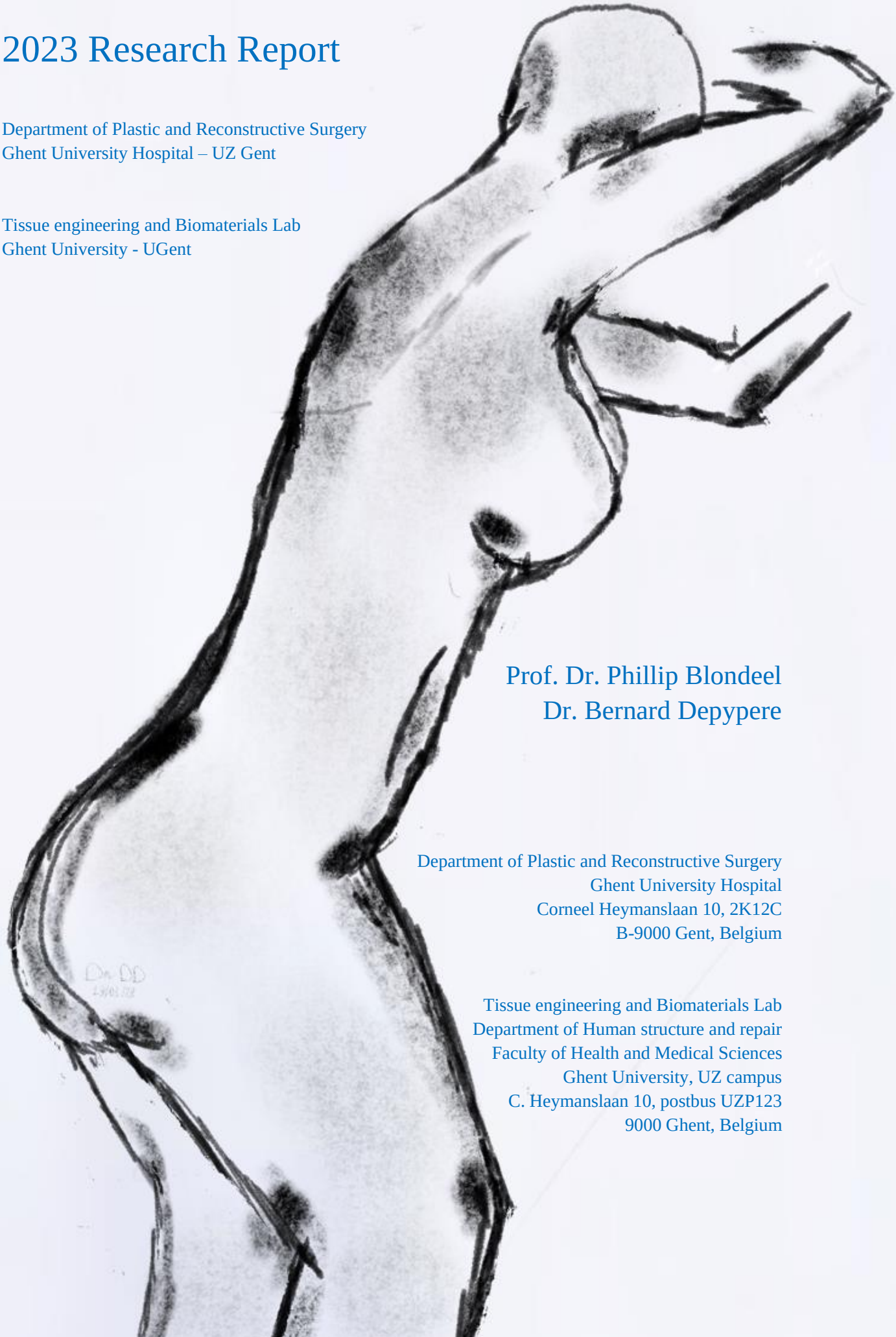
2023 Research Report

Department of Plastic and Reconstructive Surgery
Ghent University Hospital – UZ Gent

Tissue engineering and Biomaterials Lab
Ghent University - UGent



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Preface by Professor Phillip Blondeel

Throughout my career, I have witnessed the challenges inherent in traditional reconstructive techniques. From the complexities of fat resorption to the limitations of donor-site irregularities, we have grappled with obstacles that demand innovative solutions. As we stand at the threshold of a new era in reconstructive surgery, the landscape before us is both exciting and full of promise. In our quest for improvement, tissue engineering has emerged as a beacon of hope—a realm where the boundaries of what is achievable are continually expanding.

Concerning autologous breast reconstruction, we find ourselves unravelling the intricacies of constructing three-dimensional structures to replace or augment breast tissue. Yet, this journey is far from simple. It requires a profound understanding of cellular biology, biomolecular interactions, and the dynamic processes of tissue growth and development. In our research endeavours, we have embraced a bottom-up approach to tissue engineering, harnessing the inherent capabilities of cells to self-assemble and organize into functional structures. Stem cell research forms the cornerstone of our efforts, alongside advancements in spheroid technology, scaffold design, and intercellular communication.

Collaboration stands as a central pillar of progress in this endeavour. By joining forces with fellow researchers and clinicians within the GATE Platform (**G**hent **A**dvanced Therapies and **T**issue **E**ngineering), we have pooled our expertise and resources to accelerate the pace of discovery. Together, we are laying the groundwork for a future where tissue-engineered solutions become an integral aspect of clinical practice.

Yet, as we navigate this terrain of innovation, we must also confront the challenges that lie ahead. The path to scalable tissue engineering is fraught with obstacles, from technical complexities to logistical hurdles. But with perseverance and determination, we can overcome these challenges and pave the way for a future where tissue engineering transforms the landscape of medicine.

In closing, I extend my gratitude to all those who have contributed to this journey of exploration. My deepest appreciation goes to our private donors and sponsors, big and small, without whom this journey would have been impossible. Together, we are charting new territory, pushing the boundaries of what is achievable in reconstructive surgery. As we continue along this path, I am confident that tissue engineering will emerge as a cornerstone of tomorrow's healthcare—a testament to the power of innovation and collaboration in shaping the future of medicine.

Phillip Blondeel, *March 2024, Ghent*

Research Team

An overview of our research team can be found in Tables 1-3.

Supervisor	Department
Prof. Dr. Phillip Blondeel	Plastic Surgery, Burn Center, Ghent University Hospital
Em. Prof. Dr. Stan Monstrey	Plastic Surgery, Burn Center, Ghent University Hospital
Prof. Sandra Van Vlierberghe	Organic and Macromolecular chemistry, Polymer Chemistry and Biomaterial group, Ghent University
Prof. Dr. Olivier De Wever	Laboratory of Experimental Cancer Research, Ghent University
Prof. Dr. Esther Hoste	Keratinocyte micro-environment lab, VIB-UGent Center for Inflammation Research
Prof. Dr. Nathalie Roche	Plastic Surgery, Ghent University Hospital
Prof. Dr. Marlon Buncamper	Plastic Surgery, Ghent University Hospital
Dr. Filip Stillaert	Plastic Surgery, Ghent University Hospital
Dr. Bernard Depypere	Plastic Surgery, Ghent University Hospital
Dr. Nicolas Dhooghe	Plastic Surgery, Ghent University Hospital
Dr. Karel Claes	Plastic Surgery, Burn Center, Ghent University Hospital
Dr. Liesl De Graeve	Plastic Surgery, Ghent University Hospital
Dr. Renaat Coopman	Oral and maxillofacial surgery, Ghent University Hospital
Em. Prof. Dr. Hubert Vermeersch	Oral and maxillofacial surgery, Ghent University Hospital
Prof. Ward De Spiegelaere	Department Morphology, Faculty of Veterinary, Ghent University
Prof. Dr. Niek Sanders	Laboratory for Gene Therapy, Department of Veterinary and Biosciences
Prof. Hendrik Feys	Transfusion Research Center (TReC), Red Cross Flanders
Willem Delabie	Transfusion Research Center (TReC), Red Cross Flanders

Table 1 – List of supervisors.

