

A year
in stories
2022



OPENING
NEW
HORIZONS



In this yearbook

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Jo Brouns

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Flanders is at the European top when it comes to research and innovation. Flemish researchers are getting amazing results and are very much in demand inside and outside Europe. In Horizon Europe, the European framework programme for research and innovation, we consistently use more research resources than we contribute. Additionally, our researchers are often asked to be partners in European ERA-NET projects and Partnerships. "Flanders can be proud of its researchers," says minister Jo Brouns. "We support them as much as possible through many sources, including FWO."

Researchers from Flanders are very successful and receive quite a lot of European subsidies. To what do we owe those good results?

Jo Brouns: "It has to do with a combination of factors. Flanders offers outstanding higher education, and we give talented researchers sufficient and equal opportunities to participate in it and keep growing. We also have strong regional educational roots, from which we can send our best researchers to Europe and the world."

What role does the Research Foundation – Flanders (FWO) play in this success story?

"A crucial role! Firstly, FWO offers major support programmes for fundamental and strategic research projects, and for predoctoral and postdoctoral researchers. Furthermore, FWO has created

"FWO support can make the difference for researchers who are keen to be active at European level"

a 'safety net' for promising researchers who do not fully qualify for European subsidies. For example, Flemish candidates who just missed getting their Starting or Consolidator Grant from the European Research Council (ERC), or postdocs who are not quite eligible for a European Fellowship of the Marie Skłodowska-Curie Actions (MSCA). In this way, FWO support can make the difference for candidates who are keen to be active at a European level."

"FWO also makes resources available for research infrastructure and international mobility. Via the brain gain programme Odysseus, we try to attract top scientific talent to our region – even returning locals. These are all indispensable building blocks for establishing a solid

foundation from which European and global stories can emerge."

How can we make sure there will still be European support for Flemish research in the future?

"We must certainly continue our investments in Flemish research via FWO. But that will not be enough: we must also make sure we keep track of advances in the research world. Obviously, it remains important to publish the results of outstanding research in high-quality journals, and to translate those results into innovations and patents. But the definition of 'excellent research' can vary. If the European Commission and other European partners change their evaluation principles, we need to be able to react to them fast."

"FWO monitors these developments, together with other Flemish partners. In 2022, the foundation signed the Agreement on Reform of Research Assessment. We also joined the Coalition for Advancing Research Assessment (COARA). Through our scientific policies, we want to create an environment in which free and creative research can flourish optimally, in Flanders as well as in Europe. I wish FWO and all Flemish researchers and research groups every success with their activities and with their European and international collaborations."

Willy
Verstraete



Hans
Willems



“With
European
funds,
we elevate
Flemish
research to
a higher level”

Flanders and the EU, it must be said: we score. And that 'we', that is all of us: all the FWO researchers who, together, have the privilege of exploring an ever-changing scientific landscape.



Flanders is at the top when it comes to receiving European support for research and innovation. Our researchers receive more resources from the European Framework Programme than their peers from other countries, plus the amount is higher than what we ourselves contribute to the European budget.

FWO specifically prioritises the recruitment of European research funds, as they help elevate Flemish research to a higher level in terms of scope and quality. The European Commission's contributions are nice extras that supplement the hard work that the Flemish and federal governments are already doing in that respect. Additionally, every collaboration inside and outside Europe yields another important benefit. To practise science at a high level, it is crucial for researchers to exchange ideas, learn from each other, and confront each other with their diverging views. We therefore try to encourage that with a whole range of instruments.

When setting up new European research consortia, Flemish researchers have been especially welcome for many years. This excellent reputation fits with our strong regional knowledge structures. FWO makes an important contribution with its support programmes for predoctoral and postdoctoral fellowships, research programmes, infrastructure and mobility.

“Flemish researchers are especially welcome in European consortia”

Specifically, FWO makes resources available for Flemish candidates who do not fully qualify for European subsidies: for example, researchers who just missed getting their Starting or Consolidator Grant from the European Research Council (ERC), or top candidates who did not quite make the waiting list for a European Fellowship of the Marie Skłodowska-Curie Actions (MSCA).

We are active in several European Commission programmes such as ERA-NETs and Partnerships, in order to finance European consortia jointly with other national and regional players. Besides these thematic involvements, there is the WEAVE programme, which makes bilateral and trilateral collaboration of research teams across national boundaries possible.

The research infrastructure financed by FWO also has an international dimension, more precisely through the IRI programme (International Research Infrastructure). FWO likewise offers a wide range of possibilities for mobility and international scientific consultations. With the brain gain programme Odysseus, we pay extra attention to strengthening scientific funding in Flanders.

Finally, we coordinate the National Contact Point Flanders, supporting potential users of funds in the European Framework Programme, in collaboration with Flanders Innovation & Entrepreneurship (VLAIO).

Since the foundation of FWO, now 95 years ago, Flanders has made spectacular progress in the fields of science and innovation. From being the least developed and prosperous region of Belgium, we have grown into one of the strongest economies and



“In addition to financial support, collaborations produce new ideas”

knowledge societies of Europe. A great deal has been invested in the cultural and intellectual education and development of the Flemish population, with great openness to Europe and the world. We have also consistently and transparently managed and spent our resources as researchers. Now that we are celebrating FWO's 95th anniversary, we want to continue on this path in the future.



“A 3D image
of nanoparticles
is crucial to
developing
reliable
applications”

Sara
Bals
UAntwerpen

The European Research Council (ERC) fosters scientific research in Europe by financing excellent researchers. With Professor Sara Bals (UAntwerpen), an FWO study into electron tomography led to three ERC grants for the 3D structure of nanoparticles: first a Starting Grant, now a Consolidator Grant and a Proof of Concept Grant.

catalysis, or fight cancer cells. But scientists often notice that nanoparticles quickly lose their activity. We want to investigate why. Does the form of a nanoparticle change, for example if it is exposed to warmth or high-pressure? By visualising the 3D structure, it becomes possible to find the cause of the degradation, and make nanomaterials more stable."

"Let me give you a concrete example. Some nanoparticles are hollow inside. In a medical context, you could fill the inside with a specific medicine. Via receptors, the particle can attach itself to a tumour cell. If the patient is subsequently given radiation with laser light, warmth ensues as a result of the interaction between the particle and the laser light. This allows the nanoparticle to release the medicine in a very sustained, controlled way. This is how we fight tumour cells without damaging the healthy cells. I should mention that I'm not a doctor, but with my research I want to help create this type of applications."

"The three-dimensional form of a nanoparticle determines how it will react to laser light. Is it spherical,

Professor Sara Bals works at the Physics Department of UAntwerpen and specialises in transmission electron microscopy. In the context of her ERC Consolidator Grant, which she got in 2019, she wants to develop tools to visualise the 3D structure of nanomaterials. A realistic picture of the behaviour of nanoparticles is crucial to developing reliable applications, for example for hyperthermic cancer treatment.

Why is it so important for us to be able to visualise the 3D structure of nanomaterials?

