HTRIC

HTRIC: Health Technology Research and Innovation Cluster

Aiming for a sustainable future in innovative healthcare based on precision and prevention

Proposition Paper

April 2021

CAMPUS GRONINGEN

Building Together.

Preface:
Health Technology proposition paper

The Health Technology ecosystem at Campus Groningen combines powerful facilities that have existed for quite some time and individually have a strong track record. The Health Technology ecosystem is based on the medical/technological science at the University Medical Center Groningen (UMCG) and the University of Groningen (UG), specifically the faculty of Science & Engineering (FSE), but also faculties such as Behavioural & Social Sciences and Economics & Business. This unique combination promotes developments from bench to bedside and back again. Strong connections have been made with universities of applied sciences, business partners at the regional, national and international level as well as with the government.

The societal challenges in healthcare are what motivate Groningen's robust Health Technology sector to take action. Its knowledge and expertise are available in the entire innovation chain from basic scientific discovery to the development of a final product. Interactions between various actors in the Campus Groningen ecosystem are being supported as well as stimulated.

Double hat trick
Having all these elements in-house in the **Health Technology Research & Innovation Cluster (HTRIC)** allows us to do something exceptional: we combine healthcare, research, education and entrepreneurship, and focus on the entire innovation chain within this interdisciplinary cluster. This runs from (1) articulation of a question or issue from society and clinical practice (2) through groundbreaking scientific innovations to (3) first-in-human application. We focus on the interplay between (1) knowledge development, (2) health technology development and (3) business development throughout the chain.

Our strong and unique Health Technology cluster in the northern Netherlands stimulates interdisciplinary research and facilitates a one-of-a-kind environment focused on open innovation for collaboration between various professional fields and external partners.

The ecosystem aims to share knowledge and expertise, and to use these in the Netherlands and the rest of the world. We have to do this together with institutions, businesses and governments in order to collectively contribute to a more sustainable Netherlands. This brochure provides a summary of HTRIC and serves as your invitation to continue building on this together with us.

Initiating campus partners,

university of groningen

umcg

*This overview is not exhaustive

Unique **Health + Technology campus**

Campus Groningen is home to the **medical technological ecosystem** in the Netherlands that has both **Science & Engineering (FSE)** and an **academic hospital (UMCG)** in-house. This, in combination with the faculties of behavioral sciences, economics, business administration and law, gives the North of the Netherlands a unique starting point. These forces are bundled within the ecosystem.

university of groningen

umcg

Hanzehogeschool Groningen University of Applied Sciences

NHL STENDEN hogeschool

Education & Research

- W.J. Kolff Institute
- Stratingh Institute for Chemistry
- Zernike Institute for Advanced Materials
- Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence
- Data Science Center in Health - DASH
- Groningen Research Institute of Pharmacy - GRIP
- Groningen University Institute for Drug Exploration - GUIDE
- ENgineering and TEchnology institute Groningen - ENTEG
- Cancer Research Center Groningen - CRCG
- Science in Healthy Ageing and healthcaRE - SHARE
- Groningen Institute for Evolutionary Life Sciences- GELIFES
- Groningen Biomolecular Sciences and Biotechnology Institute - GBB
- Research Institute Brain & Cognition - B&C

CAMPUS GRONINGEN

1 **Knowledge** Development

2 (Health) **Technology** Development

3 **Business** Development

2 Awarded **Nobel Prizes** (FSE)

Access to **clinic** (first in human)

Science & **Engineering**

Fastest growing campus in the Netherlands

HTRIC

Health Technology Research & Innovation Cluster

#69, 2020 **Academic Ranking** of World Universities

Hands-on mentality

small talk, big ideas

> 200 **companies** on campus

investment platform '**Campus community fund'** for campus growth

brainfactory, talent for the 21st century

Collaborations and living labs

SPRINT · MOVE INNOVATE · Aletta Jacobs School of Public Health · Accel Med North · Pharma Portal · cmi nen center for medical imaging north east netherlands · dHealth · Healthy Ageing Network Northern Netherlands · PCH ECOSYSTEEM Personalised & Connected Health · Personalised Implant ECOSYSTEEM · INNO LAB The Innovation Sweet Spot Engineering · lifelines · Innovatiecluster · HealthHub Roden · Tracer Lab Chemistry for Medical Imaging · Newborn

Companies & impact

LIFE Cooperative there's more to healthy ageing · ANCORA · TRACER · LODE HOLDING · Symeres · VDL · PRAHealthSciences · DEMCON · innocore pharmaceuticals · WITEC · CERTE · POLYGANICS Transforming Patient Recovery · PolyVation · OFICHEM Group · COSMONIO · ZIUS visual intelligence · RECONCEPT_ · VentureLab North · LUMENTO Therapeutics · ORGAN ASSIST · wildsea · BIOTRACS · charles river

Investment ecosystem

A closely cooperative ecosystem that alsol works together in the development of Campus Groningen, through the Community fund 2020-2025

Campus Community Fund

triade · NXG ventures · Blue Sparrows MedTech Fund Experience to accelerate · Carduso Capital · G-FORCE CAPITAL · pharma connect capital · RUG Ventures

Welcome to Tomorrow's Capital

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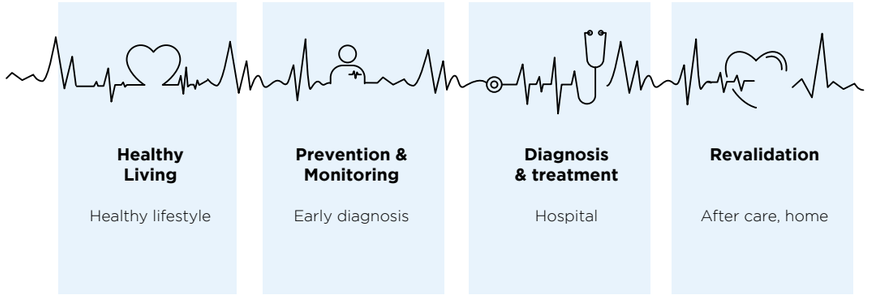
01. Why Health Technology?

The combination of the medical/technological sciences and clinical practice enables a crucial contribution to sustainably improving the quality and affordability of care and enhances the citizen's control of their own health.

