studied the relationship between the structure of biodegradable polymers and their physicochemical properties,*» says Dr Serena Maria TORCASIO. «*The primary objective of this work was to modify and synthesize different structures for biomedical applications based on the biodegradable polymer polylactide (PLA), while using green chemistry*.» Indeed, because of the high toxicity of anti-cancer drugs towards healthy cells and the desire to attack only the diseased cells, the development of specific drug delivery systems represents the most efficient solution to this health problem.

Following this thesis, completed at the University of Messina in Italy, the researcher then went on to conduct research work there with a few stays in Mons. «*That's when I learned about the BEWARE programme and decided to submit a proposal, along with two industrial partners and the academic sponsor*.»

However, and although this not a complete turnaround, her core research now focuses on materials. «*Curious by nature*, she confides, *I want to use my knowledge of chemistry to develop better materials and learn about their manufacturing processes on an industrial scale*.»

«*The aim is to develop materials that are green in their composition as well as in their production process,*» continues the researcher. «*The chemistry of biocompatible and biodegradable materials is a more sustainable chemistry than others and receives more attention, for example through the development of solvent-free techniques, operating under temperature and mixing conditions suitable for specific polymerisations*.»

The main complexity of the research lies in finding the perfect balance between the different additives to be combined with pea starch, used as the majority component in this project.

«*For these reasons, my knowledge is useful in developing a procedure that will lead to the formulation of biodegradable and water soluble films, based on pea starch,*» continues Dr. TORCASIO.

Of a real value in sustainable development, these new starch-based films will however have to be competitive in order to enter markets such as packaging and other food films.

THE **WPEAFILMS** PROJECT

Plastics derived from oil resources pose a growing threat to the environment and biodiversity, especially if they are single-use or have a very short life cycle. The need for alternative solutions to traditional plastics has been felt for several years and is gaining momentum with recent environmental movements. Bioplastics are one of the proposed solutions that are becoming increasingly prevalent on the market and starch, mainly from corn or potatoes, is a recurring component.

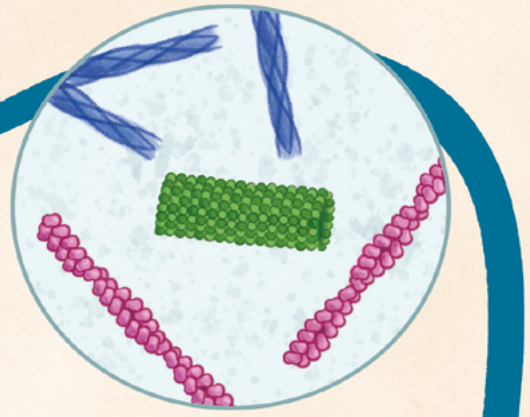
The objective of the WPEAFILMS project will be to develop a biosourced, biodegradable and water soluble film from thermoplastic pea starch. In particular, this type of plastic can be used to replace polyvinyl alcohol, a petroleum-based plastic, in packaging applications for cleaning products such as dishwasher tablets, which would have a genuine, large-scale, positive ecological impact.

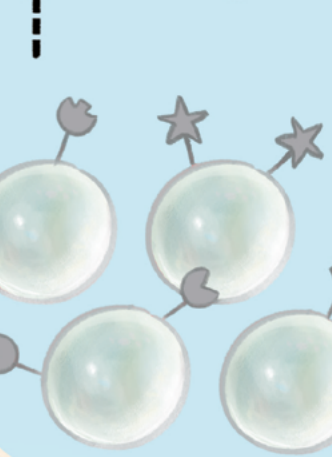
Notélé regional TV channel

REPORT

UNIVERSITÉ DE NAMUR

PROTEIN MIX





SILICA BALL

Appropriate porosity

Focused functionality

1. MONODISPERSITY NARROW
2. EXCELLENT RESISTANCE UNDER HIGH PRESSURE

PURIFIED PROTEINS

HIGHLY SELECTIVE RESULTS

- Reduced costs
- Easy to use
- Low impact

IVALINA **TRENDAFILOVA**

COUNTRY OF ORIGIN	BULGARIA
COUNTRY AT TIME OF SUBMISSION	SLOVENIA
DURATION	36 MONTHS
PROMOTERS ▾	
UNIVERSITÉ DE NAMUR (PROF. BAO-LIAN SU) | **WWW.UNAMUR.BE/SCIENCES/CHIMIE/CMI**	
SECOYA (ADRIEN DEWANDRE) | **WWW.SECOYA-TECH.COM**	

SILICA FOR PROTEINS PURIFICATION

Dr Ivalina TRENDAFILOVA is Bulgarian and currently based at the University of Namur under the BEWARE programme. Her mandate was the result of several timely meetings.

