DELFT OUTLOOK
NO. 3 | OCT 2020 | YEAR 37
TU Delft

Nynke Dekker
Winner of the Spinoza Prize

CLINICAL TECHNOLOGIST
Bridging the gap between doctor and engineer

Back to TU Delft
Alumnus becomes lecturer

THEME
Idealists

Cover:
There are few aircraft in the airplane hall nowadays. Space enough to build the Flying V here. The working model fits easily through the large doors, and can enter the wide world! (Photographer Sam Rentmeester)

Foreword
Tim van der Hagen

World reformers

Thinking about the future isn't easy when we face so many challenges in the present. Yet that's exactly what's needed right now: like a magnifying glass, the current crisis has exposed society's shortcomings. We cannot return to how things were, nor would we wish to, but must move towards a better society and more sustainable future.

What will that look like? Fortunately, we have enough world reformers in our midst who dream of and are working on the world of 2050 and beyond. Sustainable air travel, to which the Flying V's revolutionary sustainable design is contributing, an energy supply with no CO_2 emissions thanks to clean and safe thorium reactors and safe management of our data and transactions using blockchain technology.

But solutions such as sustainable air travel will not be enough to stem the consequences of climate change – more drastic steps are needed. A North Sea Dam to protect Europe from rising sea levels may sound like the ultimate engineer's dream, but not everyone is convinced of its merits or feasibility. Climate engineering goes a step further: technology with which humans actively intervene in the climate. Prof. Herman Russchenberg takes a look at the possibilities and risks. And how do our alumni see the future? Christiaan Fruneaux and Edwin Gardner study the past and link it to contemporary trends in order to develop scenarios for our cities in 2100. Nadine Bongaerts discovered synthetic biology in Delft as a technology for replacing polluting processes with biological alternatives. The new series, 'All in the Family', where we speak to several generations of TU Delft students, takes an interesting look at the future from the past.

Finally, recent months have brought some old-fashioned good news: Professor of Molecular Biophysics Nynke Dekker has won the Spinoza Prize, the highest award in Dutch science.

Professor Tim van der Hagen,
President Executive Board

PHOTO: SAM RENTMEESTER

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Delft Outlook is the magazine of TU Delft

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This summer saw unprecedented high temperatures in the Netherlands and across Europe. There was also more advertising for sun awnings and roller blinds than ever before. Climate professor Herman Russchenberg is now calling for a worldwide sun awning.

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Nynke Dekker

In late September she was awarded the Spinoza Prize of €2.5 million. The Spinoza Prize is the most prestigious award in Dutch science. What is it that drives Nynke Dekker, Professor of Molecular Physics?

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Rise of the clinical technologist

Six years ago no one had yet heard of clinical technologists, but their prospects on the job market are now looking good. The coronavirus pandemic has raised their profile and there is growing demand for their expertise. What do clinical technologists do?

DELFT IN BRIEF

The QR codes refer to the longer articles. More science news on tudelft.nl and delta.tudelft.nl.

Photo: Sam Rentmeester

Campus becomes open air lab

Using around 30 cameras, transport specialist Prof. Serge Hoogendoorn (Faculty of Civil Engineering and Geosciences/ CEG) recently began observing cyclists and pedestrians on campus. He prefers the term sensors to cameras. "They don't really film you. They register pedestrians and cyclists, showing them as moving points in a space, rather than identifiable individuals." Hoogendoorn is investigating whether people are socially distancing properly and how congestion can be prevented. Ultimately, the aim is to create a website showing traffic flows and the amount of traffic in the whole of Delft.

Online Introduction Week

Whereas last year Delft and the campus were still packed with first-year students enjoying OWee Introduction Week, this year was relatively quiet. The first-years' weekend was online, there was no mass meet-up for breakfast and lunch, only a limited info market and no parade along the Schie channel. Despite this, the big Delft student associations saw almost 60% more people sign up than last year.

Students join the fight against locusts

Swarms of locusts are plaguing the Horn of Africa and Asia. Eleven TU Delft Master's students have devised a plan to use viruses to combat them. They are competing in the iGEM competition, organised by the Massachusetts Institute of Technology. It serves as a platform for the further advancement of expertise in the field of synthetic biology. iGEM students usually tinker with the DNA of bacteria, enabling them to be used to solve societal problems. The Delft students intend to make a biopesticide by genetically modifying bacteriophages. A bacteriophage is a virus that only infects a specific bacterium. The idea is that the virus will cause bacteria in the locusts' stomachs to produce a deadly toxin. The students will present their findings to the judging panel in November.

PHOTOBEWERKING: MARIOLEIN VAN DER VELDT

Greenland ice sheet melting record

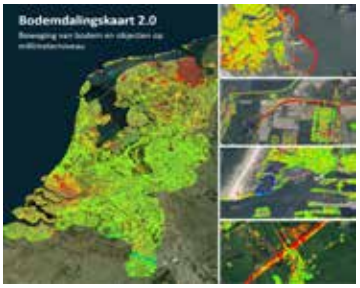
PHOTO: SAM RENTMEESTER

In 2019, the melting of the Greenland ice sheet broke a new record. This is the conclusion of a team of international polar researchers, including Bert Wouters from the Faculty of CEG, based on their evaluation of satellite observations and data from computer models. They presented their findings in Nature Communications Earth & Environment in August. In State of the Climate, published earlier that month, Wouters and his colleagues also demonstrated that other glaciers around the North Pole have been severely affected by the summer of 2019. According to the researchers, the future looks bleak for the Greenland ice sheet: even if the climate cools, the Greenland glaciers will continue to lose mass.

Alumni data captured in cyber attack on Blackbaud

Worldwide, a large number of educational institutions and organisations in the non-profit sector have been hit by a hack aimed at the American software company Blackbaud. The ransomware attack took place between 7 February and 20 May 2020, giving criminals in the case of TU Delft access to an old backup dating from early 2017 with data from nearly 60,000 alumni. This includes personal data (name, gender and date of birth), addresses and training and career data. All those affected were notified by post and e-mail, and the Dutch Data Protection Authority was notified. Blackbaud only informed the TU on 16 July, months after the hack. TU asked for an explanation. You can read the entire TU Delft statement on alumni.tudelft.nl.

The Netherlands is sinking fast



The updated interactive land subsidence map of the Netherlands shows that the Netherlands is continuing to sink. Made using radio satellite images, the nationwide map charts the movement of a billion measurement points. It provides much more granular detail than the previous version, as each individual measurement point is shown – a total of more than 40 billion. The map is the work of researchers from the Faculty of CEG, the Netherlands Center for Geodesy and Geo-informatics (NCG) and the company SkyGeo.

Traces of NSB leader found in death cell

In Death Cell 601 in the former Scheveningen prison, known as the 'Oranjehotel' (Orange Hotel) during the war, inscriptions can be seen that were made by the condemned prisoners. Collaborators were imprisoned immediately after the liberation. A section of the wall was plastered over after the war. A group of Bachelor's students from the Faculty of Mechanical, Maritime & Materials Engineering have used various techniques, including raking light photography and infrared thermography to reveal the writing under the plaster. Based on this information, they have been able to determine that Daniel de Blocq van Scheltinga, one of Mussert's right-hand men, was imprisoned in Cell 601. In July, the students' graduation thesis was published in Heritage Science.

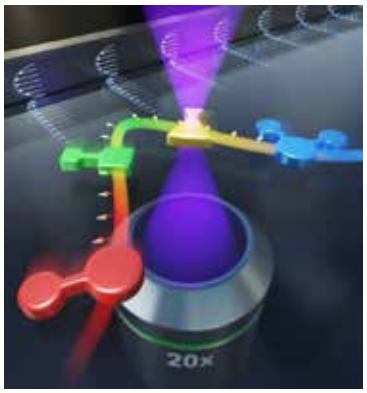
PHOTO: ULRIKE GRAFBERGER

Coronavirus-proof all year round

PHOTO: SAM RENTMEESTER

In order to make the campus 'coronavirus-proof', TU Delft has compiled a campus protocol and introduced additional measures. Working and studying from home will remain the norm. This academic year, students will receive a blend of online and physical teaching, the latter in small groups of ten to twenty students. In order to spread out students and traffic, the study day has been extended (8:00 – 18:30). How the blend of online and physical teaching works depends on the degree programme. Access to buildings is possible only with a campus card: you will need to check out as well as in. The timetables have been carefully arranged to minimise student movements.

Tetris for microparticles



Researchers in the Faculty of Mechanical, Maritime & Materials Engineering have developed a method for separating microparticles in a liquid based on their shape. The technique calculates precisely the path that a specifically shaped microparticle will take in a flow through a narrow tube. This makes it possible to configure a sorting channel in which the differently shaped particles each find their own way. The technique could prove useful in drug production or removing micro-plastics from water.

THEME
Idealists

PHOTO: SAM RENTMEESTER

Working to achieve a better world is what Delft engineers like to do. Some of them have made real progress, including the inventors of the sustainable Flying-V, a scale model of which took to the air this summer. According to Wouter Serdijn, his bioelectric medicines are not futuristic, but very much of the here and now. Other ideas may take some getting used to, such as the construction of the North Sea Dam and climate engineering. Across this theme, Delft scientists and alumni are again providing clear proof that they're not sitting idly by on the sidelines. A better world starts with yourself.

TEXT: JOS WASSINK PHOTO: SAM RENTMEESTER ILLUSTRATION: STEPHAN TIMMERS

A worldwide sun awning

Last August saw unprecedented high temperatures in the Netherlands and across Europe. There was also more advertising for sun awnings and roller blinds than ever before. Climate professor Herman Russchenberg is now calling for a worldwide sun awning.

It was the first time the Netherlands ever recorded eight consecutive days of tropical temperatures. Temperature records are being broken so quickly that it has become normal. Is no one concerned by these signs of the strength of climate change?
Of course they are. Researchers are seeing numerous countries failing to realise their self-imposed climate targets. Energy consumption remains high and the extra capacity from renewable solar and wind energy will easily be outpaced by the increased use of data centres, air conditioning, electric cars and green hydrogen production. This is compounded by the fact that all of the self-imposed CO_2 reductions together are insufficient to remain within the critical boundary of 2 degrees of temperature rise (compared to the pre-industrial age) in the Paris climate agreement. "Clearly, the actions we're now taking to reduce CO_2 emissions are not enough", Professor of Atmospheric Remote Sensing Herman Russchenberg said recently in NRC. "It will get too hot on Earth. That's why, by 2040, we need to have the technology ready to cool things down temporarily."
Little surprise then that climate researchers are looking for new technology, and in doing so beginning to encroach on an area previously regarded as taboo: Climate engineering, or in other words: deliberately influencing the climate. Until now, climate change has been an unintended side-effect of the carefree consumption of fossil fuels and the greenhouse effect of the CO_2 released in the process. Deliberately influencing the climate soon summons up images of a sorcerer's apprentice whose naïve interventions end up making things worse.

BOGEYMAN

Prof. Herman Russchenberg, Director of the Delft Climate Institute, is only too familiar with the issue. He's long been considering how you can influence the climate, and going public on this. "I used to be dismissed as a bogeyman, a professor in a white coat doing crazy things and wanting to ruin the Earth." He's recently noticed much less aversion and an increase in interest. "The idea that climate change exists is really starting to sink in. People are realising that we need these kinds of technologies and that we need to prepare ourselves."
The technologies that

Prof. Herman Russchenberg: "It will get too hot on Earth."

