VIB

ANNUAL REPORT 2020

FACING DOWN CHALLENGES

It goes without saying that 2020 was a challenging year in many ways. The COVID-19 world pandemic seriously disrupted the planned activities at VIB and beyond.

We have had to change the way we live and work, which has had a significant impact on many aspects of our daily lives.

Yet, through it all, VIB kept performing at a very high level.

Many of our labs buzzed with activity. From exploring the repurposing of drugs to mitigate severe COVID-19 infection to developing bespoke antibodies, VIB researchers continued to push the envelope. Moreover, the Grand Challenges Program funded three clinical trials that will improve our understanding of COVID-19 and take the first steps to new treatment options.
But beyond the labs, the urgency and severity of the crisis also stirred many people into action. An internal VIB taskforce quickly and efficiently set up collaborations with external partners and VIB volunteers to scale up Belgium's testing capacity. In four weeks' time, VIB – together with four partners (UGent, UZ Gent, Biogazelle, Anacura) – set up a test platform, where five teams performed around the clock to process 6,000 tests daily. From April to June 2020, this consortium carried out 120,000 tests and, as such, contributed to testing half of the samples from all Belgian residential care centers.

It was equally encouraging to see how rapidly VIB as an institute adapted to a new situation. During the lockdown, teleworking became standard. The VIB laboratories never went into complete lockdown, given the living material they work with (laboratory animals, cell cultures, plants, etc.). Depending on how the lockdowns evolved, the VIB research centers arranged the lab activities in shifts to accommodate the ongoing research projects. Conferences and training moved online with great success, and the IT infrastructure accommodated all these changes with admirable proficiency.

We also said (a virtual) goodbye to Johan Cardoen and welcomed Jérôme Van Biervliet as the new co-managing director.

Last but not least, VIB has managed to launch no less than five exceptional start-ups in 2020: MRM Health (a forward-looking interdisciplinary combination of microbiology, bioinformatics, and inflammatory disease expertise), Flamingo Therapeutics (development of new cancer therapeutics), Dualyx (focus on bi-specific antibodies for auto-immune diseases), ExeVir Bio (a direct result of VIB's COVID-19 research and the tireless work of the Discovery Sciences' team), and Animab (which will expand VIB's biotech fingerprint into the field of animal health).

Part of VIB's mission is to have a substantial, positive social impact. In 2020, we certainly lived up to it!

Ajit Shetty, Chairman of the Board of Directors
Jo Bury and Jérôme Van Biervliet, Managing Directors

SCIENCE
MEETS
LIFE

MISSION AND CORE VALUES

At VIB, we believe that breakthrough research in the molecular mechanisms of life will lead to a better quality of life, economic growth, and sustainable societal well-being.

Genuinely original, basic research is, by nature, an erratic process of experimentation and failures. Still, the successes emerging thereof are often unpredictable, disruptive, and can have a long-lasting impact on society in Flanders and beyond.

It is VIB's mission to conduct pioneering biomolecular research in life sciences to push the frontiers of scientific understanding of the mechanisms of life and to translate these into products, technologies, and economic activity that can benefit and help transform society.

We strive for excellence in everything we do, from our research to tech transfer and communication. We encourage our scientists and employees to be entrepreneurial and creative in their thinking.

Our focus on innovative technologies ensures that our research is genuinely ground-breaking, and our entrepreneurial tech transfer approach ensures that breakthroughs in science are translated into value for society. We stimulate public engagement and transparent communication to build trust and mutual understanding.

For VIB, it is of paramount importance that our scientists perform their research responsibly and safely, with scientific integrity, and according to the highest ethical and regulatory standards.

VIB strives to create an inspiring place to work and develop talents. Over the years, we have introduced a shift from a predominant focus on scientific output criteria towards a more balanced orientation on both output and internal organization/people management criteria. We believe that great science cannot be performed without effective leadership that cares about its people's well-being.

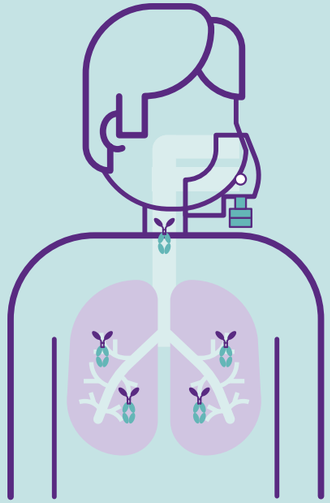
GRAND CHALLENGES

At VIB, we also want to contribute to a better world. With that in mind, we developed the VIB Grand Challenges program (GCP) to increase our societal impact. The projects selected for the GCP offer answers and solutions to critical societal questions and issues stemming from daily practice. This means that it's 'reverse translation', working backward starting from the patient or crop.

The GCP allows VIB to take our scientific leadership to the next level of societal impact. One of the program's strengths is that VIB researchers need to team up with experts outside VIB having complementary expertise, such as clinicians, farmers, engineers, health economists, etc. These cross-disciplinary teams allow us to fully exploit our knowledge, expertise, and toolboxes to generate otherwise untapped avenues to create added value for society.

In 2020, a third call of the Grand Challenges program led to the selection of two projects: a project that focuses on sustainable soy cultivation in Flanders (dubbed 'Soy in Flanders') and a second project that aims to develop inhalable biologicals against influenza and other respiratory diseases (called IBCORI).

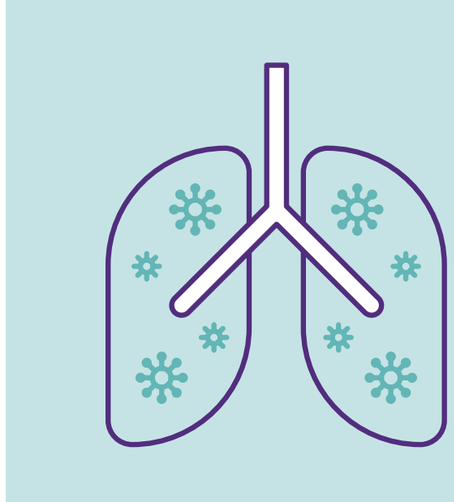
- Soy in Flanders: Soybeans are one of the most crucial vegetable protein sources and are used in meat substitutes, animal feed, and as a basis for soybean oil. But soy processors have to import most of their raw material from South America. Local production would offer many benefits for the environment, the climate, our economy, and our soil. This GCP project will introduce soy as a crop in Flanders, with the help of 1,000 citizens who will grow soy in their gardens. Ultimately, the project will produce tailor-made seeds inoculated with nitrogen fixating bacteria adapted to local soil conditions and to improve yield to acceptable levels.