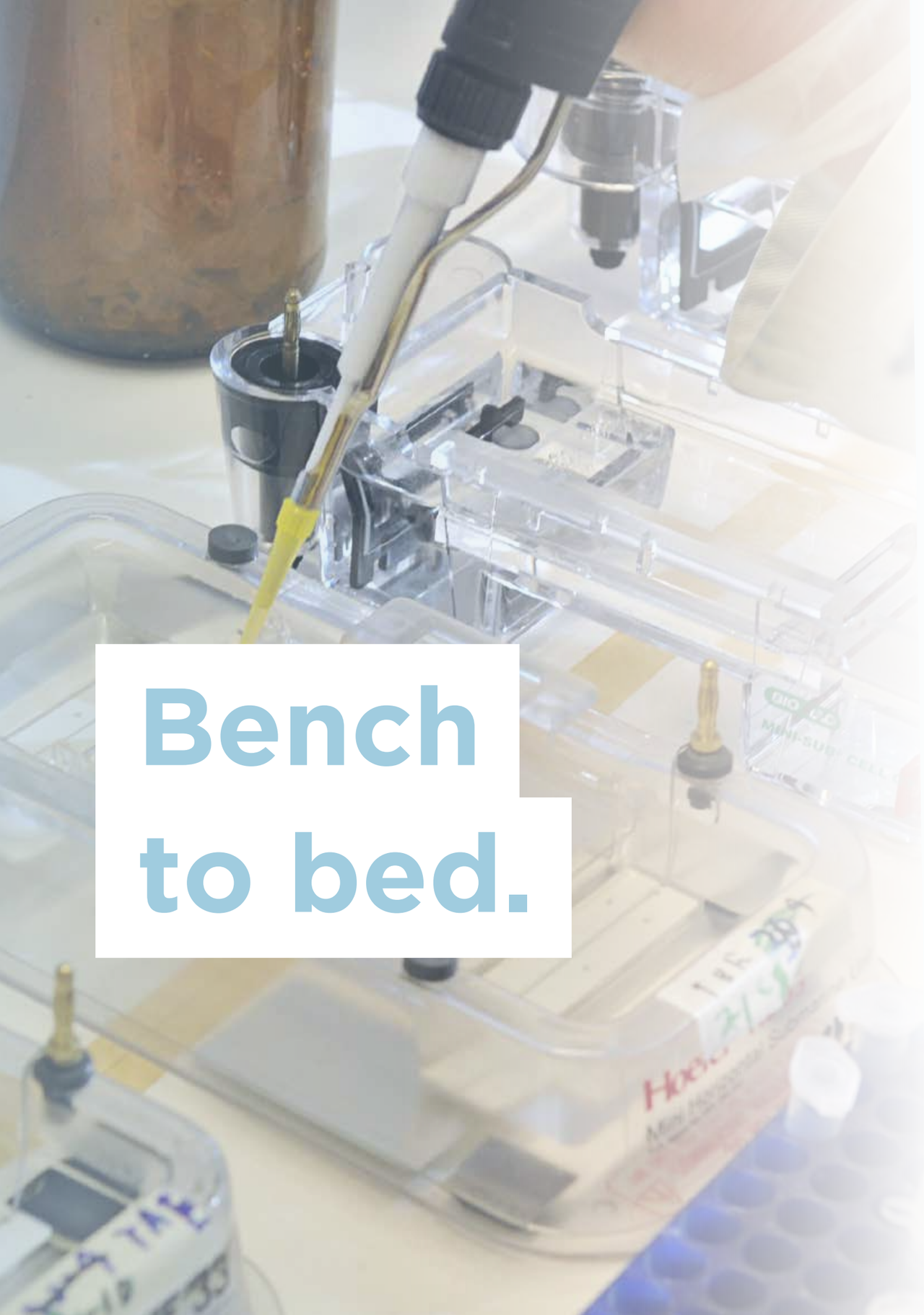
1.1 Mission & Vision

The ageing population not only puts healthcare under great pressure, it is a burden for society at large. The best way to combat this is to promote **Healthy Ageing** throughout everyone's lifetime. This is one of the top priorities in research at UG, UMCG and Hanzehogeschool Groningen (HUAS). Health Technology enables us to improve our knowledge of the ageing process and to develop smart technologies. It does not simply support people in their daily life, it also ensures that patients are able to reintegrate into society more quickly. Through our focus on Health Technology, we aim to foster a closer relationship between science and technology, healthy people, patients and society. Jointly this will expedite development and the use of innovations.

Life cycle



Through commitment and progress in the field of Health Technology, HTRIC at Campus Groningen supports public health throughout the course of a person's life, assisting healthy residents through diagnostics and monitoring, is helpful during treatments and provides support for home-care situations. Physicians will be able to provide treatment with greater precision by utilising medical/technological solutions. Social involvement and insight into people's health will also benefit. In this way, we contribute to improved quality of life and greater efficiency in healthcare. Using our vision, we are developing technology that allows for better prevention, diagnostics and treatment.



Bench to bed.

1.2. Objectives

Health Technology concentrates on the development of and support for a healthy society. In order to achieve this, prevention is an important goal and technology is an important tool to reach this goal.

Sensors, robotics, big-data analysis and artificial intelligence all play a role in health monitoring and the early detection of disease. Preventive measures are being developed using these technologies and the remote monitoring of people can benefit their health status and prevent social isolation. Healthy citizens and patients retain their independence up to a higher age.
The goal of Health Technology is to make treatment and care at hospitals more effective and efficient by means of technology. Minimally invasive procedures using imaging techniques, computer-assisted surgery, robotics and 3D printing in conjunction with biomaterials will reduce the frequency at which patients are required to undergo unpleasant diagnostic testing and invasive treatments. A decline in morbidity reduces the need for healthcare in hospital while follow-up appointments can be conducted more safely at home. Portable monitoring systems will provide people the opportunity to take more responsibility for their own health and will improve patient mobility.

The contribution to social challenges mentioned above will be achieved by connecting exceptionally strong, basic scientific knowledge in the fields of technology and the natural sciences at the Faculty of Science and Engineering (FSE) with the top clinical research at UMCG and the translational strength of the universities of applied sciences. In conjunction with the existing activities, the necessary components for a unique cluster are available.
By actively strengthening the collaboration within this cluster, we will make a special contribution to the innovative power of the Netherlands. The Health Technology Research & Innovation Cluster is in a unique position to roll out bench-to-bedside applications in the best possible way thanks to its integral role in the ecosystem at Campus Groningen. This also promises to new job opportunities and businesses.

> “Through Health Technology, we aim to foster a close relationship between science, healthy people, patients and society, in order to expedite development and the use of innovations.”

02.

Health Technology Research & Innovation Cluster (HTRIC)

©UG, photo: Marcel Spanjer

02. Health Technology Research & Innovation Cluster (HTRIC)

The Health Technology Research & Innovation Cluster at Campus Groningen comprises various actors, organisations and facilities. There are opportunities for collaboration in the fields of research, education and societal innovation. By combining knowledge development, health technology development and business development, bench-to-bedside applications will be developed more quickly.

The University of Groningen is a comprehensive research university. Its largest faculty, FSE, is known worldwide in the fields of engineering, biology, chemistry, physics, mathematics, artificial intelligence, computer science and pharmacy. The research is conducted at various interdisciplinary institutes, many of which collaborate intensively with UMCG, such as the Zernike, Stratingh, ENTEG and Bernoulli institutes. Furthermore, the faculty is responsible for all education programmes in engineering and the natural sciences. The Center for Information Technology (CIT) plays a substantial facilitating role with regard to big data.

In addition, the UMCG is among the best in the world in the field of clinical scientific research. It has proved to be a successful setting for the development of new applications in the clinical practice of Health Technology. Interdisciplinary institutes, such as W.J. Kolff, GUIDE and networks like DASH, are active in both scientific research and innovative applications. Access to patients for the early use of new medical devices or materials provides opportunities for innovation and helps in the acquisition of knowledge, expertise and inspiration for new research: **bench to bedside and back**.
This provides scientists and clinicians, as well as master's and internship students an opportunity to get acquainted with exciting innovations in Health Technology.