Sara Bals: "Many nanomaterials are designed with a specific function. They are intended to store data, improve chemical processes like



tubular, a cube? By visualising the structure, we can figure out the most suitable wavelength to activate the particle. We need to do this again and again for each application, because shapes vary."

How is a 3D image of nanomaterials created?

"Nanoparticles are too small to visualise with normal light, which is why we use electrons. In our lab, we practise 'transmission electron microscopy': the light source of our microscope is an electron source, and instead of glass lenses we use electromagnetic lenses. With electromagnetic fields, we can create a focusing mechanism: just like in a 'regular' microscope, but for electrons to visualise much smaller objects. This is how we study nanomaterials. The microscopes of UAntwerpen are among the most powerful in the world."

"Plus, our research group is really good in data processing. With our

"Like an FWO grant, a European ERC grant offers a lot of academic freedom"

mathematical algorithms, we can convert the images of our electron microscope into the three-dimensional shape of a nanoparticle. These 'smart' reconstruction algorithms already existed in the medical sector, but we have transformed the concept into an equivalent approach for electron microscopy."



“An FWO fellowship is like a quality label: as a researcher you are immediately taken more seriously, also at the European level”

What makes your research so unique?

“What’s innovative about our research is that we examine nanomaterials in three dimensions, and that we do it under real-life conditions, and not in the artificial environment of an electron microscope.”

“To create 3D images we use tomography. You can compare that to a scanner in a hospital: images are taken from various angles, and you combine those 2D images on the computer to arrive at a 3D reconstruction. However, our electron microscope is much larger than a medical scanner: it’s a machine several metres tall. This is why the microscope does not turn around the nanoparticle. We turn the nanoparticle in the microscope so that we can make still more projections.”

“With my first ERC grant, I investigated the 3D structure of nanoparticles in a traditional research environment:

at room temperature and in an ultrahigh vacuum. But those results tell us little about how nanomaterials will react under real-life conditions. For this reason, the second project now focuses on visualising nanoparticles in a more real-life setting, for example under high pressure or at high temperatures. Because nanomaterials change very quickly under such conditions, we have had to expedite our observational techniques. A ‘standard’ tomography session can easily last an hour, but we have sped up those takes to last a few minutes. And based on a single two-dimensional image, we have also developed new methods to make a reliable estimate of the three-dimensional model. In this way, we can map how nanomaterials will react in a real-life setting.”

How did you succeed in getting European financing? And what role did FWO play in it?

“My first projects concerning tomography – now several years ago – were financed by FWO. At the same time, I was promotor for several FWO PhD fellows who were working on their doctorates. The various projects led to publications in several leading scientific journals. This is how I accumulated sufficient support, knowledge and experience to apply for my first ERC Starting Grant, and afterwards also my current ERC Consolidator Grant.”

“The main advantage of European subsidies is obviously that the budgets are much higher. An ERC grant offers financing for 5 years: it allows you to accept several doctoral students or postdocs, so you can put together a good team. Furthermore, like FWO grants, ERC grants offer a great deal of scientific freedom. The results are obviously evaluated, but as a researcher you are free to try out different working methods and solutions. You aren’t bound by strict requirements when

it comes to reporting, deadlines, deliverables ... Plus, a European project like this often generates new ideas for FWO projects, so the two systems strengthen each other.”

“What I find most valuable about FWO is that they offer young, promising researchers the chance to become familiar with the amazing aspects of the research world. A doctoral grant is a real stimulus for young researchers who are just starting their careers. I myself did my doctorate as a PhD fellow, and later I frequently collaborated with FWO. For example, when I wanted to start a first research group around electron tomography in Antwerp after a year in the US, FWO offered me the opportunity. This helped me develop my own identity as a researcher.

I am so grateful for the support that I’ve always received from FWO. What’s more, within Europe FWO is seen as a quality label: if you can say that you got an FWO fellowship, people in your research field do take you a bit more seriously.”

What do you want to do in the future?

“In the current project, we are mainly researching the impact of pressure and temperature on the interactions of nanoparticles. In the future, I would very much like to add the influence of light to this. For example, photocatalysis, in which a reaction is accelerated when you shine light on certain materials. Nanoparticles are often shined on with a laser beam to induce interactions: this not only produces warmth, but also light. I would like to explore that further.”



Milos
Nesladek
UHasselt

“Diamond qubits
surmount warmth
threshold for
large-scale
quantum
computers”

Unlike regular PCs, quantum computers work with what is known as 'qubits'. Most qubits function only at extremely low temperatures of about -273 degrees Celsius. In the research project ERA-NET QuantERA II: MAESTRO, Professor Milos Nesladek (UHasselt) joins the search for a quantum processor that also works at normal environmental temperatures. The project receives national as well as European financing.

The MAESTRO project presents a new approach to developing qubit architectures that can work in environmental conditions. Can you explain some more?

Milos Nesladek: "Quantum computers cannot be compared to normal PCs. The functionality of a standard computer is based on logical processors that use 'bits' to process data. A bit has a value of 0 or 1. In quantum computers, the bits are replaced by 'qubits'. The value of a qubit can also be 0 or 1, but in superposition a qubit simultaneously has a value of 0 and 1. Compare this to throwing up a coin. So long as the coin is turning in the air, the value is not head or tails, but head *and* tails."

"A quantum processor manipulates qubits. These manipulations occur on both the value 0 and the value 1. When the number of qubits increases, the computing power rises exponentially. A quantum computer can therefore perform a great deal of calculations simultaneously. Unfortunately, to achieve this most qubits, such as superconducting qubits, need to be cooled to 0 degrees Kelvin, or -273 degrees Celsius. This is because a qubit itself has very little energy. In a warm environment, qubits lose their spinning rotation and therefore also their energy, meaning that all the information is lost. The holy grail of quantum hardware are

Professor Milos Nesladek specialises in quantum and solid-state physics and works at the Institute for Materials Research of UHasselt. In the context of the MAESTRO project, he conducts research into solid-state qubits. These also work in normal environmental conditions, which can advance the long-awaited scale increase of quantum computers.

qubits that function at a more normal environmental temperature."

How do you want to create those more efficient qubits?

"Nowadays, quantum computers use 'entanglement'. You could see this as a cabinet with two outputs: when something changes in one part, it leads to a similar change in the other part, without the need for physical contact. Then, information from two different environments can be mutually communicated. In 2023, the computer giant IBM succeeded in creating more than 400 entangled qubits. In theory, that makes 2^N parallel operations possible, even if the maximum capacity isn't yet reached."

"Scaling up superconductive computers is difficult because the cooling technique is very complex and energy-intensive. Within the MAESTRO project, we are working on qubits that can function at room temperature."

"Specifically, we are working on solid-state qubits in diamond. Diamonds consist of pure carbon that becomes crystallised under high pressure or at high temperatures. At UHasselt, we mimic the process artificially by using what is known as chemical vapor deposition. To make a qubit, we replace one carbon atom by nitrogen and leave another atom out, so that an empty space is created."