Russchenberg is referring to can be divided into two categories: reduction of solar radiation (see the drawing on page10, Z1 to4) and CO_2 removal (C1 to 6). The field of geo-engineering, or climate engineering as Russchenberg prefers to call it,

'In my view, climate engineering is too important to leave to a single country'

now has 10 different technologies in the very early stages of research. Of these, stratospheric aerosol injection (SIA) is considered to be the most promising, both in terms of technology and financial feasibility. Studies from Harvard envisage 4,000 flights per year with a special tanker aircraft at an altitude of 20 km, spreading small white sulphate particles into the stratosphere. The fact that particles like this can effectively reflect back part of the sunlight, reducing the solar heat that reaches the earth, is known from major volcanic eruptions that tend to be followed by temporary but worldwide cooling.

POPULAR

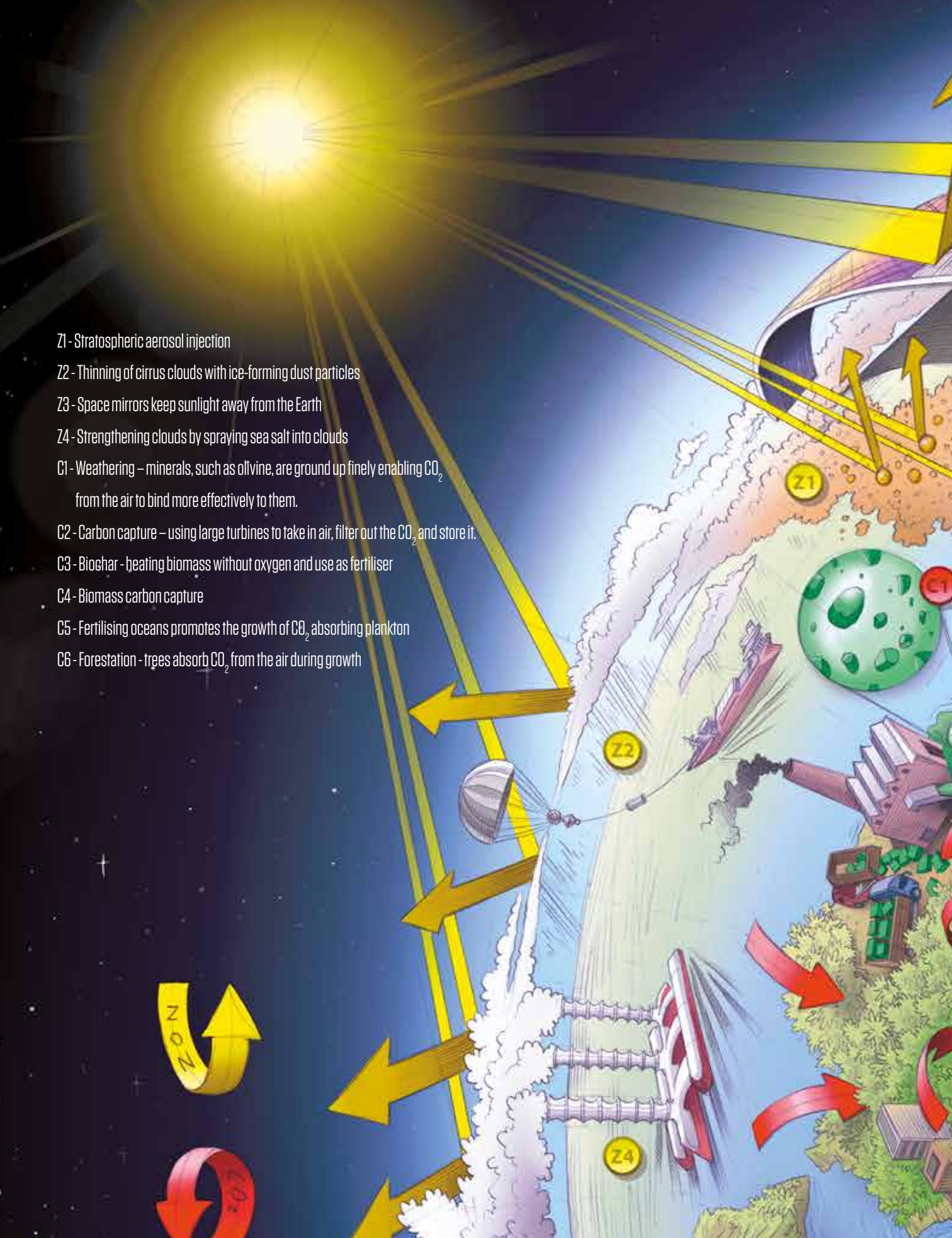
The first exploratory research is already being conducted in Delft. This includes the design of the stratospheric aerosol geo-engineering aircraft (SAGA). In laboratories, students are measuring the reflections of droplets while others are modelling cloud formation and the effect on climate models.

Russchenberg sees that climate engineering is popular with students. It gives the sense that something can be done about climate change. "The approach is more positive than the way political policy is often seen, that you have to sacrifice something."

Yet countless technical, practical and ethical questions remain. What will be the effect on global precipitation, for example? How will the aerosols affect the ozone layer? Who will decide when and how many aerosols can be sprayed and how sure are we of the effect? Could we go too far, and, if so, what then? What happens if we suddenly stop doing it after a few years? And the most dangerous of all: how do you stop people seeing climate engineering as an excuse for no longer reducing their CO_2 emissions?

Russchenberg is aware of all these uncertainties, but still hopes that the Netherlands and Europe will invest in the research, if only in order to be able to engage in high-level discussions with the United States. "They're pumping millions into this research and acquiring a lot of knowledge. In my view, climate engineering is too important to leave to a single country. These are technologies with a global impact and you don't want to leave decision-making in the hands of a single country." <<

Read more on page 10


Z1 - Stratospheric aerosol injection
Z2 - Thinning of cirrus clouds with ice-forming dust particles
Z3 - Space mirrors keep sunlight away from the Earth
Z4 - Strengthening clouds by spraying sea salt into clouds
C1 - Weathering – minerals, such as olivine, are ground up finely enabling CO_2 from the air to bind more effectively to them.
C2 - Carbon capture – using large turbines to take in air, filter out the CO_2 and store it.
C3 - Biochar - heating biomass without oxygen and use as fertiliser
C4 - Biomass carbon capture
C5 - Fertilising oceans promotes the growth of CO_2 absorbing plankton
C6 - Forestation - trees absorb CO_2 from the air during growth
Z1
C1
Z2
Z4
ZON
CO2


Z2
C5
C3
C4
C2
C6

Flying in a V-shaped wing

Air traffic accounts for approximately 2.5% of greenhouse gas emissions. However, TU Delft researchers think it can be made more sustainable. They are developing a totally new kind of aircraft: the Flying-V.

In it, the cabin, cargo hold and fuel tanks are integrated in the wing. The entire aircraft is in fact a single V-shaped wing. Last summer, a 3-meter-wide radio-controlled scale model took its maiden flight on an airfield in Germany. The Flying-V picked up speed, lifted its pointed nose into the air and soon began to climb. The test ran relatively smoothly, although it had a rough landing. It landed on its nose wheel, which broke off.

The plane's more aerodynamic shape and lower weight means it should consume 20% less fuel than the Airbus A350, which serves as a reference. The Flying-V should be able to carry the same number of passengers (314) and the same volume of cargo (160 m³).

KLM and Airbus have been closely involved in the research. If the aircraft is ever used in civil aviation, AE Dean Henri Werij believes it will be "the most revolutionary change in aviation since the introduction of the jet engine." He said this in a webcast during the presentation of the test flight.

A 20% reduction in energy consumption is quite impressive but still not enough to help achieve the climate targets, so the researchers are exploring the possibility of alternative, greener fuels, such as biofuel and synthetic kerosene.

"Ultimately, we'll need to fly completely on renewable energy", says Werij. "If CO_2 is also released during the flight, for example because we fly on synthetic kerosene, the same amount of CO_2 will be used to make the fuels. At TU Delft, we're investigating how we can achieve that."

We will have a long wait for large passenger aircraft that can fly on batteries.

> 'Even if you make advances in the development of batteries, it's still difficult to compete with kerosene'

The greatest obstacle is the gravimetric energy density: the amount of energy in a kilo of material. "Currently, 50 times as much energy goes into a kilo of kerosene as in a battery", explained TU Delft aviation researcher Joris Melkert in a recent interview in Trouw. "You can improve efficiency thanks to the electric engine that replaces the combustion engine in an electric aircraft, but kerosene is still 20 times as efficient. In other words, even if you make advances in the development of batteries, it's still difficult to compete with kerosene." TMD

More information:
tudelft.nl/lr/flying-v

PHOTO: SAM RENTMEESTER

ILLUSTRATION: SIJA VAN DEN BEUKEL

Three ideas for taming the North Sea

This summer saw the ice on Greenland melt faster than ever before. What will happen if efforts to curb climate change fail? In that case, temperatures in the year 2100 could be 2.5 to 3 degrees higher than before industrialisation. That will cause sea levels to rise by several metres (average of 2.3 m per degree).

Physical geographer Dr Sjoerd Groeskamp, who works at Utrecht University and the NIOZ (Netherlands Institute for Sea Research), was concerned about the impact on northwest Europe. With his German colleague Joakim Kjellson, he devised a rescue plan: the Northern European Enclosure Dam (NEED) between France, the UK and Norway.
'NEED may seem over-the-top and unrealistic', they write. 'It's one of the greatest ever civil engineering challenges, but it also offers the most effective protection for 25 million Europeans and their important regional economy.'
"A magnificently crazy idea", is Prof. Peter Herman's view. An ecological engineer (Faculty of CEG), he foresees an environmental disaster because the 30,000 m^3 of fresh water flowing into the North Sea every second will transform it into a freshwater North Lake within a century. Deeper oceanic trenches will remain salty, but lacking oxygen and life.

The plan devised by engineers Rob van den Haak (who died in 2019) and Dick Butijn is less intrusive. This plan for De Haakse Zeedijk (DHZ), a sea dyke that Butijn named after his late colleague provides a second coastline. A 3.5 km wide body of sand protrudes 20 m above the current average sea level, 25 km offshore. The European version

‘A magnificently crazy idea’

runs parallel to the North Sea coast for 1,100 km from Calais to northern Denmark and across to the other side (Gothenburg).
Dr Bas Hofland (CEG) sees the DHZ as a “realistic plan” because it takes account of nature, preventing salinisation, and shipping. “It’s an integrated plan and one of the potential solutions.” Hydraulic engineer Prof. Wim Uijttewaal appreciates its combined functionality. More than a flood barrier, the dyke also provides opportunities for an airport, drinking water basins and energy generation. Uijttewaal is even in favour of a semi-open North Sea dam. Dutch dykes are designed to withstand the fiercest conditions: spring tide, wind impoundment and the impact of high waves. According to his calculations, a semi-open dyke from Scotland towards Norway could reduce both the tide (average 1.5 m) and the storm surge by around a metre on the Dutch coast. “Reducing the peaks creates space for a few metres of rising sea level, buying you time”, says Uijttewaal. He envisages the dam slightly further south, where the North Sea is shallower. JW

Reliable internet

Blockchain, the technology behind bitcoin, offers the potential to manage financial affairs without the intervention of banks. It could also safeguard our privacy. TU Delft is working hard on research in this field.

