Delft Outlook
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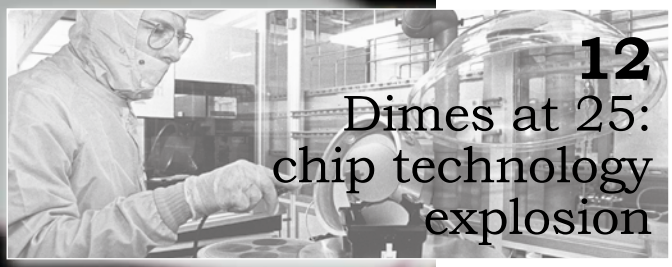
25 years Dimes
Chips with a twist

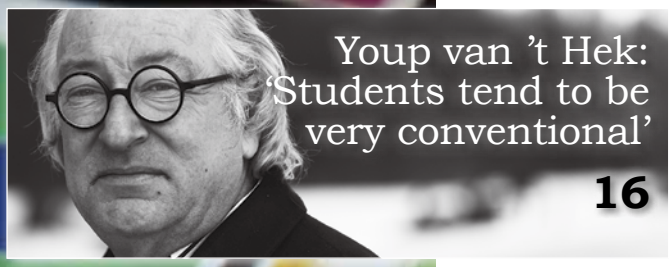
Youp van 't Hek
'People get bogged down in clichés'

Dimes must become more commercial
Working for third parties

New detectors
The bright prospects for boron

no.2 2012





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Pathos

In recent years, "valorisation" has become quite the buzzword. Knowledge must be marketed, and used to make money if at all possible. But how well does that actually work? And what effect does this drive to cash in have on the research being conducted at a university? We posed the question to Dean Rob Fastenau on the occasion of the 25th anniversary of the Delft Institute of Microsystems and Nanoelectronics. The institute must make money by doing production work for third parties now that its fixed financing is being withdrawn over the course of the next five years. Marketing knowledge requires more than just making innovative technology. You must not forget how to package the acquired knowledge, warns communication consultant Remco de Boer. "Just like the ancient Greeks and Romans, today's genius must be well-versed in rhetoric. Ethos, logos, pathos." He is referring to the tragedy-worthy Blankenburg Tunnel decision-making process. Comedian and cultural professor Youp van 't Hek will be giving Delft students a hand in the months ahead by helping them look at the world from a non-academic perspective. Thank goodness. After all, the logos-minded engineer tends to forget that a bit of pathos can make your money go farther at the market. With the help of comedy, if necessary.

Frank Nuijens
Editor-in-Chief Delft Outlook

Colophon

Coverphoto
Sam Rentmeester

Editorial staff
Frank Nuijens (editor-in-chief)
Dorine van Gorp, Katja Wijnands (managing editors)
Saskia Bonger, Tomas van Dijk,
Sam Rentmeester (image editor),
Connie van Uffelen, Jos Wassink

T (015) 278 4848
E delftoutlook@tudelft.nl

Contributing writers
Auke Herrema, Eric Verdult, Pascale Warners

Subscriptions
delftoutlook@tudelft.nl

Design & typesetting
Saskia de Been, Media Solutions TU Delft

Printing
Deltahage BV, The Hague

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Time machine

Dr Willem-Paul Brinkman (EEMCS) develops computer programs that help patients cope with traumas. A trial is currently underway at Erasmus University Rotterdam (EUR) involving subjects who were sexually abused during childhood. Patients recreate the environment in which the abuse occurred in a virtual world. Doing so compels them to sift through their mind. "Memories become less painful when you recall the event more often," says Brinkman. "The program acts as a kind of time machine. The patient and therapist can visual the events from the past by connecting personal photos, online geographic maps, webcam snapshots, and the 3-D virtual worlds to a timeline."

www.delta.tudelft.nl/24510

Photo: Tomas van Dijk

Squid in your head

Photo: Paul Breedveld

Dr Paul Breedveld was awarded a €1.5 million Vici grant from the Netherlands Organisation for Scientific Research (NWO) to further develop his highly flexible surgical "teeth". Inspired by squid tentacles, which can move in any direction and likewise vary in terms of rigidity, the biomechanical engineer designed his first controllable arm in 2004 with surgical applications in mind. Breedveld hopes to make the instrument even thinner, as well as enable the arm to be divided. His goal is to make brain operations as least invasive as possible.

www.delta.tudelft.nl/19445

Sharper image

A picture of cancerous metastases in the body that is four times as sharp, and three times faster than the time an examination currently takes (40 minutes): this is what Dr Herman van Dam's (Applied Sciences) finding can lead to within five years, according to his PhD supervisor, Dr Dennis Schaart. Metastases (the spread of cancer) are mapped by injecting patients with an appropriate radioisotope (which accumulates in tumours) and putting them in a PET scanner. The burst of light that a gamma photon creates in a special crystal makes the gamma radiation in the patient visible. By using a single large crystal together with multiple light sensors, Van Dam has now managed to increase both the sensitivity and sharpness of the scanner. The study is being done in cooperation with Philips, which is developing a combination MRI-PET scanner.

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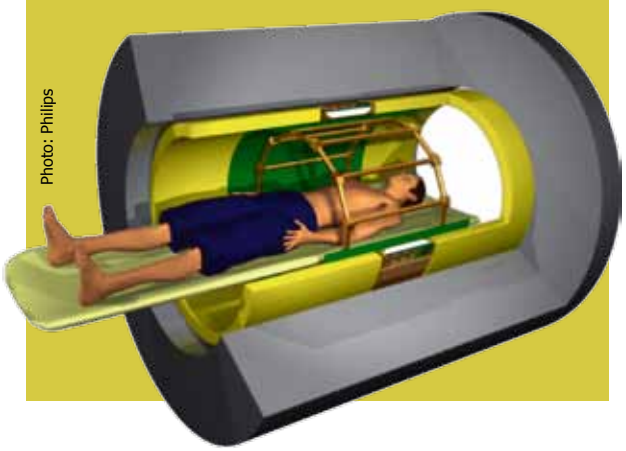

Photo: Philips

Solar cells

Photo: Unisolar

Professor Miro Zeman (EEMCS) received €750,000 for the further development of thin film solar cells along two lines of research. One of the studies, which is part of the FOM-programme Stirring of Light), aims to develop a photonic structure that absorbs all light, directing it to the silicon and reducing reflection to zero (black). The other study is part of the European KP7 programme and is designed to develop a tandem cell in which the top cell primarily absorbs blue light and the rest going into a second cell. Prof. Zeman's long-term goal is 14% yield increase, which is comparable to commercially available crystalline solar panels. However, because thin film solar cells require a fraction of the material, they are expected to prove considerably less expensive.

www.delta.tudelft.nl/24868

School stress

TU Delft students experience more school-related stress than their peers in other cities, according to a survey involving almost 5,500 students in the Netherlands. In response to the question "Do you ever have problems with severe stress related to your studies?" a whopping 52.9 percent of the Delft respondents replied "yes". "Severe" was defined as "interfering with your private life." This stress increases when students feel that they will be subject to a long-term study fine. The choice to pursue a follow-up study is likewise influenced by the fine. This was news to Executive Board member Paul Rullmann, who commented: "At Delft, delays mainly occur during a student's undergraduate years. Once they have their Bachelor's, most go on to complete their Master's in two or two and a half years. So why would anyone be frightened off by the fine?"

www.delta.tudelft.nl/24748

Photo: Hans Stalk Ibeek

Strategic alliance

Not a merger, but a strategic alliance. This is how Leiden University, TU Delft and Erasmus University Rotterdam refer to their "far-reaching cooperation" in the joint policy document "Adding Value." The alliance aims to increase the quality of teaching and research, with a more clear-cut profile for the educational programmes offered and a stronger international positioning of the research.
Leiden, Delft and Erasmus – referred to as "LDE" – emphasise that function dictates form, and see added value in the short term, namely: better education (that can be offered at each of the three universities from now on) and exploring joint LDE Centres and Graduate Schools.

www.delta.tudelft.nl/24768 and 24783

Two electrons for a single photon

The study on solar panels based on nano quantum dots garnered attention after publication in Nature Photonics (18 March 2012). Professors Laurens Siebbeles (Applied Sciences) and Tom Gregorkiewicz (University of Amsterdam) were able to successfully release two electrons in a closely packed array of quantum dots using a single photon. Normally, when an incoming light particle (photon) has more energy than it takes to create an electron-hole pair, heat loss occurs. Using q-dots, however, the excess energy may produce another electron in a neighbouring quantum dot. Because this applies solely to higher energies (short wavelengths), the yield does not double as a result of the phenomenon; instead, the theoretical efficiency is 44 percent, instead of the current maximum of 33 percent.