"By also financing fundamental research without direct applications, FWO plays an important role"



"That defect in the diamond grid contains an electron spin and can be used as a qubit. Because the qubit is part of a very stable and compact system – the diamond – the loss of spin rotation is small when the environment warms up. Thanks to this, a diamond qubit can survive for a few milliseconds even at higher temperatures, which is already a hundred times more than cooled superconductive qubits."

"Our goal is to manufacture a small quantum processor based on solid-state qubits and entanglement. It is a visionary concept for which a lot of fundamental research would be needed. We have already manufactured two diamond qubits that are entangled with each other via a two-qubit port. Toward the end of the project, we want to get at least six operational qubits and connect them to each other. That doesn't seem like much, but it's how it ultimately becomes possible to further scale up the quantum technology."

What benefits do quantum computers offer compared with standard models?

"Quantum computers are not suitable for all types of calculations, but for specific tasks they do offer enormous potential. Thanks to the enormous calculating power of quantum computers, the computer modelling of many different processes can go much faster, for example. This offers many possibilities for speeding up pharmaceutical research and development processes. The same goes for the development of catalysers for chemical processing, the production of green energy, weather or economic models, the financial sector, the healthcare sector, and many others."

"Additionally, quantum computers enable existing data to be searched much faster. Because the processor can make parallel calculations in one go over large amounts of data, it becomes easier to find an item. And what's more, the information

that quantum computers exchange is practically impossible to hack. On the other hand, the extensive calculating power does allow processors to be able to crack the safety systems of regular computers. We need to be prepared for that."

The MAESTRO project can count on national and European financing. How does that work?

"Europe attaches great importance to technological research. Via the 'Digital Europe' programme, the European Commission finances studies into digital and quantum technologies. 'Flagships' are set up for important technological challenges: large-scale and long-term research initiatives in which researchers, businesses and governments join forces. One of those landmarks is the Quantum Flagship. The QuantERA programme, part of the European Research Area Networks (ERA-NET), is part of that."

"QuantERA is a European network of nearly 40 organisations that conduct research into quantum technologies. Because MAESTRO falls under QuantERA, we receive financial support from Europe and can consult the knowledge network. The MAESTRO partners can also count on financing from their respective governments, for example via FWO. This collaboration goes via the European Joint Programme Cofund (EJP Cofund). The EJP Cofund, framed within the Horizon Europe programme, joins the various national budgets and coordinates the collaborations. Horizon Europe often contributes with some of its own financing."

What role does FWO play in this story?

"Each of the European teams of MAESTRO makes its own contribution. For example, the German team specialises in the manufacturing of qubits. At UHasselt, we have developed a new technique to read out the value of a qubit: a high-risk and visionary project."

"The Flemish contribution to MAESTRO is financed by FWO. That's important because it involves fundamental research, although we cannot guarantee in advance that it will produce successful applications. In European projects, there is often little scope for fundamental research: clear possibilities should preferably already be on the horizon. By financing fundamental research without direct applications, FWO plays a very important role."

What do you want to achieve in the coming years in terms of your research field?

"Now that we have developed our techniques to read out spin-state qubits, we want to share our expertise and make our approach available on an international scale. We are ready to make our fundamental research more practical. At the moment, a variety of technologies are being tested worldwide to launch quantum computers on a large scale, but we believe that the MAESTRO method, with diamond qubits, is extremely competitive. This is why we are preparing a large-scale European project. With our method, we also want to explore new fields and applications, such as quantum sensors, thermodynamics and quantum motors."



Caroline
De Tender

UGent
and ILVO

“Circular
potting soil
can considerably
reduce the
footprint of
greenhouse
horticulture”



The European research project Horti-BlueC focuses on sustainable and circular raw materials for greenhouse horticulture. This helps growers make considerable environmental and climate gains. Professor Caroline De Tender (UGent and ILVO) examines the valorisation potential of organic waste flows such as biochar and chitin, in order to develop more sustainable potting soil.

Horti-BlueC is part of the Interreg 2 Zeeën programme, which stimulates collaboration between Flanders, the Netherlands, France and England. The project wants to prove that it is feasible to produce sustainable and innovative potting soil for glasshouse cultivation. By using fewer fossil fuels, chemical crop protection agents and fertilisers, CO₂ greenhouse emissions can be drastically reduced.

Horti-BlueC focuses on sustainable and circular raw materials for greenhouses. Why is that so important?

Caroline De Tender: "Currently, the greenhouse sector uses a lot of potting soil based on peat. That peat is sourced from pristine peatland, which negatively impacts the sensitive ecosystems in those regions and the carbon dioxide that is stored there. In many cases, it leads to higher emissions of greenhouse gases. Furthermore, potting soil is mostly used only once, which is not sustainable.

Within the Horti-BlueC project, we investigate two things: whether we can replace the peat in the potting soil with something else, and whether potting soil can be used more than once."

"Peat has two very important properties: it makes plants grow well and it protects against soil-borne diseases. Any alternatives for peat must have the same positive properties. In my research, I develop substrate mixtures of biochar and chitin, and investigate whether those mixtures have a positive effect on plant growth and the health of lettuce and strawberry plants."

What are biochar and chitin, and what role do they play in circular potting soil?

"In fact, biochar is a by-product of biogas and bio-oil. It is a charcoal-like product that is used, among other things, as a soil enhancer. Chitin is the residual flow of crab and shrimp waste. By adding these two substances to the potting soil, plants need fewer fertilisers and crop protection agents to stay strong and healthy. Chitin is especially valuable, because it is a source of renewable nitrogen. The microorganisms in the potting soil ensure that the fertilisers are released, so that the plant can grow better.

What makes the Horti-BlueC project so cutting-edge? What do you want to achieve with it?

"Our most important goal is a major shift in materials for horticulture. We want to encourage growers to opt for less peat in the potting soil, and to apply used cutting soil a second or third time. Obviously, this is only possible if the potting soil contains sufficient nutrients, which is why we

look at the upcycling potential of five different waste sources. For me, these are biochar and chitin."

"To ensure the sustainable character of the project, the preference goes to upcycling local residual flows. The most important source of chitin, for example, is shrimp shells: to gather them we could collaborate with our own fishery sector in the North Sea. A grower would then be able to place a major fermenter on their domain, to directly process shrimp shells enzymatically."

"The project is quite ambitious: we are working on a new greenhouse concept that uses 30% less fossil fuels, 30% less crop protection agents, and 30% less peat and charcoal. The new greenhouses would emit 20% less CO₂. If our concept were to be implemented on a large-scale, it could mean enormous gains in terms of the environment and climate."



“Our new greenhouse concept uses 30% less fossil fuels, 30% less chemical soil protecting agents and 30% less peat”

So far, we are mainly talking about climate and environmental benefits. Do greenhouse farmers also benefit from this?