Doctoral Researcher	PhD Topic
Dr. Nicolas Dhooghe	Facial Surgery
Dr. Bernard Depypere	Tissue engineering in breast reconstruction
Dr. Arne Peirsman*	Tissue engineering and oncology
Dr. Mohammad Ghiasloo	Intercellular communication
Dr. Lana Van Damme*	Polymer bioengineering
Dr. Ignace De Decker	Prevention and treatment of hypertrophic scarring
Dr. Florian Vanlauwe	3D Bioprinting
Dr. Marie-Laurence De Prest	Platelet rich autologous matrices
Ir. Nicole Ritter	Development of degradable implants for breast reconstruction
Dr. Dries Opsomer	Breast reconstruction with Lumbar Flaps

Table 2 – List of Doctoral Researchers (* PhD candidates whom completed their dissertation in 2023).

Research associates, research nurses and medical students
Alexandra Cleyman - Alina De Pessemier - Bronwen Wiedeman - Carolien Sels – Charlotte Dermaux – Dries Janssens - Febe Hoste – Floor Verstraete - Jessie De Kinder (RN) – Karen Van Elewijck - Kim De Mey (RN) – Laura Schelfaut - Laurens-Jan Isenbaert – Leen Vermoesen – Louise Lecoq – Marie Simaey (MD) - Margo Van Daele – Michiel Van Der Heyden – Marie Declercq – Noah Borges – Oscar Lemmens - Sabina Shamieva – Soetkin Rapol – Stef Vermeiren – Thaïs De Witte - Thibaut Dhont – Wannes Van Buggenhout – Ward Van de Steene – Whitney Van Damme (MD)

Table 3 – List of research associates and medical students.

The cornerstones of our research

In its true essence tissue engineering, much like medicine in general, is a team sport. Therefore its research comprises not of just one, but rather several crucial pillars. To be able to achieve a viable tissue engineered construct, you need to be an expert in cell engineering, cell communication, angiogenesis, biomaterials and ofcourse you must have mastered the art of 3D bioprinting itself. Figure 1 shows an overview of all the different subdisciplines that are needed for tissue engineering. Below you can find out about the most important evolutions, achievements and projects of the last year in our Research Group.

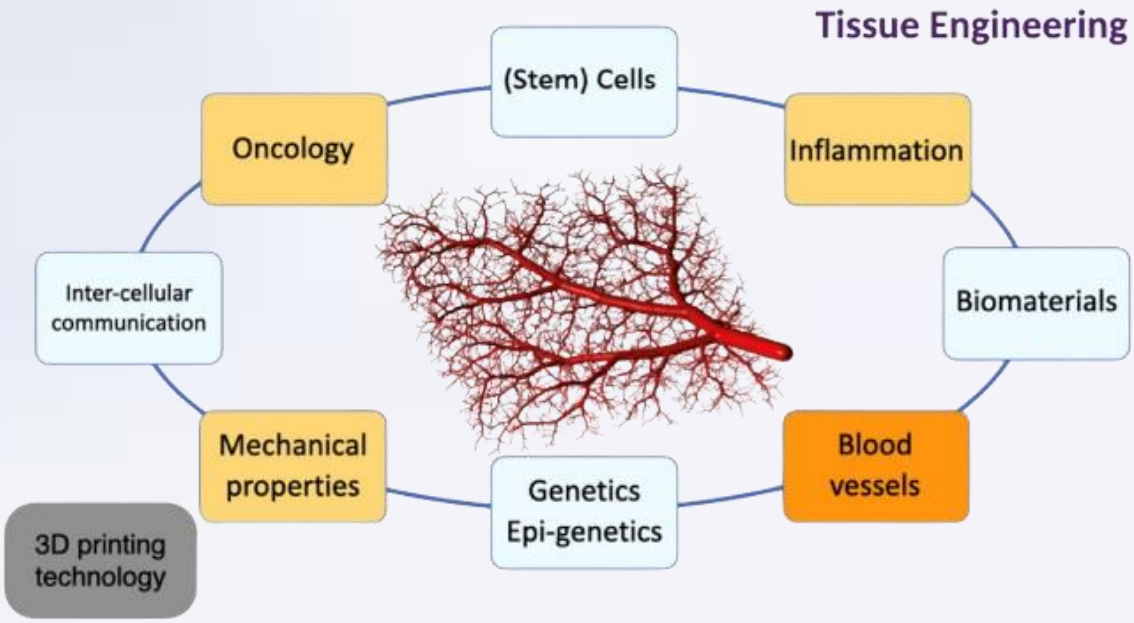


Figure 1 - Modern tissue engineering research is a collection of different basic research programs. Cells or groups of cells can later be brought together with 3D bioprinting machinery to build larger, functional organoid structures.

1. Speaking the same language across the world: MiSpheroid project

Gent has taken a leadership role in the world of spheroids and organoids by its landmark paper in Nature Methods. Spheroids are small cell clusters (±300 µm diameter) which can be applied as research models for (cancer) research and as building blocks for tissue engineering. We collaborated with the UGent Laboratory of Experimental Cancer Research (LECR, led by Prof. Olivier De Wever) to research fundamental characteristics of spheroids. Next, we instigated the international MISpheroID (Minimal Information for Spheroid IDentity) consortium and formed guidelines for the entire field to better understand and reproduce spheroid research.

2. 3D printing technology and the 3D-Platform

We are continuously advancing the development of our In-House 3D Platform, dedicated to designing and producing 3D anatomical models and surgical cutting guides. This research pillar is intricately woven into our daily clinical practice, where virtual surgical planning tools and 3D-printed models are utilized extensively, particularly in complex Maxillofacial cases. The implementation of patient-specific 3D models and surgical guides contributes significantly to achieving predictable outcomes, minimizing operating time, and reducing surgical complications. With the integration of intra-operative CT-scanning, we can promptly align surgical results with the preoperative plan while the patient remains in the operating room. This streamlined workflow ensures exceptional quality and diminishes the need for surgical revisions.

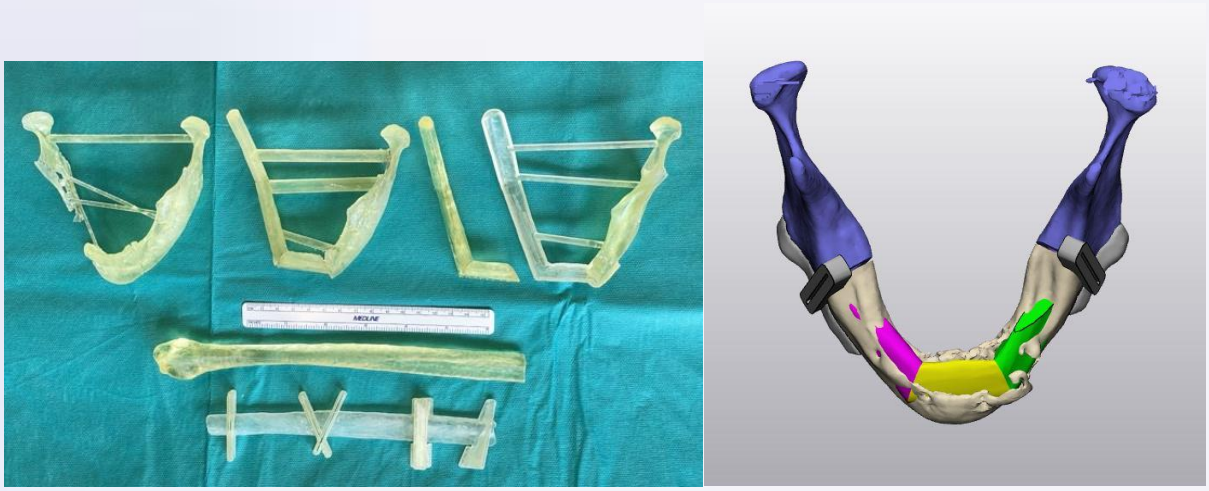


Figure 2 – Left: In House production of 3D models and cutting guides. Right: Virtual planning of mandible reconstruction