Nature Photonics, 18 March 2012, DOI 10.1038/ NPHOTON.2012.36
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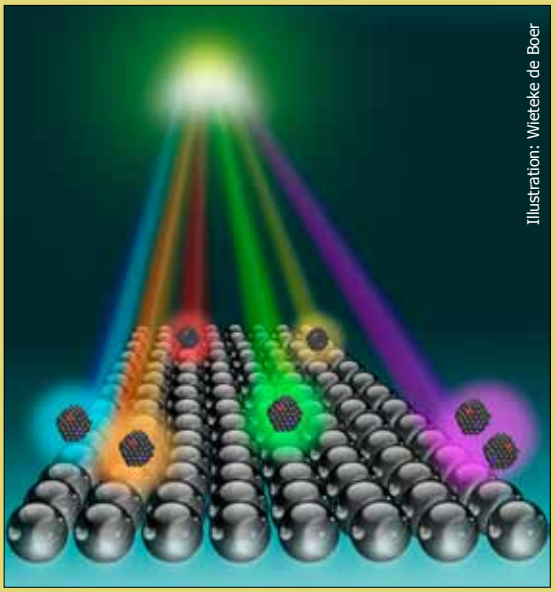


Illustration: Wieteke de Boer

Photo: Tomas van Dijk

Catalyst in action

The Mössbauer lab in the Reactor Institute Delft (RID) is unique in the Netherlands because it can show the catalysts in action. A catalyst accelerates a chemical reaction without being consumed by the reaction itself. The chance to observe the process draws customers including Shell here, as well as fellow researchers from Utrecht who are developing catalysts for bio fuel production. Their work was published in the journal Science (Hirsa M. Torres Galvis et. al.) on 17 February. With respect to Mössbauer spectroscopy and the study of chemical bonds with gamma radiation, co-author and RID employee Dr Iulian Dugulan said: "It offers you information about the sample structure, the degree of oxidation and the magnetic properties of the metal particles." This tells an expert how active the catalyst is, how it deteriorates from melting, gets corrupted or covered with carbon.

www.delta.tudelft.nl/24694

Majorana Day

April 12 was a circus at the Kavli Institute of Nanoscience (Applied Sciences), with three television crews filming more or less simultaneously. Professor Leo Kouwenhoven had a phone interview with the BBC, and appeared on the Dutch talk show Pauw & Witteman at the end of the day. The media frenzy was prompted by the experimental proof of the existence of a Majorana particle published in Science. Italian physicist Ettore Majorana predicted the existence of the unique particle 75 years ago. A great story, but one that has caused much collective head-scratching among journalists. After all, an anti-particle is difficult to imagine, let alone the Majorana particle, which is its own anti-particle. Moreover, the particle was not discovered in nature; instead, it was "generated" at extremely low temperatures on the cusp of semiconductor and superconductor. There were many glazed looks on television that evening. Still, Prof. Kouwenhoven is regarded in the media as a Noble Prize contender, and the father of the quantum computer.

www.tudelft.nl/24994

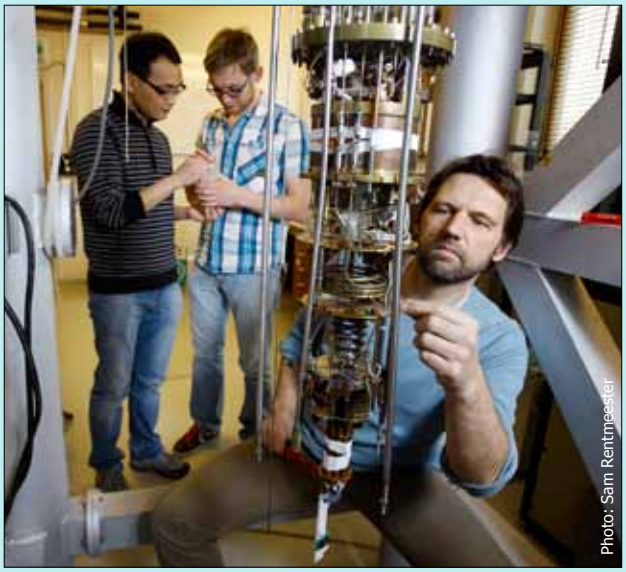


Photo: Sam Rentmeester

Reactor virtually indestructible

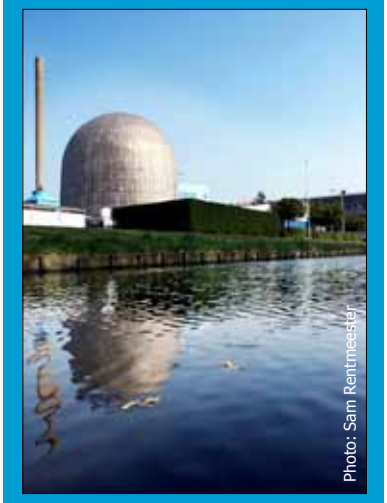


Photo: Sam Rentmeester

Hurricanes, earthquakes, floods, power outages: the research reactor in Delft can withstand virtually any catastrophe, according to a stress test conducted by the Reactor Institute Delft at the request of the Ministry of Economic Affairs, Agriculture and Innovation. In the worst "basic design accident," a leak would drain the entire cooling tank and leave the core exposed. The RID reported that it is protected against this by "various back-up lines of defence." In the event something still went awry, the core would be sufficiently cooled by convection, and the fission material plates would not melt.

www.delta.tudelft.nl/24773

Russian award

Kemo Hanjalic, professor emeritus on the faculty of Applied Sciences, has received 3.6 million euros from the Russian government to direct the "Laboratory for the Simulation of Energy Processes" at Novosibirsk State University. The Lead Scientist award given to Professor Hanjalic was created by the Russians to attract leading scientists to enhance the quality of Russian research institutions.

www.ibnfirnaslectures.tk

Steady on their feet

The family of walking robots from Delft has a classy new offspring named Tulip. PhD student Dr Thomas de Boer (3mE) developed Tulip as the successor to the elegant but fragile walking robot Flame (see also pages 10 and 11). Flame was a sensitive soul that tended to lose its balance whenever bumped into from the side. To compensate, De Boer designed Tulip to be able to quickly calculate where to put its foot down in order to maintain its dynamic balance. "When walking on two legs, it's all about controlling position and speed from one's centre of gravity," De Boer explained.

www.delta.tudelft.nl/24821

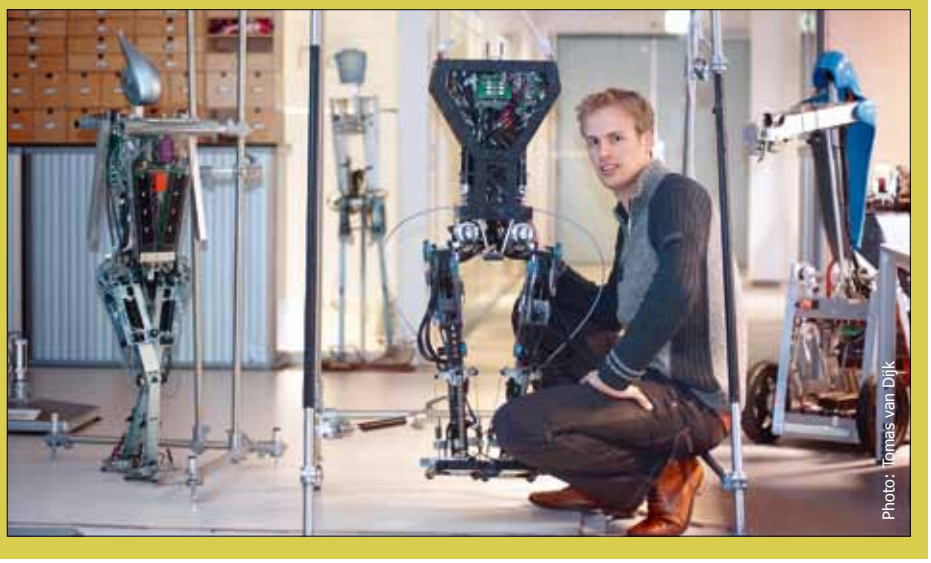


Photo: Tomas van Dijk

Photo's: Sam Rentmeester

After tests with different coatings, the detectors would not suit ill in a jewellery store.

Bright prospects for *boron*

Professor Lis Nanver at Dimes has laid the foundation for a range of new photodetectors by creating a thin coating of boron on a silicon substrate. The sensors are used in ASML's latest lithography machines and FEI's most sensitive electron microscopes.

Jos Wassink

Photodetectors made with the element boron have an ultra-thin, light-sensitive layer. This is important for the detection of short wavelength radiation. Radiation from ultraviolet (wavelengths of around 300 nm) to 'soft' X-rays, also known as extreme ultraviolet (wavelengths of around 10 nm), penetrates only a very short distance into silicon, sometimes only a few nm. This is precisely the region in which the sensors are sensitive. "These diodes are a revolution for detection in this range of wavelengths," explains Professor Lis Nanver. Her detectors have been described in some 30 publications and have also appeared in the latest generation of chip fabrication machines made by ASML and the most sensitive FEI electron microscopes. "Lis has discovered a new technology in the form of boron deposition," says Dr. Gerard van Veen, manager of science and technology at FEI Nederland. "The technology can be used in many different fields. The boron layer has such special properties that new possibilities have been created, not just for our electron microscopes but also for other types of detectors." The list of applications since 2003 (see box) illustrates Van Veen's opinion. Detectors with a boron layer are now used for an incredibly broad spectrum of frequencies: from terahertz through X-ray, ultraviolet and infrared radiation to the detection of scattered electrons.

'Detectors with a boron layer are now used for an incredibly broad spectrum of frequencies'

Dr Gerard van Veen "The boron layer has such special properties that new possibilities have been created."

Full of holes

"It all began as a joke," explains Prof. Nanver (Electrical Engineering, Mathematics and Computer Science), a slightly built woman who speaks Dutch with a slight British accent. She has a very busy agenda, a complicated schedule board and is often interrupted by phone calls, students and technicians. Welcome to the silicon device integration group at Dimes (Delft Institute for Microsystems and Nanoelectronics). Actually, 'serendipity' is a more apt word than "joke", as while looking for one thing, one finds something else. Students at Dimes were busy creating a monolayer (a layer just a single atom thick) of arsenic on a silicon substrate. They were using an epitaxial reactor, which normally grows a layer of silicon with a small quantity of doping atoms on a silicon wafer. Playful as they were, the students tried a different doping gas (diborane B2H6) and thus created a thin layer of boron on the silicon. "The result was astounding," Prof. Nanver recalls. "The current in the diode dropped by several decades, so we thought that they had just created an insulating layer and didn't give it much thought for a while."