Originally a paradise for all, the internet has been hijacked by companies such as Amazon, Facebook and Google. These internet giants trade in our data and can have a destabilising effect on democracies.
Earlier this year, researchers in the TU Delft blockchain lab and colleagues from Erasmus University Rotterdam and the UvA received €3.3 million for research into a new type of internet: the Internet of Trust. The aim is to design a reliable and EU-compliant system that can store all kinds of transactions in a blockchain, a decentralised database, by combining ideas from computer science, economics and law. The plan is to have 50,000 internet users test whether the system is reliable and future-proof.
Project manager Johan Pouwelse explains: “Internet giants like Amazon, eBay and Google are essentially traders in trust. We use Amazon and eBay as trusted intermediaries, and go to Google for relevant websites.

The idea is to use an app that only reveals information that is necessary in specific situations

They each register confidential data separately on their own servers. We want to replace these centralised, US-dominated servers with an open source alternative: a scalable and reliable way of maintaining trust and reputation.”
The Netherlands Identity Data Agency (RvIG) has joined the three universities in the project. Part of the RvIG’s contribution involves the development of a kind of electronic ID card based on blockchain, giving citizens greater control over their personal data. The idea is to use an app that shows who you are and only reveals information that is necessary in specific situations. For example, when you need to prove your age in the supermarket to pay for a bottle of wine, you can use the app to prove your age without revealing your date of birth.
The electronic passport could also be useful in the digital world. Currently, many online platforms still use Facebook or Twitter for logging on. However, with a digital stamp, that could become a thing of the past. TvD

A 'picture book' about the future

An architect who sets up a company with an historian. Although it may not seem like the most obvious combination, TU Delft alumnus and futurologist Edwin Gardner from Studio Monnik chose to do just that. "You can't think about the future without looking back twice as far into the past."

Gardner joined forces with historian Christiaan Fruneaux (UvA) to design and develop future scenarios worked out to the tiniest detail, both for clients and at their own initiative. For the Primary and Secondary Educational Councils, they developed the idea of Bloom, a fictional educational start-up in an age without classrooms, where students do individualised, adaptive educational programmes instead. Gardner invited top names from the world of education, presented himself as the Bloom CEO, distributed merchandise and showed a slick promotional video. "Educational administrators know that the future of education will be digital, but their discussions about it often get bogged down in abstractions. Bloom underlined the urgency of the situation. They began to focus on important issues, such as whether to store their data on an open-source platform or with a commercial player, like Apple. If you don't consider the future, it will catch you unawares." Next year, Studio Monnik will complete a project of its own: Alles komt goed (It'll all work out). It's a book featuring future scenarios about Amsterdam in 2089 presented in the form of anecdotes and cityscapes and drawn by illustrator Jan Cleijne. "It's impressionistic, like a fairy tale picture book", explains Gardner. In De Poreuze Stad (Porous City, see illustration) humans and nature live on an equal footing. "The biosphere is a fully-fledged user of the city." The print shows a roof landscape and an urban shepherd. Architecture plays a new role. "We've been thinking along the lines of biomimicry. Instead of barren buildings made of stone, glass and steel, we envisage a building as a growth system for ecological niches, featuring gable channels that redistribute rainwater, rather than it going straight down the drain." The book will be published by Concerto Books next spring. AB

ILLUSTRATION: STUDIO MONNIK EN JAN CLEIJNE

Amsterdam in 2089 as a porous city. The city shepherd crosses the bridge with his sheep to reach the next roof steppe.

Make nuclear energy sustainable

Could we supplement a CO_2-free energy supply by using sustainable and safe thorium reactors? Reactor physicist Jan Leen Kloosterman feels Europe should be investing in this.

Prof. Jan Leen Kloosterman first became interested in the idea of a thorium reactor in around 2005. Research at the Reactor Institute Delft was then focused on the development of an inherently safe reactor that would never suffer a meltdown. Kloosterman also aimed to make nuclear energy more sustainable by preventing long-term nuclear waste. This is possible if thorium is used as a fuel instead of uranium. The longest-living isotopes would then need to be stored for 300 years, rather than the millennia needed for the current uranium reactors.
But the thorium cycle calls for a completely different reactor design. Thorium and other substances, such as the fission products, are dissolved in molten salt that flows through the reactor as a coolant. Heat exchangers transport the heat from the core (750 degrees) to steam turbines. This kind of reactor is called an MSR (molten salt reactor).
"It has a completely different safety concept than the reactors we currently have," explains Kloosterman. "We're used to keeping the fissile fuel in the core, where nothing is allowed to happen to it. The concept of the MSR actually involves allowing the fissile fuel to flow." If it overheats, a plug at the bottom of the reactor melts and the salt flows out of the reactor with the fissile fuel. Engineers call this passive safety.
Kloosterman knows that with a CO_2-free energy supply, solar and wind energy will need to be supplemented by capacity from power plants, such as nuclear energy. So, should we do that with uranium reactors, or would sustainable and inherently safe thorium reactors be preferable?
A simple question really, but thorium reactors have not yet been developed. TU Delft researchers have been collaborating with European colleagues on the design, safety and simulations of molten salt reactors since 2010. "In the EU, we now have a good idea of how this kind of reactor behaves."
The next step is an experiment in which researchers can work with large quantities of molten salt to learn how it behaves and whether this matches the simulations. Kloosterman estimates the cost of a large-scale experiment of this kind and the development of a prototype MSR to be €200 million.
At a ministerial lobby on the subject of the energy transition with the universities of technology and NRG in Petten, Kloosterman pointed out that the date when the thorium reactor could make a large-scale contribution is too far away for politicians. Their climate target horizon is 2030.
In the meantime, the United States and China are investing heavily in the development of the thorium reactor. Can't we just import it? "In order to run this type of reactor, you really need a lot of experience with molten salt. I think that Europe needs to invest in it itself. Especially when it comes to energy supplies, you shouldn't become dependent on foreign countries." JW

PHOTO: SAM RENTMEESTER

Jan Leen Kloosterman: "In the EU, we now have a good idea of how this kind of reactor behaves."

'Especially when it comes to energy supplies, you shouldn't become dependent on foreign countries'

Treating your disorder with electronic medicines

Increasing numbers of people now have a chip in their body which they can use to make payments or check in to public transport. "It sounds futuristic, but the technology is not that extraordinary", explains Prof. Wouter Serdijn. "My dog has something similar."

PHOTO: SAM RENTMEESTER

Serdijn knows what he's talking about. As a professor in the faculty of Electrical Engineering, Mathematics and Computer Science, he works on the development of bioelectronic medicines. These tiny devices communicate with the nerves, muscles or heart and know exactly when the body needs something. A well-known example is the pacemaker, but bioelectronic medication is also used for such disorders as Parkinson's disease, dystonia or epilepsy.

"Electronic medication can often be the last resort for patients for whom drugs won't work or can no longer be used", says Serdijn. He mentions treating tremors using deep-brain stimulation, which involves inserting an electrode array, a thin conducting wire, into the brain. This is connected to an electronic impulse generator (IPG) via a subcutaneous extension cable. Implanted just under the collarbone, the IPG emits pulses that are sent to the brain to keep tremors under control. The doctor sets the speed, duration and strength of the pulses, although patients may also control some of the settings.

"It sounds extreme, because it means you're tampering with the part of the body that regulates motor skills and it's also where

someone's personality and thoughts are located. It's a risky operation, but can often make a huge difference", explains Serdijn. "It's extraordinary to see someone who shakes all the time suddenly become still and be able to pick up things when the simulator switches on."
The same technology is used for patients with balance disorders, such as Menière's disease, or to enable deaf people to hear again via cochlear implants. The future looks very promising. "I'm currently working with the Netherlands Institute for Neuroscience on a stimulation

'It's extraordinary to see someone who shakes all the time suddenly become still'

technique to enable blind people to see in high resolution and I expect bioelectronic medicines to bring about significant progress in the treatment of migraine and depression."
Serdijn's ultimate dream is to give people complete control over uncontrollable urges that are at odds with their personality. "Brain-related disorders can cause a lot of suffering. People often say: 'It's all in your head'. They're right, but this is not a question of free choice. Take addictions, for example. People used to blame them on a lack of willpower, but it's the brain that says to someone: 'You see that bottle there? I want it. I need it.' The patient is a victim of an uncontrollable urge to use substances that are not good for him or her." MvdV

More info? bioelectronics.tudelft.nl

TU Delft focuses on AI

TU Delft is intensifying its research into artificial intelligence, doubling its budget to €70 million per year, with 24 interdisciplinary AI labs.

AI has really taken off, playing a role in almost all scientific fields. That means it's time to really focus on it. Eight new 'TU Delft AI Labs' have been set up at the university and that figure is set to increase to 24 by 2021.
The research will start with eight research groups in fields including material science, urban environment, water management, computer vision, biomedical applications and human-computer interaction. John Schmitz, Dean of the Faculty of Electrical Engineering, Mathematics and Computer Science, is one of the driving forces behind the upscaling of AI research. In his view, the great thing about the labs is that they are focusing on fundamental issues as well as applications. "We plan to tackle issues that are of relevance to society." "Especially in medicine, I expect AI to bring about major advances. Take Alzheimer's, a disease linked to countless genes. That means you're dealing with an awful lot of data and it's difficult to gain an overview. Self-learning algorithms could provide an answer. The Bioinformatics group is already researching this." TvD

‘It’s really a miracle that cancer doesn’t occur more’

In September she was officially awarded the Spinoza Prize of €2.5 million. The Spinoza Prize is the most prestigious award in Dutch science. What is it that drives Nynke Dekker, Professor of Molecular Physics?

TEXT DESIREE HOVING PHOTOS SAM RENTMEESTER

On 19 June, a press release announced to the world that you had won the 'Dutch Nobel Prize'. What were you doing that day?
"In mid-May I was called by Stan Gielen, President of NWO, who told me I would be getting the Spinoza Prize. I was glad to be able to finally share the news with my research group on 19 June. It just so happened that I had scheduled a meeting with them that day to discuss our future plans. Of course I brought cake for everyone!"

Do you have an idea what you are going to spend the money on?
"About five years ago I chose a new direction: DNA replication in eukaryotes [ed.: eukaryotes are organisms that have cells containing a nucleus with DNA], i.e. copying DNA using a protein machine. This can go right, or it can go wrong. I examine the replication process at the molecular level and I am keen to explore this in more depth."

How does copying DNA with a protein machine work?
Dekker draws two horizontal lines one above the other. "This is a DNA strand of two nanometres thick." At the end of the strand, it splits into a line that slants upwards and one that slants downwards. Do you recognise the replication fork yet? The DNA is copied by the replisome, a protein complex that, in cells like ours, consists of 25 proteins. "All those proteins have to work together in an aqueous environment that contains countless other proteins. Collisions with the water molecules cause the whole to vibrate pretty much continuously. So it's a miracle that DNA replication so often goes right."