“That’s obviously the idea. Down the line, reusing potting soil can mean substantial cost savings. Growers would need to buy less potting soil, fertilisers and chemical crop protection agents, in addition to paying less to remove residual flows. These days, the use of biochar is already yielding real cost savings. Chitin is still too expensive to constitute a true alternative to mineral nitrogen, but within five to ten years it should be a feasible option. Circular cultivation substrates can therefore offer economic benefits.”

“Sustainable cultivation substrates are also better for human health. In fact, some crops are quite vulnerable – strawberries, for example, are extremely sensitive to fruit rot moulds. By adding biochar to the potting soil, strawberries become more resilient, and growers need fewer crop protection agents. We aim for a 50% reduction. In this way, fewer residues from crop protection agents end up in our strawberries, which is a major plus in terms of health.”

Horti-BlueC is financed via the Interreg 2 Zeeën programme of the European Union. This is a programme that stimulates cross-country collaborations between Flanders, the Netherlands, France and England. What is the advantage of such an overarching approach?

“Horti-BlueC is a collaboration between Belgium, the Netherlands, France and the United Kingdom, and is led by Bart Vandecasteele from ILVO. The project was launched in 2018, just before Brexit. The major advantage of our partnership is that we cover the entire North Sea region. This allows us to rely on a large part of the fishery sector for chitin. At the same time, we can involve more people in our project: not only greenhouse growers, but also others, like potting soil producers throughout Flanders and the Netherlands. That is certainly a bonus.”

“As partners, we exchange knowledge and support each other with our expertise. Our strength lies in plant technology, whereas our Dutch and French peers know a lot about the production of biochar and chitin. In that respect, it is certainly a good collaboration. Now that this project has been completed, we are also exploring possible collaboration in other projects.”



What role does FWO play in this story?

“An Interreg project receives 60% financing from the European Regional Development Fund (ERDF). The partners themselves have to come up with the rest of the money. My research into biochar and chitin falls under an FWO postdoctoral fellowship, and as such its inclusion fits nicely into the project.”

“Additionally, my FWO fellowship had already started before the Horti-BlueC project began, which meant I’d already gained quite a lot of useful expertise. For example, I had already developed a good method to get plant samples and to study the microbiology of potting soil. That was certainly a bonus when writing our application for Interreg financing, given that Interreg projects are in fact slightly more practice-oriented: they must offer possibilities for valorisation.”

What do you want to do in the future?

“Over the past three years, I have strongly focused on microbiology, especially in the context of biochar and chitin. Now I am slightly shifting gears. At the time, my doctoral research was about contamination with microplastics in the North Sea: I now want to research this in soil and in growth media like potting soil.”

“During the Horti-BlueC project, I noticed how little attention there actually is for healthy and contaminated grounds, and what influence they have on plant growth and on the health of plants and humans. About 80% of microplastics in the sea come from land. And yet a lot less research is conducted into this because it is much easier to detect microplastics in water than in soil. Because in my previous projects I’d acquired knowledge about microplastics as well as about soil and plant health, I now want to bring both aspects together.”

(Editor’s note: the Horti-BlueC project has now been completed. The findings are being used for the further development of sustainable growth media.)



Wim
De Malsche
VUB

“Vortex
chromatography
makes blood analyses
more efficient
and cheaper”



Standard monitoring of the health of diabetes patients is done based on the haemoglobin A1c protein. However, abnormal HbA1c variants in the blood can produce skewed results. Moreover, lab processing is currently quite expensive. By improving the analytical technique used, Professor Wim De Malsche (VUB) wants to make this medical monitoring more efficient, practical and affordable.

Haemoglobin is a protein in our blood that brings oxygen from the lungs to the rest of the body. The health of diabetes patients is determined by the relative presence of HbA1c in their blood. Standard monitoring is done via chromatography, an analytical separation technique. Research Professor Wim De Malsche coordinates the European Pathfinder project VORTEXLC, which wants to drastically improve standard chromatography techniques.

Chromatography is a known technique to analyse blood panels. What is missing exactly?

Wim De Malsche: "Fluid chromatography is a very useful technique to monitor the presence of particles in fluids, for example haemoglobin A1c in the blood. For a proper interpretation, the components present need to be neatly and fully separated, which is not the case with the usual methods. If there are unusual or abnormal genetic variants, things go haywire. That is why we want to do something about that."

"In chromatography, particles in fluid mixtures are led through an interacting column to separate them. The separation happens based on differences in retention time. An important reason for the limited separation quality is that mass transport of the particles through the column happens too slowly. While the particles move through the column, they keep spreading more and more, carried by the faster-moving fluid. This phenomenon is known as dispersion: the analytes in the middle of the channel move faster than those against the wall. As a result, there is mixing and thinning, resulting in poorer separation. With the current technique, the flow speed – and thus the analysis – is necessarily quite slow, because consequently, this effect occurs less."

How do you want to improve this technique?

"Within VORTEXLC, during the separation process we want to arouse the 'electro-osmotic vortices' in the

micro-channels of the column. We would be creating a sort of whirlpool by using alternating electronic fields. The electrodes are integrated into the walls of the column. Because the plus and minus poles keep changing, we can bring the fluid into a vortex and drastically accelerate the mass transport through the column. The trick is to mix laterally, in other words perpendicular to the direction of the flow."

"Because dispersion strongly diminishes, 'whirlpool chromatography' yields better protein separation. That increases the reliability of the results, plus facilitates much faster analysis."

Does an improved chromatographic technique offer other benefits, besides increased reliability and speed?

"Especially for practical and budgetary aspects we can still make quite a lot of headway. Nowadays, the blood check-ups that diabetes patients undergo every three months are done in a professional laboratory setting, which uses expensive columns. Our improved chromatographic technique is applied in plastic columns that are cheaper and can be acquired on a larger scale, and yet are still highly performative. This makes the check-ups more accessible and much less expensive."

"What's more, we can probably make the modified analysis device much smaller, as we need a lot less pressure with the vortex approach. Such a smaller and cheaper device would not

necessarily need to be in a specialised laboratory, but could be placed in a GP's surgery, for example. If we also have small, single-use columns, the doctor can perform the test locally and share the results with the patient immediately."

The VORTEXLC project is financed by the Pathfinder programme of the European Innovation Council (EIC). What are the benefits of a research trajectory via Pathfinder?

"The Pathfinder programme finances advanced research into ground-breaking technologies and innovations. And VORTEXLC fits right in. Because we want to make chro-

matographic techniques much more efficient, we need to introduce multiple innovations. The columns are being modified at different levels, detection is done differently ... And everything must be compatible with medical settings."

"The Pathfinder team allows the elaboration of an ambitious vision with a major potential impact. The basic elements for our applications are already available, but fundamental developments are still needed. It's this combination of fundamental research and a potentially impactful application that I find so attractive."

A typical Pathfinder study is both innovative and interdisciplinary. This is also the case for VORTEXLC. Which partners do you collaborate with, and how is that going?

