Medical technology for the future of healthcare

Delft Health Initiative

Delft Research Initiatives

TU Delft Delft University of Technology

Challenge the future

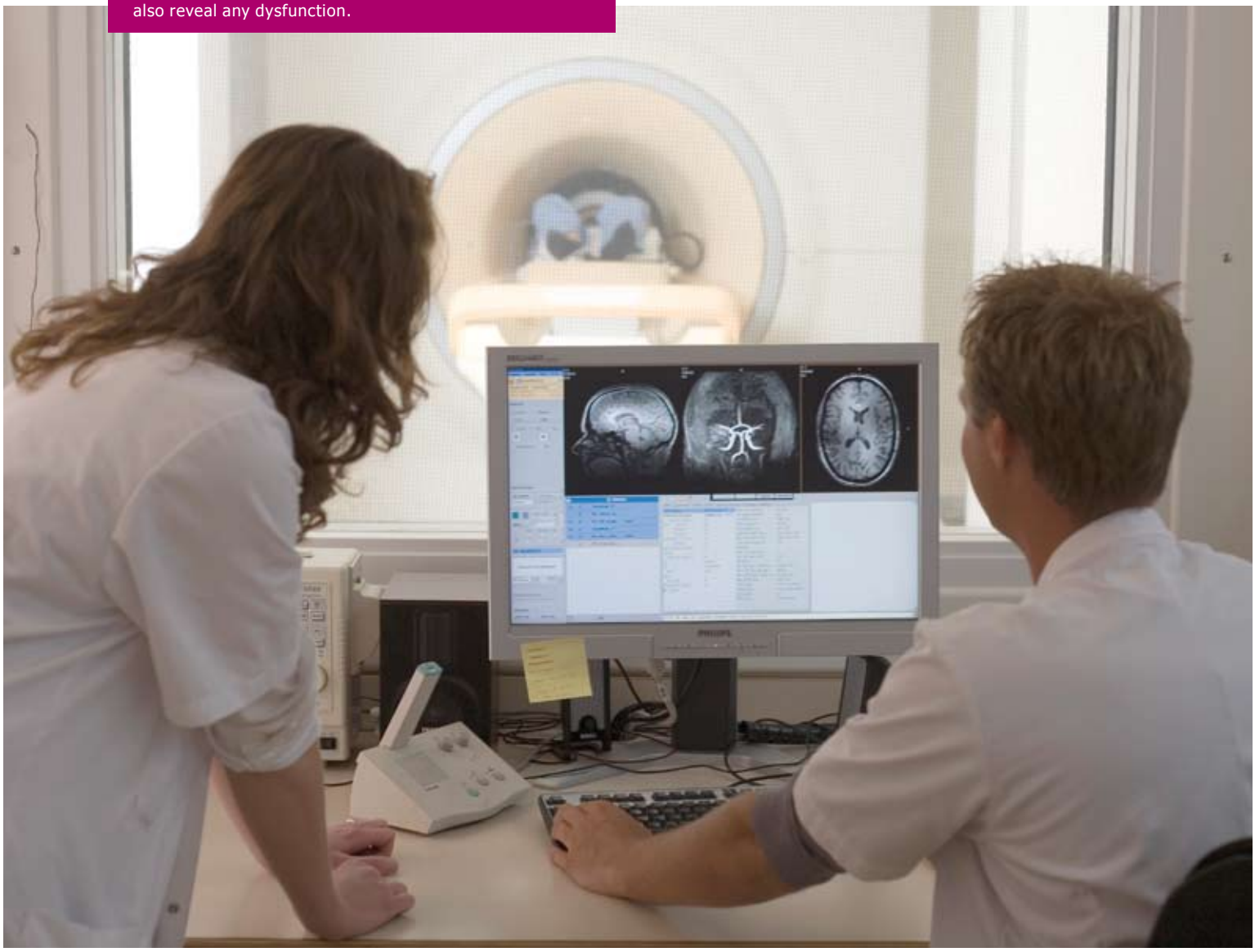
Energy, Health, Infrastructures & Mobility, and Environment

A healthy old age, affordable green energy, a clean and safe living environment and commuting and transportation with no tailbacks. Health, energy, environment, infrastructures and mobility are today's major social issues. Finding the right solutions is vital to our prosperity and welfare, and also affords promising economic opportunities. Delft University of Technology (TU Delft) acts as an expert partner for companies and government agencies working on these issues.