3. Facial prosthetic reconstruction

Patients with facial defects stemming from traumatic, oncologic, or congenital causes have options for reconstruction using either autologous tissue or facial prosthetics. The integration of endosseous implants has significantly improved the quality of life for patients with prosthetic solutions, offering superior retention and aesthetics compared to glued prostheses. This project seeks to develop a standardized methodology for fabricating facial prostheses. Furthermore, it aims to refine the surgical protocol to expedite facial reconstruction, targeting a timeframe of within three weeks post-resection.

4. Intercellular communication

Cells are the architects of their environment. Thorough meticulous signaling, cells maintain, regenerate and/or remodel tissues. Understanding the ongoing communication is therefore crucial, as it offers a manual for the tissue engineering of complex tissues. Within this research line, we study the communication between cells within adipose tissue, seeking to identify and exploit signals permitting the development of complex tissues outside of the human body. Together with advances in biomaterial development and fabrication,

understanding of the cellular communication is crucial for the successful development of more performant breast cancer reconstructive strategies.

5. Predicting the degradation behavior of biodegradable polymers

Interest in biodegradable implants is growing, with applications ranging from reconstructive surgery to temporary expanders. Accurate prediction of material degradation and changes in properties is crucial, often achieved through in vivo testing. However, efforts to minimize animal testing are underway, necessitating the development of standardized in vitro and in silico models for commonly used biomaterials. A key challenge is devising accelerated testing methods for slower degrading polymers like PLA and PCL. Accelerated degradation studies are underway for biopolymers, particularly for breast expander designs. Comparisons are being made between acidic, basic, and enzymatic conditions at various temperatures, with results validated against in vivo data. Additionally, in silico models are being developed to simulate implantation and degradation, aiding in preparation for in vivo studies and enhancing their efficiency. Standardized in vitro and in silico models represent a significant step towards introducing new medical devices to clinical practice.

6. Biodegradable biomaterials and our preferred BioInk: GelMA-NB

In tissue engineering, the quest for natural, biodegradable biomaterials has never been more pressing. Conventional synthetic materials often lack the intricacies and bioactivity necessary to faithfully mimic native tissue environments, hindering the efficacy and long-term success of tissue regeneration therapies. Furthermore, concerns over long-lasting foreign body responses and environmental impact underscore the urgent need for sustainable, biodegradable alternatives. Our research focuses on addressing these challenges by harnessing the power of natural biomaterials, such as gelatin, to develop biocompatible, biodegradable solutions tailored for tissue engineering applications. By leveraging the inherent biocompatibility and tunable properties of gelatin, we aim to create biomimetic scaffolds capable of promoting cell adhesion, proliferation, and tissue regeneration while seamlessly integrating into the host environment and ultimately degrading harmlessly over time. We are committed to advancing the frontiers of biomaterial science to meet the growing demand for sustainable, effective solutions in tissue engineering and regenerative medicine, heralding a new era of biodegradable biomaterials. Figure 3 shows an overview of different scaffold materials that are encapsulated with ASC's.

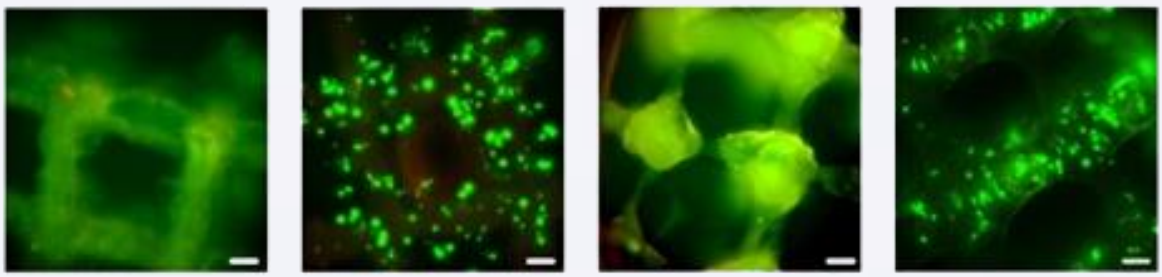


Figure 3 – Overview of different scaffold materials that are encapsulated with ASC's.

7. Supplying a supportive environment for cell proliferation and survival

Our collaboration with the Transfusion Research Center (TReC) of the Red Cross Flanders continued this year and to both research teams' delight, much progress has been made. Platelets have the potential to be used to stabilize adipose tissue whilst also providing a nutritious environment. This nutritious and stable matrix (see Figure 4) would optimize breast reconstruction after mastectomy by supplying a healthy cell-supportive environment and might therefore avoid potential (multiple) repeat procedures. This project yielded crucial research results that resulted in obtaining a Baekeland mandate from VLAIO (*Het Agentschap Innoveren en Ondernemen*). This will support our research into an autologous fat transplant construct that is optimized with platelets for reconstructive medicine such as burn injuries in the short run, and three-dimensional tissue engineering in the long run.

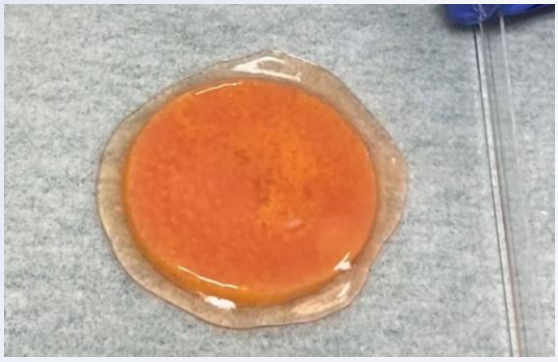


Figure 4 – A platelet-rich autologous fat scaffold.

8. Supplying a supportive environment for cell proliferation and survival

The culture of organs/tissues in the lab will be an important improvement to correct soft tissue defects caused by trauma, tumor removal and abnormalities present from birth. Having the tissue that is needed for reconstruction fabricated in the lab prior to surgery reduces the duration, complexity and invasiveness of the operation. However, without the presence of blood vessels, the cells in the core of the tissue will struggle to survive due to a lack of nutrients and oxygen. In our research projects, we aim to create a vascular network to support the survival and growth of fat tissue in the lab and after transplantation. By combining endothelial cells with stem cells from liposuction fat, a stable blood vessel network can be formed in 3D bioprinted hydrogels (see Figure 5).

The current research focus is to find the best cell and hydrogel configuration for blood vessel formation. From there on, the optimal configuration will be 3D bioprinted in the shape needed for the reconstruction of patient specific soft tissue defects.