Our bodies copy DNA millions of times a day to create new cells. How often does that go wrong?
"If we include damage repair, it goes wrong in one out of one to the power of ten nucleotides [ed.: nucleotides are the letters that make up our DNA]. In other words: for every ten genomes [ed.: a genome is your complete DNA] that are copied, one will contain an error. That is not often. But when it does really go wrong, it can lead to a genetic disease, cancer or ageing."

But if it doesn't often go wrong, why do so many people get cancer?
"All of our cells together copy about a light year [ed.: 9.5 trillion kilometres] of DNA in our lives. That's incredibly long, all the more when you consider how tiny DNA is. So you may think that one in three people getting cancer is a lot, but it's really a miracle that it doesn't occur more. I want to understand why."

Can certain properties of DNA in tumours be traced to errors in the replication process?
"I am trying to improve our understanding of the molecular aspect of DNA replication so that we can find out what can stop the replication fork and what the consequences are for the DNA. I am currently building a consortium

'It's a miracle that DNA replication so often goes right'

which will examine these molecular and cellular processes in relation to replication. We are also collaborating with research groups that are studying certain tumour cells that are known to be able to cope more flexibly with faulty DNA replication. If we can gain a better understanding of how this works, we may be able to exploit certain sensitivities of tumour cells by administering specific molecules and ultimately prescribing better treatments. It's motivating to be able to contribute to this work."

As a physicist, what is it that makes you so interested in such biological processes?
"It interests me that while the whole replication process is an exceptionally well-functioning machine, at the same time it evidently does not always function well. As a scientist, I try to understand the whole machine."

You studied mathematics and physics at Yale, graduated in physics at Leiden University and obtained your PhD in physics at Harvard. What is the source of your fascination with physics?
"My father has a background in physics, so it wasn't new for me. When I was in secondary school, I learned about Watson and Crick's discovery of the DNA structure in Biology class, but I didn't find it that interesting at the time. I was more interested in mathematics and the other more exact sciences. I had an aha-experience when I learned about the link between the periodic table of elements and quantum mechanics. I was fascinated when this led me to understand how each element is

CV

Professor Nynke Dekker has been a Professor of Molecular Biophysics with the Department of Bionanoscience at the Kavli Institute of Nanoscience since 2008. There she has her own team that is investigating the molecular processes of DNA replication. She graduated with distinction at Yale and Leiden and did a number of years of research at Harvard, where she obtained her PhD in 2000. She then carried out two years of postdoctoral research in Paris, before establishing her own research group in 2002. In 2009 she gave her inaugural lecture entitled: The revolution of a single molecule. Her research has also appeared in renowned scientific journals. Dekker was a member of The Young Academy of the KNAW and received both a Vidi grant (2005) and a Vici grant (2010) from NWO. She was awarded the Spinoza Prize in September.

arranged according to a fixed pattern. But I'm glad I did not just study sciences at Yale; I also studied French, music and many other subjects."

Why did you return to the Netherlands?

"After I received my PhD I did a postdoc in Paris, so I was already more in the neighbourhood. Cees Dekker [ed.: Professor of Biophysics] told me in 2001 that he was developing a biophysics research group in Delft. I visited them and they offered me a position. I had the feeling that the people there knew what they were doing and that I could do the research I wanted to do there. So I accepted their offer, also because I felt that I would have more freedom to organise my life the way I wanted to here; at Harvard, I felt like I was part of a rat race."

What do you do when you are not working?

"I like to spend time outdoors walking, jogging or cycling. I regularly bike the thirty kilometres from my home in Leiden to my work in Delft. I bike at a relaxed speed, because life is already fast enough as it is. I don't want to have any commitments outside my work, so I really exercise for the fun of it. I've also been singing in a local choir for the past year or two."

You have been with TU Delft eighteen years now. What gets you out of bed in the morning?

"Research. I work with fantastic people in my research group and like to bring people together and share my enthusiasm for the research."

When you came to TU Delft, the university was not yet very involved in fundamental biology. Why did you seek to make a connection with that field?

"When I started in Delft, Biophysics was housed in the Applied Physics building. That was fine at first, but as a biophysicist you really need to have a link with biology. On 1 January 2010, we had the opportunity to start a new Bionanoscience department. This was an important step for the development of TU Delft. You now see more biological research being conducted throughout the university."

You were the first female board member of the Foundation for Fundamental Research on Matter (2012-2017). Do you see yourself as a role model?

"It doesn't feel like it, but I probably am. Fifteen percent of physics students are now women, and there are even more in nanobiology. I used to give talks on information days. I offered to do so again recently, but something came up, which is a pity, because that's the time to recruit women."

As a female scientist you are cited less often than the men. Does that bother you?

"I do not experience any barriers whatsoever as a female scientist. Sometimes an article or grant is rejected, but there are always plenty of other sources of recognition available. I cannot claim that being a woman has been a handicap in my career. For example, there were only two or three women at Yale who studied physics, so in terms of name recognition it worked in my favour."

What are your plans for the future?

"My research group is working to increase our quantitative understanding of existing biological processes and systems and deploys biophysics and biochemistry to this end. My goal for the next 10 to 15 years is to integrate this research with cell biology, bioinformatics and other related disciplines. This will enable us to maximise our impact, including, hopefully, on medical research." <<

IN PERSON

This year saw the Netherlands receive 42 European research grants for young scientists. Two of these went to Delft: **Caroline Paul** (Applied Sciences) and **Peyman Mohajerin Esfahani** (3mE) were the recipients. The starting grants are intended for scientists with two to seven years of work experience after their doctorates. They can use the grants, up to €2.5 million each, to employ their own research team. Paul's grant is for research into biocatalytic alkylation and Mohajerin Esfahani's is for research into decision-making problems in uncertain and dynamic environments.

Dr **Irene Haslinger** was appointed Director of TU Delft Library on 1 September. She succeeds Wilma van Wezenbeek, who will become the Director of Student and Education Affairs at Vrije Universiteit Amsterdam. Previously, Haslinger was EEMCS Faculty Secretary and Programme Manager for TU Delft Open Science.

(PHOTO: SAM RENTMEESTER)

The Executive Board has appointed IDE's Prof. **David Keyson** as Diversity Officer with effect from 1 September. He succeeds Prof. Rinze Benedictus, who held the position for three years. The role was introduced in order to promote diversity, inclusion and equality at TU Delft. In the years ahead, David Keyson will continue to shape the university's diversity policy and expand the diversity network within and outside the organisation.

The limits of control

We will travel to distant planets setting up colonies as modern explorers, discover bizarre worlds and gaze at a sunset with three suns.

My ambition when I started studying aerospace engineering was something like that.

I was 18 and it was 1996.

After just a few lectures, my heart sank. The sheer scale of the universe was overwhelming... Okay, you can travel to the moon in three days, but imagine if you wanted to go to the next-closest star after our sun. It'd take you more than four years, if you could travel at the speed of light (which is impossible). And that's just the next-closest star.

In any case, most of the planets around the distant stars that astronomers have discovered in recent years are totally incapable of supporting life. They're so hot that you'd melt spontaneously, spacesuit and all. Over the years, I've come to accept that we will continue to be able to study the most far-off worlds only from a distance, but travelling to them is simply unrealistic for human adventurers. It's impossible now, will be so in a decade and will still be impossible in a century.

Controlling your environment could perhaps be seen as the running theme in an engineering degree programme. But to what extent are there limits on that control? For me, the theme of this Delft Outlook – Idealists – immediately calls to mind an intrepid engineer who really can devise a solution for everything.

I wouldn't wish to discourage ambitious world reformers with noble plans, but I believe in putting things into perspective: most things in life are not under your control. Reforming the world is no easy job when your original plan is in tatters because – to cite just one example – a worldwide pandemic breaks out. Or your partner or child becomes ill and you have to become a carer.

But that kind of random event that diverts you from your original path can sometimes turn out surprisingly well. For example, you may be attempting to reform the world a little by conducting research into bacteria that can prevent infections and you suddenly realise that there's absolutely no bacterial growth around a certain mould in your lab and that this could be a much more important discovery altogether. That's what happened to the Scottish doctor Alexander Fleming, the man behind penicillin, in 1928.

There are countless other examples of brilliant inventions that first make you think that a world reformer with a determined plan must have been behind them, but where it was actually chance that really made it happen. Or as John Lennon once sang: 'Life is what happens while you're busy making other plans'.

'Life is what happens while you're busy making other plans.'

Tonie Mudde is an aerospace engineer and science editor at de Volkskrant newspaper.

THE FIRM

How do you make the rainforest so valuable that deforestation for agricultural purposes no longer happens? With his company ForestWise, that's what alumnus Dirk-Jan Oudshoorn is working on.

Palm oil or rubber – that's roughly the choice for farmers in West Kalimantan. Rubber makes little profit, palm oil even less and its production is highly polluting. This needs to change, thought Dirk-Jan Oudshoorn, who arrived in Sintang seven years ago

'We try to offer work to as many people as possible"

when his girlfriend started working for a charity that protects orang-utans. He discovered that, for centuries, farmers have planted Shorea stenotera plants when old rice fields are exhausted. This indigenous, protected tree species produces illipe nuts that are used to make oil and butter. In the 1980s, most of them were replaced by palm oil and coconut. Oudshoorn has now boosted production, together with that of arenga sugar, buah merah oil and kukui nut oil, using fruit and nuts with respect for nature and harvested from the wild.

"The idea for ForestWise was based on a small pilot we did for the foundation", says Oudshoorn. "The only way to upscale was to set up a company. Thanks to a grant from the British government, we attracted other investors, including two Dutch private funders. By the end of 2018, we had the finance we needed, just before the season started." It is a variable product, with good and poor harvests

Dirk Oudshoorn: "Agreeing new contracts is proving difficult thanks to the coronavirus crisis." (Photo: Dirk Oudshoorn)

from year to year. "But according to a Dutch report I found from 1937, it never fails more than two years in a row," says Oudshoorn, "and good years provide a huge harvest, ensuring that you always have supplies."

The nuts are processed in the company's factory, employing 32 people in the high season. "We try to offer work to as many people as possible."

Oudshoorn hopes to be able to improve the production process to get even more oil from the nuts. "My colleague Theo Smits is working on that. Even though I'm the one who studied at TU Delft, he takes care of the technical side", Oudshoorn says with a smile. He says he has had many benefits from his degree. "I learned how to manage projects with different stakeholders, such as maintaining contact with farmers and government. And thanks to strategic product design, I know how to market a product."

ForestWise currently sells its products to several Dutch food and cosmetics producers. "Agreeing new contracts is proving difficult thanks to the coronavirus crisis", says Oudshoorn. "Companies are hesitant about introducing new products."