A low reverse current (the leakage current when the current is reversed and the diode should block the current) is actually an attractive property in a photodiode. A photodiode usually consists of a junction between silicon with too many free electrons (n-type semiconductor) and silicon with 'holes' where electrons are missing (p-type semiconductor), and, in principle, does not conduct in the reverse direction. However, when a photon strikes the diode, it creates an electron-hole pair in the junction region. Electrons then move to the n-side (cathode) and holes move to the anode, creating a current. This means that it is important for the sensitivity of photodetection that the reverse current is as low as possible in the absence of light. The new material with a thin layer of boron had such a low reverse current that, at first, it was assumed to be an ordinary insulator, which would have been of little interest. That might have been the end of the story, but it wasn't.

Prof. Nanver: "A few years later, we carried out some experiments, and it turned out that boron creates a layer that functions in exactly the same way as a doped p-type layer on an n-type silicon substrate. We had, in fact, created a diode junction. This was wonderful news, because the low temperatures we were working at meant that the junction was just a few nanometres thick."

The "low" temperatures (500 °C to 700 °C) meant the boron had not diffused into the silicon, as it would have in the normal p-doping process. When this happens, boron

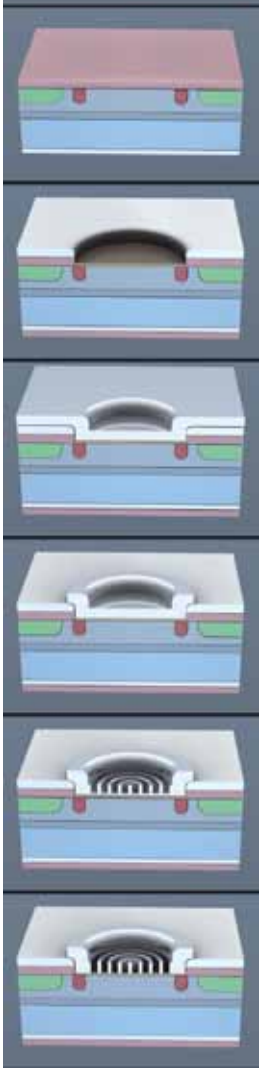
atoms become embedded in the crystalline silicon substrate creating a positively charged hole with three valence electrons for four bonds. At lower temperatures the boron atoms cannot penetrate into the crystalline silicon and thus remain in the amorphous outer layer. Images made using an electron microscope show that the layer is only a few nanometres thick. Prof. Nanver: "Using diborane, you create so many holes in the interface layer in just a single second that you produce the same function as a normal diode, but with a layer that is far less deep."

'Moore's law forces chip manufacturers to use increasingly short wavelengths'

Despite numerous published articles, the pure boron layer remained unique to TU Delft. Prof. Nanver thinks that this is because other teams do not have the combination of expertise in using the epi(taxial) reactor (which is able to create monolayers on a silicon substrate, using vapour deposition) and knowledge of diode physics and manufacturing. The vapour deposition machine, an ASM Epsilon, requires a great deal of knowledge and experience to produce good results. "It's more an art than a science," the professor jokes. There are rumours that many laboratories have exchanged the ASM Epsilon for other machines, because they weren't able to use it well. For operating the Epsilon, Prof. Nanver relies on the experience of Wiebe de Boer, who was involved in the development of the machine and still works one day a week at Dimes, despite being retired. "Wiebe is worth his weight in gold," Prof. Nanver says.

Professor Lis Nanver:"It all began as a joke."

A detector in six steps.



Extreme

Moore's law forces chip manufacturers to use increasingly short wavelengths. Lithography is an optical technology, which means that the minimum dimensions are determined by the wavelength of the light used. The wavelength used in chip manufacturing machines made by ASML has decreased from ultraviolet (365 nm) to deep UV (245 and 193 nm). Extreme UV (13.5 nm) will be used in future machines.

Currently, there are many difficulties associated with using extreme ultraviolet (EUV). Just producing EUV radiation requires a set-up that seemingly comes from the fantastical laboratory of Professor Sickbock, a character created by the famous Dutch cartoonist, Marten Toonders. A ball spins in bath of molten tin and spreads tiny droplets of tin into the air. When these droplets are exposed to a high-energy laser beam, they emit extreme UV light. This manner of producing EUV radiation is known as laser-produced plasma (LPP). Another problem is that EUV cannot be used with lenses. Mirrors (which must meet extreme flatness requirements) are used for imaging.

Boron-layer photodetectors are ideal for this kind of extreme environment, because the ultrathin sensitive layer gets the most out of the radiation received. Additionally, the dark current is extremely low (picoamps per cm2 at 1 volt reverse voltage) and the detector is able to withstand long exposure. These properties are the reason why ASML plans to use Prof. Nanver's photodetectors in their next generation NXE-3300 machine. A single detector measures the intensity of the EUV radiation. Two other detectors are used to precisely position the wafers using a combination of grate techniques.

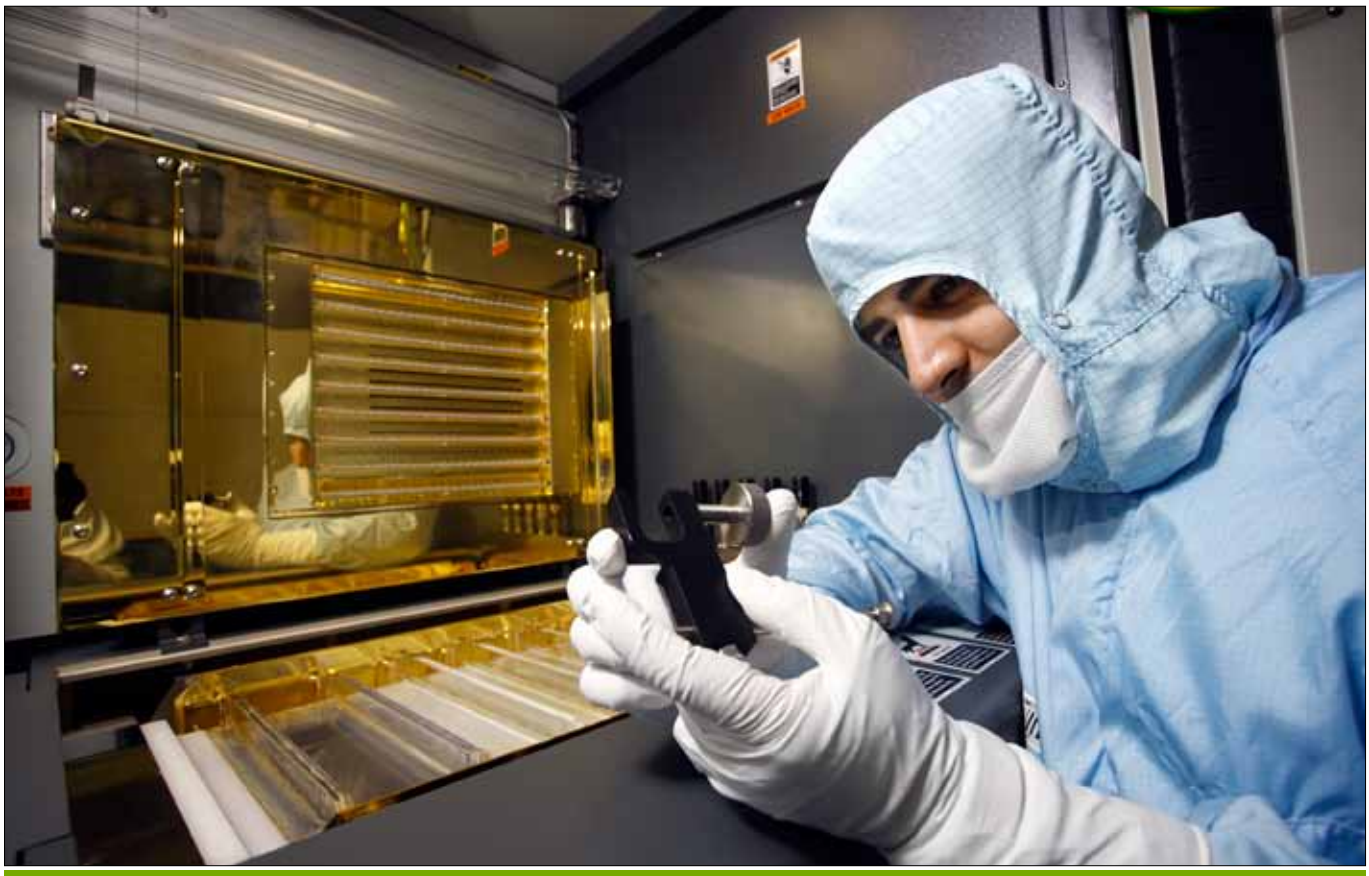
Last year, ASML decided to move production of EUV detectors to the IMEC laboratory in Leuven, Belgium, after the initial development at Dimes.

'Naked' detector

"Roughly three years ago, we spotted the technology at ASML," says Van Veen, of the new electron detectors that are expected to give FEI's electron microscopes a decisive advantage. "The technology appealed to us, but we did need to make adjustments to various things." In roughly 18 months, FEI, in collaboration with Dimes, developed a naked detector the size of a collar button. For her contribution to the project, PhD student Agatha Šakić was awarded the IEEE 2010 Roger A. Haken Best Student Paper Award.

For the detection of slow electrons (with energies from 1,000 eV), it is important that the sensitive layer is 'naked' (directly on the surface). In contrast to EUV detectors, a coating cannot be used. Furthermore, the 1.8 nm boron layer is thinner than in EUV detectors. A special pattern of metal tracks and very slight doping of the topmost n-type silicon layer were developed to minimise electrical resistance and capacitance and reduce response time. Particularly at low energy levels, the boron layer offers advantages compared to other detectors; for example, the efficiency of a boron layer is 70% at 1,000 eV. Other types of detector only achieve an efficiency of 45% or 19%.