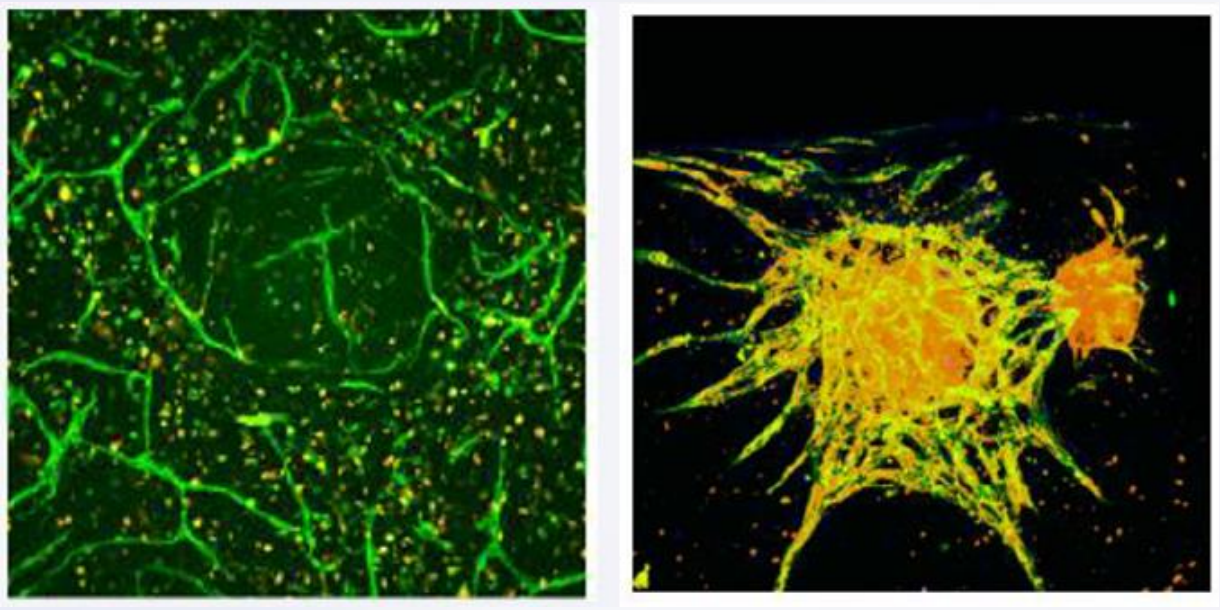


Figure 5 - Green and orange indicate the endothelial cells forming blood vessels. This shows the sprouting angiogenesis from prefabricated adipose microtissues.

9. Hydrogel formulations for pain-free drug administration in burn patients with scarring

Hypertrophic scarring (HTS) commonly follows burns, impeding patient recovery due to physical and cosmetic concerns. Scar management involves UV protection, hydration, pressure therapy, and, when needed, minimally invasive treatments like intracicatrical corticoid injections. Microneedle arrays (MN) provide a less invasive drug delivery method to the dermis, improving efficiency and reducing discomfort. Our research has shown promising results in using MN for treating hypertrophic scars in burn patients. We're now focusing on developing sustained-release microneedles for controlled, long-term painless treatment, particularly using poly(ε-caprolactone) (PCL) polymers. MN offer non-invasive application and precise drug delivery, making them useful for various medical conditions, including cancer, arthritis, and dermatological issues. They have potential to replace painful injections, especially for pediatric burn patients. Our polymer-based MN demonstrate superior performance compared to commercially available alternatives

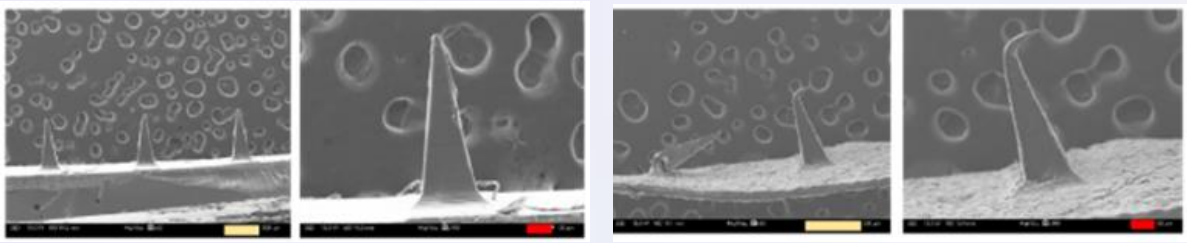


Figure 6 – The images display various phases of two microneedle array types: our custom-made microneedles on the left and commercially available ones on the right. Our microneedles exhibited more apparent drug release. After releasing the drug, our microneedles remained intact after compression and skin insertion, while the commercially available ones deteriorated under pressure.

Second GATE meeting was a BIG success!

It has been a great honor for our department to participate in the creation of GATE. We saw the need within the Ghent University to unify research groups that were working in very similar research areas. Very often DNA, stem cells and inter-cellular communication were the common ground. Interestingly, many of these groups were also using the same research tools. Finally, we were all looking for ways to heal or regenerate diseased or damaged human cells in a wide variety of medical pathologies. We therefor decided to create a new research platform where different researchers within the field of gene therapy, cellular therapies and tissue engineering decided to work together. We felt that this collaboration would boost our work in the entire field of regenerative medicine.

The goals of GATE include the following:

- GATE creates a step-up for researchers in the area around Gent to contact and communicate with each other
- GATE stimulates a modern multidisciplinary approach of research for example by encouraging the use of core facilities
- By gathering and centralizing background information on research groups, GATE helps collaboration and helps to excel in new, ground-breaking research
- GATE stimulates learning AND teaching environments
- GATE valorizes research efforts into business opportunities
- GATE helps to increase the visibility of joint research efforts (f.e. to business partners)

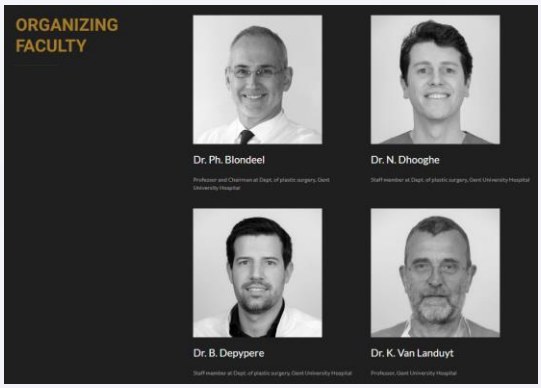
On October 2021 we held the big kick-off event. By attracting more than 150 delegates from academia and industry, 4 sessions (featuring >25 scientific talks and industry pitches showcasing successful collaborations between U(Z)Gent and industry) and 2 extensive panel discussions by industry experts about the future directions of gene & cell therapy and regenerative medicine, the first GATE conference proved to be a success!

Following the success of the kick-off event in 2021, GATE was pleased to announce the 2nd Academic-Industrial meeting ‘Cell & Gene Therapies and Tissue Engineering’, held on the 17th of March 2023, in Ghent. Researchers from UGent, UZ Gent, imec, and VIB presented breakthrough research on topics of gene and cell therapy, and regenerative medicine. Next to scientific and technological innovation, the event highlighted successful academic-industry partnerships to advance gene and cell therapy programs towards the clinic. Stakeholders were invited to give the newest insights into the rapidly evolving ATMP landscape in Ghent, Belgium, and beyond. The event was highly successful, with engaging presentations, lively discussions, and valuable networking opportunities. Attendees praised the quality of the research presented and the collaborative spirit fostered throughout the event. It served as a platform for fruitful exchanges between academia and industry, paving the way for future collaborations and advancements in the field of life sciences. Discussions at the event centered around the future of tissue engineering and the upcoming goals. Overall, the 2nd Academic-Industrial meeting was a resounding success, contributing significantly to the advancement of cell and gene therapies and tissue engineering.

More events upcoming in the near future! Check it out at https://gatehealth.be/news-events

Second GAPS meeting in 2024 !

50 Years ago, Professor Guido Matton founded the department of plastic Surgery at the Ghent University Hospital. He created an environment for research and innovation in this rapidly evolving and broad field of medicine. Today, his legacy lives on in the Ghent Academy of Plastic Surgery (GAPS), training the Belgian Plastic Surgeons of tomorrow and sharing their knowledge with fellows from every corner of the world. As a pioneer in the field of Reconstructive Surgery, a pupil of Professor Matton, a dedicated teacher towards residents and fellows and past EURAPS-president, Professor Blondeel leads the GAPS (research) team.