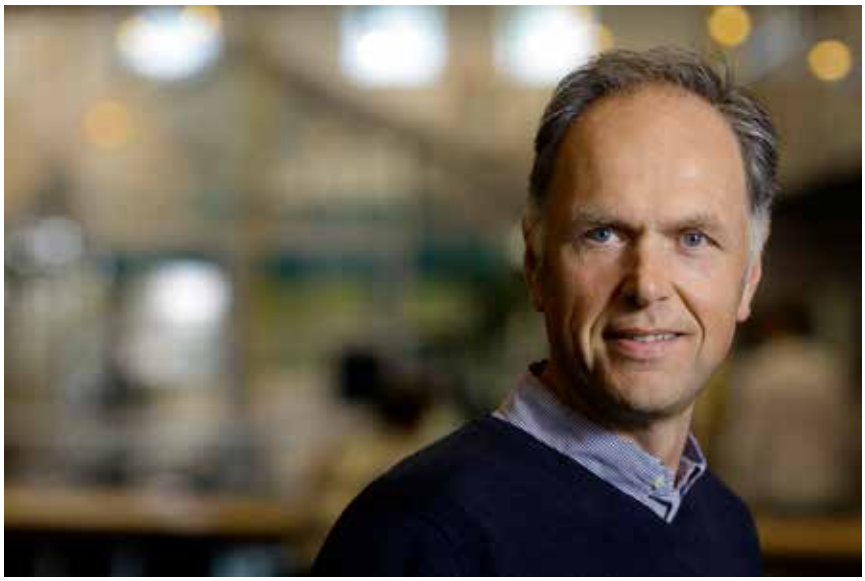
Oudshoorn is working on a line of cosmetics and developing new products. "If you can do this on a large scale, it can be a solution to deforestation. You can make more out of it than palm oil plantations. We need to ensure that the rainforest itself becomes so valuable that deforestation no longer happens." DvG

Company:	ForestWise
Founder:	Dirk-Jan Oudshoorn
Place of residence:	Sintang (West-Kalimantan) Indonesia
Degree programme:	Technische bestuurskunde and strategic product design
Founded:	2018
E,ployees:	32 in the high season
In five years:	"Are we known we are known as the reliable producer of sustainable products from the Indonesian rainforest in the cosmetics and food industry and do we help ten thousand families to a sustainable income."

How a guest lecturer

Many former students return to TU Delft later in their careers as guest lecturers. Two of them talk about their experiences. "The questions students ask make you reassess your own assumptions."

TEXT: SASKIA BONGER
PHOTOS: SAM RENTMEESTER



Anton Paardekooper: "An important learning objective involves confronting students with the feasibility of their own plans."

Anton Paardekooper

Managing director and founder of the start-up BBBLS. He graduated in Mechanical Engineering in 1992 and has been a guest lecturer at 3mE (Mechanical, Maritime & Materials Engineering) for six years.

Over that time, he has seen groups of first-year mechanical engineering students every week. He graduated on the same programme in 3mE himself in 1992, is an entrepreneur and has a start-up specialising in energy-saving greenhouses with incubator Yes!Delft. Paardekooper is a guest lecturer in first-year design classes, the source of some amazing mechanical products every year: climbing delivery dogs, coffee cup grabbers or walking beer crates.

"One afternoon a week, I see groups of seven or eight students every half hour. Having prepared myself on the details of their designs, I give them feedback so they can progress. It's intensive, but very energising", he said.

Paardekooper became a guest lecturer when he heard there was a shortage of lecturers for projects in 3mE. Every year, hundreds of first-year students in the faculty have to do a design project. After two smaller group assignments in the first six months, this culminates in a media event where students show their designs to the public and their lecturers.

As an alumnus, he helps students by teaching them to be critical about their own designs and to plan effectively. "An important learning objective involves confronting students with the feasibility of their own plans. We help them to realise that it can often be much simpler." In his start-up, things actually work in a similar way, explains Paardekooper. "There are so many similarities, but it always involves coming up with ideas that you were not previously aware of."

Paardekooper acquired the teaching skills needed to convey these insights to students during his career in industry and later as an entrepreneur. "I've always had graduates and young people around me. They challenge you to find things out with the help of the laws of nature. The students are incredibly intelligent. They have an

'The students have an open attitude and take criticism seriously'

open attitude, take criticism seriously and achieve some surprising results. It's great to watch how they develop."

What changes have there been in the faculty where Paardekooper studied 30 years ago? "There's such an upbeat atmosphere in the faculty and whole university: so many more students, more contact and support. I'm totally jealous of today's first-year students."

enhances education

Niels van der Pas: "A guest lecturer opens up the practical side of the field for students."

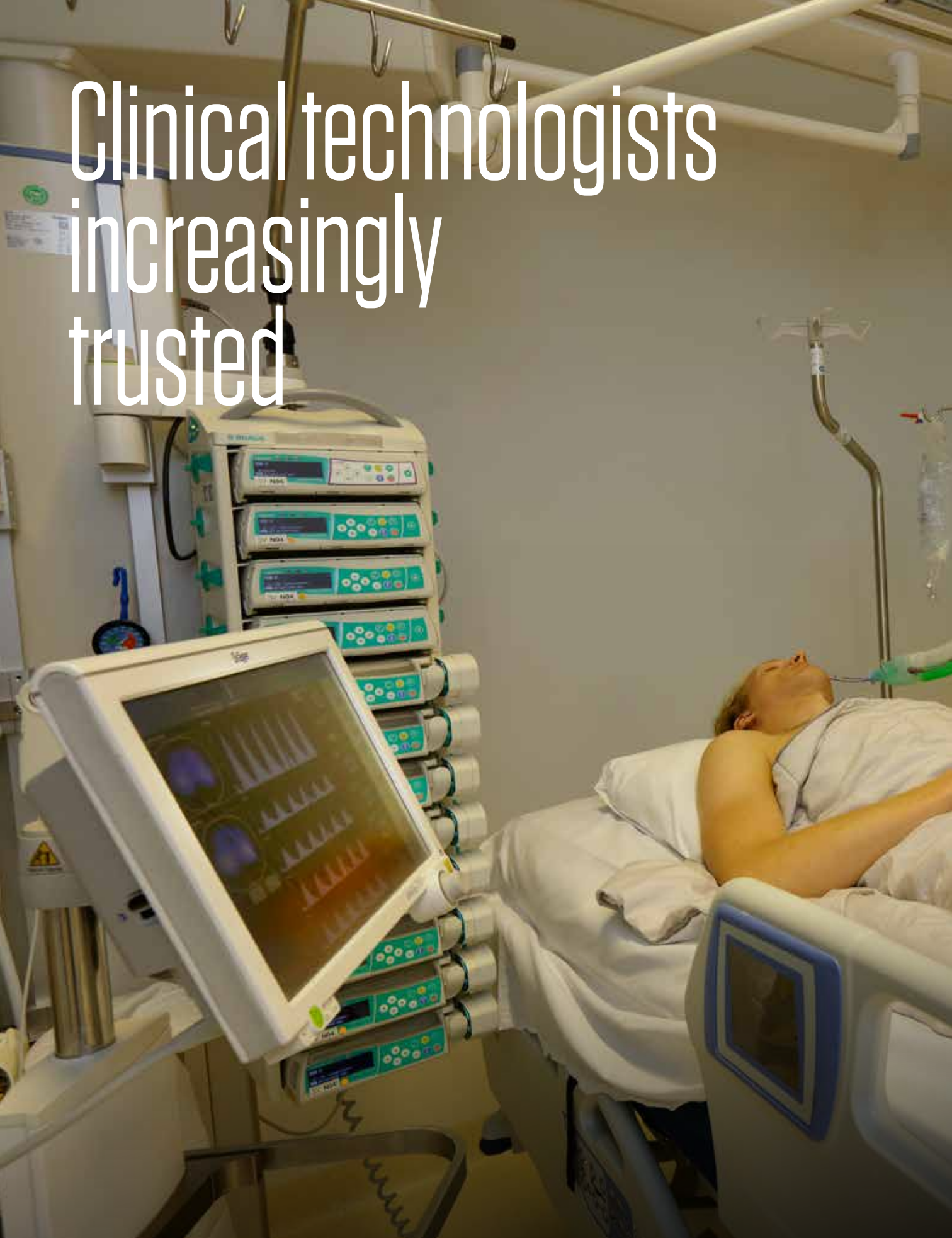
Niels van der Pas

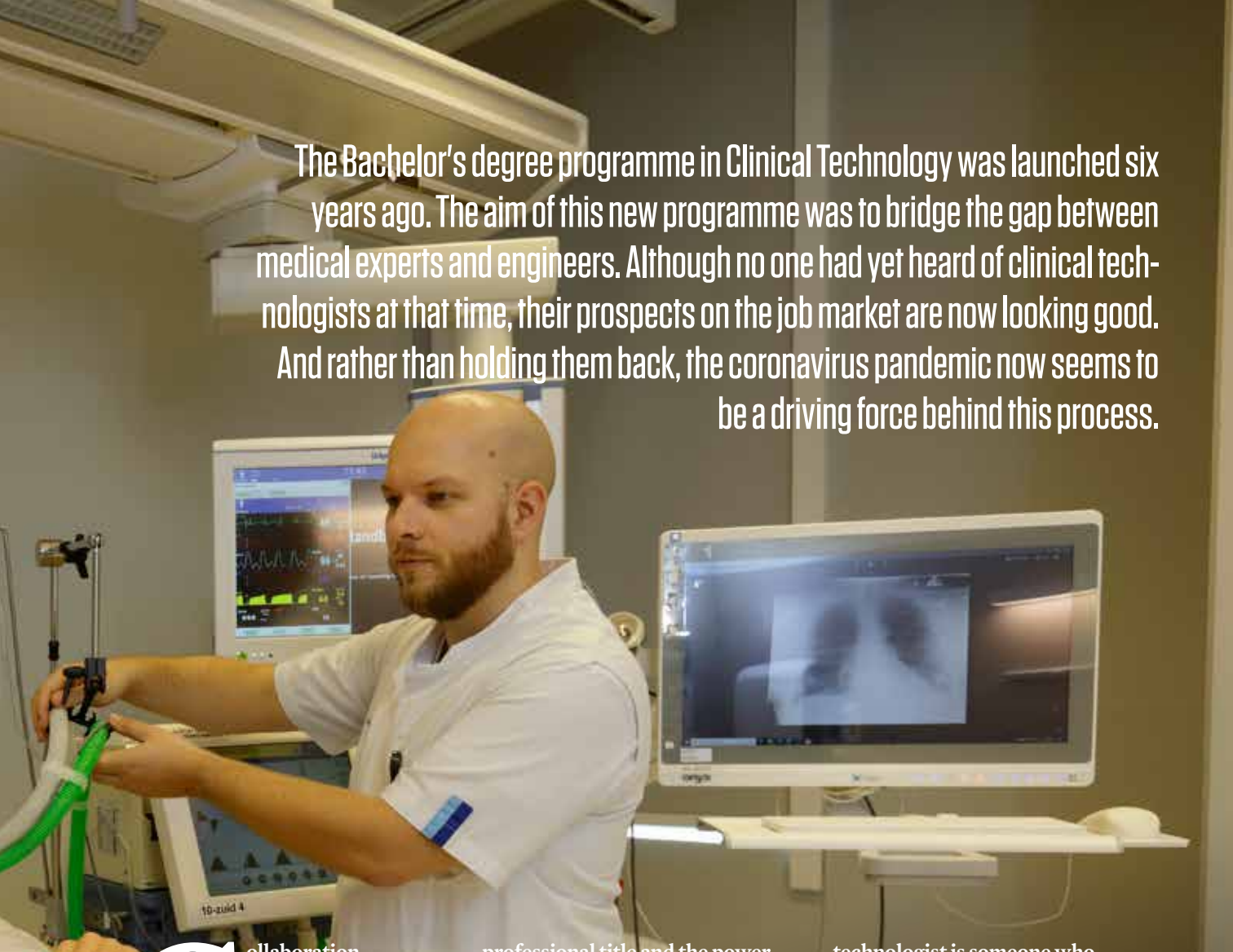
Thermal engineer at Airbus Defence and Space Netherlands B.V., graduated in Space Systems Engineering five years ago and has been a guest lecturer in Aerospace Engineering for two years.