There is a hole in the middle of the detector through which



Detectors for electronic microscopes and lithography machines are being created in the cleanroom.

the beam of electrons passes in an electron microscope. The detector, which is suspended in a stationary position 5 mm above the object, catches electrons that are reflected by the surface (called 'backscattering'). In this form of microscopy, the electron bundle scans the surface line by line. The detector consists of concentric rings and segments which can be used to control contrast and image information. The innermost rings make chemical information visible, because heavy elements reflect more electrons than light elements and produce a higher image signal. The outermost ring is mainly suited to scanning the structure of the surface.

FEI would prefer to have the new boron layer detectors produced at Dimes by, for example, arranging for external staff to work in the TU Delft clean rooms. In the high-tech industry, this is known as the 'foundry model'.

Prof. Nanver is now researching the other end of the spectrum: infrared. One of her PhD students, Amir Sammak, is creating layers of germanium on silicon. In combination with boron (and gallium), these layers offer promising possibilities for the development of ultrasensitive single photon detectors. There are great expectations for these types of sensors in medical applications, because they could dramatically speed and simplify the diagnosis of melanomas. A more fundamental advance is the combination of layers of gallium, arsenic and indium on a germanium substrate, which would allow detectors to be made for any band of wavelengths. Prof. Nanver sees innumerable applications for this type of detector. "There's still so much wonderful work to do," she says.

Range of applications for boron

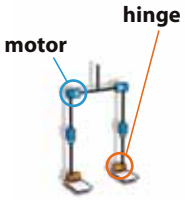
Wavelength	Project	Together with:
Sub-mm, ~ 30 micron	Compact integrated circuits for terahertz imaging	Philips and TNO, with support from Smartmix Memphis
Infrared, ~ 1 micron	Infrared detectors based on germanium on silicon	ASM and Bionics, with support from Smartmix Memphis
Visible light, ~ 500 nm	High-efficiency boron layer process for solar cells	Tempress and ECN
Deep UV, ~ 100 nm	Photodetectors with a pure boron layer are better than detectors using other technologies	TNO, ASML and ASM, with support from STW
Extreme UV, ~ 13 nm	Detectors for ASML next generation lithography machines	TNO, ASML and ASM, with support from STW
X rays, ~ 10 nm	New detectors for electron microscopes	FEI and PANalytical with support from NanoNextNL
Low energy electrons ~ 0.1 nm.	New detectors for backscatter electron microscopes (200 eV to 1 keV)	FEI

For more information:
Professor Lis Nanver
L.K.Nanver@tudelft.nl

Wobbly walker evolves into

Seventeen years ago, a graduate student of the Faculty of Mechanical, Maritime and Materials Engineering built the first Delft walking robot. Not a walking computer with heavy motors, but an energy-efficient autonomous robot. That quest into human walking has developed into the Delft Biorobotics Laboratory, where 15 researchers work on biologically inspired robots. New insights should contribute towards the treatment of people with walking disabilities. Whereas the first robot, Baps, could take a few steps, the latest robot, TUlip, must be able to play a bit of football. This infographic sets out the evolution of four walking robots developed as PhD projects. More information: **www.dbl.tudelft.nl**.

Passive dynamic walking
The objective was to create a robot that passively performs a natural, stable walking motion, without a controlling device. Motion instability is self-correcting.



Coupled cyclic motion
The objective was to create a light, energy-efficient bipedal walking robot. Stability had to occur automatically by harmonising the natural oscillatory motions of swing leg 1, body 2 and lateral motion 3.

Arms
The two arms have no function in walking. But it does look more natural.

Empty head
The robot can walk without thinking: no measuring or control devices.

BAPS
80 cm tall
3.35 kg

DENISE
1,5 m tall
8 kg

McKibben-muscles

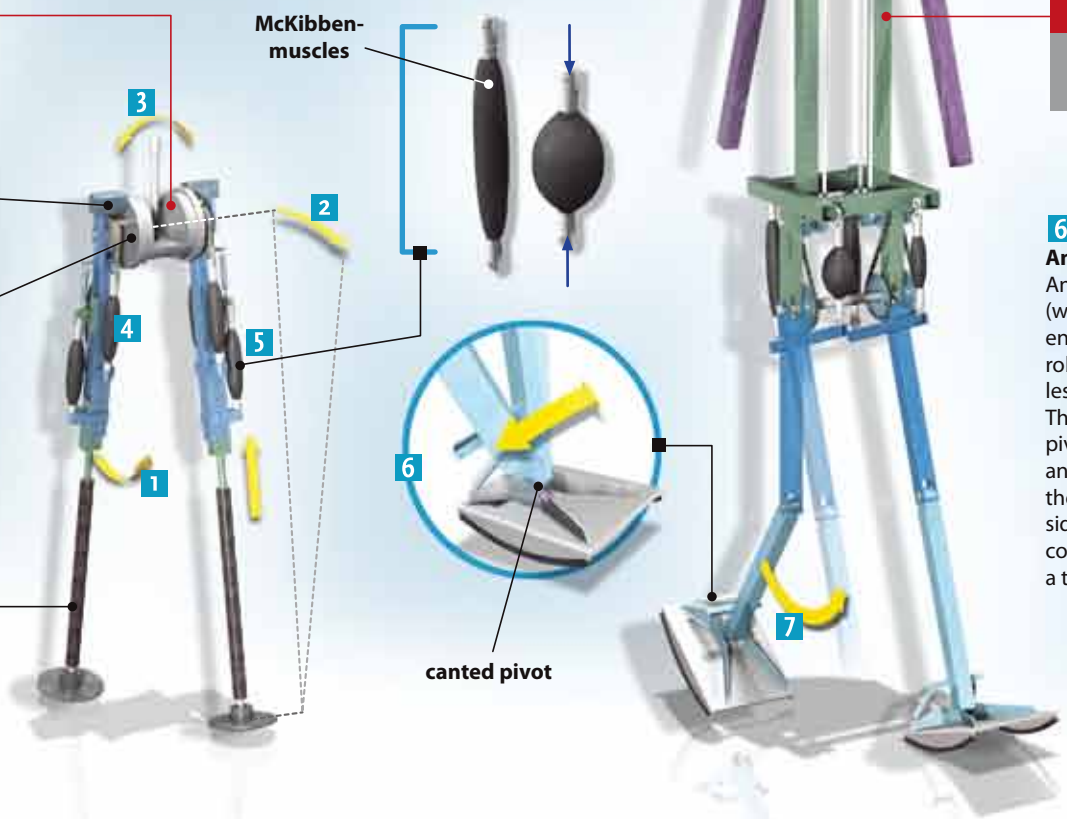
leg gyroscope

Controls
The body has room for pneumatics and electronics (e.g. battery, amplifiers and controller).

Rigid leg
The legs have no knee joints.

canted pivot

6 Ankle joint
Ankle joints (without motor) ensure that the robot falls over less easily. The tilted rotary pivot of the ankle causes the robot to veer sideways and continue at a tangent.



Pneumatic muscles
The robot is actuated by six pneumatic artificial muscles. The muscles consist of rubber balloons in plastic sheaths. Increase in pressure causes the muscle to contract; the sheath cannot extend, only expand in diameter. A simple controller activates the hip muscle 4 of the swing leg, based on the signal of a gyroscope. The hip muscle contracts and propels the leg forward. Simultaneously, another muscle 5 extends the stand leg, enabling the swing leg to make its swing (to prevent it dragging the ground).

Result RICHARD VAN DER LINDE, DOCTORATE 2001

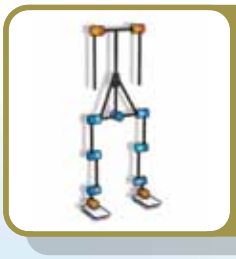
The walking motion does not automatically lead to lateral stability. The robot takes up to eleven steps and then falls.

Knee hinges
Knee joints make the walking motion more humanlike (the knees = Denise). The knee joint has no motor and therefore uses no energy. There is, however, a controllable latch. When the left foot lands on the ground, a sensor under the foot sends a signal to the right knee to be released. At the same time, the hip muscle ensures that the right leg swings forward. Because inertial mass holds the foot back, the knee bends during the swing 7. At the end of the swing, the right leg is straightened again and the knee becomes locked. The rigid leg now becomes the stand leg and the movement is repeated.

Result MARTIJN WISSE, DOCTORATE 2004

Denise takes 20 steps before falling. She is unable to start walking from a standstill position; she must first be set in motion.

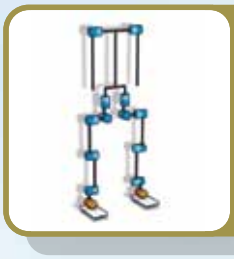
soccer star



Convergence towards walking stability
The objective was to measure disturbances (with balance sensors in the body) so that the walking motion can automatically be recovered. In order to achieve this, the robot has motors in its ankles and knees. During a disturbance, the robot moves its feet sideways to retain upright stability.

Ballistic walking

The most elementary bipedal robot, hips with rigid legs, can walk unaided down a slope. The robot remains standing on one leg (the stand leg) while the body tips forward. At the same time, the other leg (swing leg) swings forward (humans would bend their knee), the foot comes down on the ground and takes over the function of the stand leg. The natural pendular motion of the legs makes walking very energy-efficient. This ballistic approach by the Delft Biorobotics Lab is quite different to the approach to the Japanese Asimo, where each movement is controlled and stopped by heavy motors that use a lot of energy.