Join us as we celebrate the rich legacy of the Ghent Academy of Plastic Surgery (GAPS) at our second GAPS Meeting, taking place on June 14th and 15th, 2024. Expect an engaging program featuring sessions on Lymphatic, Microsurgery, Breast, Transgender, and facial surgery, alongside discussions on innovations in tissue engineering. With a blend of surgical techniques, insightful debates, and camaraderie, our meeting promises a stimulating exchange of knowledge and ideas.

While the GAPS Meeting may be small in capacity, it boasts a prestigious international faculty delivering high-quality lectures. Join us in the vibrant city of Ghent to reconnect with colleagues, expand your professional network, and immerse yourself in the latest advancements in plastic surgery. Don't miss this opportunity to be part of our thriving community and celebrate excellence in plastic surgery. See you there!

Building upon the success of our inaugural gathering, we invite you to honor Professor Koen Van Landuyt, a distinguished surgeon and one of our founding fathers. Professor Van Landuyt will share his view and expertise on the ever-changing field of Plastic Surgery and give an honorary lecture on the evolution of care throughout the years. Many of the residents & fellows whom he trained will attend the meeting. In conclusion: the second **'GAPS'**-meeting will be a source of knowledge for every plastic surgeon whom attends, combining aesthetic and reconstructive surgery in their daily practice.

Spotlight: Frédéric Clement on *'The CORE'*

In a recent interview, **Frédéric**, **Core Research Facility Manager** at the Faculty of Medicine & Health Sciences, provided insights into the evolution of core facilities and his vision for The Core. Frédéric's journey commenced with the introduction of the concept of Core facilities in 2016, and by 2019, he assumed the role of Core Facility Manager, collaborating closely with principal investigators to shape Core facilities & The Core into its current form.

By consolidating research infrastructure, Core facilities enhances efficiency and cost-effectiveness while promoting sustainability through reduced redundancy and streamlined management. Access to these facilities can be granted to researchers through a structured fee system, further contributing to its sustainability. Since start of the move-operation into The Core on January 1st, 2024, (the official inauguration is planned end of May), The Core has emerged as a pivotal innovation hub on the UZ Gent campus, departing from traditional research models by emphasizing collective resource ownership, with users contributing financially to leverage university-owned assets. Key to The Core's success are its dedicated support teams and optimized operational processes. By reducing downtime, enhancing equipment utilization, and streamlining assistance and maintenance, Core facilities ensure that every resource is leveraged to its fullest potential.

Overcoming challenges in fostering a collective mindset shift among researchers and students has been crucial to the Core Facilities and The Core's success. It stands as a unified space where the majority of UGent Pre-clinical, clinical and biomedical research activities are centralized. Frédéric estimates that around 85% of all research activities within the faculty of Medicine & Health sciences are housed in one of the 3 Medical research Buildings (MRB I, MRB II and The Core). Equitable access to resources is paramount, with a commitment to democratizing access regardless of personal connections or financial means. Moreover, in supporting academic endeavors, Core facilities in collaboration with the Ghent University's business development services, to researchers seeking to translate their findings into solid outcomes, fostering innovation and knowledge dissemination through collaborative projects and engagement with external entities.

Looking ahead, Frédéric envisions that Core facilities & The Core emerge as a symbol of innovation and inclusivity, driven by a community united by a common goal. Essentially, it serves as the pulsating center of scientific advancement, offering accessible avenues to state-of-the-art resources and expertise.

Research exchange programs

Previous: Dr. Lana Van Damme – University of Sydney; Sydney, Australia

Lana Van Damme, a physician and doctoral researcher specialized in bio-ink used in 3D printing, embarked on a research stay in Australia. The host organization for the research stay was the light activated biomaterials (LAB) group led by research associate professor Khoon Lim at the University of Sydney.

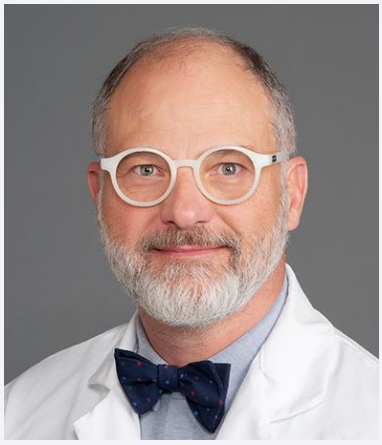
Prof. Khoon Lim had garnered several competitive awards and grants, including the Young Investigator Award in 2018 from the International Society of Biofabrication, Emerging Investigator Award in 2021 from the Australasian Society for Biomaterials and Tissue Engineering, and the Jean Leray Award from the European Society for Biomaterials. The lab focused on utilizing photo-polymerizable hydrogel bioinks, employing visible light initiation, and furthering research on various physiological processes such as the spatiotemporal control of angiogenesis and the development of functional tissues including vascularized bone and adipose tissue. Additionally, the group had been exploring methods to spatiotemporally control angiogenesis through indirect sacrificial printing.

In conclusion, the experience gained in visible light photo-crosslinking and processing to stimulate vascularized adipogenesis offered valuable insights to enhance the scientific standing of our research group.

Upcoming: Dr. Florian Vanlauwe – Wake Forest University; Winston-Salem, North Carolina

Florian Vanlauwe, a physician and doctoral researcher specializing in the vascular aspect of tissue engineering within our group, is poised to embark on an enriching journey at Wake Forest University under the mentorship of Prof. Dr. Ramon Llull. During his visit, Florian will delve into the intricacies of vascular printing for adipose tissue engineering, a cutting-edge field poised to revolutionize regenerative medicine.

Under the guidance of Prof. Dr. Ramon Llull, renowned for his pioneering work in tissue engineering, Florian will have the opportunity to explore the latest advancements and methodologies in vascular printing. This innovative technique involves the precise deposition of cells and biomaterials to recreate intricate vascular networks within engineered tissues, mimicking the natural blood supply essential for their survival and functionality.



During his stay at Wake Forest University, Florian will engage in hands-on experimentation, collaborative research endeavors, and in-depth discussions with experts in the field. By immersing himself in this dynamic research environment, he aims to gain invaluable insights, refine his skills, and contribute to the advancement of adipose tissue engineering.

New Research Facility MRB3 (The Core)

On the grounds of UZ Gent, a magnificent new research edifice is taking shape! This visionary structure is set to supplant the worn-out Block B, providing a vibrant hub for an array of cutting-edge research facilities. These spaces will unite across themes, disciplines, and faculties, fostering a dynamic synergy within their core facilities.

At its heart lies the fusion of biomedical science and advanced technology, where state-of-the-art equipment converges in these core facilities. This convergence sparks collaboration, amplifying expertise and resources through a dazzling display of scale and potential. Imagine the possibilities: joint project proposals, pooled financing, and an ever-expanding arsenal of clustered equipment, all orchestrated by the diverse tapestry of research groups contributing to this bold venture.

After significant dedication and financial investment, our research division will have a dedicated space and access to specialized equipment within this building. This achievement represents a significant milestone for tissue engineering at Ghent University, providing our researchers with the resources and infrastructure they need to push the boundaries of innovation in this field. With this new chapter, we anticipate exciting opportunities for collaboration, discovery, and breakthroughs in tissue engineering research.

Awards

EOS PIPET 2023 – Public Award

Ignace, one of our doctoral researchers, accepted the EOS Pipet 2023 Public Award. The EOS Pipet, organized by the scientific magazine EOS, is a competition aimed at recognizing promising young researchers in Flanders who are pursuing doctoral or post-doctoral studies. Out of over 100 Flemish researchers, Ignace was honoured to be among the five finalists, ultimately securing forty percent of the votes cast, underscores the profound resonance of our research with the audience.