So, how did Niels van der Pas acquire his teaching skills? A thermal engineer at Leiden-based Airbus DS NL, he has been a guest lecturer in Aerospace Engineering for two years, returning to the faculty where he graduated five years ago. He's never had training as a teacher, but has no doubt why he finds it easy to face a group of students: "The Bachelor's course in presentation skills proved really helpful. I would actually like to thank to TU Delft for that."
Van der Pas teaches the satellite thermal control course to Master's students of Space Systems Engineering. The group of 20 to 30 students gets seven lectures from him, a workshop at Airbus and various assignments. "We teach them the basics. This equips them with the ability to do a thermic analysis at a conceptual level, which is enough to start out in the industry. They'll soon pick up the other details there."
He took over the role of guest lecturer from an Airbus colleague. The course was developed a decade ago, when the aerospace company needed thermal engineers, but TU Delft and other local universities lacked the specific knowledge in-house. This TU Delft alumnus aims to use the course to show students what you can do with the knowledge he can offer them. "A guest lecturer opens up the practical side of the field for students. A visit to our cleanrooms, where solar panels and launch structures are assembled and tested, and the hardware I bring into lectures, immediately make the theory more concrete."
The guest lecturer system has more advantages, believes Van der Pas. It ensures there is continued contact with the degree programme that delivers many future colleagues, making it easier to find interns. "In my teaching, I get a good sense of which students would fit in well with us. That's a good thing, because we have plenty of research projects for students to get their teeth into."
But that's not all. Van der Pas believes students also help you to stay alert and open. "The questions students ask make you reassess your own assumptions and the way you work. That keeps me on my toes." <<

All education at TU Delft is directly affected by the corona measures, also the courses of guest teachers. Niels van der Pas switches to online lessons and searches for alternatives for his students to visit the cleanrooms. Anton Paardekooper sees the first year students mechanical engineering physically. They are all allowed to come to the faculty four hours per week. Splash guards are placed and is there is enough space made to keep distance.

Clinical technologists increasingly trusted





The Bachelor's degree programme in Clinical Technology was launched six years ago. The aim of this new programme was to bridge the gap between medical experts and engineers. Although no one had yet heard of clinical technologists at that time, their prospects on the job market are now looking good. And rather than holding them back, the coronavirus pandemic now seems to be a driving force behind this process.

Collaboration between medicine and technology lies at the heart of the Clinical Technology programme. Clinical technologists look at the human body from an engineer's perspective, working with the latest technologies in healthcare. This is a joint programme between TU Delft and the medical faculties at Erasmus University Rotterdam and Leiden University.

According to its Director of Studies, Pleun Hermsen, last year saw two crucial developments that will help boost the job market for clinical technologists. "Since recently, they have been able to join the BIG-register of recognised healthcare professions. This gives clinical technologists a protected professional title and the power to perform certain medical procedures. They are also now permitted to initiate their own treatment processes and claim the costs. This is making it an increasingly interesting position for clinical practice."

In Hermsen's view, the coronavirus pandemic has accelerated crucial changes in healthcare: "I sense that there has been a kind of paradigm shift and clinical technologists could turn out to be even more important than they already were."

FORGING A LINK

So, what exactly does a clinical technologist do? Hermsen: "In healthcare, there are numerous unresolved medical problems where the embedding of technology can prove advantageous. A clinical technologist is someone who understands both the technology and the medical side and can help to find solutions by forging a link between the two domains."

That link is needed to bridge the age-old gap between doctors and engineers. Hermsen has previously described doctors' reluctant attitude towards clinical technologists as 'cold feet'. The end of that phase now appears to be in sight, agrees Tim Boers, who chairs the Dutch Association for Technical Medicine (NVvTG). "This fast-growing professional group is quickly spreading across the healthcare landscape. As a result, our added value is being increasingly recognised."

Read more on page 30

PHOTO: OPERATIONAIR

During the corona crisis, students proved that they were able to build a respirator in three weeks time.

Sell yourself

Martine Breteler agrees. "I've noticed that, as a technical physician, you really have to sell yourself and show what you're capable of – much more than a doctor needs to do." Breteler is a technical physician at UMC Utrecht and conducts research into wireless monitoring of patients in nursing wards and at home just after being discharged from hospital. "We use sensors, wearables and smart algorithms to monitor patients' vital functions in an attempt to prevent them falling into remission unnoticed."
The outbreak of the pandemic gave Breteler a unique opportunity to demonstrate the added value of the profession: "Covid is a very unpredictable disease. Patients' conditions can deteriorate suddenly when you least expect it. That's why, on the Covid ward, I was immediately asked to implement continuous patient monitoring. We kept track of patients' breathing, heart rate and oxygen levels from a control room. To take the pressure off the nurses, medical interns and students of technical medicine from the University of Twente were on hand to monitor trends, sounding the alarm if things started to go wrong."
In just a few weeks, Breteler introduced a system that would normally take a year to prepare. "We worked incredibly hard and I also really noticed that my role as a technical physician was of huge added value, surpassing anything a doctor could have offered."

Trust in the profession

Peter Somhorst already works as a technical physician in the Intensive Care (IC) department at Erasmus MC. "When I started, more than five years ago, I noticed the team were wondering why they should trust my knowledge of medical procedures. Since then, I've seen that trust in me and our profession has grown incredibly."
Somhorst is working on electrical impedance tomography (EIT), a technology used to optimise patients' breathing (including Covid patients) in consultation with the intensive care doctor. At the peak of the pandemic, his advice and respiratory expertise became increasingly important. "The demand for my expertise increased hugely and my advice was accepted much more easily than five years ago."

'As a technical physician, you really have to sell yourself and show what you're capable of'

Students are also noticing increasing acknowledgement of the profession of clinical technologist. Joris Behr, chair of the Clinical Technology Study Association (S.K.V.T) Variscopic: "When I started this degree, three years ago, doctors often asked me what I actually did. I now notice that there's much more support and interest."
Behr mentions Operation Air, a project at the height of the Covid crisis in which fifty students proved that it's possible to develop a new ventilator in the space of three weeks. The project received national and international acclaim.
Fleur Brouwer completed her Master's in Technical Medicine on 10 July 2020, making her one of the first ten graduate clinical technologists in Delft. She has never had any concerns about her job prospects. "You get such a wide-ranging education. Because of that, I think it's purely up to you to decide what you enjoy most."

Job opportunities

According to the chair of the NVvTG Tim Boers, clinical technologists have never had a problem finding employment. Apart from a few positions in industry, these tend to be research jobs and PhD positions that doctors and biomedics could also apply for. "It was – and still is – difficult to start out in a clinical setting from the get go," says Boers. "That's now changing for the better, with increasing numbers of fellowships."
A fellowship is a clinical training programme in which a clinical technologist specialises in one or several medical disciplines.
This is also what Fleur Brouwer hopes to do. "Ideally, I would like to do a fellowship in the IC at Leiden University Medical Center, were I also did my graduation internship. I hope to hear soon whether that will go ahead."
Martine Breteler and Peter Somhorst see the fellowships as a positive development. In our view, there should be more of them and the education of clinical technologists should go a step further. Somhorst: "A technical physician or clinical technologist has a very wide-ranging educational grounding. A fellowship is a great start to a career in clinical practice and a good first step towards

clinical specialisation, but it would be nice if, as in the case of a junior doctor, there was a clear training pathway, quality standards and ultimately registration as a specialist. At the moment, that's not yet the case."

Covid

Opportunities within clinical practice do not necessarily need to take the form of a fellowship. Recently, the Internal Medicine and Diabetes Care department at the Radboud University Medical Center in Nijmegen opted to appoint a clinical technologist instead of an internist. "It was a deliberate choice", explains internist and clinical pharmacologist Bas Schouwenberg. "Most of the care for diabetics is about self-management and it increasingly involves technology. Pumps, sensors, closed-loop systems ensuring that patients receive the right amount of insulin almost automatically, and various types of software. It's all fantastic, but we want to be able to supervise it all more effectively. A clinical technologist can treat patients and also help us to enhance the quality of care."

The fact that the Radboud vacancy has emerged now is no coincidence. Schouwenberg: "It's been in the pipeline for a while. Covid has just emphasised why we need to make it happen." Schouwenberg explains that there has been talk of an online video system for remote care for years. "It has never actually happened. It was seen as 'not secure' and we couldn't claim on the insurance without a physical consultation. Things like that are now suddenly possible."

Peter Somhorst is working on Electrical Impedance Tomography (EIT), a technology used to optimise the patient's breathing (including Covid patients) in consultation with the intensive care doctor.

Springboard

"That's the paradigm shift I'm referring to," says Pleun Hermsen. "A huge opening has emerged for remote care, offering opportunities and jobs for clinical technologists in clinical practice." Tim Boers adds: "It's difficult linking something positive to the pandemic, but it's become a springboard for reaching greater heights more quickly."

Pleun Hermsen puts this in a wider context: "There are still countless unsolved medical problems. These are situations in which you'd actually like a clinical technologist to have some input." There are regular occasions when this does not happen because teams in the clinics are unaware of the possibilities. In that sense, Hermsen believes there is a latent need for clinical technologists.

'The BIG register gives them a protected professional title and the power to perform certain medical procedures'

Boers feels the same. He conducts research into the treatment of benign thyroid tumours. "Broadly speaking, you have two options: you either cut out half of the thyroid gland or insert a needle and burn away the tumour from inside. It's a technique known as ablation. It's a relatively new treatment which is why not everyone is aware that it exists. That can make it difficult for a patient to make a fully-informed decision."

Boers continues: "We need to carry on telling the world what we can offer. We're making great progress, but are still at the pioneering stage. The professional association is campaigning for further training programmes, specific job profiles and a position within the hospital job structure. We're gradually building on what we've achieved. As we see more and more examples of clinical technologists being successful at work, the added value we offer will become increasingly clear." <<

‘There are too few generalists in academia’

Bert van Wee has been named Professor of Excellence 2020. What are his views on his doctoral candidates and the influence of coronavirus on transport systems?

Professor of Transport Policy in the Faculty of Technology, Policy and Management since 2003, Bert van Wee is well known outside the university for his many media interviews about developments in transport. He is capable of putting the news into context, clearly and cogently. According to the Delft University Fund, which awards the prize annually to a professor who excels in research and teaching, Van Wee has ‘made an indelible mark on the international, national and Delft transport community’. The Fund praised his ‘constant drive to improve teaching, including his own’ and the ‘engaged and critical, but also positive, way in which he supervises his graduates and doctoral candidates’

When did you decide to specialise in transport?