TU Delft supplies independent knowledge and driven engineers. Advanced scientific research and education, together with academic inquisitiveness, provide new insights and innovations. This makes the university an expert and above all, an inspiring partner in consulting or project-based alliances. The Delft Research Initiatives (DRIs) for Energy, Health, Infrastructures & Mobility and Environment bring the knowledge, the engineers and the facilities of TU Delft within your reach.




Modern image processing technologies not only visualize detailed pictures of organs in a detailed matter; by quantifying anatomical structures and function they can also reveal any dysfunction.



Medical imaging and image processing

Enhancing and combining physical imaging technologies such as MRI, CT, PET, SPECT and ultrasound permits the extraction of anatomical and functional information leading to better diagnoses. Early and differential diagnosis increases the effectiveness and safety of treatment; thereby improving vitality and quality of life. Techniques that can visualize individual living cells – and even the molecules in those cells – reveal the mechanisms behind the development of diseases. Tracers that attach to tumour cells make them easier to see, so the surgeon knows precisely where to operate. Image processing technologies also assist surgeons while the operation is in progress, displaying the operating area with great precision using minuscule cameras.

Cure and care technology

Minimally invasive surgery and automated monitoring systems relieve the workload of medical staff and increase patient compliance. They provide patients with more freedom of choice and make them more selfreliant. How? A keyhole operation causes far less damage to the patient than a conventional operation which substantially shortens the recovery time and therefore the length of hospital stays. Autonomous robots or steerable instruments navigate in and around the body under full control.

Specific target-seeking molecules are being developed that will enable radioactive substances to be deliverd at the tumour site, thus reducing or even completely avoiding damage to the surrounding healthy tissue.

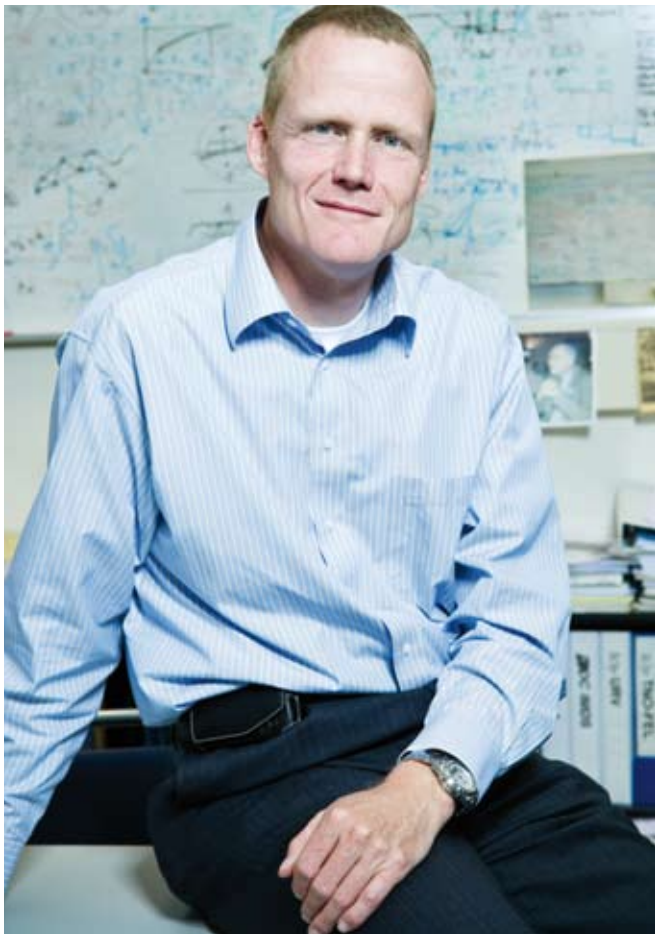
Biosensors carry out measurements in the body and sound the alarm if there is a bacterial infection that could endanger the patient. Advanced models from cellular to organ level provide additional information that makes diagnoses more accurate. Anonymised images from smart cameras in patients' homes facilitate monitoring of and warrant patient safety during the recovery process. Hazardous situations are detected at an early stage so paramedics can arrive on the scene sooner in an emergency.