WK RoboCup
The goal is a robot that can take part in the football World Cup for robots in 2013.

Flame head
Flame has TU Delft's flame logo as a head.

FLAME
1,3 m tall
15 kg

TULIP
1,3 m tall
19 kg

8 Body motor
The sideways movements of the legs are coupled by means of a spindle motor. This single motor keeps the body automatically upright.

Electric elastic motors
In order to walk smoothly, the coupling that actuates the joints must be continually adjustable. This is difficult to achieve with pneumatic muscles. Flame is therefore equipped with seven electric motors. Each motor spindle is connected to a joint by a cable 9 and two springs. The motor and the joint contain angular displacement encoders. By measuring the variation in angular displacement (3000 counts per revolution), the extension of the spring (and therefore the joint's torque) is known. This makes torque control possible, necessary for smooth walking.

Optimum place to put your feet
If a robot stands on one leg and starts to fall, it can regain its balance by placing its other foot on the ground. In this research project the optimum place where the robot should put its foot was calculated (= capture point theory). To make it possible for the robot to place its foot anywhere, both legs have complete freedom of movement (six degrees of freedom). This requires two extra motors 10 for each leg.

Body 11
The body is filled with electronics, batteries and a control system.

illustration & text
Eric Verdult,
www.kennisinbeeld.nl

Result DAAN HOBBELEN, DOCTORATE 2008

Flame can walk thirty steps straight ahead and step over 8 mm bumps. Flame loses her balance and falls over when nudged.

Result TOMAS DE BOER, DOCTORATE 2012

Tulip can balance on a wobbly plank and remain upright when nudged (can be viewed on youtube). Stable walking requires further research.

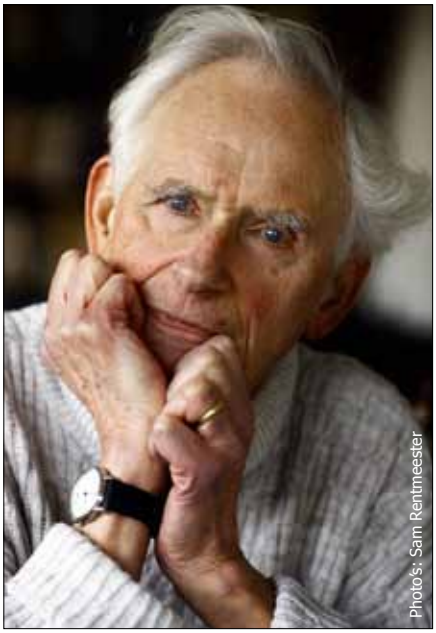
Never

be left running behind the bandwagon again

TU Delft plays an active role in the world of integrated circuits. It hasn't always been that way. "Before Dimes was set up, most of what the TU Delft produced was second rate," says Jan Davidse, one of the founders of the institute.

Tomas van Dijk

The invention of the transistor caused a revolution in electronics. "In the mid-1960s, the world of electronics revolved around the transistor," says former professor, Jan Davidse. So Davidse couldn't believe his eyes when he first started working at TU Delft: "At TU Delft, the attention given to transistor technology consisted of not much more than a kind of appendix to the course manual. They had really fallen a long way behind. It was all second rate."



Photo's: Sam Rentmeester

Emeritus professor Jan Davidse: "It was an opportunity to make the courses completely up-to-date with one supreme effort."

Davidse was working on colour television at Philips when he was offered a position as professor at the department of Electrical Engineering in 1964. He is regarded as one of the founding fathers of Dimes (Delft Institute for MicroElectronics and Submicron technology) together with professor emeritus for electronic instrumentation, Simon Middelhoek.

If he had known how much fuss would be involved in setting up the institute, he would never have started, Davidse says now. "So much energy and trouble went into it. If I had known that in 1975, I would have said: Guys, let's set about this in a different way."

The two men, who were then in their thirties, say they were "naïve" and saw an opportunity to set up something big when integrated circuit technology emerged towards the end of the 1960s.

"It was the beginning of an entirely new era," beams Davidse. "IC technology was emerging. Circuits had to be designed in completely new ways. It was an opportunity to make the courses completely up-to-date with one supreme effort."

The two professors did not believe the course material should be based only on scientific literature. "It would have been like swimming on dry land. You would never be able to test the quality of the structure you'd designed and you'd always be left running behind the bandwagon."

The professors wanted a real laboratory. And they got what they wanted in 1976 in the form of the so-called IC workshop, the forerunner of Dimes. Here, students could observe how chips were made and they could tinker with transistors and diodes. A certain amount of scientific research was also carried out in the

IC workshop

"We had been given a whole floor for the workshop - the fourth floor of the faculty building that had just been built. It was not an ideal location because we used toxic gases, such as arsenic and phosphorous, during the processing of silicon. The gases had to be carried up to the roof and vented there. It is quite a distance from the fourth to the twenty-third floor. A chimney was constructed that passed through all the intervening floors," the chip expert says, laughing.

At the time, Philips was friendly towards TU Delft. The company benefited from good training. Some Philips technicians came to work at the IC workshop. "One of the experts was Linus Smit. You really have to mention him. He knew all the tricks. Because of that, we were able to make working chips very quickly. Things we could be proud of."

Chip technology thundered on. "It took off like

a rocket," says Davidse. "Nobody had foreseen that. We soon wanted to do even more and had an eye on the large power engineering halls where research was no longer being conducted. The halls were relics of earlier times when the electrical engineering department still had to build large electrical machines and generators for mechanical engineering," recalls Davidse, who when he retired wrote a comprehensive book about the history of the TU Delft electrical engineering department.
In 1981, the two professors proposed expanding the IC workshop to create a National Workshop for Integrated Circuits and Sensors (NASS). Davidse: "The proposal included a clearly set out budget section and also proposed an eventual move from the rather unsuitable fourth floor of the high-rise building to accommodation in the low-rise buildings."
The Nass proposal, which remained completely a TU Delft project despite the name, did not go down well with similar institutes at the universities of applied science in Eindhoven and Twente, which wanted facilities of their own. In response, the TU Delft group came up with a modified concept: Dass. Dass would be part of Nithoss (Netherlands inter-university organisation for integrated circuits and sensors).
"And then a whole circus began," says Davidse. "The submission of the Nithoss plan led to endless meetings with a large number of parties, of which the most important were the three technical universities of applied science, the Foundation for Fundamental Research on Matter, the Ministry of Education and Science, and the Ministry of Economic Affairs."

Stubbornness

In the corridors at Dimes, the story is that Simon Middelhoek's directness and stubbornness exasperated other delegates.
"Yes that story is true," says Middelhoek. He laughs as he gives his own brief version of the story. "I wasn't there myself, but the prime minister at the time, Lubbers, is said to have pounded the table with his fist and said that all the fussing about had to stop."
"I think it was absurd," Middelhoek continues. "The Netherlands had a large IC industry in the south of the country. There was a need for well-trained electronic engineers. Setting up a lab like that is an obvious thing to do. We had a good plan, but nothing happened. Perhaps we were naïve."
Philips also played a role in the decision-making process. "Philips tried to block us in many ways," says Davidse. "We wanted to do research as well and they said that this was a pretension we could not deliver on. Their reaction was understandable in view of the miserable reputation for research we had built up until then."
However, the tide changed in favour of

Dimes in the eighties.

Delft. Not long afterwards, Philips started an enormous effort to catch up with Japanese technology companies. Davidse: "Money was made available by the government and the strategic microelectronics plan was developed. This enabled us to make a strong case.
"The fact that we had been busy with it for so long paid off. We got the largest amount of money by far, much more than Twente or Eindhoven. In 1986, TU Delft received a direct government subsidy of 33 million guilders, which the institution would complement with a further 24 million guilders.
"We first thought up the name 'Dime', like an American ten-cent coin. But the name became 'Dimes' with an 's' for submicron at the end, because the Applied Physics submicron centre was also going to participate. This created an

'Because of that, we were able to make working chips very quickly. Things we could be proud of'

institute with a very broad research scope. There wasn't much synergy. By and large, the parties coexisted peacefully."
Davidse says that the chip researchers at Dimes were especially good at designing and making low power electronics. This was very important for devices such as hearing aids and pacemakers. "We saw that the existing devices made by well-known companies were actually put together rather clumsily," Davidse recalls. "By connecting transistors in different ways and coming up with other tricks to ensure that as little energy was lost as possible, devices could be made that were far more sophisticated. In the end, we were really good at doing that."
According to Davidse, the relationship with Philips improved: "We worked with Philips in many projects. When we started Dimes, there was no question of Philips investing in us." Middelhoek feels that Philips has always "looked down" on TU Delft.
What do the emeritus professors expect will happen now that the direct funding by TU Delft is going to be reduced in steps (see the article "Dimes must become more commercial" on page 20).
Davidse remarks that Dimes has always been successful at acquiring indirect funding (NWO subsidies). "But," he adds "you shouldn't ask someone over 80 that sort of question. This is a matter for today's generation."
Middelhoek doesn't mince his words: "They will have to dance to industry's tune."
Davidse: "Long ago, there was a large mechanical workshop at the site where Dimes is now. You took your drawings there and they made the parts you needed. I think it would be a pity if Dimes becomes a factory like that again."

Photo: Sam Rentmeester

A medieval “prayer nut” has been reborn six centuries later as a 3D print using data from a highly detailed CT scan. The nut, which is the size of a chestnut, belongs to Amsterdam’s Rijksmuseum, which wanted to learn more about the object. The European facility for synchrotron-based imaging in Grenoble was able to help. High resolution synchrotron tomography revealed that the entire scene inside the nut was carved from a single piece of wood, which testifies to superb craftsmanship. The Rijksmuseum now wants to use the 3D dataset to commission a supersized version for the exhibition. Art historian and chemistry professor Dr Joris Dik (3mE) went ahead and made an enlarged 3D print of the decorated exterior. He is not entirely satisfied with the results; the rough print requires some touching up by hand. Ultimately, the enlarged version will be put on display alongside the early 15th century original.