"Obviously, you cannot conduct such extensive and in-depth research on your own; you need multiple partners. I personally work mostly on developing the separation columns, in addition to my task as coordinator. For the actual

"With our new techniques, doctors can share the results of a blood analysis with their patients immediately during the consultation"

manufacturing of the columns, we collaborate with businesses and research organisations in Austria, France and Greece. The integration of optical detectors is in the hands of Professor Heidi Ottevaere from B-PHOT (VUB), and a research team from UZ Brussels provides know-how on diabetes analysis. That naturally requires a lot of consultation, but we work together very well."

What role does FWO play in your career? Has your FWO background played a role in your selection for Pathfinder financing?

"After my doctorate, thanks to FWO I had two 3-year periods in which I conducted fundamental research. At the time, it was about pressure-driven analytical separations in structured channels. Those research years shaped me as an independent researcher and gave me the opportunity to reflect on new concepts. My FWO fellowships first led to a grant from the European Research Council: an ERC Starting Grant. You can see Pathfinder



financing as a next stage in the process: it is confirmation that we are now really doing advanced research, and that we are approaching concrete applications. The VORTEXLC project runs until 2026."

What do you want to achieve in the coming years in terms of your research field?

"I want to look for fundamental limitations in technologies for chemical, pharmaceutical, diagnostic and other applications, then try to find solutions for them."

"From my perspective, very many solutions can be realised using advanced micromanufacturing. To accelerate progress in this field, at VUB we are building a brand-new 'open access clean room'. It will become operational later this year, and will be specifically aimed at microfluidics systems. To make optimum use of that space, we will further enhance our multidisciplinary collaborations with academic and industrial partners in Belgium and abroad."

"In the coming years, I want to transition even more into research in the medical and pharmaceutical sector, because that's where I can probably achieve the greatest societal impact. I feel that quite a few medical and pharmaceutical technologies can become more efficient and accessible. This is important not only for Belgian patients, but certainly for people in developing countries, where what we consider 'minor' conditions can still result in widespread fatalities. Which is why I want to intensify existing collaborations with peers in countries like Tanzania and Ethiopia, in the context of neglected tropical diseases (NTDs), for example. Simple and affordable diagnostic techniques can make a big difference in those regions."

“Good digital skills protect people against disinformation”

Leen
d’Haenens
KU Leuven



The European policy instrument ERA-NET (European Research Area Networks) stimulates collaboration between researchers from different countries. Professor Leen d'Haenens (KU Leuven) collaborates via ERA-NET with researchers from six European countries on the REMEDIS project, which focuses on media literacy and digital skills in Europa.

Professor Leen d'Haenens works in the Institute for Media Studies of KU Leuven. Among her areas of interest are social media use by vulnerable youth and people with a migration background. Together with research partners from six European countries, she is working on the two-year ERA-NET project REMEDIS: 'REthinking MEdia literacy and Digital Skills in Europe'. Its aim is to offer practitioners as well as policymakers a user-friendly toolkit with which they can objectively evaluate the impact of an intervention programme.

REMEDIS links media literacy and digital skills to increased wellbeing and digital inclusion. What exactly is your project about?

Leen d'Haenens: "REMEDIS is a more practice-oriented successor of another H2020 project, ySKILLS (read: Youth Skills). In it, we research how digital skills can boost the wellbeing of children. Within REMEDIS, we research the efficiency of intervention programmes for media literacy and digital skills. Both in Flanders and in Europe, numerous programmes have been launched to get everyone on board digitally, and to reduce the digital gap between disadvantaged and privileged families. Now the question is: do such initiatives yield tangible results, and if they do, how can we measure them?"

"The project has been running since October 2022. The first step is a systematic evidence review: we screen all relevant scientific publications of the last ten years.



After a first screening of about 6,000 abstracts, we are now continuing with the full content of 600 articles. This is done in order to map which research already exists about which types of intervention programmes, and which concrete results they produce. After all, the idea is for the target groups to change their behaviour effectively and benefit from the intervention."

"After the literature study, each participating country embarks on two concrete intervention programmes. We aim for a wide spectrum: one team works on programmes in schools, we work around family-oriented programmes ... We choose the concrete programmes together with Mediawijs and Coface, the umbrella of which the Gezinsbond (Family Association) is also part. Based on the insights from the evidence review, we will adjust the selected programmes and test the new approach on specific target

"There are ever-more campaigns and programmes to close the digital gap, but do they really lead to behavioural change? That's what we're trying to find out"

groups. In late 2023, we will report the tangible results that these improved intervention programmes have produced."

What do you want to achieve with REMEDIS?

"We would like to end the programme with a practical toolkit for policymakers and practitioners. Such a toolkit consists of a series of tips and guidelines



to improve intervention programmes around media literacy and digital skills for vulnerable groups. These vulnerable groups could be children, seniors or even people with a migration background.”

“If every country analyses two examples, we will arrive at a toolkit with twelve different types of intervention programmes. We indicate how these programmes can yield the best results, and how the impact can be measured. In this way, practical organisations and other bodies can deploy more focused initiatives.”

Why is REMEDIS such a pioneering project?

“REMEDIS differs from most other studies in that we really want to

evaluate the impact of the intervention programmes. The screening of the existing studies makes it clear that little experimental research has so far been conducted into the impact of programmes for media literacy and digital literacy. Such research is often limited to a round of questions about how many people have followed an intervention programme. But whether people also modify their behaviour afterwards isn't generally measured. We are also innovative because we focus specifically on intervention programmes for vulnerable target groups. There is a need for it: families in a vulnerable situation have a lot to catch up with, digitally speaking.”

“Because we work with researchers from different countries, we can also paint a broad picture. Countries like Estonia and Finland, for example, are already quite advanced when it comes to digital skills, whereas a country like Spain still has a lot of work ahead. The participating countries were strategically chosen and form a good sample of the situation in Europe.”

Financing of REMEDIS is done via ERA-NET: various European partners have merged their financing. How does such a project work?

“REMEDIS consists of a number of outlined work packages that are mutually dependent on each other. Each country's team participates in each package, but teams alternate in taking the lead. Two reports are already expected in April-May 2023: one about the background and the outcomes of intervention programmes, the second about the critical factors that are important to create impact with an intervention programme.”

“Based on these two reports, all the participating countries will try to improve their chosen intervention programmes. This is how we map both types of intervention programmes, plus include measures to make them more impactful. We will then continue to work on the digital toolkit and on the dissemination of results. In June 2023, the team members of all 26 selected projects will meet for the first time in the Estonian capital Tallinn to discuss the progress.”

What is the most important added value of a European collaboration?

“Larger budgets obviously offer more possibilities, but in addition to that the European context is particularly valuable. By working together, we can map differences between countries, exchange best practices ... We create a mix of different policy visions and media contexts. And that produces many innovative insights. In Estonia, for example, misinformation is a national security issue. For us, at least for now, that is less sensitive, although it is gaining increasing attention.”