How did you find yourself in the heart of the Walloon capital ?

IT – *I have a traditional researcher background. After my master's degree in chemical sciences at Sofia University, I started my PhD at the Institute of Organic Chemistry with Center of Phytochemistry which is part of the Bulgarian Academy of Sciences and then a post-doctorate in Slovenia, at the National Institute of Chemistry in Ljubljana follows. In 2018, I took part in the* 4th International Conference on Advanced Complex Inorganic Nanomaterials, *a world-renowned conference of a particularly high standard in the field of inorganic nanomaterials, organised by Prof SU in Namur. I had the opportunity to chat with him, visit his laboratory and to assess the research atmosphere. I then expressed my wish to do a post-doctoral or short-term stay. In February 2020, Prof SU was giving a presentation in Ljubljana, and once again we discussed a potential collaboration.*

Then the MICROSPHERES project was submitted and selected…

IT – *Exactly, working closely with the partner company, we will work on the development of porous and monodispersed functionalised silica microspheres for protein purification. This research is also an opportunity to work with other laboratories at the University of Namur, including the* Namur Medicine and Drug Innovation Center (Namedic) *of the Faculty of Medicine. It is a very global project.*

International collaborations are also planned.

IT – *Yes, in addition to the continuing education provided by participating in various conferences, together with Prof SU, we have planned two stays, one at the laboratory of Prof Kazuki NAKANISHI at Osaka University in Japan, and the other with Prof Michel WO-CHI-MAN at the University of Montpellier. There I will further my knowledge of the chemistry of silica surfaces. Both these laboratories already have close partnerships with the one in Namur.*

You have also been able to rely on the support of a former BEWARE researcher !

IT – *Indeed, within Prof Su's team Tarek BARAKAT* (see Vol.1) *helped me through the initial administrative procedures, which is always very useful.*

THE **MICROSPHERES** PROJECT

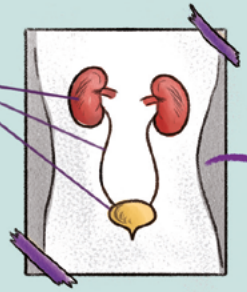
The significant development of biotechnologies in the Walloon Region has made it possible to bring these new generation drugs to market. Unfortunately, it is very costly to produce these peptide and protein molecules due to their complexity. While producing the proteins of interest by fermentation is reasonably priced, their purification to separate them from numerous contaminants (other proteins, cellular waste, etc.) requires up to eleven chromatographic steps and represents about 80% of the production costs for the protein of interest.

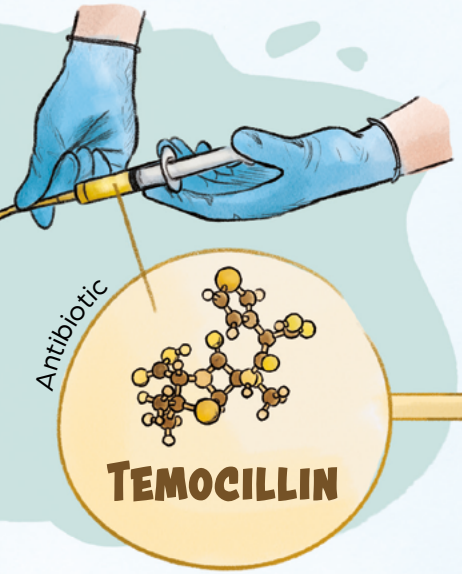
The MICROSPHERES project aims to develop porous microspheres for the highly selective purification of proteins with a reduction in terms of cost, productivity and environmental impact. The benefits of the project will be multiple:

- reduced production costs for an expanding market in Europe
- increased accessibility to new generation drugs by the public
- a significant reduction in the use of resources through the use of soft, green and energy efficient technologies.

URINARY TRACT INFECTION

E. Coli
K. Pseudomonas





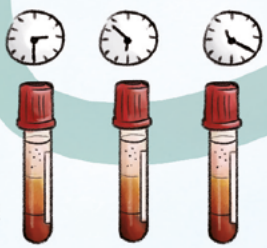
OUR GOALS

Cure the patient

Avoid side effects

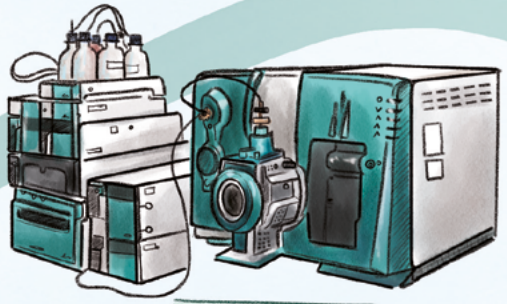
What dose ?
How long ?
How many times per day ?