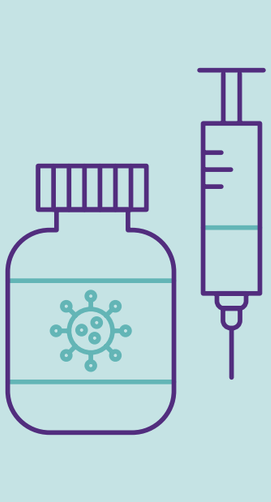
- IBCORI: Each year, general practitioners, hospitals, and ICUs are overwhelmed with influenza patients. This viral infection is highly contagious, mainly affects the respiratory system, and can affect everyone. In addition to these seasonal outbreaks, global pandemics can also hit the population. The focus of influenza treatment is prevention rather than curation. This GCP project will develop a radically different approach to control influenza: create biologicals that can be administered through a nebulizer to treat and/or prevent influenza. The study also looks into the cost-effectiveness of the proposed biological-based solution, focusing on prophylactic treatment in the elderly.

In response to the COVID-19 pandemic, the Grand Challenges Program - with support from the Flemish government - decided to support the downstream analyses of three ongoing clinical trials to better understand severe COVID-19 infection: Contagious, SARPAC, and COV-AID. VIB hereby relies on close collaborations with clinicians and clinical trial teams in the University hospitals of Ghent and Leuven.

- Contagious consists of a large observational clinical trial investigating the early identification of COVID-19 patients at risk for lung damage. The study aims to decipher the underlying molecular responses to COVID-19 infection and downstream immune responses. The single-cell characterization of neutrophils in that perspective is unique. Researchers showed that patients with severe COVID-19 infection have impaired T-cell function that, together with impaired monocyte-to-macrophage differentiation, contribute to excessive neutrophil-based inflammation.



- The SARPAC trial is a multi-center interventional project. The researchers performed a randomized, open-label study to investigate the efficacy of GM-CSF (Granulocyte-macrophage colony-stimulating factor) in severe COVID-19 patients. GM-CSF is beneficial in viral pneumonia by stimulating alveolar macrophage development which reduces local inflammation.



- COV-AID is an interventional clinical trial with COVID-19 patients admitted to the ICU with severe respiratory symptoms requiring invasive mechanical ventilation. Some of these patients showed an overreaction of the immune system, leading to a deadly ‘cytokine storm’. This COV-AID study has demonstrated that patients do not benefit from anti-IL6 therapy.

SCIENCE

728 PUBLICATIONS

86 PHD GRADUATIONS

262 PUBLICATIONS IN TIER 5 JOURNALS

TECHNOLOGIES

9 CORE FACILITIES

60 TECH WATCH PROJECT APPLICATIONS APPROVED

5 PARTNER UNIVERSITIES → 90 RESEARCH GROUPS

1 INSTITUTE

77 NATIONALITIES ← 1,652 COLLABORATORS (FTES)

TOTAL INCOME

%46 FLEMISH GOVERNMENT

%54 OTHER INCOME

TECH TRANSFER

3 INWARD INVESTMENTS

5 NEW SPIN-OFFS

30 M € TOTAL INDUSTRIAL INCOME

SCIENCE MEETS SCIENCE

SCIENCE WITH IMPACT

VIB's impact on society and the biotech ecosystem springs forth from the world leading science that is being done in all its centers. With this science as firm base, clinical applications, business collaborations, and spin-off creation are continuously developed in close contact with various units at VIB headquarters.

The selection of papers here serves to illustrate the internationally recognized and cutting-edge work that VIB scientists from all VIB centers engage in. Their pioneering work is routinely published in leading scientific journals in several fields of the life sciences.

IMMUNOLOGY & INFLAMMATION

MEET NICHENET

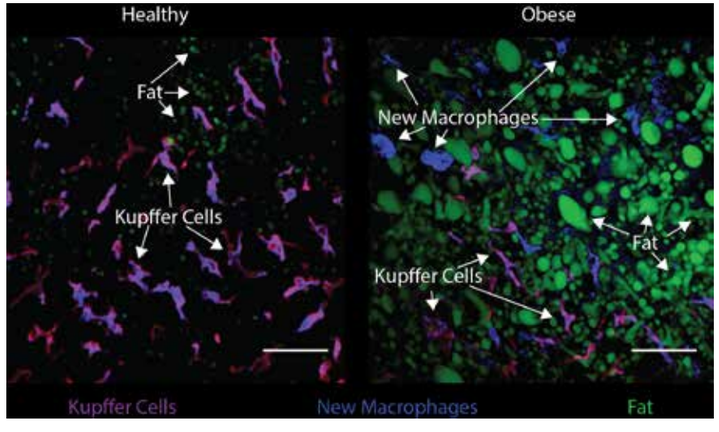
Multicellular organisms' cells don't function on their own, they produce signaling molecules that influence gene expression in interacting cells. This intercellular communication plays an important role in many biological processes, such as the development and functioning of cells. Studying intercellular communication is not only important to understand fundamental biology, but also to gain insights into diseases like cancer. Interactions between cancer cells and other cells in the microenvironment of the tumor are crucial for its growth. Using machine learning and AI techniques, VIB computational scientists have developed a novel bioinformatics tool NicheNet (https://github.com/saeyslab/nichenetr), a method that predicts ligand–target links between interacting cells by combining their expression data with prior literature knowledge on signaling and gene regulatory networks. NicheNet helps researchers to gain insight into how the gene expression of cells is regulated by interacting cells. NicheNet has a broad range of potential applications in fields like immunology and tumor biology.
Browaeys S *et al.*, Nature Method 2020

A NEW TYPE OF IMMUNE CELL

There are several types of dendritic cells (DCs) that perform antigen-presenting functions. Because monocyte-derived DCs are easily prepared in vitro from monocytes isolated from human blood, it was always assumed these cells were very important antigen-presenting cells. Clinical trials using monocyte-derived DCs in cancer therapy have however been disappointing. The researchers in this study demonstrated that surprisingly monocyte-derived DCs actually do not present antigens and identified a new type of DC, the inflammatory type 2 conventional DC, or inf-cDC2. This new DC combines some of the characteristics of monocytes, macrophages, and conventional DCs, to induce the best form of immunity, revealing a new target for therapeutic intervention for viral infections and other inflammatory diseases.
Bosteels C *et al.*, Immunity 2020

OBESITY AFFECTS IMMUNE CELLS IN THE LIVER

By investigating the livers of obese mice, the team of Charlotte Scott has identified a new population of macrophages (immune cells) not present in healthy livers. These new cells were primarily located in the most damaged regions of the obese liver where they produce a protein that can be used to identify patients with severe fatty liver disease. With no treatment currently available for fatty liver disease, this discovery opens up potential new treatment options aimed at specifically targeting the different macrophages to improve patient outcomes.
Remmerie *et al.*, Immunity 2020



PLANT SYSTEMS BIOLOGY

PLANT DEFENSE GENES

Plants produce a vast array of defense compounds to protect themselves from pathogen attack or herbivore predation. Saponins are a specific class of defense compounds. The model legume *Medicago truncatula* synthesizes two types of saponins. The Alain Goossens lab reports the identification of the seed-specific transcription factor, which controls saponin biosynthesis in seeds, as well as the genes involved. The genes encoding the identified biosynthetic enzymes are present in clusters of duplicated genes in the *M. truncatula* genome, providing insights into the metabolic evolution of saponins.
Ribeiro *et al.*, Plant Cell 2020