‘Dare to make your own choices’

Cabaret performer Youp van ’t Hek currently holds the position of cultural professor at TU Delft. He is working with 20 students to build “something” that takes the viewer “beyond their senses”. If the subject comes up, he is quite happy to share his life experiences with his students: “Dare to make your own choices, regardless of your parents. As a child, it is also your job to raise them.”

Saskia Bonger

Sagging jeans, unruly hair, jacket hanging open and a plastic bag containing cartons of milk in his hand. “I thought you might like some milk in your coffee,” says cabaret performer, Youp van ’t Hek, as he unlocks his impressive Amsterdam house after dropping by the local supermarket.

In his kitchen, with its view over a frozen park, there is a bear from the Kika foundation on the table. It’s for his two-year-old grandson. “He had the nerve to go and live in America,” explains Van ‘t Hek, as he whisks the milk and turns on the Nespresso machine.

He explains that he was first invited to be TU Delft’s cultural professor two years ago, “but I didn’t have time back then. Now, as ever, I’m writing a new show. It’s great to be able to do this at the same time.”

In order to take part in your master class, students have to describe, in 300 words, ‘an impossible idea, a fantasy gone mad, a future dream or something you’ve always wanted to do, but can’t.’ So what do they write?

“These students are truly imaginative, but what they write is totally different from what I expected. What that was, I will keep to myself. I don’t want to single out any one example.”

The theme of your master class is ‘Totally free!’ You want to make the impossible possible, build ‘something tangible’, without any restrictions. Something that takes the viewer ‘beyond their senses’. What kind of thing do you mean?

“That’s something I will only share with the students. I do have something in mind, but the students may come up with something better. They know what is technically possible. It suits me if they say: ‘that won’t work, but this will.’”

I read on the internet that it will be a kind of decor

“I’m saying nothing, except that it can go where everyone can see it. On campus? Perhaps, it belongs to TU Delft. It may all go terribly wrong, and we will have nothing to show for it at my departing speech in early May. If that happens, it will probably be my fault. Or maybe the students’. But I think we can come up with something great. Anything is possible: building, writing, poetry, films.”

Cabaret?

“Yes, why not? I don’t know if there is anyone in the group who wants to do that. I don’t know the students yet. All I’ve done is read their letters. Along with the rector and three others, I’ve chosen 20 students. I find it hard having to reject people.”

You never went to university and only completed junior general secondary education via a roundabout route. Can you empathise with students?

“I think I can. When I was 18, I moved out of home. All my friends were studying. I lived as they did. I just didn’t do exams, but cabaret instead.”

In Groningen, you were well known for going to the student discotheque De Blauwe Engel after performances. Do you still do that?

Cultural professor

Since last year, the traditional guest writer has been extended to include new disciplines. From now on, the guest lecturer will spend two months as cultural professor. Artists, composers, filmmakers and photographers will be invited as well as writers. Last year, photographer Vincent Mentzel was the very first cultural professor.

On 8 March, Youp van ’t Hek gave his inaugural address as cultural professor. Fifty students applied for his master class. Only 20 were ultimately selected. On 10 and 11 March, the students were in Barcelona with Van ’t Hek. His main aim was to visit the Dalí Theater-Museum in Figueras, a 90-minute train journey from Barcelona. The students will have seven seminars with Van ’t Hek. On 11 May, he will give his departing address and present the results of the master class.

Photo's: Sam Rentmeester

'I think that texting and email cause lots of arguments, because people respond to each other too quickly'

"That was fun. I ended up on the bar at Albertus (sister association to Virgiel, ed.). Sadly, I don't do that any more. Youtube and Facebook have taken all the fun out of it. It used to be great if you were just there by chance. Then you were part of it. Now, 300,000 people watch it on the internet."

One of our readers asked: what would you like to have invented?

"So many things. The paperclip. That's something I find beautiful: that man who sat twisting that bit of wire, just wonderful. Or the wheel. But I think it's the computer that has brought about the greatest changes in recent years. Personally, I'm not at all technical. Sure, I can mend a puncture or put up a shelf. But if I want to switch on my computer and it doesn't work, I have to call someone to sort it out. My father would have been 100 this month. God rest his soul, if God exists. All the changes he saw in society are just unbelievable. The world has been totally transformed."

For the better or for the worse?

"Both. Nowadays, if you move house, you just open your laptop and carry on. Computers and mobiles make everything so much faster, but sometimes slow can be beautiful, too. In the past, if you were in love, you would write a letter. You would put it in an envelope, write your name on it and stick a stamp next to it. You'd go to the post box and then decide not to post it after all. Nowadays, you'd just send a text straight away. I think that texting and email cause lots of arguments, because people respond to each other too quickly."

In your shows, you satirise bourgeois existence, a humdrum life and the loss of the ideals of youth. Will you be warning your students about this?

"Students are often very bourgeois, especially if they are members of a student association with those age-old traditions. Everything has been thought out in advance, based on precedent. Sons do what their fathers did. And of course, they love seeing their sons wearing silly trousers like they used to. That's why I often prefer students who are not members. Be original. After graduating, take a trip around Australia. Why do people all have to do the same?"

What is your view of people who personify your nightmare scenario?

"I think people are funny, precisely because they are so predictable. In the evenings, I hardly ever go to the pub now. Because when I do, someone nearly always comes up to me and starts talking. Every time, without fail, it is tedious. Or take Het Gooi, the area I come from. All the men there play golf. Is it because golf is so much fun? I'm not convinced. They do it because everyone else does. Because then, they don't really have to talk to each other, because it's good for business. Or all those people who have a baby and buy a transporter bike. Or funerals. They're always the same. Why don't they ever tell stories about why the person was such fun, with some good anecdotes? People stick with clichés, because it's safe."

And can your performances change that?

"My sermon only lasts two hours. People laugh and then go back home. Of course, I hope that something sticks. Recently, a psychologist told me that I have changed the Netherlands more than I think, that there are people who have quit their stressful jobs to retire and go travelling. I'm not sure if it's true, it's just one person's opinion."

Have you always done your own thing?

"Yes. People don't always like it. That I don't go to a certain party, for example, because I don't feel like it. That I don't feel obliged to spend Christmas with my in-laws. I don't understand why people do that every year. 'Otherwise my in-laws would be hurt', they say. Dare to make your own choices, regardless of your parents. As a child, it's also your job to raise them. My children really don't have to visit me out of duty. Maybe that's why they actually come so often. My parents never forced me to do anything and I have also never told my children what they should do. All that matters is that they are happy. That's hard enough. Keeping your relationship fun when you're busy with work and children. It helps to do what you really want to do. Dare to make your own choices"

That's easy for you to say. You have talent and the money to buy freedom.

"In the first ten years, I earned very little, you know. For me, it was never about the money. I think that's the secret of my success. I've had plenty of failures in my personal life. That's something people are scared of: failure. They stay in their comfort zones. Every Friday evening, millions watch 'The Voice of Holland' and find an excuse for it: they say they're only watching it with their children. That programme: I've seen a bit of it and read a lot about it in the press. It's so manufactured, and the way they extort texts from people - terrible."

Who is Youp van 't Hek

When Joep van 't Hek (Naarden, 1954) left primary school, he knew what he wanted to be: a priest. He went to a seminary, but did not complete the first year. He then spent nine years gaining his secondary school qualifications, at a variety of schools. He joined the cabaret while at school. In 1973, Joep changed his name to Youp, after a girlfriend wrote the 'P' on his shirt with the words: 'We help you'. Since then, Van 't Hek has worked in theatre. His breakthrough came in 1983 when he appeared in the TV programme, De Alles is Anders-show. In 2011, Van 't Hek took part in the year-end cabaret review (oudejaarsconference) for the seventh time. He is a columnist for NRC Handelsblad and the Vara guide and has published many books. Youp van 't Hek is married, with three children and one grandchild.

Column

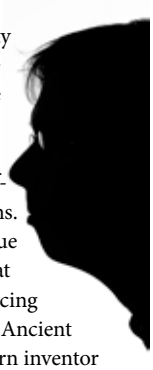
Rhetoric

Remco de Boer is a technology & science communication specialist

I can be found in a community or conference centre somewhere in the Netherlands almost every week, because that's where the open forum and information evenings are held. It's here that the guardians of public interest and those whose interests they look after come together. Increasingly in these meetings, the government and citizens oppose one another. It could be about a wind farm, more intensive railway use, gas storage or even gas extraction, but technology always plays an important role. Until late in the last century, technology was seen largely as a solution and a bringer of prosperity. Now it is seen increasingly as a problem and threat to our wellbeing. If that same wind had blown a hundred years ago, there would be little to defend now. Without motorways and railways, we wouldn't have become the prosperous distribution country we are today. And without a local support base, it wouldn't have been possible to exploit Slochteren.

Photo: Sam Rentmeester

Those who dare to change the status quo today are regarded with suspicion. That applies in particular to engineers; they are the personification of the danger. There is no room for nuances. You're either for or against. It has little to do with knowledge. And that's precisely where an engineer gets his authority from, which means he has a problem. This is literally what they hear during the meetings: "You may well claim all that, but who's to say it's true?" Expertise has become a relative concept. Vast quantities of information are only a mouse click away. Anyone can use it to create their own reality. Knowledge is not even a condition anymore for playing an important role in decision-making. Among those opposing the construction of the Blankenburg Tunnel was a retired engineer, who presented the Directorate-General for Public Works and Water Management with a proposal for a drilled version. He had no understanding of tunnels; that was provided behind the scenes by a Dutch construction company. Lobbyists from the anti-tunnel movement brought him to the heart of The Hague decision-making process, which put a cat among the pigeons for many months. The strategy of sowing doubt is one of the most successful tactics in the art of conflict.