“I graduated in human geography in 1983, when the recession had hit the employment market. I was asked to take on a student job at a research consultancy specialising in transport: doing traffic counts, measuring speed and demand for parking - simple work. It suited me while I was looking for a job, but I

soon really took to it. I was offered a contract, did some courses and became project manager. I ended up in transport research by accident."

You're often called on for media interviews. Do you always have your story ready?

"I often need to check the exact figures. A journalist will ask if driving faster is more dangerous. The answer's yes, because every kilometre above 100 km/h increases fatal accidents by three to four percent. I then have to check if it's 3.2 or 3.6 percent, but they often don't mind about the exact numbers."

Will coronavirus permanently affect our transport system?

"You need to draw a distinction between people's patterns of activity and travel behaviour on the one hand and the transport system on the other. There are some indications that we can expect long-term changes in people's activities and the way they travel. People are using the train less and are no longer taking international flights for activities that can be done another way. I expect to see an increase in the use of online resources, in other words teleworking, rather than coming to campus, in our case. If we end up permanently avoiding the rush hour by working from home or leaving at different times, that will make capacity increases in the transport system less financially viable."

What characteristics do you insist on from your doctoral candidates?

"They all need to abide by the ethical guidelines, such as ensuring research can be reproduced. I also select based on certain characteristics. Can a doctoral candidate apply theory to support their argument and devise effective research methods? Do they know exactly what lies at the core of their research? Ideally, they should be able to write decent English. Social skills are also important. Some people are loners who shut themselves away and come up with amazing things, but, at TPM, we do research that's socially relevant.

> 'There's an awful lot being published about transport, in the air, water and on the roads'

That means it's useful to be able to communicate and explain why you're carrying out a study and why it's relevant."

The title Professor of Excellence assumes intensive contact with graduates and doctoral candidates. How has that worked out recently?

"There's been a lot of email and online consultation. My actual visits to Delft have been very rare."

Was that enough?

"Yes and no. It's possible to share ideas and knowledge remotely. The personal side goes less smoothly. Every year, there are occasions when a student bursts into tears during a meeting, but that doesn't happen online. Online, people are more reluctant to let you know if they have issues or are at risk of getting bogged down."

You have only four years to go before retirement. What else do you want to achieve?

"I'm currently supervising 16 doctoral candidates and will continue that work. I also want to update a textbook from 2013 about the transport system. I co-edited it with TPM colleague Jan Anne Annema and David Banister from Oxford University. I'm an extreme generalist, as is Jan Anne Annema. I want to nurture new generalists to prevent a gap appearing when we leave."

How do you make someone into a generalist?

"By encouraging them to explore different areas and teaching them to select quickly. There's an awful lot being published about transport, in the air, water and on the roads. It's also important to understand how things interrelate, as this helps the pieces of the puzzle to fall into place. This can be painstaking work: reading the literature, lecturing on different subjects and supervising graduates on many different topics."

Can a single person do that?

"When I became a professor, people said: you need to concentrate on a single topic or you'll never make it into international scientific journals. I've proved that's not true."

Read the full interview with Bert van Wee at

TEXT: MARJOLEIN VAN DER VELDT / SASKIA BONGER PHOTO: SAM RENTMEESTER

New future for Delft Dream Teams

With the Nuna solar car, the Hyperloop and many other projects over the last 20 years, the TU Delft Dream Teams have proven to be an innovative way for students to learn. New requirements are now being developed to continue this.

In 1999, the DUT racing car and Nuna solar car laid the foundations for what the Dream Teams now stand for: innovative, multidisciplinary projects where students take responsibility from start to finish. Over the years, the number of teams has increased and is now 13. Students from many generations have been shaped by this innovative form of learning. TU Delft has won worldwide acclaim for these student teams, not least because of their success in numerous competitions.

D:Dream Hall

Almost all of the teams are based in the D:Dream Hall, the workshop behind the Faculty of Civil Engineering and Geosciences. Students usually work there night and day, developing even better versions of their projects: faster cars, more stable submarines, more usable exoskeletons. But things have been silent since the coronavirus outbreak. A perfect opportunity to review the current structure and to reshape the future, a process that was still very much a work in progress at the time of writing.

It is clear that there will be new qualification requirements to secure a place in the hall. This will be based on three criteria: safety, throughput and governance (the rights and duties of the student projects).

Safety

Why this new policy? Communication Director Joost Ravoo explains on behalf of the Dream Hall steering committee: "Take safety. Designing moving and racing objects always involves risks, as the NunaX that burnt out last summer shows. We don't want to undermine teams' autonomy, but as a university we do feel a certain degree of responsibility. Each year, every team recruits new members to improve the project and step up a gear. It's never finished. A team doesn't stop after having proved something fundamental."

He cites Forze as an example. This year, the high-tech hydrogen racing team's car was the first hydrogen-electric vehicle ever to beat petrol-powered cars to a podium place in an official

race. “The team proved that it’s possible! But what is the goal for next year? To go even faster? Or is there something else to be proved? ”This is why the steering committee wants to examine the finiteness of projects: when has a project passed the radical innovation stage and ‘done’ with the Dream Hall?”

Wider focus

The steering committee would also like to see the return to the hall of broader societal themes, in which TU Delft aims to make an impact with its science and education. Ravoo: “Traditionally, the Dream Hall has relied heavily on 3mE projects, with a mechanical focus. That could be widened.”
Possibly, not all of the teams will return to the Dream Hall when it reopens, but that does not mean that the teams will then stop immediately. The Vattenfall Solar Team (Nuna)has opted to continue its development elsewhere, for example.

When has a project passed radical innovation and is it ‘done’?

The steering committee is talking with the Dream Teams and various internal and external stakeholders. There will be a new policy later this year enabling the first cohort in September 2021 to apply the new concept from the outset. <<

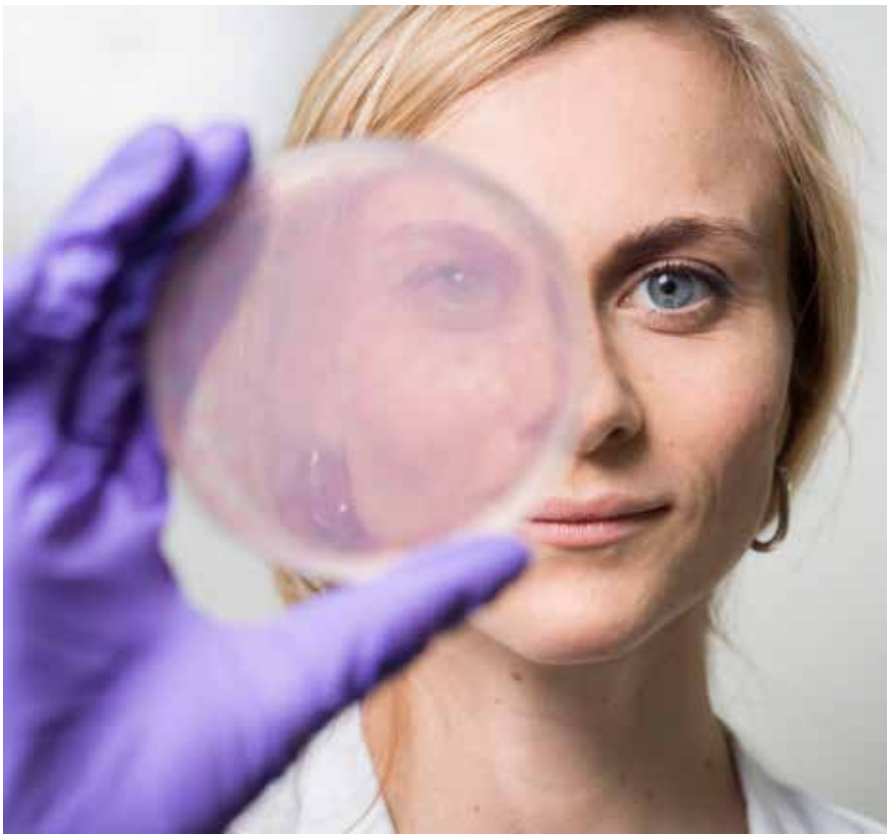
The 13 Dream Teams

- **Eco-Runner Team Delft**: hydrogen-powered vehicle
- **Delft Hyperloop**: capsules that hurtle frictionlessly through vacuum tubes
- **Human Power Team Delft & Amsterdam**: aerodynamic incumbent bike
- **Formula Student Team Delft**: lightweight, highly manoeuvrable racing car
- **Delft Aerospace Rocket Engineering**: rocket reaching an altitude of 100 km
- **Forze Hydrogen Electric Racing**: hydrogen-fuelled racing car
- **TU Delft Solar Boat Team**: low-resistance solar-powered boat
- **Project March**: exoskeleton for people with cerebral palsy
- **Vattenfall Solar Team**: solar-powered racing car
- **Wasub**: human-propelled submarine
- **Nova Electric Racing**: electric motorbike
- **AeroDelft**: aircraft fuelled by liquid hydrogen
- **Silverwing**: one-person electric aircraft

TEXT: AGAATH DIEMEL PHOTOS: PATRICK GAILLARDIN (PARIS, FRANCE)

‘We’re attempting to make foie gras based on stem cells’

Currently working in France, Nadine Bongaerts looks back with satisfaction at her student days in Delft. “The network I built up is incredibly valuable. Compared to French universities, TU Delft is really good in the practical, hands-on application of theory, which gives students very valuable skills.”



Nadine Bongaerts: “I tried to show that biology-based technology has now been developed to the stage where it can be used in all kinds of areas outside the pharmacy.”

Nadine Bongaerts studied Life Sciences and Technology (LST), the TU Delft and Leiden University joint programme. She had her Eureka moment in 2010, competing with a student team in the IGEM competition, an international synthetic biology contest. “That was at the time of the Gulf of Mexico oil disaster, which inspired us to create bacteria that can break down oil molecules into CO2”, she explains. “At the start, LST was all about studying biology. iGEM made me realise that we can use biology as the ultimate technical tool for sustainable development.”

Having completed her doctorate, Bongaerts now works at the start-up Gourmey, the first French company with plans to market cultivated meat. “We’re attempting to make foie gras based on stem cells. Foie gras is probably the ultimate French product, but incredibly unethical because of the

way it's produced", she explains. It is likely to take years before the first jar of Gourmey arrives in the supermarket. "There are so many questions that need to be answered first, some involving fundamental science. Cultivated meat is a subject at the cutting edge of numerous fields, including food science, biotechnology, stem cell technology and genetics. That's what makes it so interesting. All of us, academic research groups and start-ups like Gourmey, are creating a totally new field."

'I hope that we can make a greener world with the help of technology'

She was recently able to share her passion for synthetic biology at a DEAN event. DEAN (Dutch Engineers Alumni Network) is the alumni network for the four Dutch universities of technology. "During lockdown, I gave a Zoom presentation for a seminar especially for alumni in France. I hadn't realised that there are so many TU alumni in France and I got to know a lot of new people. It would be great if meetings like this could be held in person again soon."

Bongaerts highlighted some recent developments in synthetic biology. "When people think of technology, they still tend to think of robotics and AI. I tried to show that biology-based technology has now been developed to the stage where it can be used in all kinds of areas outside pharmacy."