THE MAIZE ROOT MICROBIOM

When maize is grown in the Northern hemisphere, its development is heavily arrested by cold temperatures. This work, by the group of Sofie Goormachtig, analyzed the impact of cold temperatures on the root microbiome. Twelve abundant and enriched bacterial families that colonize maize roots were identified, consisting of bacteria recruited from the soil, whereas seed-derived endophytes were lowly represented. They further identified two bacterial strains that boost maize growth under chilling conditions, providing potential avenues to increase yield in challenging environmental conditions.
Beirinckx *et al.*, Microbiome 2020

GENOMES ON CANVAS

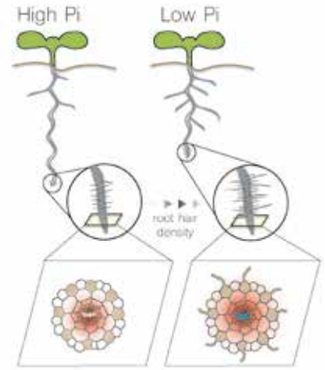
The plant-based food (fruits, vegetables, legumes, grains, nuts, and seeds) that we process in our kitchen originate from a wild ancestor that was domesticated, cultivated, and improved. Humans selected varieties that, for instance, grow bigger, develop more fruits on the same plant, or do not possess undesired features. Here, a methodology to track these changes is presented which involves the unique combination of modern genetics with art history. It is a societal project coined #ArtGenetics and it maps the history of our current fruits, vegetables, and cereal crops.
Vergauwen & De Smet, Trends Plant Sci 2020

CRISPRING TREES FOR A CLIMATE-FRIENDLY ECONOMY

Researchers led by Wout Boerjan have discovered a way to stably finetune the amount of lignin in poplar by applying CRISPR/Cas9 technology. Lignin is one of the main structural substances in plants and it makes processing wood into, for example, paper difficult. This study is an important breakthrough in the development of wood resources for the production of paper with a lower carbon footprint, biofuels, and other bio-based materials.
De Meester *et al.*, Nat Communication 2020

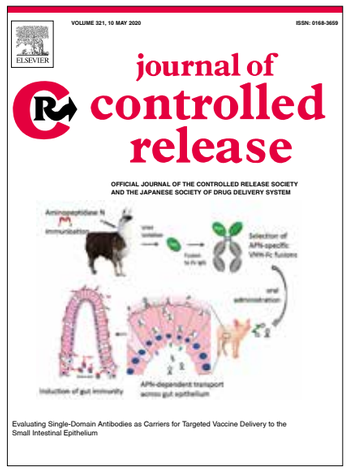
CONNECTING TO ADAPT

In this study, the teams of Bert De Rybel and Yvan Saeys pioneered the development of single-cell transcriptomics in plants. In doing so, they identified how plants translate indications of low phosphate availability into growth adaptation. This discovery may enable the modulation of plant growth in a targeted way to enhance nutrient uptake efficiency and adaptation to changing environmental conditions.
Wendrich, *et al.*, Science 2020



MEDICAL BIOTECHNOLOGY

ANTIBODIES FOR TARGETED VACCINE DELIVERY



Targeting a vaccine to the mucosal surface has recently been recognized as a promising approach to efficiently induce mucosal immune responses against enteric pathogens. However, poor uptake and inefficient transport of orally delivered subunit vaccines combined with weak immune responses still present important bottlenecks for mucosal vaccination. This paper describes potent and selective VHHs against porcine aminopeptidase N (pAPN) which showed in vivo internalization across the porcine gut epithelium. These results demonstrate the potential of bivalent VHH-MG fusions as delivery vehicles for vaccine antigens.
Bakshi S *et al.*, J Control Release 2020

COVID-19 ANTIBODIES

Coronaviruses make use of a large envelope protein called spike (S) to engage host cell receptors and establish membrane fusion. Because of the vital role of these S proteins, they represent a vulnerable target for the development of novel therapeutics. This study describes the isolation of single-domain antibodies (VHHs) from a llama immunized with prefusion-stabilized coronavirus spikes. These VHHs neutralize MERS-CoV or SARS-CoV-1 S pseudotyped viruses, respectively. The researchers also show cross-reactivity between the SARS-CoV-1 S-directed VHH and SARS-CoV-2. These data provide a molecular basis for the neutralization of pathogenic betacoronaviruses by VHHs and suggest that these molecules may serve as useful therapeutics during coronavirus outbreaks.
Wrapp D *et al.*, Cell 2020

CYTOKINES AGAINST CANCER

Systemic toxicities have severely limited the clinical application of tumor necrosis factor as an anticancer agent. Activity-on-Target cytokines (AcTakines) also called 'designer cytokines' are a novel class of immunocytokines with improved therapeutic effect. This paper describes an AcTakine that increases local activity by targeting the CD13-positive tumor vasculature, while simultaneously lowering the binding affinity to the respective cytokine receptor, thereby reducing off-target effects on normal cells.
This elegant approach makes it possible to concentrate the effect of cytokines precisely to the tumor site, increasing the therapeutic effect and avoiding the negative side effects and systemic toxicity. Therefore this work is certainly an important step forward in the development of AcTakines suitable for clinical applications.
This paper was also commented in a News & Views contribution in EMBO Mol Med 12: e11801
Huyghe L *et al.*, EMBO Mol Med 2020

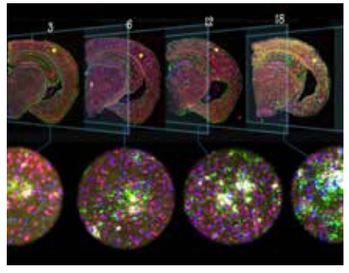
NEUROSCIENCES

DOPAMINE PROMOTES LEARNING

A fundamental type of learning, known as associative learning, is commonly observed in animals and humans. It involves the association of a stimulus or an action with a positive or negative outcome. In this paper, VIB researchers have demonstrated that dopamine is activated by novel stimuli and promotes learning. They further provide direct experimental support for a group of theoretical frameworks in computer science, which incorporate a 'novelty bonus' to account for the beneficial effect of novelty. Incorporating such a bonus can speed up machine learning algorithms and improve their efficiency. From a very practical perspective, the results remind us to break our routine more often and seek out novel experiences to be better learners.

Morrens J *et al.*, Neuron 2020

STUDYING ALZHEIMER'S DISEASE *IN SITU*



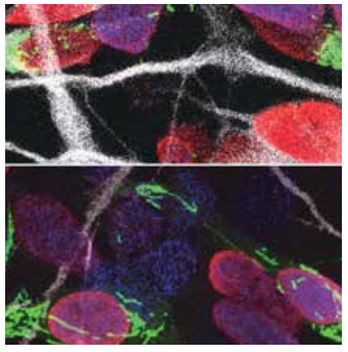
Although complex inflammatory-like alterations are observed around the amyloid plaques of Alzheimer's disease, little is known about the molecular changes and cellular interactions that characterize this response. In this study, VIB researchers have investigated the transcriptional changes in tissue domains in a 100-µm diameter around amyloid plaques using spatial transcriptomics. They were able to demonstrate both early and late alterations in gene co-expression networks and confirm these via *in situ* sequencing on mouse and human brain sections. These results provide an unprecedented approach to untangle the dysregulated networks near pathogenic hallmarks of Alzheimer's and other brain diseases.