HTRIC is also home for expertise on issues such as social acceptance, economic feasibility, privacy aspects and care logistics. In addition to UMCG and FSE, this broad ecosystem consists of various faculties within UG, Hanzehogeschool Groningen University of Applied Sciences, NHL Stenden University of Applied Sciences and various institutions for vocational education..

Health Technology.

The health and medical technology industry in the north of the Netherlands is robust and innovative. Examples of innovations include ‘repair’ using advanced medical technologies (tracer-guided surgery), medical devices (degradable surgical implants) and drug delivery (inhalers). It is a thriving sector in which small to medium-size businesses such as Polyvation, Lode, TRACER, Polyganics, Demcon, Innocore, Pezy, VDL Wientjes, Symeres and PureIMS have joined forces in the LIFE Cooperative. They collaborate closely with research institutes on various projects and in different networks and facilities. There are also many other businesses in the region that work on medical and healthcare innovations, including J&J Vision, Ophtec, Witec Medical, BD Kiestra, Perkin Elmer, Philips and Machnet. Examples of fruitful collaboration on innovation with businesses can be found in various field labs (dHealth, Move2Innovate and Newborn). Last but not least, the investment ecosystem plays an essential role. Parties like NOM, Triade, RUG Houdstermaatschappij, Pharma Connect Capital and Next Gen Ventures offer support to start-up companies in terms of financial investments and for continued development towards strong regional businesses.

The Health Technology Research & Innovation Cluster at Campus Groningen will improve and accelerate collaboration in the innovation process with the help of UG, UMCG, HUAS, startups, businesses and the investment ecosystem in the region.

A Solid Foundation

Historically, there are wonderful examples of scientists who worked on innovative applications. Hans Wijnberg is considered to be one of the founders of asymmetrical organocatalysis and was the doctoral supervisor of Nobel Prize winner Ben Feringa. After retiring in 1988, Wijnberg and others founded the company Syncom (now Symeres), a business for contract research with a specific focus on the pharmaceutical industry. One of his doctoral students, Ton Vries, is currently the head of technology and innovation here. Jointly with Martien Woldring, Hans Wijnberg is also the founder of the PET centre for nuclear medicine.

Ger Challa and Albert Pennings were also key players when significant innovative developments were just beginning. Polymer chemistry (including that of human lactic acid) took off under their direction in Groningen, resulting in various businesses (Polyganics, Polyvation, Innocore).

Groningen has a long tradition of imaging. In 1953, the Nobel Prize for Physics was awarded to Frits Zernike for the invention of the phase-contrast microscope, which enables visualization of the contents of living cells.

Substantial collaborative programs are carried out within the HTRIC cluster, as summarized in this global impression. These Groningen programmes are ambition-driven development programmes that support the nationally defined impact fields within MedTech NL and the top sector Life Sciences & Health. The strengths present in Groningen, such as **(molecular) imaging, artificial intelligence, big (health) data, robotics and material technology,** are reflected in all programmes in order to meet societal challenges.

Unique **Health + Technology campus**

Campus Groningen is the only **medical technology ecosystem** in the Netherlands in which the **Faculty of Science & Engineering (FSE) and the Medical Sciences (UMCG) join forces**. Expertise from other faculties and partnerships with companies accelerate groundbreaking innovations.

umcg

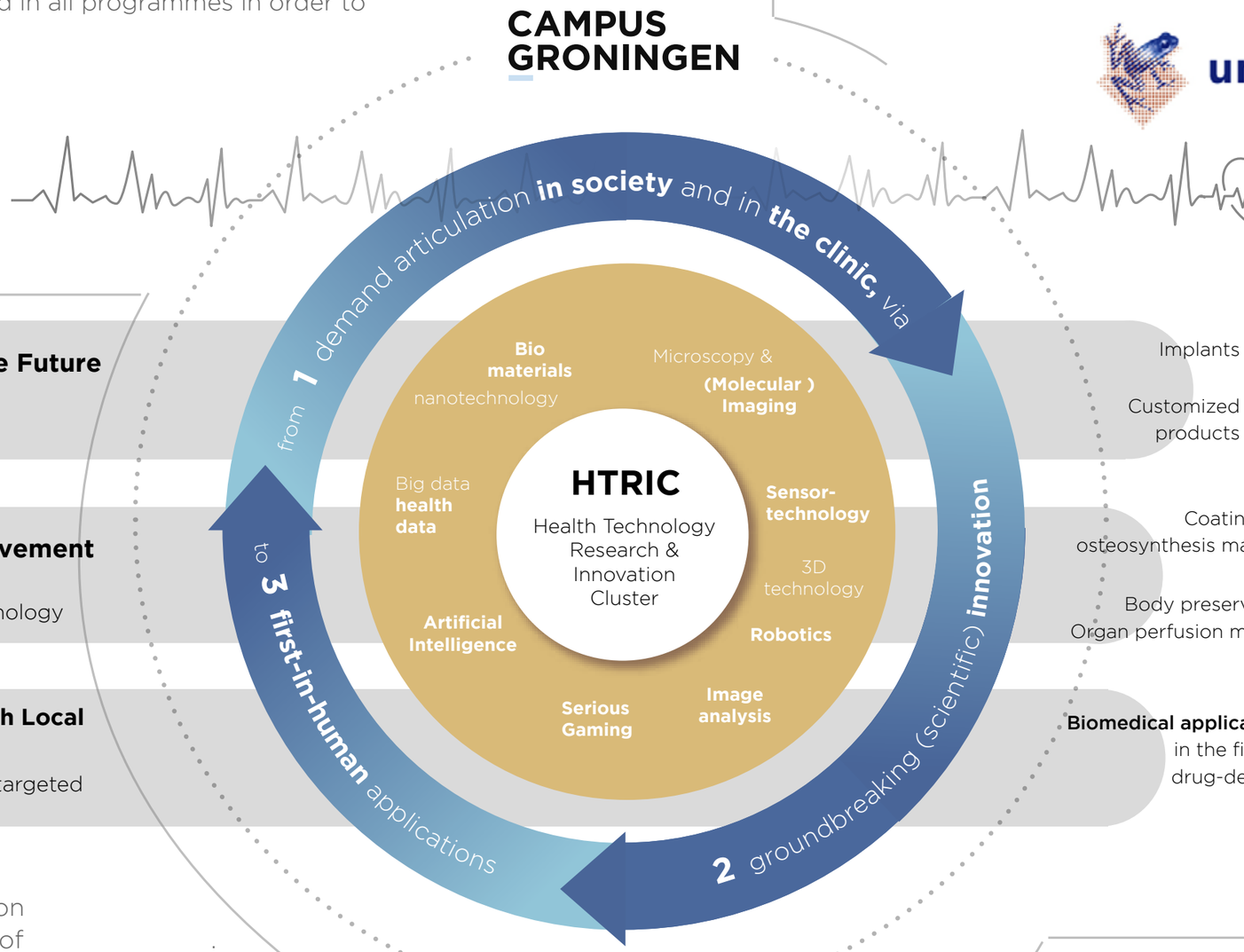
university of groningen

Groningen **programmes:**

Operating Theatre of the Future
Surgical techniques with calculated accuracy

Replacement and Improvement in the Human Body
From biomaterials to 3D technology

Innovative Technology with Local Precision
Observation, monitoring and targeted treatment



Implants

Customized products

Coatings on osteosynthesis material

Body preservation
Organ perfusion models

Biomedical applications in the field of drug-delivery

An important starting point within **Healthy Ageing** is that what people need to stay, or to become healthy, changes throughout the entire life cycle. That is why this life-course approach is central to the Groningen programmes.