The time when engineers could limit themselves to content alone is long gone. The natural authority that once came with the degree has vanished. The social debate is an increasingly important factor in decision-making, and facts have to compete with half-truths and complete fabrications. If the engineer wants to continue having an influential role in that debate, he must present convincing answers – literally. Just like the Ancient Greeks and Romans, the modern inventor requires rhetorical skill. Only then will he stand a chance. Ethos, logos, pathos. The Forum Romanum is now a small room in Bathmen, Pieterburen or Scheemda. Only those with knowledge and the ability to persuade in that arena will be able to develop technology and see it used in practice.

Under Construction

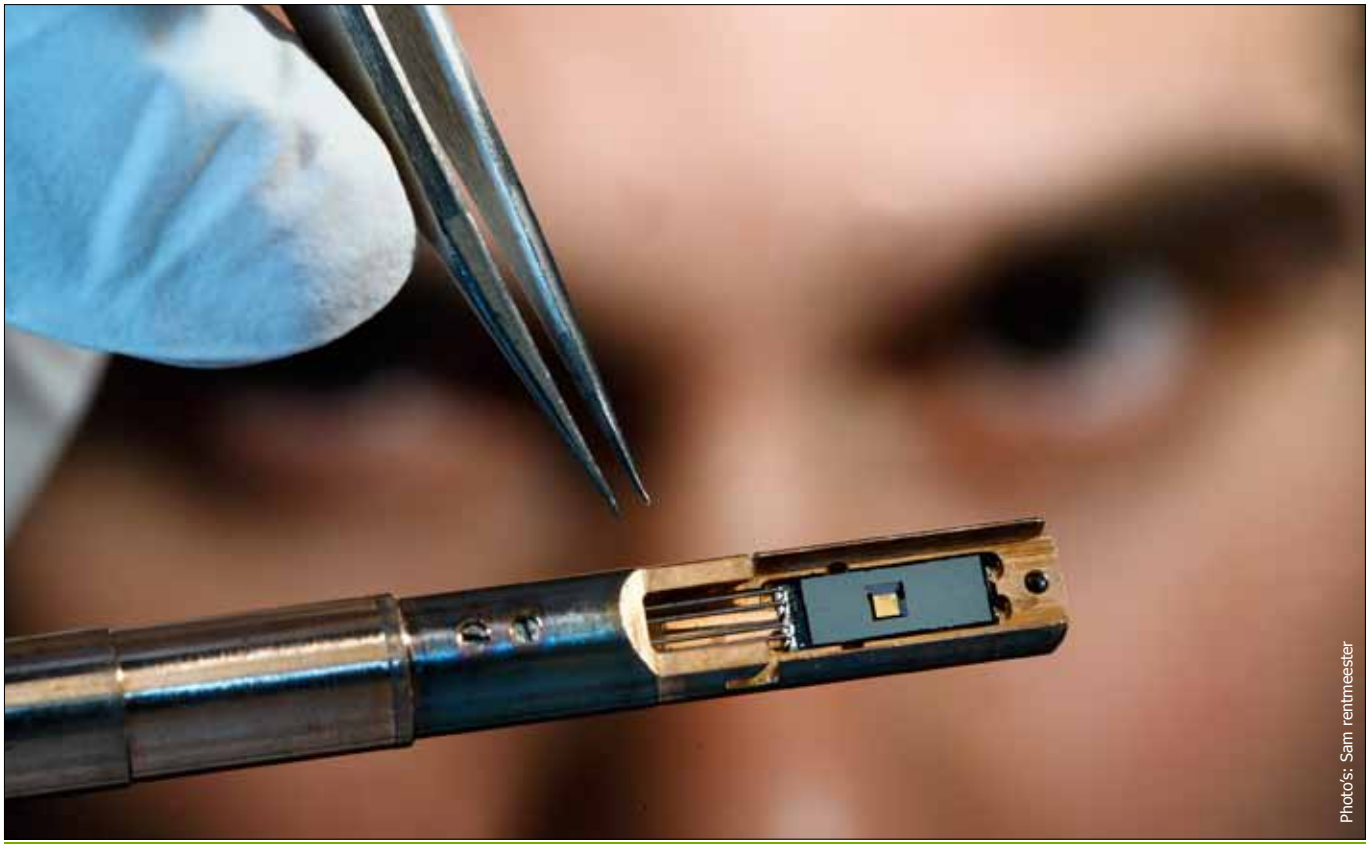
Photo: Sam Rentmeester

It was built as Laboratory for Applied and Analytical Chemistry. Later on it became a squat, a hip hop studio and a filmset for the Dutch movie 'Zwartboek'. Now the building on the De Vries van Heijstplantsoen has been partly demolished and rebuild into a student housing complex. The six storey complex consist of 297 rooms.

Dimes
must become more commercial

As part of austerity cutbacks, the TU Delft Executive board has decided to reduce the fixed funding of the Dimes Technology Centre from four million euros per year to zero in five years. The Dean of Electrical Engineering, Mathematics and Computer Science faculty, Professor Rob Fastenau, explains how Dimes will have to generate its own funding through research and production for third parties: "It is obvious that there is no other way."

Jos Wassink



Photo's: Sam rentmeester

Research in the Dimes cleanroom is going to cost money.

How much income do you expect from TU researchers?

"I don't know the exact figures. But, suppose a professor has a PhD student who spends a great deal of time in the clean room. That professor will have to pay a fee for the student, amounting to roughly 50,000 euros per year. This will make the PhD student roughly twice as expensive as he or she is now. Our assumption is that the professor will be able to pass the amount on to the party funding the research."

In other words, professors will have to find more funding for their research?

"They will have to find reasonable funding for the research that we do. We are now in a phase in which we have to adjust to this. It is a rather difficult process. A number of professors find the amount very high. Naturally, this makes their lives even more difficult."

This doesn't make research any easier. Companies often want technologies that were

developed at Dimes to also be manufactured at Dimes, or at least a first series. Is Dimes open to this?
"Yes, we are making preparations to accept this kind of order. The preparations mostly concern logistics and making processes more stable, but they also concern the available people and skills and whether we can deliver on our promises. This requires a different structure than we need to take on research assignments."

Why?
"Research assignments are on the basis of 'best efforts' – you do your best to discover something, but it is understood that you might fail. A manufacturing order means delivering an agreed quantity within an agreed time. This requires a completely different organisation. There are risks that are not only technical risks, but also organisational risks."

Possibly also a financial risk in the case of contracts with penalty clauses?
"No, we would never accept that. But you have to arrange something with the client to make the risk acceptable. For example, you can try to build up a reasonable buffer of stock. If a problem arises due to a member of staff being ill or a machine being out of operation, you can always fall back on the buffer."

'A researcher has to have a technician nearby, who is able to take over the task'

Once, things also went badly wrong. ASML wanted to have detectors made by Dimes, but they went to IMEC in Leuven in the end. What was the reason for that?
"ASML believed we would not be able to deliver reliably. Their machines have a price tag of tens of millions of euros. This means there are serious consequences if a particular component cannot be delivered on time. ASML is very worried about risks in the supply chain."

The so-called "foundry model" is sometimes proposed, in which third parties are hired to manufacture products using the Dimes facilities. Do you support this approach?
"Yes, that is also possible. Our ambition is to be able to fulfil orders like these with the facilities that we have. But there is a distinct possibility that we will work with other parties – perhaps spin-offs from the university – who build a business based on using our facilities – at a price of course – to fulfil manufacturing orders."

Would it be possible to prevent manufacturing interfering with research?
"You simply have to prevent that, because supporting research is the primary task of the DTC [Dimes Technology Centre, ed.]. We need, in any case, to be careful not to involve researchers and PhD students too much in manufacturing tasks."

Actually, you don't want that at all?
"You should not want that. But, there is grey area between making a prototype as a result of research and then making the second and third versions. The researcher must be free from the pressures associated with manufacturing. A researcher has to have a technician nearby, who is able to take over the task. This is the model we propose."

This also applies to the research supervisor: a professor who might keep getting calls to ask whether the parts are finally ready. One would need to have a kind of manufacturing supervisor instead.
"This is true. That's also what we want. But we don't want to set up a complete organisation for that. The head of the DTC and his or her team should take over the responsibility whenever manufacturing is concerned."

Three years ago, a similar kind of organisation was considered, but nothing much has come of that. Why should things be different now?
"I think that there is greater consensus now. Paradoxically, the announcement by the TU Delft Executive Board that the funding of Dimes will be reduced has made very clear that other sources of income will have to be found. This also made clear that we will have to do things for the external market."

For the sake of clarity: In the long term, you will carry out external assignments to the value of 2 million euros. The other half will have to be generated by providing research facilities.
"Yes. The necessity is clear, and it is understood that we will have to finance our own infrastructure in two ways. Three years ago, it was all much less clear. That was before the *herijking* or review process [the term the Executive Board uses for the current austerity measures, ed.]. At the time, the question was: 'Do we really want that?' Now, it is clear that there is no other way."

How much time will Dimes be given to prove itself?
"Funding will be reduced from 4 million a year to zero over five years. This will have to be supplemented from other sources. If we fall behind the trend line, it is immediately

Professor Rob Fastenau: "It's no use having half a nuclear reactor."

clear that we will not manage to do that. We must be able to show that we are doing things in the right way by the end of this year. If we don't, other measures will be taken."