“To become more resilient against disinformation, a critical disposition and good digital skills are important. The EU wants to protect its citizens – certainly the most vulnerable – against this, because misinformation can have major, damaging consequences.”

What role does FWO play in this project, and in your career in general?

“After my doctorate at UGent, I worked for a while at Radboud University Nijmegen. It was only when I came to work at KU Leuven in 2005 that I submitted a project to FWO for the first time. Since then, we have

collaborated multiple times, and I have also become a member of an FWO expert panel that assesses new submissions. This helped me gain knowledge and experience, which was useful for my research application to ERA-NET.”

“With each new research project, you expand your network further. My first European project was EU KIDS Online, and I have kept many good contacts from it. My European experience, together with support of FWO, were important elements to convince ERA-NET. Besides, Belgium is not just a partner in REMEDIS, we are the leaders. FWO has made a total of €300,000 available to this end: a nice amount with which we can conduct extremely valuable research.”

What do you want to achieve in the coming years in terms of your research field?

“I want to keep working for a while on digital skills, media literacy and disinformation. I am presently looking into possible collaboration with colleagues in Hungary. Additionally, I would like to conduct more research into the connections between digital skills and citizenship elements such as democracy and migration. How are democratic elections influenced by fake news? What narrative is used to talk about migration, and what are the consequences for the formation of public opinion? For a long time, what we call 'news' is no longer just about facts but also about emotional aspects. If you are not resilient, you can be easily manipulated.”



Frederik
Coppens
VIB

“By sharing data,
researchers
can have better
collaborations”

Europe attaches great importance to collaborating within a research field. The European organisation ELIXIR brings digital tools and databases together in one single umbrella research infrastructure, in order to safely share and manage the growing amount of data in the life sciences. Frederik Coppens (Flemish Institute for Biotechnology) heads the Belgian node of ELIXIR.

The ELIXIR project is part of the European roadmap for research infrastructure and an initiative of the European Strategy Forum on Research Infrastructure (ESFRI). Frederik Coppens heads the Belgian branch of ELIXIR, as well as leading the brand-new VIB Data Core, which will be providing researchers with data management tools. He ensures that the ELIXIR research infrastructure is being optimally structured.

ELIXIR wants to stimulate the use/reuse and valorisation of research data in the life sciences. How does that happen exactly?

Frederik Coppens: "ELIXIR is a European research infrastructure that wants to bring together scientific data from the life sciences and make it accessible. This will make it easier for researchers to collaborate across countries and domains."

"The amount of data in the life sciences has grown enormously in the last ten years: every researcher creates new data. But not everyone has the right tools and infrastructure to be able to

use such data. Certainly if you want to work at an international level, clear agreements are needed: what information are we sharing, how will we organise it, which metadata are we releasing? ELIXIR improves mutual aligning of the entire bioinformatics infrastructure – from tools to databases and research results. This raises their added value for the research world."

Are you yourselves building new infrastructure? Or are you mainly synchronising existing systems?

"Both. ELIXIR works via a hub-and-spoke model. The central hub is in Cambridge, which is also where the

general coordination takes place. Each country that participates in ELIXIR creates its own node. Via these national nodes, existing infrastructure is brought together and better aligned to each other. If needed, we develop new units in order to add missing links or solve problems. Improving the interconnectivity between existing systems can take us a long way."

"To make ELIXIR even more effective, we founded Communities around a variety of topics. For example, there is a Data Management Community, a Galaxy Community, a Plant Community ... In those Communities, infrastructure specialists come into contact with researchers from the field. That's important, because even the most advanced infrastructure is useless if no one uses it. We therefore need to offer systems customised to the users. ELIXIR already has fifteen Communities but within VIB, the emphasis mainly lies in data analysis and data management."

How does ELIXIR add value to the research world?

"The European Commission attaches great importance to collaborating within a research field. But if people want to use each other's data, they must first be able to find them and process them with the available tools. In many cases, that's where things go wrong. Because the data systems are not harmonised, people have no or insufficient access to each other's results. We want to make as much data available as possible, so that other researchers can further build on it."

Because ELIXIR is a European initiative, the focus lies mainly on Europe. But we also collaborate with organisations in the United States, Latin America, Australia ... Ultimately, we all face similar problems and challenges, so we join forces as much as we can."



Since 2015, Belgium has its own node in ELIXIR. What is your role within the whole?

"ELIXIR now has 23 nodes. The Belgian unit is coordinated by the Flemish Institute for Biotechnology (VIB). Our most important task is building a network. Throughout Belgium, we bring together experts on research infrastructure. Together, we set up projects to improve our local infrastructure, to build new elements, or if necessary to implement new tools or systems at the European level. We are now working with all Flemish and two Walloon universities, and with the federal research centre Sciensano."

The ELIXIR project is part of the European roadmap for research infrastructure and an initiative of the European Strategy Forum on Research Infrastructure (ESFRI).

How is it structured?

"ESFRI is the body that joins together and steers all research infrastructures in

Europe. ELIXIR is one of them. Each participating country pays membership dues, which help cover the costs for central operations and coordination. By combining financing from different countries, we can have a larger budget to reach our goals."

"A large part of the ELIXIR budget is used to finance concrete projects. That is fairly unique and constitutes an important added value. Through these project operations, we can solve specific problems in a very focused manner. It also opens the doors for countries to collaborate. For example, there are funds for staff exchanges, allowing people from different nodes to support each other. In fact, the structure of this knowledge network is the most important added value of ELIXIR."

The Belgian contribution to ELIXIR is structurally financed by FWO. How does such a collaboration work?

"Ten years ago, I completed my doctorate with an FWO fellowship. Now I'm focusing fully on building research infrastructure, again with Flemish support. Since 2017, FWO has

been making funds available for Belgian participation in ELIXIR. This is unique within Europe: virtually no other single node receives structural financing from the government. These contributions allow us, as a small country, to still be involved in many aspects of ELIXIR. We can also offer our staff a long-term perspective, allowing us to facilitate valuable expertise within our node."

"By definition, a well-functioning research infrastructure is a long-term project. Designing a new database or software tool is amazing. However, to get something out of it, you need to provide ongoing support in the long term too, integrating them into the existing ecosystem. We can certainly use the support of FWO in this process. Needless to say, our FWO financing is regularly evaluated."

What do you want to achieve in the coming years in the field of research infrastructure?

"I want to keep building ELIXIR as a professional infrastructure. In the last four years, we already set up some services for data management and analysis for bioinformatics.

We want to make this even more professional, so that we can really offer useful services to professionals in the life sciences. A new focus is building infrastructure for sensitive data, such as human genomes, also providing links to medical data, for example."

"We also want to even better connect ELIXIR with other initiatives, such as the Flemish Supercomputer Center, which is financed by FWO to offer computing resources to researchers. For researchers within our research domain, having access to it is not always guaranteed. We want to play a facilitating role."