Our ongoing investigations now include the exploration of less invasive treatments for overactive or hypertrophic scars, which present significant challenges for patients. We are delving into the potential of soluble microneedles delicately integrated into patches to provide relief without causing undue discomfort. The recognition of our work with the EOS Pipet Public Award underscores the significance of our research on polymer-based dissolvable microneedles. Currently, our team is expanding on this concept with a focus on drug-eluting long-term sustained release dissolvable microneedles, with recent scientific publications reflecting our progress. While the technology holds promise, rigorous testing and optimization are essential before it can be integrated into clinical care.

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Doctoral dissertations

In 2023 we had the honor of having two members of our research team achieving the highest academic degree possible. After a successful public defense of their works, each of them was bestowed the degree of '***Doctor of Philosophy (PhD) in Health Sciences***'. This title is the reward and proof of successfully concluding both extreme mental and intellectual challenges in their respective research field. A short description of their hard years of work can be found in the following paragraphs:

1. Lana Van Damme - MD, PhD

Title: ***'Reshaping the future of breast reconstruction exploiting photocrosslinkable hydrogels towards tailored adipose tissue remodeling'***

There is a growing need for innovative solutions in breast reconstruction, and adipose tissue engineering (ATE) holds promise in addressing these challenges. Lana aimed at developing biomaterials capable of enhancing tissue engineering and regenerative medicine, particularly in ATE.

Gelatin-methacryloyl (Gel-MA) has been widely used in tissue engineering, but concerns regarding immune responses and pathogen transmission have prompted exploration of recombinant proteins. Gel-B and RCPhC1 were modified with photo-crosslinkable functionalities, resulting in hydrogels with properties mimicking the extracellular matrix. These materials exhibited excellent biocompatibility and differentiation potential for adipose-derived stem cells. In 3D printing of scaffolds using Gel-B and RCPhC1-based materials, both direct and indirect printing methods were explored, with comparable properties achieved. Modified scaffolds demonstrated efficient crosslinking, mechanical stability, and superior adipose-vascular crosstalk. Polyvinyl alcohol (PVA) moulds were evaluated for cell encapsulation in hydrogel building blocks. Modified gelatin derivatives showed promise for soft tissue engineering applications, with suitable mechanical properties and high cell viability.

An injectable gel based on crosslinked gelatin microgels was investigated for minimally invasive adipose tissue regeneration. Microgels exhibited stable rheological properties, excellent injectability, and superior angiogenesis and adipogenesis compared to a commercial filler.

Overall, Lana's work demonstrated the potential of photo-crosslinkable biomaterials and 3D printing techniques for ATE, offering insights into scaffold design, composition, and clinical applications.

2. Arne Peirsman – MD, PhD

Title: ***'Exploring spheroids in the light of adipose tissue engineering'***

Soft tissue defects are a common challenge in plastic and reconstructive surgery. Current therapeutic options include synthetic materials like fillers and implants, as well as natural tissues such as grafts and flaps, each with specific pros and cons. Ideally, defects are restored with minimally invasive techniques using autologous, vascularized, functional soft tissue for predictable results. Tissue engineering offers various approaches like cell-seeding scaffolds and 3D cell clusters such as spheroids and organoids, known for in vivo-like behavior and scalability. However, the diversity in spheroid formation protocols hinders reproducibility and comparison. Our systematic review found that more than 80% of protocols are unique, lacking crucial information. Culture medium significantly influences spheroid characteristics and cellular behavior. To address this, we've made our review publicly available and proposed spheroid reporting guidelines, supported by an extensive image database for guidance. This effort aims to enhance transparency and reproducibility in spheroid research, fostering advancements in adipose tissue engineering and other tissue engineering approaches through improved data sharing and reporting standards.

Science communication – junction of experimental & clinical research

Besides the more fundamental and basic research performed by our department of Plastic Surgery, our team is additionally known for producing high-standard clinical research. Clinical research is the primary incentive for conducting basic research since it is able to reveals the gaps in the current medical care and therefore demonstrates to our team and the scientific community in general were medicine should be heading in the (near-)future.

A publication list of the articles produced in 2023 in our department with the corresponding authors list, title and journal can be found in Table 4.

AUTHORS	TITLE	JOURNAL	IMPACT FACTOR
Roberto de Barros N, Wang C, Maity S, Peirsman A, Nasiri R, Herland A, Ermis M, Kawakita S, Gregatti Carvalho B, Hosseinzadeh Kouchehbaghi N, et al.	Engineered organoids for biomedical applications.	Advanced Drug Delivery Reviews	16.1
Nguyen HT, Peirsman A, Tirpakova Z, Mandal K, Vanlauwe F, Maity S, Kawakita S, Khorsandi D, Herculano R, Umemura C, Yilgor C, Bell R, Hanson A, Li S, Nanda HS, Zhu Y, Najafabadi AH, et al.	Engineered Vasculature for Cancer Research and Regenerative Medicine.	Micromachines	2.5
Peirsman A, Nguyen HT, Van Waeyenberge M, Ceballos C, Bolivar J, Kawakita S, Vanlauwe F, Tirpáková Z, Van Dorpe S, Van Damme L, Mecwan M, Ermis M, Maity S, Mandal K, Herculano R, Depypere B, Budiharto L, Van Vlierberghe S, De Wever O, Blondeel P, et al.	Vascularized adipose tissue engineering: moving towards soft tissue reconstruction	Biofabrication	9.0
Herculano RD, Dos Santos TO, de Barros NR, Pegorin Brasil GS, Scontri M, Carvalho BG, Mecwan M, Farhadi N, Kawakita S, Perego CH, Carvalho FA, Dos Santos AG, Guerra NB, Floriano JF, Mussagy CU, Tirpáková Z, Khorsandi D, Peirsman A, et al.	Aloe vera-loaded natural rubber latex dressing as a potential complementary treatment for psoriasis	International Journal of Biological Macromolecules	8.2
Abdalla G, Mussagy CU, Sant'Ana Pegorin Brasil G, Scontri M, da Silva Sasaki JC, Su Y, Bebber C, Rocha RR, de Sousa Abreu AP, Goncalves RP, Burd BS, Pacheco MF, Romeira KM, Picheli FP, Guerra NB, Farhadi N, Floriano JF, Forster S, He S, Nguyen HT, Peirsman A, et al.	Eco-sustainable coatings based on chitosan, pectin, and lemon essential oil nanoemulsion and their effect on strawberry preservation	International Journal of Biological Macromolecules	8.2
Piccinni F, Peirsman A, Stellato M, Pyun J, Tumedei M, Tazzari M, De	Deep learning-based tool for morphotypic analysis of 3D multicellular spheroids	Mechanics in Medicine and Biology	0.9