Chen WT *et al.*, Cell 2020

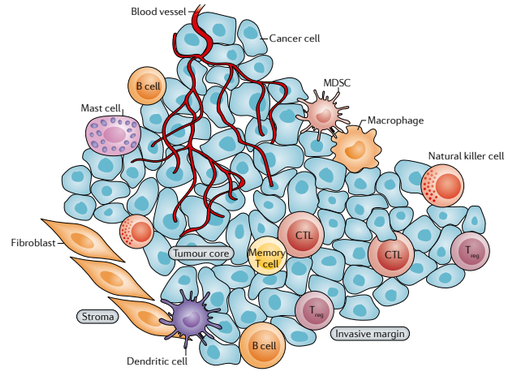
MITOCHONDRIA AND THE FATE OF STEM CELLS

The conversion of neural stem cells into neurons is associated with the remodeling of organelles, but whether and how this is causally linked to fate change of these cells is poorly understood. In this study, scientists examined and manipulated mitochondrial dynamics during mouse and human cortical neurogenesis. Shortly after cortical stem cells have divided, daughter cells destined to self-renewal undergo mitochondrial fusion, whereas those that will become neurons retain high levels of mitochondria fission. These findings reveal a postmitotic period of fate plasticity in which mitochondrial dynamics will determine the cell fate.

Iwata R *et al.*, Science 2020



CANCER BIOLOGY



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A PAN-CANCER BLUEPRINT OF THE HETEROGENEOUS TUMOR MICRO-ENVIRONMENT

The stromal compartment of the tumor microenvironment consists of a heterogeneous set of tissue-resident and tumor-infiltrating cells, which are profoundly molded by cancer cells. An outstanding question is to what extent this heterogeneity is similar between different cancers. This study presents the results of 233,591 single cells profiles from patients with lung, colorectal, ovary and breast cancer. The researchers identified 68 stromal cell populations, of which 22 are unique for specific cancers. This comprehensive blueprint - accessible through an interactive web server - generates the first panoramic view on the shared complexity of stromal cells in different cancers. http://blueprint.lambrechtslab.org

Qian J *et al.*, Cell Res 2020

A SINGLE CELL TRANSCRIPTOME ATLAS OF MURINE ENDOTHELIAL CELLS

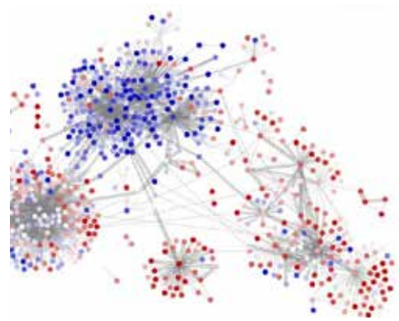
In this single cell transcriptomic atlas of endothelial cells from multiple tissues, the Carmeliet lab documented substantial heterogeneity and tissue-specific metabolic transcriptome signatures of endothelial cells at the single cell level. By using a wide range of computational tools, 78 endothelial cell subsets were identified and characterized in human and mouse lung tumors and eye disease. The endothelial cell EC atlas taxonomy enables to identify endothelial cell subclusters in public scRNA-seq datasets and provides a powerful discovery tool and resource value. In an accompanying 2020 Cancer Cell paper (by Goveia J), the Carmeliet lab developed an integrated approach to combine single cell RNA-sequencing with other multi-omics and meta-analyses methods to identify novel angiogenic targets.

J. Kalucka *et al.*, Cell 2020

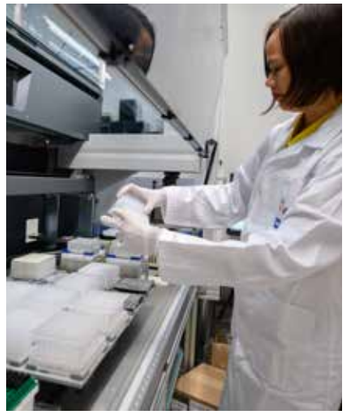
GENE REGULATORY NETWORKS IN MELANOMA

Melanoma cells can switch between a melanocytic and a mesenchymal-like state. Scattered evidence indicates that additional intermediate states may exist. In a search for such states and to decipher their underlying gene regulatory network, VIB researchers studied 10 melanoma cultures using single-cell RNA sequencing (RNA-seq). Despite each culture's unique transcriptome, they identified shared GRNs that underlie the extreme melanocytic and mesenchymal states and the intermediate state. They additionally unraveled the sequential and recurrent arrangement of GRNs during phenotype switching. These analyses indicate that an intermediate state exists and is driven by a distinct and stable 'mixed' GRN rather than being a symbiotic heterogeneous mix of cells.

Wouters J *et al.*, Nat Cell Bio 2020



MICROBIOLOGY



STATIN THERAPY LINKED TO LOWER PREVALENCE OF GUT MICROBIOTA DYSBIOSIS

Microbiome analyses have recently identified the Bacteroides2 (Bact2) enterotype, an intestinal microbiota configuration that is associated with systemic inflammation and has a high prevalence in loose stools in humans. Here, by exploring obesity-associated microbiota alterations in the quantitative fecal metagenomes, scientists identified that statin therapy is a key covariate of microbiome diversification. The prevalence of Bact2 correlates with body mass index and systemic inflammation levels in Bact2-enterotyped individuals are higher than predicted. It is also observed that obesity-associated microbiota dysbiosis is negatively associated with statin treatment, hinting at potential benefits of statins.

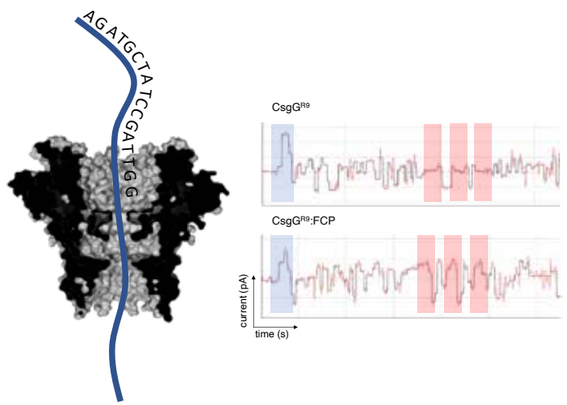
Vieira-Silva S *et al.*, Nature 2020

STRUCTURAL BIOLOGY

A DUAL-CONSTRICTION BIOLOGICAL NANOPORE IMPROVES SINGLE-READ ACCURACY

Single-molecule long-read DNA sequencing with biological nanopores is fast and high-throughput but suffers reduced accuracy in homonucleotide stretches. Here scientists combine the CsgG nanopore with the 35-residue N-terminal region of its extracellular interaction partner CsgF to produce a dual-constriction pore with improved signal and base-calling accuracy for homopolymer regions. Both constrictions contribute to electrical signal modulation during single-stranded DNA translocation. DNA sequencing using a prototype pore with two constrictions improved single-read accuracy by 25 to 70% in homopolymers up to 9 nucleotides long.