"Like I just said: the network aspect of ELIXIR is very important. We connect numerous people with each other: staff from different nodes, peers in Flanders, collaborators from other initiatives ... With any question or challenge we face, within the vast ELIXIR community there is always someone who has experience with it and wants to share their knowledge. In this way, we can make great progress in the short term."

"Building a knowledge network is the most important added value of ELIXIR"



Our mission

FWO finances scientific research

The Research Foundation - Flanders (FWO) finances and stimulates scientific research in Flanders: from fundamental research and strategic basic research to clinical scientific research, the purchase of large-scale and medium-scale research infrastructure and the management of large computing capacity. With the financial resources made available to us, primarily by the Flemish Government, we subsidise fellowships and research projects, infrastructure, travel grants and international scientific cooperation.

Science creates opportunities

Fundamental scientific research focuses on deepening knowledge about humans and their environment. As the knowledge level in our society grows, so do quality of life and the quality of our education. This gives young people every opportunity to develop their talents in a wide range of disciplines. Research funded by FWO, in particular strategic basic research, is also an important step in the valorisation of scientific breakthroughs.

Science is essential to our wellbeing

In the long term, the combination of a high knowledge level and strong human capital leads to focused and applied research. This also has a policy-supporting function, allowing certain economic or societal choices to be driven by outstanding research groups. Groundbreaking research can underlie solutions to today's major societal challenges, such as the environment, mobility and health.

Science drives innovation

In the long term, fundamental research is essential for our prosperity and wellbeing. In the short term, however, it rarely leads to economic or social valorisation. This is why FWO relies on financial support from the government. There is a need for a balanced distribution of resources between targeted and non-targeted research. By financing strategic basic research, FWO itself is already taking an important step toward valorisation.

FWO and the international community

Europe has a tradition of non-governmental 'research councils': FWO is a member of Science Europe and supports the activities of the European Research Council (ERC). Through a variety of programmes, we are closely involved in various European research initiatives (ERA-NET, JPI, ESFRI ...). FWO has also signed many bilateral agreements with leading funding agencies in China, Quebec and Switzerland, among others.

FWO supports the Flemish Supercomputer Center

The Flemish Supercomputer Center (VSC) is a virtual centre for both academia and industry. It is managed by FWO in collaboration with the five Flemish university associations.



Our approach

What kinds of researchers do we support?

Whether it is a **young talent working on their doctorate**, a researcher wanting to keep developing their skills as a **postdoctoral researcher**, or a professor wanting to set up a **research project** with a team: they all qualify for FWO support. Our aim is both to help train the researchers of tomorrow and to support experienced researchers in their explorations. Plus, all scientific disciplines are eligible.

At FWO, the quality level of the researcher and the research proposal are what counts. We evaluate each proposal objectively, regardless of scientific discipline, the institution where the researcher works, their gender, or their political or religious convictions. We implement family-friendly measures and offer flexible working conditions in order to achieve a good balance between male and female staff. Researchers with disabilities can count on additional support to purchase adapted equipment and materials.

FWO stimulates **international cooperation** within the European Union and beyond. We promote international mobility by attracting foreign researchers and giving our own researchers the opportunity to gain experience abroad.

Every year, FWO presents two **scientific awards**. This not only rewards outstanding research, it also highlights the societal relevance of scientific research.

For more information and a list of recipients, visit www.fwo.be.

How does such a project work?

In order to decide which researchers and research proposals will receive funding, FWO calls upon independent experts from Belgium and abroad. They are brought together in expert panels. The composition of the panels and the procedures followed depend on the funding channel. For the fundamental channels, there are 31 subject-specific panels and 1 interdisciplinary panel.

Applications for fellowships in **strategic basic research** are processed by 25 thematic panels. At least one third of the members of these panels have a background in industry. The expert panels for the strategic basic research projects are generalist panels that evaluate thematically linked economic and societal projects. For the Applied Biomedical Research with a Primary Social Finality (TBM) programme, the submitted project proposals are divided into thematic groups.

To evaluate **research infrastructure**, FWO relies on the Science Committee for the scientific evaluation and on the Invest Committee for the evaluation of financial feasibility. The **Cross-Domain Panel** (CDP) assesses applications submitted for various scientific fields, with a local or international dimension.

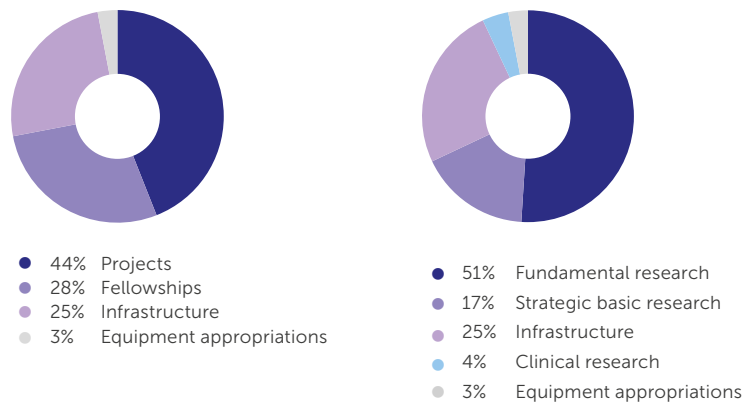
The **International Collaboration Committee** (CIWC) gives advice on the international mobility of researchers, the organisation of scientific meetings in Belgium, etc.

For a complete overview of all the panels and their members, visit www.fwo.be.