PHASE I



Bood samples

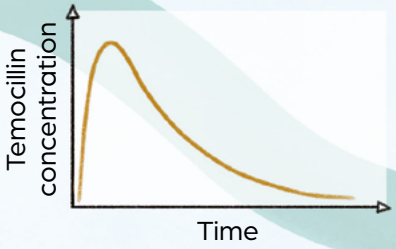
Drug concentration measure



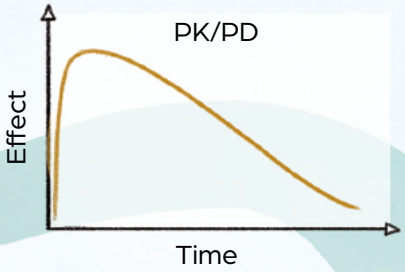
LC-MS/MS

PHASE III

PharmacoKinetics (PK)



PK/PD

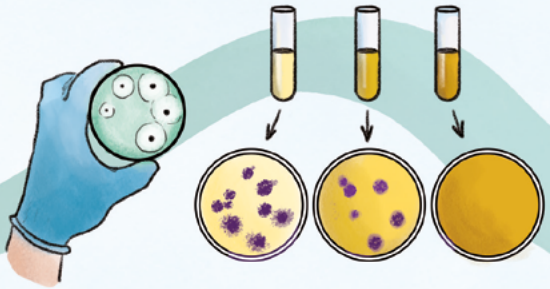


Same process

PHASE II

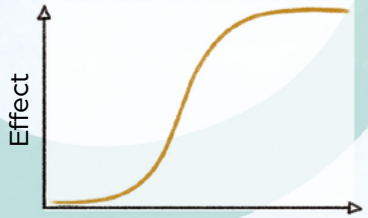
Patient's bacteria

Drug susceptibility measure



Tests in the lab

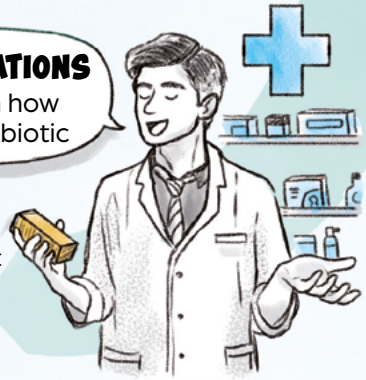
PharmacoDynamics (PD)



RECOMMENDATIONS

to doctors on how to use the antibiotic

- higher or lower dose
- more or less frequent administration
- longer or shorter treatement



GERT-JAN **WIJNANT**

COUNTRY OF ORIGIN	BELGIUM
COUNTRY AT TIME OF SUBMISSION	UNITED STATES OF AMERICA
DURATION	36 MONTHS
PROMOTERS ▾	
UCL (PROF. FRANÇOISE VAN BAMBEKE) | **HTTPS://UCLOUVAIN.BE/EN/RESEARCH-INSTITUTES/LDRI**	
EUMEDICA (SÉBASTIEN VAN DE VELDE) | **WWW.EUMEDICA.COM**	

COMBINING SCIENCE AND HUMANITARIAN AID

«*I always wanted to work in science and humanitarian aid,* says Gert-Jan Wijnant, *and that's why after my pharmacy degree at Ghent University, during which I completed an ERASMUS stay in Spain, I studied tropical medicine and international health for a year at the Institute of Tropical Medicine in Antwerp.*»

In 2015, the researcher had the opportunity to combine his interests in pharmacology and microbiology through a PhD at the London School of Hygiene and Tropical Medicine, as part of the Innovative Training Network Euroleish (which, like BEWARE, is integrated into the European Commission's Marie Skłodowska-Curie Actions). There he developed new pharmacokinetic and pharmacodynamic methods to aid in drug discovery for cutaneous leishmaniasis, a neglected tropical disease. His work has also led to successful partnerships between pharmaceutical companies and the non-profit drug research organisation Drugs for Neglected Diseases initiative in Geneva.

«*After completing my PhD in October 2018, I took part in two projects on leishmaniasis in India where this disease is highly endemic. After successfully applying for three travel grants, I brought the microdialysis technique from the lab bench to the patient bedside in Kolkata, West Bengal,*» says the researcher. «*While there, I worked with the Institute of Postgraduate Medical Education and Research to study the clinical skin pharmacokinetics of the drug miltefosine in patients, for the first time. I then completed a second project in India on antileishmanial therapy in Patna, Bihar, on drug susceptibility testing at the Rajendra Memorial Research Institute of Medical Science.*»

It was after meeting a Belgian researcher living in the United States that Dr Wijnant headed for New Jersey. There he moved from leishmaniasis to tuberculosis. He spent two years there before taking advantage of the lockdown to file a BEWARE project and return to Belgium. «*Clinical research is more in line with my expectations and is of major interest to society,*» he says. And the REBEL project fits perfectly into this framework, as it studies the use of antibiotics in patients suffering from renal failure.