With focus on **interaction** of **knowledge** development, **technology** development and **business** development

Open innovation and R&D environment

This substantive course of HTRIC supports the Dutch mission from LSH and MedTech and will **improve the quality of healthcare with focus on precision and prevention.**

03. The Northern Approach: Three Programmes

Groningen has been a longtime proponent of Healthy Ageing. The social benefits of Healthy Ageing are enormous and well worth ambitious investments. In Healthy Ageing, it is important to begin under the assumption that what people need to remain healthy changes throughout their lifetime. That is precisely why this approach to life is central to the Groningen programmes.

Various development programmes are under way in the HTRIC cluster. These demand- and ambition-driven development programmes support the nationally defined priority areas in MedTech NL. These key technologies and strengths, such as imaging, artificial intelligence, big data, robotics and materials technology, are used to realise the ambitions of the programmes.

1 . Operating Theatre of the Future
Surgical techniques with calculated accuracy

2 . Replacement and Improvement in the Human Body
From biomaterials to 3D technology

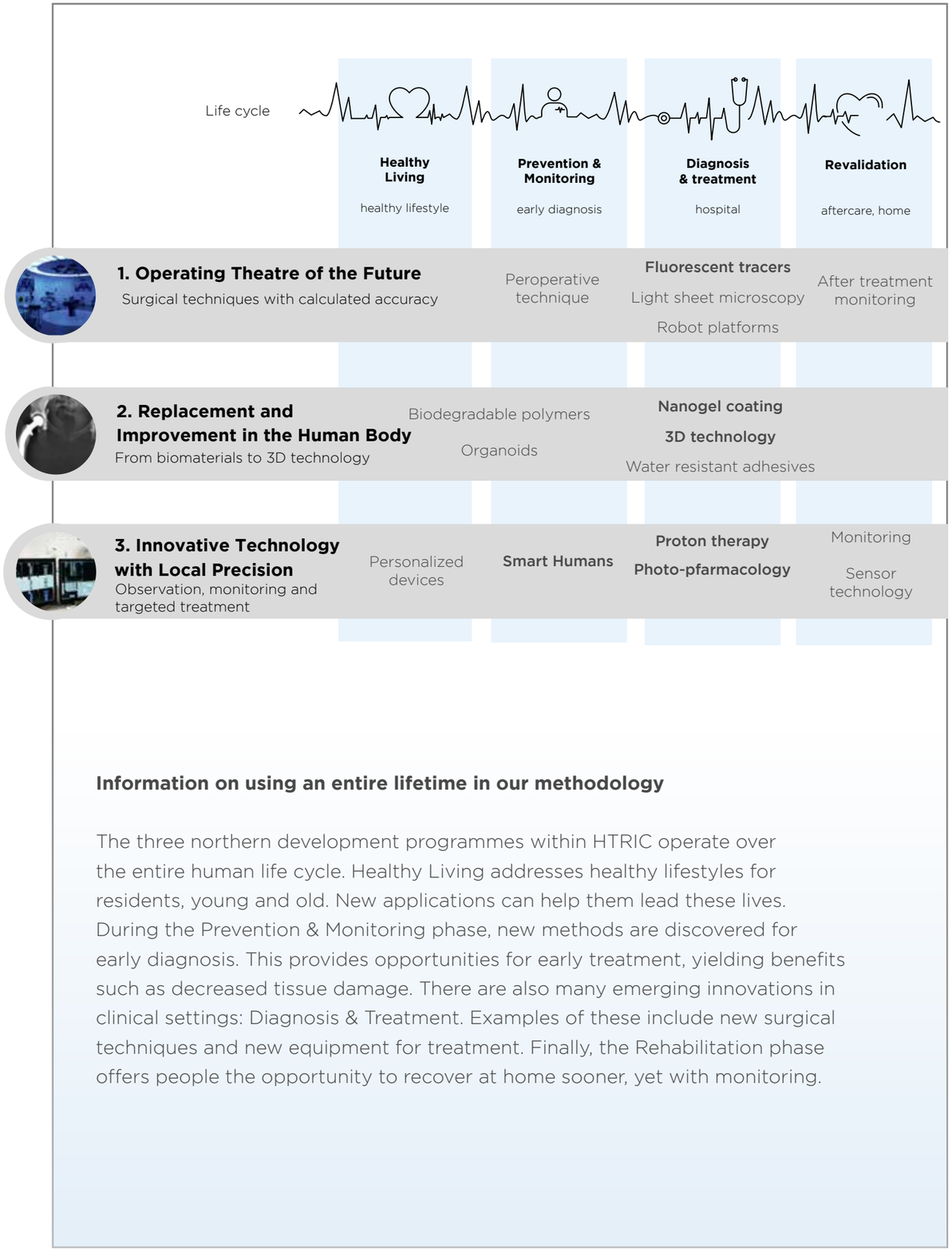
3 . Innovative Technology with Local Precision
Observation, monitoring and targeted treatment

Data science plays a role in comprehensive support

The Centre for Data Science and Systems Complexity (DSSC) in FSE and DASH at UMCG provides new opportunities through the use of **artificial intelligence in data analysis**. Important health information is shared with the individual and society.

03. The Northern Approach: Three Programmes

Explanation photo: the IvyONe -a portable intravenous drip- of Niels Wijermans, student at the Faculty of Science and Engineering. Awarded the Ben Feringa Impact Award 2020



Information on using an entire lifetime in our methodology

The three northern development programmes within HTRIC operate over the entire human life cycle. Healthy Living addresses healthy lifestyles for residents, young and old. New applications can help them lead these lives. During the Prevention & Monitoring phase, new methods are discovered for early diagnosis. This provides opportunities for early treatment, yielding benefits such as decreased tissue damage. There are also many emerging innovations in clinical settings: Diagnosis & Treatment. Examples of these include new surgical techniques and new equipment for treatment. Finally, the Rehabilitation phase offers people the opportunity to recover at home sooner, yet with monitoring.

3.1 Programme 1

Operating Theatre of the Future

Surgical techniques with calculated accuracy

3.1.1 Introduction and Ambition

The implementation of robot-assisted, high complexity operations in surgery is taking place steadily. The combination of the knowledge and expertise in robotics, navigation and computer technology at FSE and a high-quality, innovative research team in the surgical discipline at UMCG takes this research line to a higher level. Computer-assisted surgery technology in conjunction with robot-assisted surgery will ensure greater accuracy in minimally invasive procedures. Patient risk is in turn minimised, and operations are performed more quickly and with higher efficiency.