Van der Verren S *et al.*, Nat Biotechnol 2020



SCIENTIFIC IMPACT 2020

451 PUBLICATIONS, IN TIER 25 JOURNALS

262 PUBLICATIONS IN TIER 5 JOURNALS (BREAKTHROUGH PAPERS)

20 RUNNING MARIE SKŁODOWSKA-CURIE ACTIONS
- **14** INDIVIDUAL FELLOWSHIP
- **6** INNOVATIVE TRAINING NETWORK

27 RUNNING ERC GRANTS
- **6** STARTING GRANTS
- **12** CONSOLIDATOR GRANTS
- **8** ADVANCED GRANTS
- **1** PROOF OF CONCEPT

A SELECTION OF INTERNATIONAL RECOGNITIONS

- GENERET AWARD
- DAVID HAGUE EARLY CAREER INVESTIGATOR AWARD OF THE ALZHEIMER'S RESEARCH UK
- EMBO GOLD MEDAL
- MOLECULAR CLOUD DISTINGUISHED RESEARCH AWARD

TECHNOLOGIES WITH IMPACT

The driver of frontline research

Whether it is to acquire fundamental insights into biomolecular mechanisms that steer developmental processes or interfere with target molecules that drive (the onset of) progressive disease phenotypes, access to cutting-edge technology is vital in the modern life sciences arena. At VIB, we anticipate this techno-scientific nature of top-notch research by offering our research community open access to a suite of state-of-the-art core facilities.

Notwithstanding the challenges presented by the COVID-19 pandemic; in 2020, the VIB cores excelled. When the SARS-CoV-2 virus invaded Europe in March, all cores rose to the occasion and contributed their collective, complementary expertise and know-how to participate in testing ~120.000 patient samples as members of a National Testing Platform. As such, the cores' professionalism once again formed a unique asset for Flanders.

With the uptake of single-cell activities; scale, dimension, and resolution play a prominent role in VIB's main research lines. Thus it comes as no surprise that the cores are also taking action to integrate single cell-, spatial- and multi-omics-driven service portfolios via concerted efforts between individual core facilities.

Scanning the technology horizon

The Tech Watch (TW) initiative is an established technology evaluation and implementation program at VIB where breakthrough technologies are identified, enabled and de-risked. TW provides funding for VIB groups to access emerging technologies through specific tracks focusing on pre-commercial and recently commercialized tools and supporting 'in-house' technology development.
The program has been expanded in 2017 with the roll-out of the 'Technology Innovation Lab' (TIL), where early access instruments are being evaluated and optimized with hands-on support, offering a bridge between high-risk prototype platforms and commercial walk-away instruments.

Recent Tech Watch projects, run together with VIB Labs, Core Facilities or Expertise Units, are the Tapestri instrument from MissionBio for single-cell DNA sequencing, the MPOne instrument from Refeyn that allows real-time measurement of e.g. proteins, nucleic acids, and complexes based on mass photometry, the ExoView instrument from Nanoview Biosciences that enables the detection of exosomes and microvesicles based on specific markers, and the research instrument from Sphere Fluidics for single-cell encapsulation followed by downstream assays and sorting. In 2020, Tech Watch funded 60 projects.

New initiatives

In 2020, Tech Watch launched several new initiatives.

First, a new co-investment track named 'technology implementation'. This track aims to facilitate the uptake and establishment of emerging breakthrough technologies that are not commercialized, and required to remain at the forefront of fast-moving technology fields (e.g. single-cell omics, microscopy).

Second, to support the creation of custom microfluidics set-ups, Tech Watch helped establish the Fab Lab. The Fab Lab is a collaborative partnership between VIB and the KU Leuven Biosensors group of Jeroen Lammertyn to allow custom microfluidic devices to be built for selected VIB labs for a 2-year trial period.

Finally, the TW and New Ventures team at VIB have closely collaborated over recent years to reinforce knowledge of emerging technologies within life sciences to help position VIB spin-off companies. As a result, a collaborative project with imec has been initiated to spin out a single cell multi-omics platform company. Throughout 2020, the two institutes worked on a joint business and marketing plan intending to incorporate in 2021.

Single Cell Accelerator

Furthermore, TW launched the 'Single Cell Accelerator' (SCA) initiative in 2018 to strengthen VIB's position in the single-cell field. The SCA was extended from 2019 to 2021. In the SCA, dedicated funding and FTE support were added to the Tech Watch initiative to boost the uptake and development of single-cell technologies. The SCA provides a future-looking strategy to remain at the forefront of this fast-moving field. In 2020, the SCA program was recognized as one of the top European single-cell centers by the prestigious LifeTime consortium.

Janssen Pharmaceutica was the first industrial partner to plug in into VIB's SCA initiative in 2018 for an initial two-year period. VIB and Janssen Pharmaceutica combined forces to excel in the single-cell field by evaluating, optimizing, and implementing multiple single-cell technologies. The implemented single-cell methodologies are optimized and disseminated across the VIB centers by dedicated single-cell sequencing experts closely collaborating with the VIB labs and core facilities. After finalizing the initial milestones, the collaboration has been extended by an additional two years (2021-2022) to focus on additional projects in a variety of single cell technology fields, including single-cell CRISPR screens and multi-omics technologies.

The SCA AgBio initiative was set-up in 2020 at the VIB-UGent Center for Plant Systems Biology to help establish single-cell technologies in the plant field, which is highly challenging due to the nature of plant organisms and the subsequent compatibility with the many single-cell technology platforms. Three companies have already joined the initiative.

SCIENCE MEETS BUSINESS

SCIENCE-BASED BUSINESS FOR ECONOMIC IMPACT

VIB's Innovation & Business team guides the development of innovative research towards applications and products that benefit patients, farmers, and consumers. In 2020, the team – despite the challenging situation for business development – supported the creation of diverse spin-offs and R&D and license deals. This record amount reaffirms VIB's position as a business partner of choice and a source of innovation within the life sciences ecosystem.

MRM Health leverages microbiome knowledge

Together with KU Leuven and Ghent University, VIB announced a new spin-off last February: MRM Health, a biopharmaceutical company focused on discovering and developing innovative therapeutics based on the human microbiome. MRM Health leverages the extensive microbiome and bioinformatics capabilities of the Jeroen Raes lab (VIB-KU Leuven Center for Microbiology) and the multidisciplinary know-how in arthritis and inflammatory diseases of Dirk Elewaut and his team (VIB-UGent Center for Inflammation Research).

The new company got off to a flying start. It debuted by announcing a collaboration with DuPont Nutrition & Biosciences. It also completed its first external investment round of 14 million euros with the participation of Ackermans & van Haaren, DuPont Nutrition & Biosciences, MRM Technologies, Qbic II, and VIB.