Wever O, Tesei A, Martinelli G, Castellani G			
Van Hove L, Toniolo A, Ghiasloo M, Lecomte K, Boone F, Ciers M, Raaijmakers K, Vandamme N, Roels J, Maschalidi S, Ravichandran KS, Kasper M, van Loo G, Hoste E.	Autophagy critically controls skin inflammation and apoptosis-induced stem cell activation	Autophagy	13.3
Greant C, Van Durme B, Van Damme L, Brancart J, Van Hoorick J, Van Vlierberghe S	Digital light processing of poly(ε-caprolactone)-based resins into porous shape memory scaffolds	European Polymer Journal	3.9
De Decker I, Klotz T, Vu P, Hoeksema H, De Mey K, Beeckman A, Vermeulen B, Speeckaert M, Blondeel P, Wagstaff M, Monstrey S, Claes KEY.	Influence of Moisturizers on Skin Microcirculation: An Assessment Study Using Laser Speckle Contrast Imaging.	Personalized Medicine	2.3
De Decker I, Notebaert M, Speeckaert MM, Claes KEY, Blondeel P, Van Aken E, Van Dorpe J, De Somer F, Heintz M, Monstrey S, Delanghe JR.	Enzymatic Deglycation of Damaged Skin by Means of Combined Treatment of Fructosamine-3-Kinase and Fructosyl-Amino Acid Oxidase.	International Journal of Molecular Sciences	5.6
Claes KEY, De Decker I, Blot S.	Burn management: From survival to quality of survival.	Intensive and Critical Care Nursing	5.3
De Decker I, Hoeksema H, Verbelen J, De Coninck P, Speeckaert M, De Schepper S, Blondeel P, Pirayesh A, Monstrey S, Claes KEY.	A single-stage bilayered skin reconstruction using Glyaderm® as an acellular dermal regeneration template results in improved scar quality: an intra-individual randomized controlled trial.	Burns and Trauma	5.3
De Decker I, Beeckman A, Hoeksema H, De Mey K, Verbelen J, De Coninck P, Blondeel P, Speeckaert MM, Monstrey S, Claes KEY.	Pressure therapy for scars: Myth or reality? A systematic review.	Burns	2.7
Rijpma D, Pijpe A, Claes K, Hoeksema H, de Decker I, Verbelen J, van Zuijlen P, Monstrey S, Meij-de Vries A.	Outcomes of Meek micrografting versus mesh grafting on deep dermal and full thickness (burn) wounds: Study protocol for an intra-patient randomized controlled trial.	Plos One	3.8
De Decker I, Logé T, Hoeksema H, Speeckaert MM, Blondeel P, Monstrey S, Claes KEY.	Dissolving microneedles for effective and painless intradermal drug delivery in various skin conditions: A systematic review.	Dermatology	3.4
De Decker I, Szabó A, Hoeksema H, Speeckaert M, Delanghe JR, Blondeel P, Van Vlierberghe S, Monstrey S, Claes KEY.	Treatment of Hypertrophic Scars with Corticoid-Embedded Dissolving Microneedles.	Burn Care and Research	1.8

Claes KEY, De Decker I, Vyncke T, Verbelen J, Dhooghe N, Monstrey S, Hoeksema H	Enzymatic debridement with nexobrid ® reduces surgery in laser doppler imaging-confirmed deep burns	Annals of Burns and Fire Disasters	0.7
Schuermans N, El Chehadeh S, Hemelsoet D, Gautheron J, Vantyghem MC, Nouioua S, Tazir M, Vigouroux C, Auclair M, Bogaert E, Dufour S, Okawa F, Hilbert P, Van Doninck N, Taquet MC, Rosseel T, De Clercq G, Debackere E, Van Haverbeke C, Cherif FR, Urtizberea JA, Chanson JB, Funalot B, Authier FJ, Kaya S, Terryn W, Callens S, Depypere B, et al.	Loss of phospholipase PLAAT3 causes a mixed lipodystrophic and neurological syndrome due to impaired PPARγ signaling.	Nature Genetics	30.8
Verfaillie A, De Corte K, Van Parys H, Roche NA, Stillaert FB, Vermeersch HF, Peeters PC, Colenbie L, De Cubber J, De Roeck F, Blondeel PN, Lemmens GMD.	Facial Allograft Donation: An Interpretative Phenomenological Analysis of the Experiences of Family Members	Craniofacial Surgery	1.3
Alighieri C, Bettens K, Perry J, Hens G, Roche N, Van Lierde K.	Achieving the next level in cleft speech intervention: A protocol of a randomized sham-controlled trial to provide guidelines for a personalized approach in children with cleft palate	International Journal of Language Communication Disorders	2.9
Matsui C, Escandón JM, Mohammad A, Tanaka T, Wynn ET, Mizuno H, Roche N.	Clinical applications of the chimeric anterolateral thigh (ALT) flap in head and neck reconstruction	Acta Chirurgica Belgica	0.8
Stillaert FBJL, Opsomer D, Blondeel PN, Van Landuyt K.	The Lumbar Artery Perforator Flap in Breast Reconstruction	Plastic and Reconstructive Surgery	5.2
Clausen-Oreamuno C, Perez-Rodrigo S, Stillaert FBJL, Tejerina A, Tejerina A, Shellock FG.	Benefits of Using Magnetic Resonance Imaging During Breast Tissue Expansion: Literature Review and Case Series	Aesthetic Surgery	3.1
Poelaert J, Coopman R, Ureel M, Dhooghe N, Genbrugge E, Mwewa T, Blondeel P, Vermeersch H.	Visualization of the Facial Nerve with Ultra-high-Frequency Ultrasound.	PRS Global Open	1.5
Delrue C, Speeckaert R, Oyaert M, Kerre T, Rottey S, Coopman R, Huvenne W, De Bruyne S, Speeckaert MM.	Infrared Spectroscopy: A New Frontier in Hematological Disease Diagnosis.	International Journal of Molecular Sciences	5.6
Van Der Kelen L, Ureel M, Bauters W, Vermeersch H, Coopman R.	Neurectomy of the Masseteric Nerve Using an Extra-Oral Approach to Treat Masseter Hypertrophy: Case Report and Literature Review.	Oral and Maxillofacial Surgery	1.8

Muylaert F, De Kock L, Creytens D, Verstraete K, Coopman R.	High-grade osteosarcoma arising in DCIA flap reconstruction after a prior resection of maxillar cemento-ossifying fibroma: A case report.	Stomatology, Oral and Maxillofacial Surgery	2.2
Coropciuc R, Coopman R, Garip M, Gielen E, Politis C, Van den Wyngaert T, Beuselinck B.	Risk of medication-related osteonecrosis of the jaw after dental extractions in patients receiving antiresorptive agents - A retrospective study of 240 patients.	Bone	4.1
D'Haese R, Coopman R, Vrombaut T, De Bruyn H	Fit and strength of a 3 unit temporary prosthesis made by different manufacturing techniques: in vitro study	International Journal of Prosthodontics	2.3
Van Doorne L, Vandeweghe S, Matthys C, Vermeersch H, Bronkhorst E, Meijer G, De Bruyn H.	Five years clinical outcome of maxillary mini dental implant overdenture treatment: A prospective multicenter clinical cohort study.	Clinical Implant Dentistry and Related Research	3.6
Everaert S, Schoeters G, Claes K, Raquez JM, Buffel B, Vanhaecke T, Moens J, Laitinen J, Van Larebeke N, Godderis L.	Balancing Acute and Chronic Occupational Risks: The Use of Nitrile Butadiene Rubber Undergloves by Firefighters to Reduce Exposure to Toxic Contaminants.	Toxics	4.5
Morrison SD, Claes K, Morris MP, Monstrey S, Hoebeke P, Buncamper M.	Principles and outcomes of gender-affirming vaginoplasty.	Nature Reviews Urology	11.0
Timmermans FW, Ruyssinck L, Mokken SE, Buncamper M, Veen KM, Mullender MG, Claes KEY, Bouman MB, Monstrey S, van de Grift TC.	An external validation of a novel predictive algorithm for male nipple areolar positioning: an improvement to current practice through a multicenter endeavor.	Journal of Plastic Surgery and Hand Surgery	1.5
Shoham Y, Rosenberg L, Hickerson W, Goverman J, Iyer N, Barrera-Oro J, Lipovy B, Monstrey S, Blome-Eberwein S, Wibbenmeyer LA, Scharpenberg M, Singer AJ; DETECT Investigators.	Early enzymatic burn debridement - results of the DETECT multicenter Randomized Controlled Trial.	Burn Care and Research	1.8
Coon D, Morrison SD, Morris MP, Keller P, Bluebond-Langner R, Bowers M, Brassard P, Buncamper ME, Dugi D 3rd, Ferrando C, Gast KM, McGinn C, Meltzer T, Monstrey S, Özer M, Poh M, Satterwhite T, Ting J, Zhao L, Kuzon WM, Schechter L.	Gender-Affirming Vaginoplasty: A Comparison of Algorithms, Surgical Techniques and Management Practices across 17 High-volume Centers in North America and Europe.	PRS Global Open	1.5