The available robotic surgical systems will evolve in the direction of high-tech computer platforms, in which diagnostics and multi-modular treatments will be integrated. Procedures will be better adapted to individual patients through the increased use of artificial intelligence during diagnosis, in fine-tuning the schedule as well as in the execution of the operation. Current developments within HTRIC include integration of perioperative ‘decision control’ in the next generation of robot platforms as well as the improvement of robot arm placement in robotic surgery and the development of nano-robotics in close collaboration with the University of Twente.

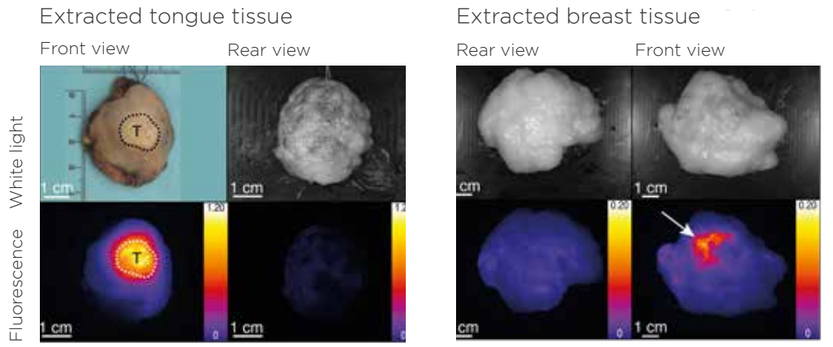
The use of new technologies in the operating theatre must be addressed collectively and be optimised in a clinical setting. For this reason, healthcare logistics in relation to complex procedures is playing an increasingly important role and must be developed further. As a testing location for the operating theatre complex, the skills centre is a crucial factor in this development.

Visual Precision.

©Demcon

3.1.2 Leading examples

Leading Role in Optical Imaging



In oncological surgery it is essential to remove all tumor tissue, while sparing as much adjacent healthy tissue as possible. The UMCG plays a leading role internationally in optical imaging through the use of tumor-specific fluorescent-labelled probes during surgery in order to enhance difficult, clinical decision-making.

The OMIG research group has multiple research lines in which a variety of expertise come together, such as the chemical development of fluorescent tracers, the technological development of optical imaging and the digital development of software and analysis techniques. Collaborations with PRA Health Sciences, Li-COR, SurgVision/Bracco and Philips indicate that the industry is extremely interested in these developments.

Ecosystem partners: Zernike Institute, Bernoulli Institute, W.J. Kolff, OMIG, Tracer, SurgVision

Technology: Imaging, Tracers

Future opportunity: New applications: intra-operative pathology assisted surgery (IPAS) and tissue diagnostics during surgery.

3.2 Programme 2

Replacement and Improvement in the Human Body From biomaterials to 3D technology

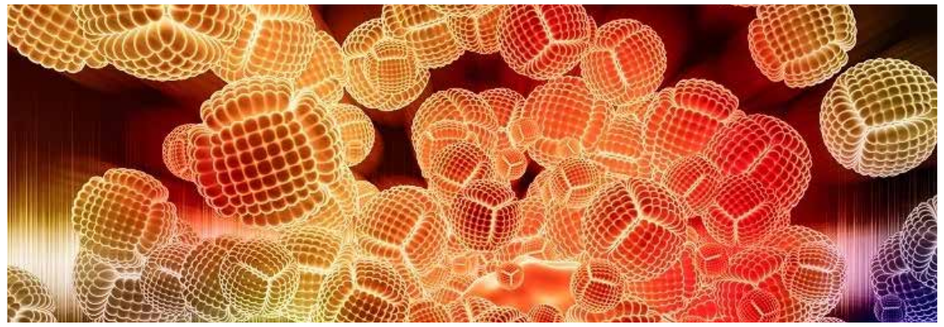
3.2.1 Introduction and Ambition

Modern medicine cannot exist without the use of biomaterials and nanotechnology. Well-known examples are implants such as prostheses and artificial heart valves, while there are exciting innovations in the works for intelligent implants that offer new or renewed functionality. After damage from cancer, trauma or age, functional recovery can be stimulated through the use of biomaterials. The use of new materials and specific, custom-made implants not only yields substantially shorter operation times, it also results in increased efficiency and reduced morbidity. In conjunction with the use of antibacterial coatings, new materials offer reduced risk of infection.

Various supramolecular polymers (derived from natural materials) are being fine-tuned for specific applications, by using expertise in Groningen in both experimental and theoretical-numerical analysis. Examples include nature-inspired water-resistant adhesives with potential applications in surgical procedures, nanogels for coatings and hydrogels that serve as model systems for, for instance, the extracellular matrix to be used in tissue engineering. Moreover, work is being done on the reconstruction of structures and organs using 3D technology. Coatings that are developed for these constructs serve to improve integration into tissue and to prevent and treat infections resulting from the use of foreign-body materials. Finally, organoid models are being developed both in vivo and in vitro for the isolation and characterisation of stem cells. This holds the promise of being able to repair cells for specific organs, such as salivary glands.

3.2.2 Leading examples

Nanogel coating for medical materials



Coatings have long been used on implants in order to improve acceptance by the body or for imaging purposes. A substantial challenge for the development of these coatings is that they must be precisely adjusted to the myriad implant materials that are being used clinically.

Nanogels offer highly interesting possibilities for accelerating the innovation process. Nanogels have been developed for better antibacterial activation while being sensitive to fluorescence and MRI. These nanogel coatings are successfully applied on various materials including polymers, rubbers and titanium. Beside proof of the intended performance, additional characteristics such as the ability to be sterilised and the product lifetime have to be demonstrated.

Ecosystem partners: Zernike Institute, W.J. Kolff, PolyVation, Polyganics

Technology: Biomaterials, Coatings

Future opportunity: Nanogel coatings with a wide range of applications

Smart Data.

3D Technology

The 3D lab MKA/UMCG has access to techniques, software and clinical expertise to virtually schedule a surgical procedure and make patient specific implants. Using 3D visualisation, these can be used in the operating theatre during the procedure in order to work with extreme precision. Furthermore, patient-specific tools and implants are being developed for first-in-human prototypes and created using 3D printers.

The power of the lab is that it combines the core scientific knowledge of various partners from the RUG with expertise from surgical disciplines at UMCG. The short lines of communication with the business community regarding the development and application of various printing technologies contribute to rapid implementation in clinical practice.

Ecosystem partners: Bernoulli Institute, W.J. Kolff, HG, 3D Lab, DASH, DSSC, WITEC, ENTEG

Technology: 3D Technology, Imaging, Data Integration, Big Data Analyse

Future opportunity: Shape and material optimization of implants. 3D printing of organs with tuned biomaterials and metamaterials.

3.3 Programme 3

Innovative Technology with Local Precision

Observation, monitoring and targeted treatment

3.3.1 Introduction and Ambition

Monitoring plays a significant role in the clinical setting as well as at home. By using personalised devices (sensors and diagnostic tools), we strive to develop innovative and personalised healthcare technology that is not only used to promote personal healthcare management, but also to enable diagnostics and treatment tailored to the patient. Various partners in the Groningen ecosystem are already deeply involved in the development of innovative medical tools, sensor technology and medical software.

Imaging has been surpassing mere observation for quite some time now. Imaging technologies, in combination with nanotechnology, help in diagnostics, in determining specific and complex therapies (drugs, radio- or proton therapies) and in monitoring the responses to these treatments, thus helping to avoid unnecessary collateral damage.