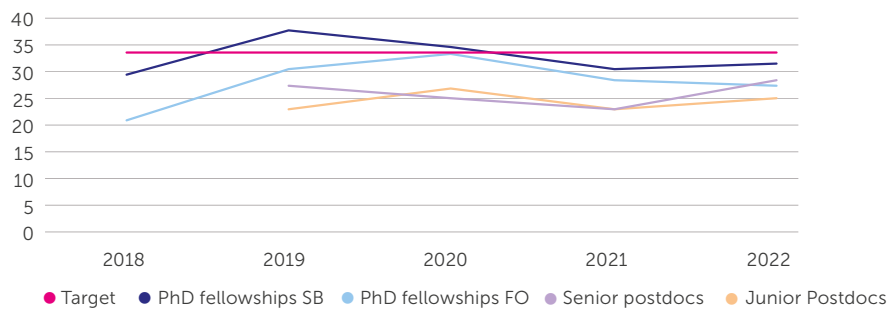
Progression of incomes



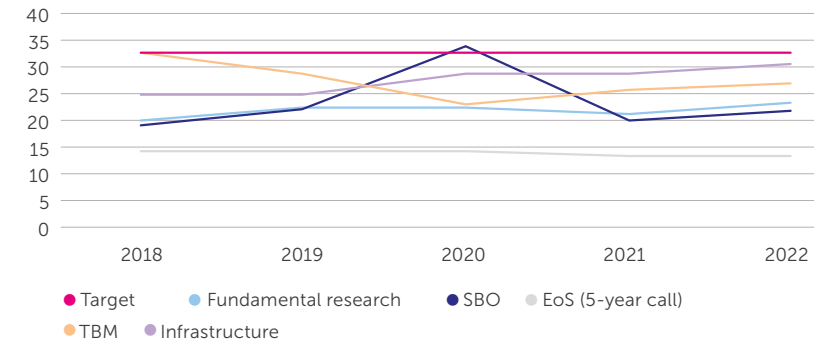
Allowance spread



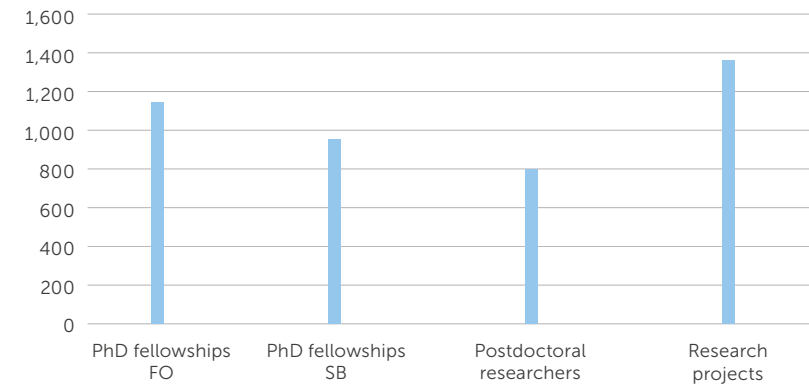
Progression of success rates of fellowships



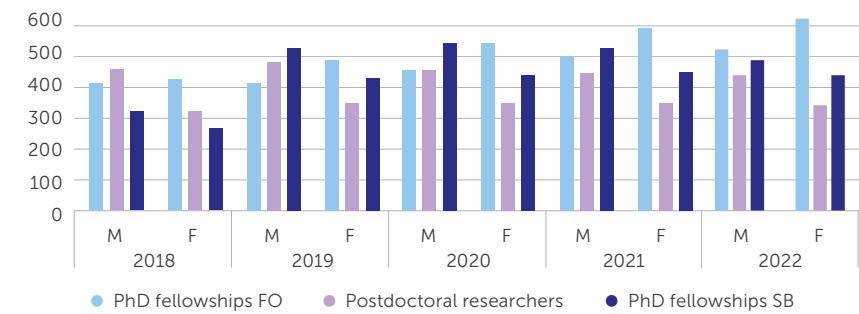
Progression of success rates of research projects



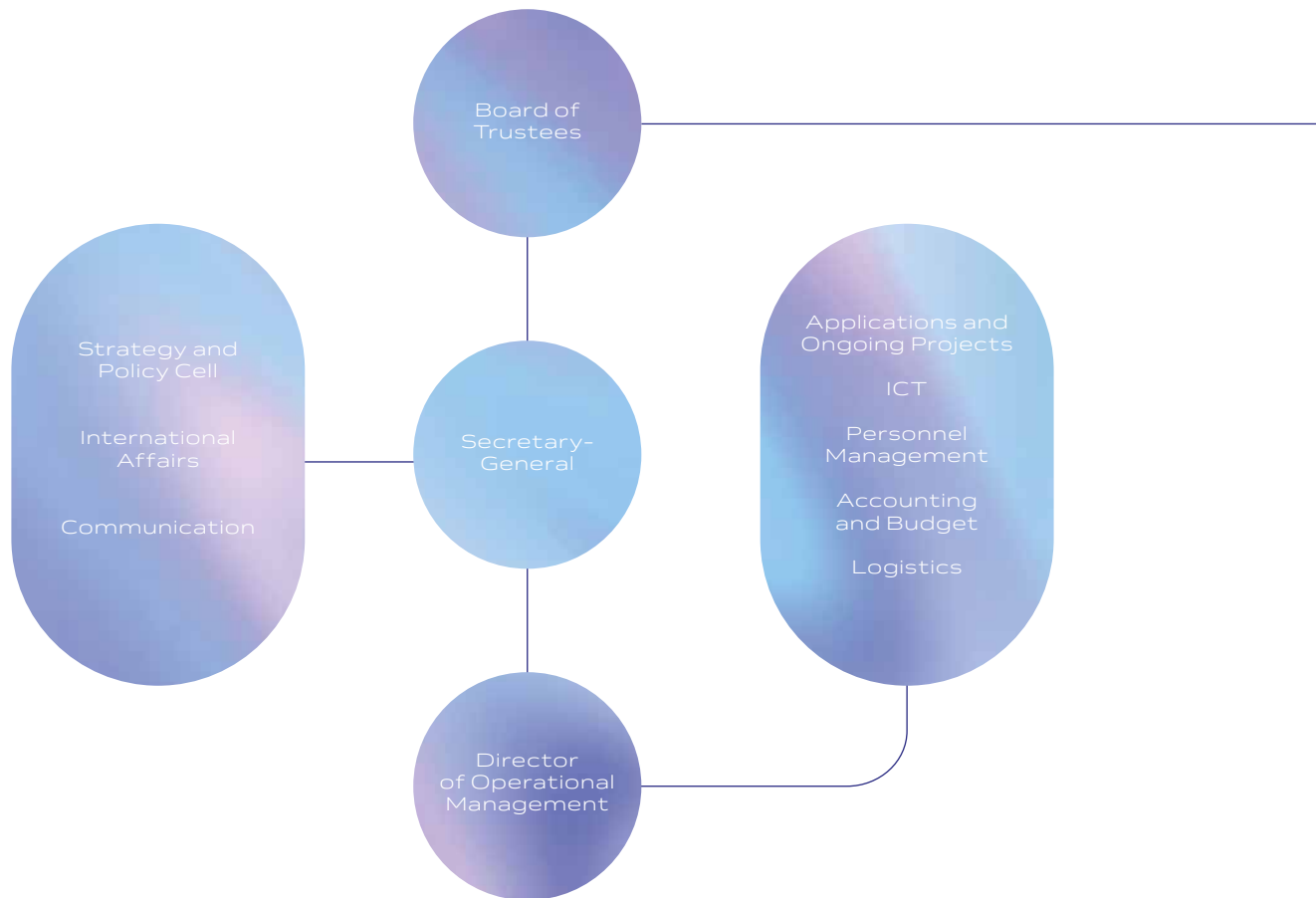
Employed researchers (as of 1.11.2022)



Ratio of men/women employed



Our organisation



Administration

The FWO team is always ready to assist our researchers. It manages the efficient organisation of the various evaluation processes within FWO, to guarantee that the various projects and fellowships are awarded and followed up on time and properly. Our administration always aims for a researcher-friendly approach.

Board of Trustees

The Board of Trustees takes decisions that include the advice of the expert panels and other committees, as well as FWO operations, budgeting and accounts.

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Kennismakers

Stories of, by and
about researchers

Scientific research is closely connected with our daily lives. Without science, we could be living in a world without internet, velcro or antibiotics. Want to hear what FWO researchers are doing these days?

Find out at our Kennismakers (Knowledge Makers) platform

www.kennismakers.be.

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