Targeted molecular technology

An understanding of how diseases develop down to the molecular level will enable drugs to be tailor-made with the result that therapies will become more effective.

TU Delft is developing fast microscopic and spectroscopic technologies to study individual molecules and how they interact. We are using modern bioinformatics to develop algorithms that will give us an understanding of the contribution that molecules, cells and organs make to physical function – and sometimes dysfunction. Specific target-seeking molecules are being developed that will enable radioactive substances to be delivered at the tumour site, thus reducing or even completely avoiding damage to the surrounding healthy tissue. Modern imaging technologies not only visualize organs in a detailed matter; by quantifying anatomical structures and function, they can also be used to assess the progression of disease and the effects of therapy.

"Medical technology is creating a wave of innovation in healthcare, improving quality and efficiency while keeping costs manageable."



Prof.dr.ir. L.J. van Vliet

Scientific director of the Delft Health Initiative

Lucas van Vliet studied Applied Physics and received his Ph.D. degree cum laude, majoring in the development of image analysis techniques for the high-precision measurement of geometrical structures in 2D and 3D digitized images. He was appointed Antoni van Leeuwenhoek Professor in 1999 to work on Multidimensional Image Analysis. He combines the post of Director of the Delft Health Initiative at TU Delft with that of Chairman of the Department of Imaging Science & Technology. He is also Head of the Quantitative Imaging Group and sits on the board of the national graduate school for computing and imaging (ASCI).

"The past five to ten years have made us realise that the partnership between engineers and medical doctors is going to raise healthcare to a new level that we can hardly imagine at present. I regard it as a challenge to shape this process, in which TU Delft aims to play a leading role."

Multidisciplinary hub

The Delft Health Initiative is the hub where scientific knowledge of medical technology is brought together with an understanding of society's healthcare needs. We are working together with doctors and other healthcare professionals to develop solutions that will make healthcare for an ageing population more efficient, more effective and less intrusive for patients. Industry and government are also involved in promoting rapid marketing of innovations. We are embarking upon multidisciplinary research projects to tackle specific existing problems from various angles.

Solution-oriented supply chain approach

Medical technology is a driving force behind innovations in patient-centred healthcare. It requires a close interaction between developers, end-users in the medical world and industry. This 'supply chain approach' takes into account the needs and possibilities, from design to deployment on patients. To facilitate the process TU Delft is creating innovation chains in its medical technology projects, with regional, national and international partners working on solutions, translating basic ideas to clinical tools and marketing. TU Delft has extensive experience in performing this translation process in innovation chains.

Challenges for the future

The ageing population will place greater demands on healthcare services while, at the same time, fewer personnel will be available. The Delft Health Initiative is working on solutions that will not only improve the quality and safety of healthcare but keep it accessible to future generations. Here are some examples:

- Innovations in tools for keyhole (minimally-invasive) operations and their use, combined with image-guidance systems, to reduce the stress on patients, enabling a more rapid recovery and return to daily life;
- Early and differential diagnoses that will facilitate increased use of targeted treatments;
- Medical technology tools that will be used to care for patients and making the individual more self-reliant, thereby relieving the workload on healthcare professionals;
- Training medical technologists and physicians in the use of advanced tools.

Services of the Delft Health Initiative

Knowledge

- Access to independent knowledge
- Patent and software licences
- Contract research
- Assistance with grant applications
- Dialogue and advice

Talent

- Access to students (as trainees and potential employees)
- PhD projects for staff
- Postgraduate teaching in collaboration with medical centres

Research and testing facilities

- Clean rooms with fabrication facilities on micrometre and nanometre scale
- Reactor Institute Delft (RID)
- Microscopic imaging
- Neuromuscular lab
- Haptic lab
- Biotechnology infrastructure

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