Spider's silk

"You can now use DNA for data storage – a DNA molecule stays intact for a thousand years, making it ideal to store information on, better than the average hard drive. Currently, it's still difficult to read or change the data efficiently, but there are all kinds of experiments involving the use of DNA as a means of storing important secret data", she continues. "Biosensors are another example. They're already being used in diagnostics: a Covid-19 test senses whether or not a specific piece of virus is present. All kinds of other applications may be possible, such as measuring toxic substances."

Innovative materials will also come from nature. "Take spider's silk, for example, it's light but incredibly strong. Some companies are now trying to produce it using yeasts or bacteria."

Biosensors, cultivated meat, spider's silk: for Bongaerts, these are all advances towards a new world, where polluting processes can hopefully be replaced by their biological alternative. "I hope that we can make a greener world with the help of technology. Biological processes are perfect for that and I would like to contribute to achieving it", she says.

Until then, there are still some barriers to be overcome. "Currently, pollution is not taken into account in product pricing. This means that new technologies that require a lot of investment cannot compete with products that pollute and consumers are unwilling to pay for them. Technologically, it will all work out, but the major social and political challenges are much bigger. They will ultimately be the decisive factor." <<

Have you been inspired by this story and would you like to find out how you can continue to be involved at TU Delft? Then we'd love to hear from you! Send an email to alumnirelations@tudelft.nl.

Alumni activities

From online events to career coaching, to lectures on campus. If you want to participate in an event, the information offer can be found on the alumni events page: Alumni.tudelft.com/events

Get in touch

Questions, comments or ideas?
Email: alumnirelations@tudelft.nl
Website: alumni.tudelft.nl
Community: tudelftforlife.nl

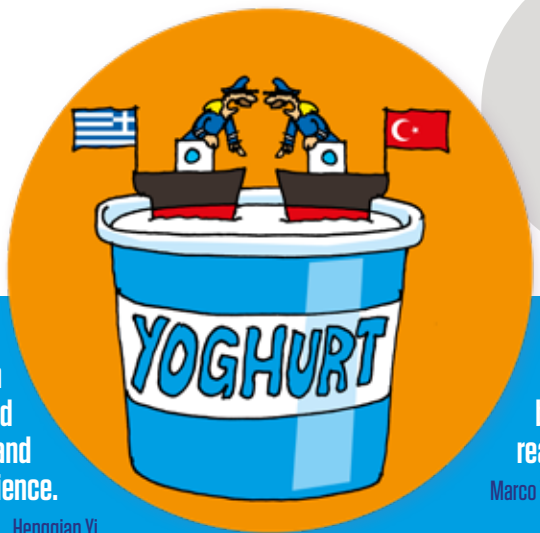
'TU Delft for Life' is the online community for all TU Delft alumni. Expand your network, meet your old university peers and stay up to date on the latest news and events. Sign up on tudelftforlife.nl.
You can also change your contact details and communication preferences there.

HORA EST

The future of surgical instruments lies in a cam mechanism from the 18th century. (‘The Writer’ automaton’)

Paul Henselmans, ‘Mechanical Snakes: Path-Following Instruments for Minimally Invasive Surgery’

“This proposition refers to a kind of mechanical toy with cams and axles from the 18th century. Between 1768 and 1774, the Swiss Pierre Jaquet-Droz built three doll automata, which can still be seen in a museum in Neuchâtel. These dolls can be pre-programmed to perform complex movements, which is why they are considered a kind of remote ancestors of the modern computer. ‘The Writer’ is the most complex doll automaton. Our goal was to make a flexible snakelike instrument for use in minimally invasive surgery that works on the same principle. This snake needs to be able to follow a circuitous route through the body without touching the body along the way. Such complex movements often use robotics (i.e. computers, sensors, electric motors), but in a medical setting robotics are very expensive as well as being difficult to sterilise. A mechanical solution enables you to keep the costs down and make the instrument widely accessible. Pierre Jaquet-Droz’s mechanism gave us the inspiration for our surgical instruments of the future.”



Greek yoghurt is Turkish.

Gamze Tillem

Creativity does not come from brainstorming but from a solid foundation of knowledge and experience.

Hengqian Yi

If ‘no one has researched this before’, maybe there is a good reason why.

Marco Virgolin

In the long term, sea level rise forms a greater risk for the Eastern Scheldt storm surge barrier than scour hole development.

Y.B. Broekema

The future is exciting and scary. Privacy and human interaction are extinguishing.

Sergio Moreno Wandurraga

Surgical robotics should only be considered when mechanical alternatives do not suffice.

Paul Henselmans

Abundant use of technology facilitates an indolent society driven by instant gratification, where time-consuming pursuits of truth hand opinions supported by facts are secundary.

Werner Daalman

Semiconductor fabrication is much easier than cooking, since it only depends on pre-defined process recipes.

Hongyu Tang

SAVE THE DATE: TU DELFT BEST GRADUATE AWARD CEREMONY 17 NOVEMBER 2020

On Tuesday 17 November, TU Delft together with Delft University Fund will proudly present eight brand-new engineers who can call themselves Best Graduate 2020 of their faculty. These exceptional talents will be put in the spotlight during the TU Delft Best Graduate Award Ceremony and everyone will have the opportunity to attend this event online.

During the award ceremony, one of these eight nominees will receive the prestigious title TU Delft Best Graduate 2020. You will witness eight inspiring presentations and learn about 2020's most outstanding master thesis projects. Join us in cheering for these excellent graduates!

Registration will soon open for this online event.
Check: www.universiteitsfondsdelft.nl/bestgraduate

PLANNING YOUR LEGACY

The social significance of technology is inevitable in tomorrow's world. By including TU Delft in your will, you will give new generations of students and scientists the opportunity to excel and make a positive impact on society. At Delft University Fund we gladly take the time to answer any questions you may have regarding leaving TU Delft in your will.

For more information or personal advice, please contact:
Machteld von Oven via m.w.vonoven@tudelft.nl
www.universiteitsfondsdelft.nl/legacy
Machteld von Oven
Relation Manager Legacies
Delft University Fund

TU Delft | Universiteitsfonds

TEAM UP
WITH
EXCELLENCE

ALL IN THE FAMILY

The Dekker family

Some families have several generations who all study at TU Delft. In this series, parents and grandparents discuss their student days with their children and grandchildren. Read the full version at:

Grandson Hans (Computer Science Engineering), his father Joost (Applied Chemistry) and grandfather Bert Dekker (Applied Physics) were all known to miss the odd lecture. But they still did reasonably well in exams. Despite this, conditions were not always ideal. Father Joost recalls an oral exam with a professor who had a room in the 'Yellow Chemistry' basement. "He smoked cigars all day long – just entering the room made your eyes water." According to grandfather Bert, it was quite normal in those days for professors to offer students a cigarette to put them at their ease. How different things are now: we now have a no-smoking campus.

Lots of other things have changed over the years. The biggest difference? Digitisation. "I can ask questions whenever I like. Some lecturers even have a kind of consultation hour", says Hans. That's something new for his grandfather. "In my day, professors were 'gentlemen of a certain standing'." He dared not even speak to them. "Professor Kramers was an exception. The atmosphere in his department was special. Everyone would meet there for coffee at a set time. You could sit with these clever people and solve all the world's problems. Those discussions gave me food for thought well into the evening. It was just amazing." MvdV

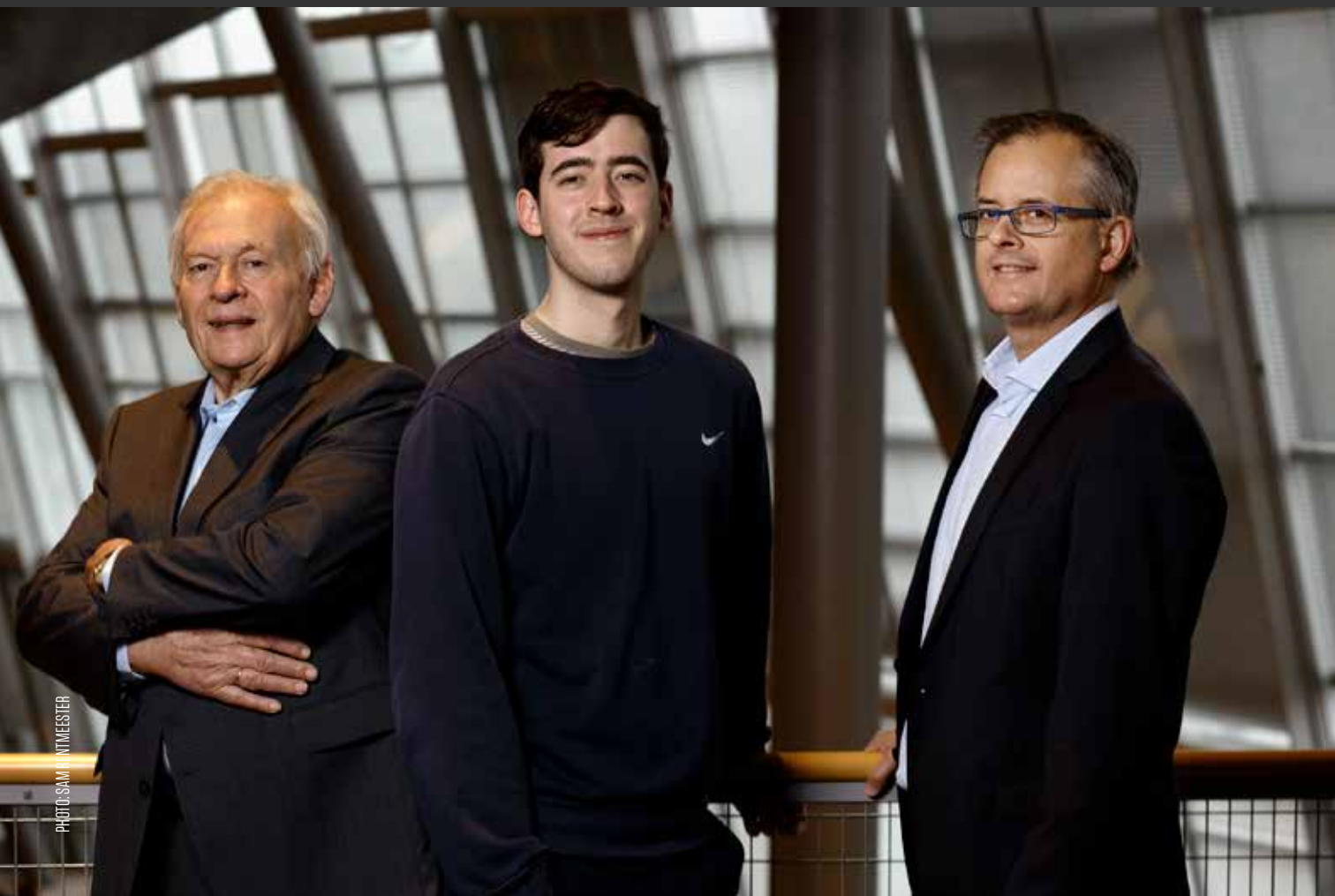


PHOTO: SAM RENTMEESTER