MRM Microbial Resource Management Health

ExeVir

Record timing for COVID-19 anti-body spin-off ExeVir Bio

When COVID-19 went global in early 2020, VIB researchers led by Xavier Saelens and Nico Callewaert (VIB-UGent Center for Medical Biotechnology) quickly identified and developed an effective antibody – with the help of Winter the llama – to fight the SARS-CoV-2 virus. To further develop these antibodies into a medicine, VIB established a new start-up, ExeVir Bio, in July 2020.

Fund+ stepped in as a lead investor to raise funds needed to take the ongoing trial to clinical testing as quickly as possible. Soon afterward, an ambitious investment syndicate made up of UCB Ventures, V-Bio-Ventures, FPIM, and several Belgian family offices successfully raised 23 million euros in the first A round.

The new company will start testing the drug in COVID-19 patients in the spring of 2021.

animab

Animab, first VIB spin-off in animal health

Animab develops monoclonal antibodies for oral administration to ensure the intestinal health of livestock. The initial focus is to improve the resilience of piglets during the fragile post-weaning period. Animab builds on a proprietary platform technology enabling efficient generation of monoclonal antibodies to prevent intestinal infections in farm animals. This new class of orally administered antibodies is designed to improve the health and performance of animals by targeting specific disease-causing pathogens.

Animab is backed by a solid European investor consortium that invested 3.4 million euros in a seed round led by Seventure Partners and PMV, and with the participation of Agri Investment Fund, V-Bio Ventures, and VIB.

In addition to these three new start-ups, VIB also launched Dualyx, a seed-stage company developing novel and differentiated biologicals for autoimmune disease, and Flamingo Therapeutics that develops novel and innovative drugs for specific cancer types.

Sharing expertise with industry

Beyond guiding the creation of spin-offs, VIB also often collaborates with industry via R&D and license deals. Sharing expertise in this way ensures that VIB science finds its way into the pipeline of leading companies.

In 2020, the Remaut lab published a new study in collaboration with Oxford Nanopore Technologies concerning a nanopore that is engineered to hold two constrictions. Such dual constriction nanopores are shown to be advantageous in resolving regions of DNA more difficult to read by conventional nanopores and support the generation of very high accuracy nanopore sequencing data.

Drawing international attention

The biotech expertise in Flanders, coupled with the collaborative spirit, is embodied by its fertile ecosystem of spin-offs and industry partnerships. This combination regularly catches the attention of international companies interested in expanding and establishing local facilities. VIB is part of Flanders Life Sciences Welcome team, which guides international companies when exploring to set up activities in Flanders. In 2020, these efforts helped in attracting three foreign businesses.

ECONOMIC IMPACT 2020

27 START-UPS
- **5** NEW SPIN-OFFS IN 2020
- **1.3B** € CAPITAL INVESTMENT
- **900** DIRECT EMPLOYEES

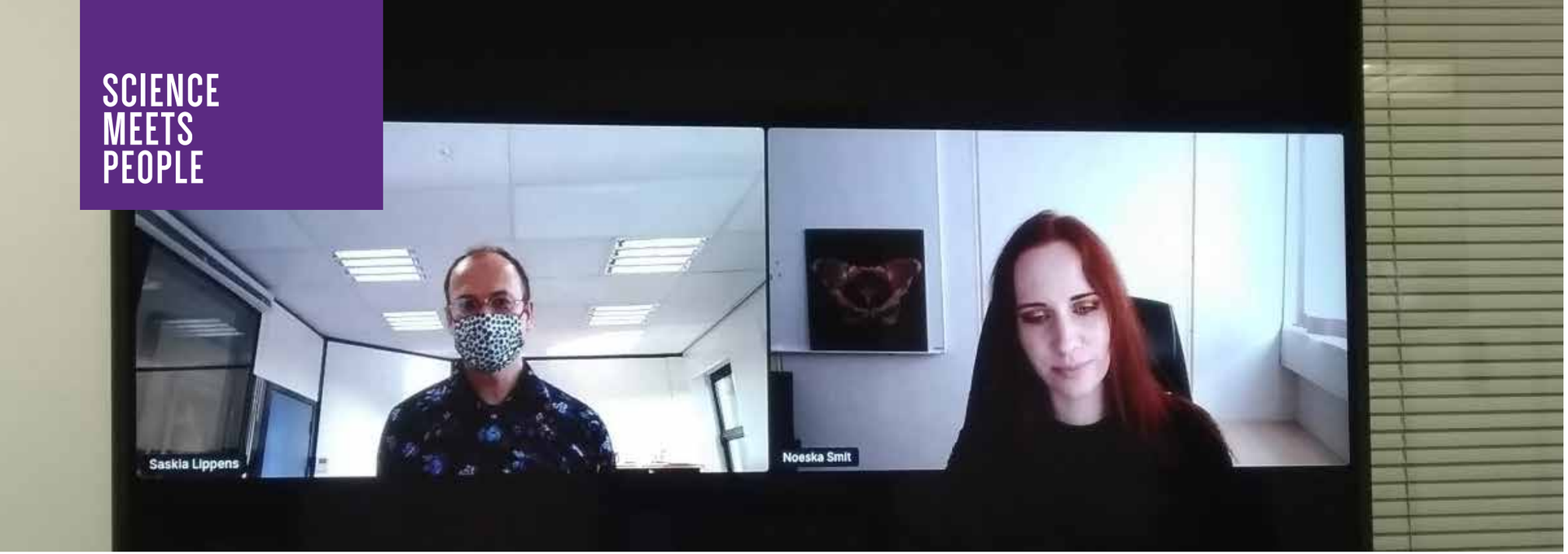
VIB

INTELLECTUAL PROPERTY
- **690** TOTAL NUMBER OF PATENT APPLICATIONS
- **241** TOTAL NUMBER OF ACTIVE PATENT FAMILIES

INDUSTRIAL INCOME
- **144M** € OVER THE LAST 5 YEARS

INWARD INVESTMENTS
- **3** INWARD INVESTMENTS IN 2020
- **2.6B** € CAPITAL INVESTMENT
- **1000** DIRECT EMPLOYEES

SCIENCE MEETS PEOPLE



"Our first virtual VIB conference was a great success, thanks to the very lively participation of all attendees. Mindblowing talks by Amoys Tanay, Fabian Theis, and so many others, and the opportunity to talk to keynote speakers and PhD students. While initially hesitant, I really liked this virtual format with ample room for networking, maybe even in an easier fashion than at a traditional conference."

Yvan Saeys, VIB-UGhent Center for Inflammation Research, BE

"I love the Hopin platform; stable. Very well organized!"

Mojca Strazisar, VIB-UAntwerp Center for Molecular Neurology, BE

The foundation of every successful research institute lies in its people. Infrastructure, sophisticated equipment, and state-of-the-art technologies are essential, but without people, without passion and creativity, we are nowhere. That is why we want to ensure that our scientists and all who support them can work in a stimulating environment where everyone is treated with respect and understanding.