It is exactly this combination of imaging and nanoscience/nanotechnology in which Groningen research is strong. The field encompasses the entire range of relatively small, functional polymers used for the detection of aberrations, but also for things like drug delivery systems (GRIP). We are known internationally for our pioneering research on photoactive polymers developed for photopharmacology purposes.

The collaboration between FSE and UMCG brings together a broad palette of knowledge and expertise, enabling disruptive developments in targeted diagnostics and treatments.

3.3.2 Leading examples

Smart Humans

The Smart Human project involves the continuous monitoring of risk factors and personalised recommendations for lifestyle changes. This can help people to stay healthy longer or be better prepared to undergo treatment (prehabilitation).

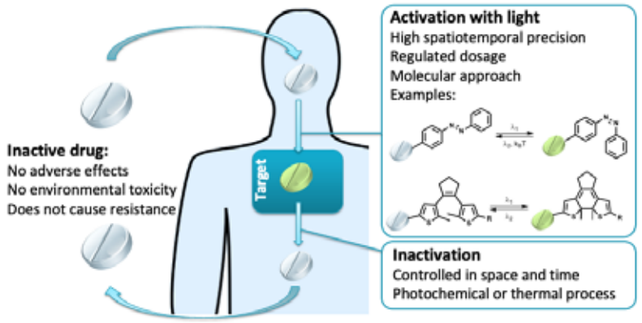
The Smart Human approach requires a technology chain that begins with sensors, followed by a system combining sensor information with a decision support system that uses these data to formulate a recommendation.
The quality of these recommendations can be improved by making this a self-learning system through the use of machine learning.

Ecosystem partners: W.J. Kolff, ENTEG, Bernoulli Instituut, DSSC, DASH, HUAS, SPRINT, Lode Holding, Philips, Oro Muscles (previously BlackTop Labs BV)

Technology: Sensors, Machine Learning, AI, Big-data

Future opportunity: The development of machine learning systems

New Targets in Photopharmacology



Most current medical treatments rely on the use of bioactive substances with a pharmacological response through the interaction with molecular targets in the human body. The selectivity of this interaction is crucial, but difficult to achieve because the targets are expressed in both healthy and diseased tissue. Photopharmacology is equipped to resolve the problem of off-target activity and serious side effects by controlling the activation of the drug by the use of light.

Currently, photopharmacology focuses on defining and evaluating molecular targets. Significant breakthroughs have been made in light-controlled cancer chemotherapy, neurology, diabetes and antimicrobial substances. Anticipated milestones on the road to clinically applied photopharmacology include in vivo testing, molecular imaging of localised drug activation and extensive toxicity studies.

Ecosystem partners: Stratingh Institute, W.J. Kolff, Lumento Therapeutics, GBB, GUIDE

Technology: Photo-pharmacology, Molecular imaging

Future opportunity: Theranostics, where diagnostics and therapy are combined.

Precision Proton Radiation

Proton therapy is a precise radiation technique that is offered at UMCG. Currently, more than half of all cancer patients require radiation (radiotherapy) to destroy cancer cells while at the same time as many healthy cells as possible must be spared. Proton therapy allows for radiation treatment that is more precise and causes less collateral damage.

The proton centre in Groningen is the first of three facilities in the Netherlands. Research is also being conducted here in order to improve the quality and effectiveness of treatments. New knowledge and expertise is being sought in areas such as the treatment of moving tumours and organs, adaptive radiotherapy and radiomics, and modelling. For example, the in-beam positron emission tomography (PET) of very short-lived isotopes is being studied for its potential use in the real-time monitoring of proton therapy. Another example is the clinical evaluation of image-guided adaptive proton therapy in static (e.g. head-and-neck tumours) and in moving tumours (e.g. lung and esophageal tumours).

Ecosystem partners: Bernoulli Institute, CRCG, GUIDE, DASH, CIT, TracerLab

Technology: Imaging, 3D technology, Precision on moving target

Future opportunity: Real-time imaging linked to real-time bestraling

‘The Groningen Proton Therapy Centre is the first operational centre of its kind in the Netherlands and currently treats roughly 400 cancer patients each year. The most important research theme of the department is “prevention and treatment of toxicities caused by radiation”’

04.

Continued Development for 2021-2025

©Polyganics

4. Continued Development for 2021-2025

4.1 The Campus Community Fund: a Vehicle for HTRIC Growth

The members of Campus Groningen are ambitious and innovative. As a collaborative ecosystem, we can see the Campus Groningen's impact on the region and we are navigating the course that has been set for the next five years. In order to make these developments financially feasible, 'capital for tomorrow' was set up through the **Campus Community Fund**. Acting based on 'Drivers for Growth' helps Groningen to continue positioning itself as a top region for innovations, where the world of tomorrow is being built.

In the Campus Community Fund, Campus Groningen is budgeting €500 million for the continued development of the campus during the 2020-2025 period with regard to property and infrastructure, facilities and services and business activities. The belief is that the growth potential of the campus must be sought in the development and stimulation of the 'Drivers for Growth'. In this way, Campus Groningen distinguishes itself from other regions and campuses both domestically and abroad. **HTRIC is a representative of one of these Drivers for Growth**.

4.2 The Gap Between Science, Innovation and the Market

Across the globe, innovations in devices, materials, coatings etc. travel a difficult road towards their first applications in or on human beings. In a similar context, there is often discussion of a gap between science, innovation and how these are marketed. This hinges on a strong need for improved knowledge, expertise and collaboration. Incubators like **AccelMed** and **Pharma Portal** assist in the rapid progress of good ideas by accelerating investments. Furthermore, various testing areas (**dHealth, Move2Innovate** and **Newborn**) strengthen the collaboration between businesses and research institutions with regard to innovation. Access to the patient for the development of new applications from science is already under way, but revised legislation and regulations as well as a lack of knowledge in this field make these kinds of projects more and more challenging.

Building Tomorrow Together.

4.3. Necessary Developments

In order to speed up and strengthen the Groningen ambition from the three programmes described, the vital elements for progression have been identified. The connection between clinical practice, research and businesses demands close collaboration, a certain courage in actively sharing knowledge and expertise, and mutual trust. The physical proximity of the various players and good access to patients is key to the future of HTRIC. By supporting a strategy based on ‘shared facilities’, enormous added value will be generated. More specifically this means a focus on three elements: (1) reinforcing infrastructure, (2) human capital programmes that increase interaction and (3) securing the necessary funding at an early stage. Achieving these creates enormous potential for the Netherlands in terms of innovations for the life sciences sector.