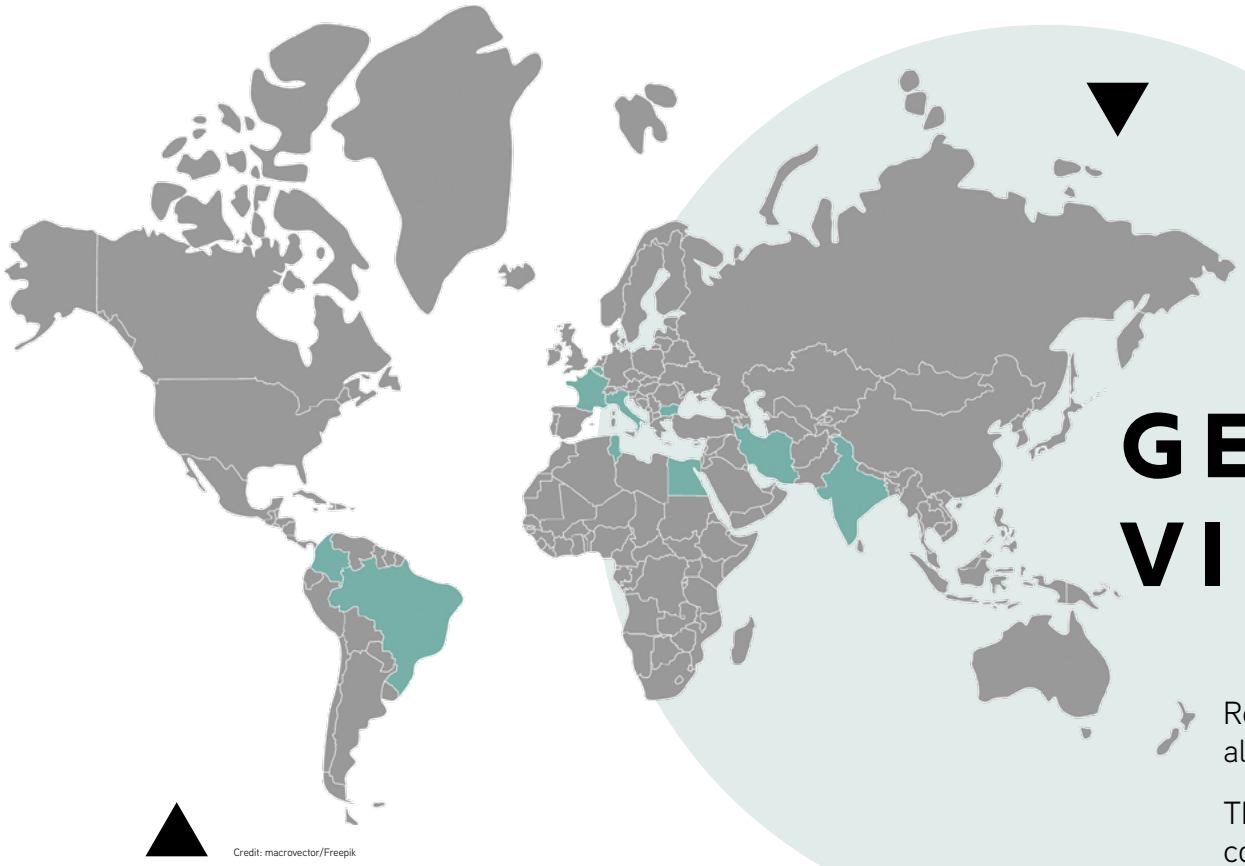
Note: Leishmaniasis is a parasitic disease that causes visceral, cutaneous or mucocutaneous disorders.

THE **REBEL** PROJECT

Antibiotic resistance is a serious problem. Few new antibiotics active against drug-resistant bacteria are put on the market. An alternative strategy is to reintroduce older antibiotics. However, their properties have not been studied in accordance with current standards. The company related to the REBEL project markets drugs with niche indications, including antibiotics.

The project's objective will be **(a)** to characterise the microbiological activity of such molecules on recent collections of clinical isolates and to optimise the methods of measuring this activity to make them robust and reproducible and **(b)** to study the pharmacokinetic profile (evolution of the concentration in the blood) of one of these molecules in patients with varying degrees of renal failure in order to propose an optimised dosage for such patients.

LIST OF RESEARCHERS



Credit: macrovector/Freepik

GEOGRAPHICAL VIEW

Researchers engaged by the BEWARE programme come from all continents.

They contribute to the influence of companies, universities, colleges and research centers of Wallonia.

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