Monstrey SJ, Govaers K, Lejuste P, Lepelletier D, Ribeiro de Oliveira P.	Evaluation of the role of povidone-iodine in the prevention of surgical site infections.	Surgery Open Science	1.5
Roblee C, Hamidian Jahromi A, Ferragamo B, Radix A, De Cuypere G, Green J, Dorafshar AH, Ettner R, Monstrey S, Schechter L.	Gender-Affirmative Surgery: A Collaborative Approach between the Surgeon and Mental Health Professional.	Plastic and Reconstructive Surgery	5.2
de Jongh FW, Schaeffers AWMA, Kooreman ZE, Ingels KJAO, van Heerbeek N, Beurskens C, Monstrey SJ, Pouwels S.	Botulinum toxin A treatment in facial palsy synkinesis: a systematic review and meta-analysis.	European Archives of Oto-Rhino-Laryngology	2.6
Waterschoot M, Hoebeke P, Verla W, Spinoit A, Monstrey S, Buncamper M, Lumen N	Staged Phalloplasty by Metoidioplasty First Does Not Appear to Lower Complication Rates	Transgender Health	2.0
Platteau E, Denys A, Buncamper M, van Ramshorst GH.	A systematic review of female sexual function after surgery for locally advanced or recurrent colorectal cancer - first step to filling the knowledge gap.	Colorectal Disease	2.7
Philippine Roijera, Marleen Vallinga, Thomas Pidgeon, Aline Ceulemans, Alex Bakkerd, Brenda Carrière, Tina Rashide, James Bellringere, Javier Belinky, Marlon Buncamper, et al.	The GenderCOS project: study protocol for the development of two international Core Outcome Sets for genital gender affirming surgery	International Journal of Transgender Health	4.6
Waterschoot, M, Buncamper, M, Hoebeke, P, Waterloos, M, Verla, W, Claeys, W, Lumen, N	PD12-12 excision and primary anastomosis or staged urethroplasty for anastomotic strictures after phalloplasty?	Urology	7.5
Tondu T, Jacobs C, Vandevivere Y, Verhoeven V, Tjalma W, Hubens G, Blondeel P, De Greef K, Ysebaert D.	Dermal Nipple-Areola Complex Perfusion through Circumareolar Scars: A Delay Model in Two-Stage Nipple-Sparing Mastectomy.	Plastic and Reconstructive Surgery	5.2
Dhooghe N, Brusselle M, Ureel M, Sinove Y, Vermeersch H, Blondeel P.	The effect of various muscle transfer procedures on eye closure and blinking in longstanding facial palsy patients	Plastic, Reconstructive and Aesthetic Surgery	2.9
Blondeel P.	The perpetual changing paradigm in reconstructive surgery: Developing a vision for the future.	Journal of Plastic, Reconstructive and Aesthetic Surgery	2.9

Table 4 – List of publications produced by *or* in cooperation with the department of Plastic Surgery of the Ghent University Hospital.

How to contribute to our research?

As you might know or certainly can imagine, research is an expensive endeavor. Our team largely depends on our benefactors for financial support to be able to continue with our research program. Our team explicitly wants to thank all our donators for their support in the past. They have made it possible for us to take off and start with 'the chicken and the egg' story. At this point in time we can honestly admit that the egg has turned into a young energetic chick. Meanwhile our team is embarked an everlasting quest for financial support.

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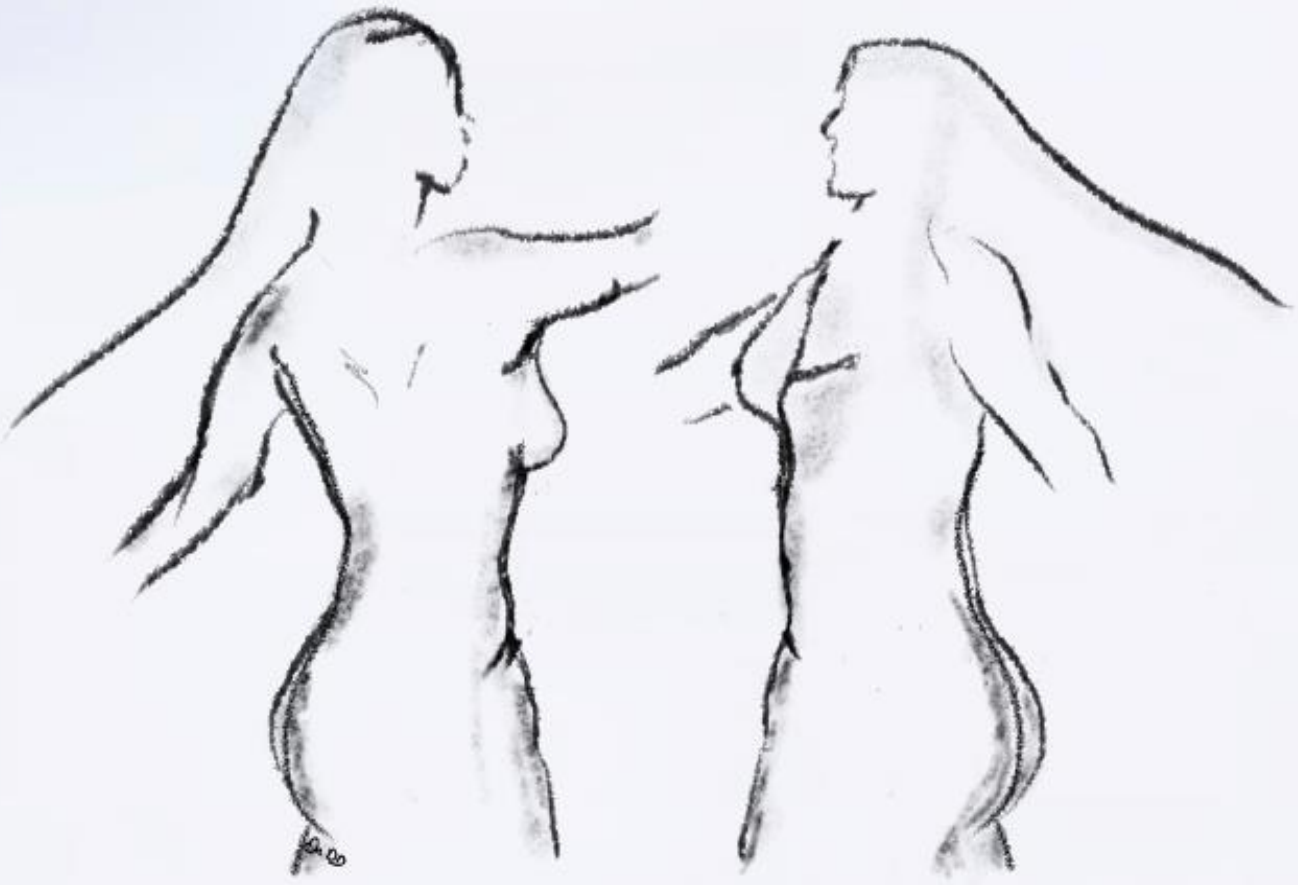

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