Further, exceptional science should not be locked in an ivory tower but should be shared – and more and more often co-developed – with the public-at-large. VIB strives to build bridges between its scientists and society. Translational research is one way to achieve this. Outreach is another very powerful tool in our arsenal to achieve this.

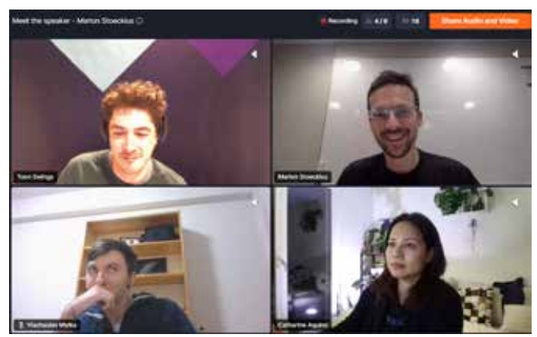
2020 presented unique challenges in terms of outreach, which usually thrives on in-person contact. Yet, VIB has – in many ways – managed to (virtually) connect science to people.

SCIENCE DAY

An annual event during which VIB promoted its biotech research is the national Science Day. During this day, scientists from all over the country explain how science and technology affect our daily lives. In 2020, this event moved online. Still, as is the case every year, VIB scientists were eager to contribute. We contributed with a very popular Grand Challenges quiz, tomato DNA extraction, and a 'breed your own bacteria' tutorial.

VIRTUAL CONFERENCES

Scientific collaborations often find their origins during a conference, where researchers share their work, data, and plans. Here too, COVID-19 threw a spanner in the wheels. Fortunately, VIB adapted quickly. On 19-20 November, the first edition of Emerging Technologies in Single Cell Research took place as a virtual conference. And the numbers don't lie, it was a great success. There were more than 400 attendees, 78 posters with Q&A, 18 'meet the speakers', 184 one-to-one meetings, and 2,855 conversations. The feedback from the attendees was laudatory.



THE VIB COVID-19 TESTING TASKFORCE

In response to federal minister Phillipe De Backer's call to upscale COVID-19 testing, VIB assembled an internal task force to contribute. During the first lockdown period, VIB volunteer teams were integrated in a collaborative effort with several external partners, contributing greatly to COVID-19 testing in Belgium.

The VIB taskforce consisted of several colleagues from the cores, including Stefaan Derveaux, Geert Van Minnebruggen, Saskia Lippens, Alexander Botzki, Tony Montoye, and Nele Vlaminck. They worked with the support of local coordinators in the research centers. They set up a detailed online survey to collect volunteer information, made an inventory of available infrastructure, determined the practical needs, and set up the necessary standard operating procedures. The actual roll-out of this scenario was only possible thanks to the continuous input, availability, and expertise of the UGent and IRC colleagues Geert Berx (local coordinator) and Isabelle Carpentier (manager of the IRC tissue culture facility).

The testing was part of a joint effort between UGent, Ghent University Hospital, Biogazelle, and Anacura. VIB helped with the labor-intensive steps from sample registration to inactivation, while Biogazelle performed the sample extraction and RT-qPCR detection.

On May 22nd, Biogazelle initiated their TECAN platform, automating the testing procedures and doing the manual work done by the motivated VIB volunteer teams. In total, together with our partners at Ghent University, Ghent University Hospital, Anacura, and Biogazelle, we have processed more than 115,000 samples, to which the VIB volunteers have significantly contributed with over 30,000 samples processed.

On April 15th, 2020, the first Ghent-based VIB team of volunteers started to test patient samples to determine whether they have been infected with the SARS-CoV-2 virus.

COVID-19 TESTING: VOICES OF THE VOLUNTEERS

VIB's efforts in upscaling COVID-19 testing would be fruitless were it not for the many volunteers who responded to the COVID task force's survey. Their work and motivation are the drivers behind the rapid response.

"When I first got the email about volunteering for the COVID-19 testing, I didn't hesitate to register. Nice to see that VIB took its responsibility even though it is not obvious to organize this in such a short period. I have some experience with human samples due to my previous job, and it is nice to know that in these crazy times we can contribute, even if it is just a little piece of the bigger puzzle. Thanks to the COVID-19 task force's effort, things quickly began to run smoothly, and quite a lot of samples were processed every day. Hopefully, this crisis will be over soon, but in the meantime, we are happy to do whatever we can."

Evelien Van De Velde

"When I heard that VIB was looking for volunteers to set up a COVID-19 task force, I did not hesitate. After a few weeks of working from home, I looked forward to being back in the lab and doing some practical work. Although our work is just a small part of the whole testing procedure, the feeling of doing something that matters in these challenging times is gratifying."

Marlies Ballegeer

"As a lab technician, it is hard to telework. So, when the question came from the VIB task force to help testing Corona patients, I didn't hesitate to volunteer.
Every sample we process is a person we help; after each working shift, I left with a feeling of satisfaction. I'm thrilled that I could be a small part of this admirable initiative."

Gillian Blancke

"Everyone can contribute to the fight against COVID-19. For me, there is no better way than doing it pipetting. I was delighted I got the opportunity to help. May the Task Force be with you!"

Tessa Van de Steene

WELLBEING IN TIMES OF COVID-19

At VIB, we value our people's wellbeing at all times, especially during the COVID-19 pandemic with its particular challenges. In June, we conducted a survey to get some insight into how COVID-19 has impacted VIB collaborators. Besides the feeling of missing the colleagues and the working routines and the lack of informal communication, the responses did not raise major concerns. In general, the VIB community has adapted reasonably well to the changing circumstances.

COVID-19 has forced most of us to work from home, either entirely or partly. Everyone faced challenges while doing so, from simultaneously caring for children to adjusting to virtual collaboration with colleagues. Some reported that home and work-life completely merged and that it was difficult to set boundaries. However, for others, working from home was more effective and a blessing: no traffic jams, healthier work-life balance, and higher focus for the tasks at hand.

#COFIT19 CHALLENGE: STAY FIT AND CONTRIBUTE

VIB has a longstanding reputation for participating in sporting events to raise money for scientific research. COVID-19, however, decided to interfere, and unfortunately, all these events were canceled or postponed. Hence, we invited all VIB colleagues to walk, run or bike for charity during the long weekend of May 1st.

The response was overwhelming, and the good weather inspired many to take on the #Cofit19 challenge, raising money to support nursing homes to thank them for their COVID-19 efforts. With the #Cofit19 challenge's proceeds, we offered a special treat to the residents and carers of two residential care centers.

VIB TRAINING GOES (MORE) VIRTUAL

In March 2020, the COVID-19 pandemic forced us to rapidly and efficiently rethink the VIB Training events. Thanks to the trainers' flexibility, most of the training events scheduled this spring could continue online, sometimes requiring some rescheduling. Only a few courses were canceled or postponed.

We noticed that there was quite some interest in many courses, even more than before the pandemic when courses were only offered live. Some people might have had a bit more time during the lockdown to follow courses, but in addition, we believe that the participants see the advantages of attending online courses.