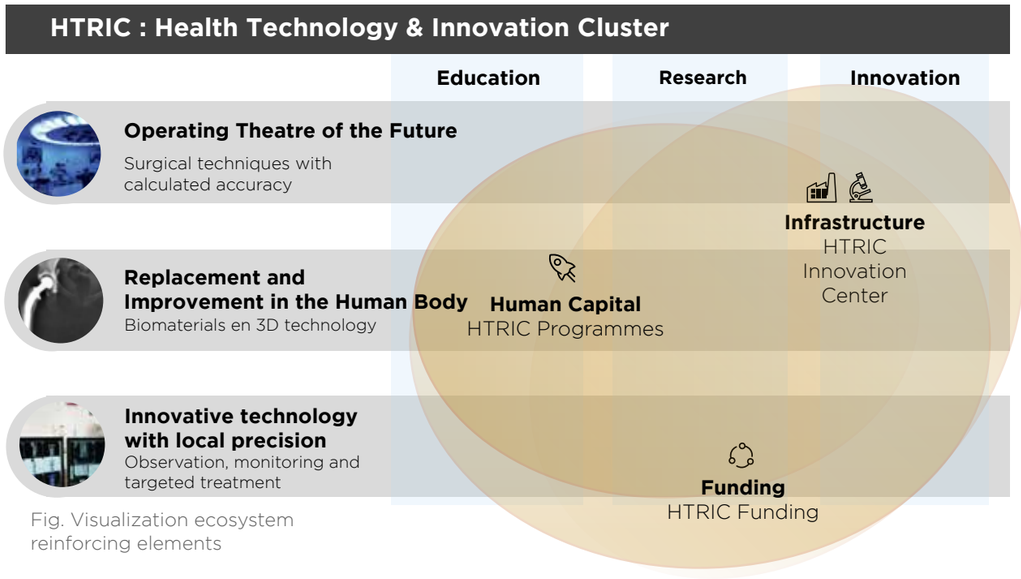


Fig. Visualization ecosystem reinforcing elements

Connection and interaction within the HTRIC is of utmost importance. In order for this unique combination of the northern cluster to achieve groundbreaking impact, facilitating close collaboration is a must. The combined strength of UG (FSE), UMCG, Hanzehogeschool Groningen, NHL Stenden and the business community offers excellent opportunities to bring **Technological Research applications to the Human Body**.
By focusing on the combination of infrastructure, human capital and funding, **we are stimulating and facilitating this collaboration and making a unique contribution to the innovative power of the Netherlands**.

05.

In-House Knowledge

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5. In-House Knowledge

For over 400 years, the northern Netherlands has been recognised as a source of high-quality scientific knowledge and expertise: Nobel prize winners, the first female medical student, the first Dutch astronaut and the first president of the European Central Bank. They were all educated in the northern Netherlands. Research, training and entrepreneurship come together at HTRIC and lay the foundations for innovation.

5.1 Human Capital & Talent

A priority area of Campus Groningen is to ensure that the Human Capital Agenda is in aligned to the needs of the scientific and business communities. At Campus Groningen, a wide range of education programmes in Health Technology are offered at various academic levels. Everything from **Biomedical Engineering, Chemistry, Nanoscience** and **Artificial Intelligence** at FSE to **Chemical Technology and Sensors & Smart Systems** at HUAS and **Medicine** at UMCG is available.

Alignment with the business community is reinforced through the **Center for Development and Innovation**, while **VentureLab** supports startups. There is a focus on additional competences, such as entrepreneurship, that are suited to new applications and how these are positioned in business and the market. A total of 168 startups have been created through the programme, and this has led to an impact on funding (€26.1 million) and generated jobs (370). In 2020, at HUAS almost 1000 students and alumni started a new company, mainly in the field of Healthy Ageing. Moreover, various incubators, such as **AccelMed** and **Pharma Portal**, provide support in the growth process from idea to the application, including the content of the ideas and applications themselves. These 'innovation accelerators' assist in the rapid progress of good ideas in order to receive investment more quickly.

> 'The connection between clinical practice, research and businesses demands close collaboration, a certain courage in actively sharing knowledge and expertise and mutual trust. The physical proximity of the various players and good access to patients benefit HTRIC. By supporting strategy based on 'shared facilities', a huge added value will be generated.'

5.2. Research & Research Institutes

UG - Faculty of Science and Engineering (FSE)
The faculty is home to a wide range of disciplines in the exact sciences and in engineering. Researchers focus on fundamental issues in close collaboration with partners in the industrial and medical worlds. Various research institutes play an essential role in this Health Technology cluster:

- Engineering and Technology Institute Groningen (ENTEG)
  The institute works on the design and analysis of new and often sustainable technologies through the integration of fundamental knowledge into the engineering sciences. The institute also works with the Faculty of Economics and Business on smart-industry applications.

- Stratingh Institute for Chemistry
  The institute works in the field of molecular and supramolecular chemistry. The focus lies on synthesis, catalysis, functional materials, chemical biology and complex molecular systems. The institute is a world-class centre for green catalysis and molecular motors.

- Zernike Institute for Advanced Materials (ZIAM)
  The strength of the institute lies in combining knowledge from physics, chemistry and biology to develop innovative functional materials. These materials find use in new technologies, such as sensors, soft robotics and in biomedical engineering.

- Groningen Research Institute of Pharmacy (GRIP)
  The focus of the institute lies on innovative medicines and therapies. Their success relies on the ability to bridge the gap between the basic, natural sciences and the field of clinical research.

- Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence
  The power of the institute lies in how it combines insights and methods from complementary research paradigms: fundamental and applied science, complexity, data science and modelling. The robotics lab works on systems that collaborate with humans, but that can also interact with their dynamic environment.

- Groningen Institute for Evolutionary Life Sciences (GELIFES)
  This institute is characterised by a broad, multidisciplinary research portfolio on the broad topic of adaptation in biological systems, including humans. Technology for human health, such as wearables and smart devices, is being developed in order to monitor behaviour and to change behaviour through instruction or treatment.

- Groningen Biomolecular Sciences and Biotechnology Institute (GBB)
  The institute is world renowned for its research into a fundamentally better understanding of life from the molecular up to the cellular level, and the interaction with the environment. This yields molecular insights that are directly relevant for an improved understanding of various diseases and that can be used for biomedical innovations, such as photopharmacology, for the development of small-molecule drugs and enzymes, etc.

- Groningen Engineering Center (GEC)
  The GEC provides a platform for interdisciplinary technological research, education and collaboration with the industrial sector. This is where basic science and its application meet. The Groningen Engineering Business Center (GEBC) was founded to facilitate sustainable collaboration with industry.

- Data Science & Systems Complexity (DSSC)
  The DSSC center brings together researchers from various scientific disciplines to work on big data and complexity issues.

University Medical Center Groningen (UMCG)

UMCG has the second-oldest faculty of medicine in the Netherlands. The subject of Healthy Ageing is a social challenge and the UMCG contributes to it through research. Many research institutes of the UMCG play an essential role in the Health Technology cluster:

- W.J.Kolff Institute
  The institute is an expertise centre for biomedical technology and engineering, where the development from the basic scientific research to the application in clinical practice and the evaluation of the technology in humans are brought together. The goal of the institute is to build a bridge between fundamental scientific research in technology and the clinical setting.

- Groningen University Institute for Drug Exploration (GUIDE)
  The institute focuses on and stimulates translational, innovative, drug-oriented research in different chronic disease profiles in an interdisciplinary setting. Insight into pathophysiology provides opportunities for drug development and the optimisation of existing treatments.

- Cancer Research Center Groningen (CRCG)
  The institute aims to translate fundamental insights into the formation and behaviour of tumours into prevention, earlier detection and improved cancer treatment.

- Science in Healthy Ageing and healthcaRE (SHARE)
  The institute focuses on research into improving adaptation to a disease and on encouraging of the social participation of patients with chronic physical or mental disorders. It also examines the cost-effectiveness of vaccinations, drugs and psychosocial interventions. The Health Technology assessment is an important topic in the VALUE research programme.

- Brain and Cognition (B&C)
  The institute utilises classical and new research techniques to focus on a better understanding of perception, mental function and how the brain operates as a whole in healthy individuals and patients. This knowledge is used to develop more effective treatments, so that the patient of tomorrow can be offered more than the patient of today.

- Data Science Center in Health (DASH)
  DASH is a collaborative network within UMCG: a knowledge hub, a community and a facilitating organisation in health data science. Research projects are supported by involving experts from the fields of data science, machine learning and artificial intelligence.

UG - Faculty of Behavioural and Social Sciences
The Heymans Institute conducts research in psychology and in related fields. It provides valuable knowledge about humans and behaviour in the healthcare system.

UG - Faculty of Economics and Business (FEB)
Through the expertise centre Centre for Public Health in Economics and Business, the FEB generates and disseminates insights into the fields of economics, business and management in order to stimulate and encourage health throughout a person's lifetime.

UG - Faculty of Law
It is important to properly arrange matters like ethical questions, data management and privacy. The Faculty of Law provides expertise in these areas and others.

UG - Faculty of Philosophy
The Faculty of Philosophy is known worldwide as one the best centres for philosophical education and research in Europe. The Department of Ethics, Social and Political Philosophy operates at the intersection of philosophy and disciplines such as the cognitive sciences, psychology and economics. It poses ethical questions within healthcare and finds answers to them.

Hanzehogeschool Groningen (HUAS)
HUAS focuses on the TRL levels 4 to 6 and aims specifically to apply knowledge and expertise in SME's. Through Health Technology, HUAS stimulates the close relation between science, a healthy human, the patient and society. Two knowledge centers are key and contribute to research in this field: The Centre of Expertise Healthy Ageing and The Centre of Expertise Biobased Economy.

NHL Stenden
At NHL Stenden University of Applied Sciences, the Smart Industries research group is investigating 'serious gaming'. Games for Health can influence health results, which may be the result of promoting healthy behaviour or helping in the prevention, diagnosis or treatment of various physiological or psychological disorders.

University of Twente
Various faculties at UG and UMCG have a close connection with the University of Twente, especially its Technical Medical Centre. Together with specialists from UMCG, technical innovations specifically in the field of robotics are being developed for first-in-human use. Students in the Technical Medicine master's programme at University of Twente are taught in various departments at UMCG. Doctoral candidates and post-docs are involved in clinical research at UMCG on a wide range of topics.

5.3. Collaborations & Testing Areas

AccelMed North
An initiative for establishing sustainable, effective and targeted connections between 'idea owners' and regional partners with knowledge and expertise to help MedTech ideas progress (VentureLab North, VDL Wientjes, Pezy Group, Lode, ItoM Medical, Demcon, LIFE Cooperative, SPRINT and UMCG).

Aletta Jacobs School of Public Health (AJSPH)
The AJSPH is a collaboration between UG, UMCG, and the Hanzehogeschool Groningen and is a proud proponent of Healthy Ageing in the northern Netherlands. It is a network of researchers and partners with one shared goal: more healthy years. Rooted in fundamental research, it actively shares knowledge and expertise through education, advice and integral collaborations.

Healthy Ageing Network Northern Netherlands (HANNN)
HANNN is an independent foundation that builds coalitions for healthy living, sports and physical activity, personalised and customised healthcare, healthy food and healthy skills.

Health Hub Roden
Health Hub Roden is a physical location for training, collaboration and innovation between entrepreneurs, research institutions and the government. Here, students can put their theoretical knowledge into practice by working on projects with entrepreneurs. Health Hub Roden was designed to be an independent foundation in which UMCG, Hanzehogeschool Groningen, Noorderpoort, Alfa college, Noordenveld municipality and Drenthe province participate.

Innolab Engineering & Chemis
Open innovation labs on Campus Groningen. The Innolabs is full of motivators for entrepreneurs with regard to innovation and R&D: high-end workspaces, modular labs, equipment, product design and prototype labs, office and conference space and networking opportunities.

Innovatiecluster Drachten
Innovatiecluster Drachten is a group of collaborating high-tech businesses. This close collaboration with FSE and others has already resulted in a Smart Factories graduation track that is available in Drachten. The Mechanical Engineering master's programme is also another fruit of their labour.

Lifelines
Lifelines is a unique, large-scale research project. All kinds of data and body materials are collected from the 167,000 participants in the northern Netherlands from three generations and are made available to researchers.

Tomorrow's Recipe.

LIFE Cooperative
LIFE Cooperative is a community of 30 small-to-medium businesses and 20 startups. These form a strong cluster in the life sciences and MedTech sectors in the northern Netherlands.

Open Diagnostics
Open Diagnostics is evolving into a strategic partner for the development of new diagnostics.

PCH Ecosystem
The Personalised & Connected Health (PCH) Ecosystem is creating the ideal network in the northern Netherlands for businesses that connect to PHEs. These innovations are an integral part of health, physical activity, sports, nutrition, lifestyle and prevention. (UMCG, dHealth, HANNN, Thunderbyte.ai, Certe, Lifelines, InterPsy, Ikdus, EmpowerMi, Ancora Health)

Personalised Implants Ecosystem
The Personalised Implants ecosystem strives for efficiency and effectiveness in the transformation of the entire production value chain as well as all the links to personalised implants. (PolyVation, Witec, VDL Wientjes, Bether Encapsulates, UG and UMCG)

Pharma Portal
An initiative of UMCG, UG, Hanzehogeschool Groningen and the LIFE Cooperative for encouraging the growth of several strong, high-quality initiatives for drug development in the northern Netherlands.

dHealth Testing Area
dHealth is an initiative by UMCG, Hanzehogeschool Groningen, UG and the IT companies Ziuz, Wild Sea and Reconcept. It responds to the demand for making more digital health products available on the market and the potential for further optimising the potential of this market.

Newborn Testing Area
Newborn is a collaborative project between UMCG, Philips and the LIFE Cooperative. Living Lab Newborn is a testing environment in which innovative products can be tested in the Lifelines NEXT study for their contributions to the health and wellbeing of young families at home.

Move2Innovate Testing Area
This is a collaboration (UMCG, Lode, LIFE Cooperative) in which businesses can quickly and efficiently test and validate new products and leading-edge innovations in health and physical activity.

SPRINT
A research centre that is a co-initiative of UG, UMCG, University of Twente, Hanzehogeschool Groningen and 80 businesses from a wide range of sectors with equally different areas of expertise and that focuses on creating smart prevention, rehabilitation and intervention technologies: smart technology that assists residents and patients in taking control of their health and adjusting their lifestyles.

TechHub Assen
TechHub Assen aims to make medical technology publically available for SME's and knowledge institutions in the region. It is an initiative of Ondernemend Assen, HUAS, Province of Drenthe, Municipality of Assen and Drenthe College.

www.CampusGroningen.nl