When extended with online Q&A sessions and exercises, we believe these training forms can be as effective as live training. VIB training also developed e-learning modules with the exercises that are part of some courses to complete the theoretical online lectures. We were happy to see that, for the coaching sessions we organized at VIB, most people were very satisfied after attending the course.

"The transition from a face-to-face to an online course was a big effort from the trainer and I truly appreciated it."

Participant' Experimental Design', 2020

"I prefer face to face, but this counseling session was also very good regardless of the fact it was online."

Participant' Career Counseling', 2020

"Thank you for the online course on prism. This was my first-time using prism and the videos were very clear and helpful."

Participant 'GraphPad Prism', 2020

"I prefer face-to-face training, but this online training was organized very well!"

Participant' Communication Skills – Establishing Connective Clarity', 2020

"I think the e-learning exercises worked really well: everything was clearly explained and there were options to check the correct answers and even to retry the exercises. I liked it a lot this way."

Participant' How to write a winning grant proposal', 2020

GOOD GOVERNANCE

VIB has established a 'Good Governance Charter'. The full text of the charter is public and can be consulted on our website (vib.be). Our principles of good governance are regularly tested and adjusted.

This means that we are able to capitalize on local and international developments in this context and meet the needs of all our stakeholders.

BALANCE SHEET

(€ THOUSANDS)

ASSETS	31.12.2020	31.12.2019	31.12.2018	2020-2019 %
Intangible fixed assets	1 925	1 091	907	76%
Tangible fixed assets	33 970	32 466	33 707	5%
Financial fixed assets	46 686	35 882	34 789	30%
Contracts in progress	14 265	14 090	11 491	1%
Amounts receivable within one year	19 942	20 698	18 196	-4%
Investments	90 418	83 715	73 500	8%
Cash at bank and in hand	35 373	37 911	40 461	-7%
Deferred charges	2 730	4 009	13 025	-32%
TOTAL ASSETS	245 309	229 862	226 076	7%

LIABILITIES

Allocated funds	115 184	108 475	103 761	6%
Investment grants	34 438	31 517	31 991	9%
Amounts payable after one year	15 120	10 232	12 264	48%
Amounts payable within one year	51 918	50 361	53 379	3%
Accrued charges and deferred income	28 649	29 277	24 681	-2%
TOTAL LIABILITIES	245 309	229 862	226 076	7%

PROFIT AND LOSS STATEMENT

(€ THOUSANDS)

Operating income	**120 464**	**114 405**	**108 503**	**5%**
Turnover (from contract research)	34 313	32 243	30 085	6%
Contracts in progress (+/-)	175	2 599	2 846	-93%
Grants and subsidies	84 248	76 769	73 217	10%
Other income	1 728	2 794	2 355	-38%
Operating expenses	**-117 550**	**-109 138**	**-101 854**	**8%**
Raw materials and consumables	-12 160	-12 066	-11 076	1%
Services and other goods	-30 802	-26 592	-26 589	16%
Remuneration, social security costs and pensions	-63 730	-60 301	-54 944	6%
Depreciation	-9 961	-9 333	-8 484	7%
Other operating expenditures	-897	-846	-761	6%
Financial income	**506**	**970**	**1 138**	**-48%**
Financial charges	**-848**	**-9**	**-957**	**9322%**
Extraordinary income	**9 796**	**2 359**	**24 114**	**315%**
Extraordinary expenditure	**-5 659**	**-3 873**	**-14 635**	**46%**
PROFIT/LOSS FOR THE FINANCIAL YEAR	6 709	4 714	16 309	42%

VIB

Basic research in life sciences is VIB's raison d'être. VIB is an independent research institute where some 1,500 top scientists from Belgium and abroad conduct pioneering basic research. As such, they are pushing the boundaries of what we know about molecular mechanisms and how they rule living organisms such as human beings, animals, plants and microorganisms.

Based on a close partnership with five Flemish universities – Ghent University, KU Leuven, University of Antwerp, Vrije Universiteit Brussel and Hasselt University – and supported by a solid funding program, VIB unites the expertise of all its collaborators and research groups in a single institute.

VIB's technology transfer activities translate research results into concrete benefits for society, such as new diagnostics and therapies and agricultural innovations. These applications are often developed by young start-ups from VIB or through collaborations with other companies. This also leads to additional employment and bridges the gap between scientific research and entrepreneurship.

VIB also engages actively in the public debate on biotechnology by developing and disseminating a wide range of science-based information.
More information can be found at www.vib.be

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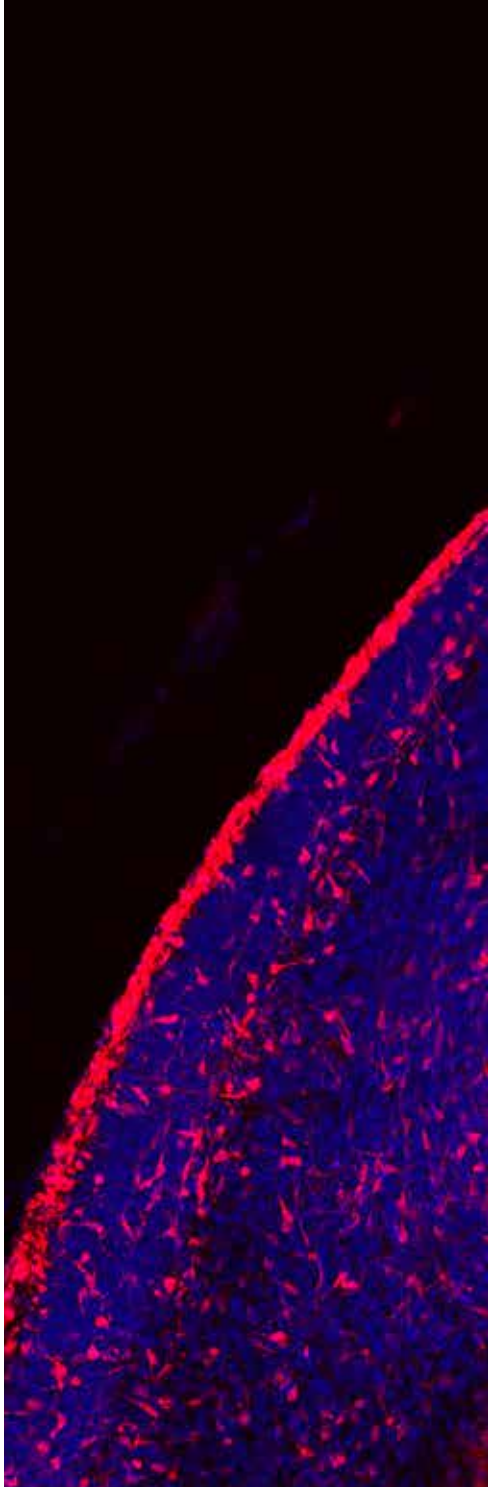

The image on the cover shows migrating inhibitory neurons in developing mouse neocortex