In other words, you really have to earn 800,000 euros this year?
"Yes. That is what is in the budget. If we don't quite manage that because of delays and the economy isn't doing well, I will understand that. But if we only make 150,000 euros instead of 800,000, things look rather bleak."

What do you mean by "other measures"?
"Look, there is a minimum cost price, which you can't go below. It's no use having half a nuclear reactor, for example. Activities such as Dimes cost several million. You can make some cutbacks, but you can't cut back to half."

In other words, if income is structurally much less than planned, Dimes cannot be maintained. That's what it comes down to.
"Yes."

Will we live to see Dimes celebrating its 50 anniversary?
"I don't know if I'll still be around. I would like to be. I would like to be there and will do my best to see that it happens."

Light and colour

The right light at the right place at the right time. Iris Dijkstra's Atelier Licht en Kleur (LEK) on Rotterdam's Coolsingel fulfils this mission.


Photo: Sam Rentmeester

Iris Dijkstra (37) would never have started her own company if she had not been "pulled into the light". After many unsuccessful job applications, she made contact with the Centrum Beeldende Kunst in Rotterdam through her graduation supervisor Han Brezet (Industrial Design Engineering). There, a project team evaluated the Christmas lights and actually wanted to do more with the lighting on Coolsingel. Dijkstra was interested in the project: her graduation design had links to lighting and to the well-known Rotterdam street.

For her graduation study, "West meets East in the middle", which was about culture and product design, Dijkstra had designed a stage with a lectern. She had Coolsingel in mind as a location, because Prague and Rotterdam are twinned cities.

Although she was not a lighting expert, she seemed the ideal person to make a light planning that would give Coolsingel an air of Champs-Élysées. A Paris boulevard feeling: on a grand scale, with shop windows, lines of sight, rhythm, continuity and a clear end-point to travel to. "The question was: why doesn't it feel like that on Coolsingel?"

'Coolsingel a Paris boulevard feeling'

Dijkstra took photos in the evening and noticed that the lighting drew the eye to objects – particularly the trees and lamp posts – rather than to the street itself. All the characteristics of a boulevard were present, but they were obscured by advertising, differing distances between lamp posts and untidy street furniture.

Because of this urban architecture approach, Dijkstra asked other industrial designers, including Sjoerd van Beers, for their thoughts. In the end, she created a stronger link between the Erasmus Bridge and Hofplein square by aligning the street lighting along a single horizontal line and illuminating the fountain, which formed a clearly visible end point. She also used clever lighting to accentuate the typical Rotterdam character of buildings, such as the city hall and the Havenmuseum.

This was followed by so many new projects that Dijkstra was too busy to apply for jobs. Instead, she founded Atelier Licht en Kleur in Rotterdam on 1 January 2005, with Sjoerd van Beers as her business partner. "When you're working on projects together, it's handy to have just one bank account number," Dijkstra says. "I felt that we only really had an actual company when we had an office together. Before that we worked at home and discussed things via MSN."

Having her own company suits her: "The freedom of being an entrepreneur feels good." She also teaches at the faculties of Architecture and Industrial Design Engineering in the field of light and architecture and gives guest lectures and lighting workshops. All in all, she has plenty of work. In fact she has so much work that after splitting up – with each of the business partners going their separate ways – she is now looking for new staff for Atelier LEK. (CvU)

www.atelierlek.nl

Smart glasses

Imagine you are recovering from Alzheimer's – quite something in itself – and when you go out and meet people again, you find that everyone has become part of a virtual world, or, more accurately, a semi-virtual world. People are still walking around outside, but the contact lenses they are wearing mean they see the world differently. Buildings are perhaps a bit more attractive and the surroundings are much greener. This scenario was described by the American author, Vernor Vinge, in his book "Rainbows End".

Is this the stuff of science fiction? Dr. Stephan Lukosch of the Systems Engineering Section (TPM) believes that developments are moving in this direction. "I have my reservations, but the fact is that the technology I am working on is one of the 'stepping stones' for a world like that described by Vinge," he says.

Lukosch is involved in the 'CSI The Hague' project at the Netherlands Forensic Institute. One goal of the project is to enable forensic investigators to cooperate more productively using augmented reality.

Lukosch and his colleagues are working on developing glasses equipped with cameras that make stereoscopic pictures of the surroundings. The glasses are connected to the internet, enabling people to view remotely what the investigator is looking at.

"The people at the scene of the crime do no always have the knowledge required to look for DNA traces, reconstruct bullet trajectories or examine blood splashes," explains Lukosch, who is originally a computer scientist. "These glasses enable experts to see what the wearer is seeing and give advice."

'Wearers of the glasses feel a bit like robots'

"But we go further than that," Lukosch adds. "We aren't only working on *augmented reality*, but also on *mediated reality*. In other words, people remotely viewing the image the wearer is seeing, are able to modify the image. For example, if they do not want the wearer to enter a certain area because he or she may destroy evidence, they can mark off the area with a (virtual) ribbon."

Experiments have shown that wearers of the glasses feel a bit like robots. They are given instructions such as: go here, go there. "That can be unpleasant," Lukosch says, "especially if people you don't know are looking over your shoulder. To make the connection a bit more personal, we want to add the advisors to the image in the form of avatars."

Lukosch's broader objective is to enable people to collaborate more effectively, not just in a CSI scenario. It is ironic that his work may lead to people actually withdrawing from the real world into their own virtual world, as Vinge describes in his book. "But this technology will break through sooner or later," says Lukosch. "I'm very excited to be playing a part in determining how that will happen."

(TvD)


Photo: Sam Rentmeester

In Person

Dirk Jan van den Berg has been approved by the Supervisory Board to start a new term as chairman of the Executive Board. Van den Berg has served since 1 March 2008. In addition to positions at various ministries, his CV includes Permanent Representative of the Netherlands to the UN and ambassador to China.

Internationally renowned railway expert Professor **Ingo Hansen** (CEG) has left TU Delft. Hired as a professor of Transport and Planning in 1994, Prof. Hansen spent 15 years conducting research on railway safety and maximizing train transport efficiency. Over the course of his work, he investigated the state of the Dutch railway and issued strong criticisms of NS and Prorail.

Linda Kester is the recipient of the Dewis Award for her PhD dissertation. The award recognizes the quality of dissertations by young female researchers at TU Delft. Kester is an assistant professor of Strategic Marketing at the faculty of Industrial Design Engineering.

The new chair of Morphodynamics in the Hydraulic Engineering department (Civil Engineering and Geosciences) will be occupied by Dr **Zheng Bing Wang**. The chair focuses on the morphodynamics of lagoons and estuaries, and the Dutch and German Wadden Sea in particular. Wang has been a university associate professor in the Hydraulic Engineering department since 1990.

Professor **Ramon Hanssen** has been appointed guest lecturer at the University of Wuhan in China for three years. Prof. Hanssen is making great strides in his areas of expertise, namely satellite radar interferometry and geodesy. Wuhan is one of the leading universities in China in the field of geodesy, and arguably the world's largest education institution in this field.

Dr **Peter Rem** has been appointed professor of Resources and Recycling (Civil Engineering and Geosciences). TU Delft is one of the few universities in the world involved in advancing science and technology in this field. Rem previously earned the TU Delft's entrepreneur award for his innovative recycling technology that resulted in high-tech start-up company ReSteel.

Dr **Eco Wiebe Bijker**, professor emeritus in Coastal Engineering at TU Delft, died on 27 February. He was 87. He gained international acclaim for his contributions to coastal engineering. In addition to his work at TU Delft, he was closely involved in the Technical Advisory Council for Surge Barriers, the CUR and the Subsidence Board. Prof. Bijker received numerous awards.

Chemist and art history professor **Joris Dik** (3mE) was recently inducted into the Royal Netherlands Academy of Arts and Sciences' Young Academy. Using x-ray fluorescence to examine paintings, Dik can look deep into old layers of paint. His discovery of a portrait of a woman hidden under Van Gogh's Patch of Grass made him famous worldwide.

Dr **Alan Hanjalic** (photo left), Dr **Sabine Roeser** and Dr **Ibo van de Poel** have been appointed to the position of Antoni van Leeuwenhoek professor. The TU Delft created this distinction to give young outstanding scientists the opportunity to focus on their research with a minimum of management duties. They are not immediately assigned their own department.

Hanjalic (faculty of Electrical Engineering, Mathematics and Computer Science) specialises in multimedia retrieval; smart online searching for images, video and music.

Roeser and Van de Poel were both university professors in the philosophy research group in the faculty of Technology, Policy and Management. Roeser has been the head of the "moral emotions and risk politics" research group since 2010. In addition, she has been an endowed professor at Twente University in October 2010. Her research topics will include the nuclear power debate, prompted by the Fukushima disaster.

Van de Poel received a €1.5 million Vici grant in early 2011 for his research on the introduction of new technologies into society.

Propositions

Raising objections is way easier than countering them.
Zahid Shabir,
civil ingineer

Concise formulating originates from sound knowlegde.
Herman van Dam,
physics engineer

Puzzling results generated in research labs are often resolved in quiet moments outside the lab.
Solomon Agbo,
elektrotechnical engineer

The development of the knowledge-based economy does not benefit from the smalle number of people in the parliament that have a science background.
Toeno van der Sar,
physics engineer

Science and science-fiction are merely seperated by the quality of the scientist.
Marios Kotsonis,
space technology engineer

To better understand your own country you first have to live somewhere else.
Vlad-Mihai Sima,
computer engineer

Proposition

Technological developments have little effect on ethical developments.
Claire Stolwijk, industrial engineer

Defence

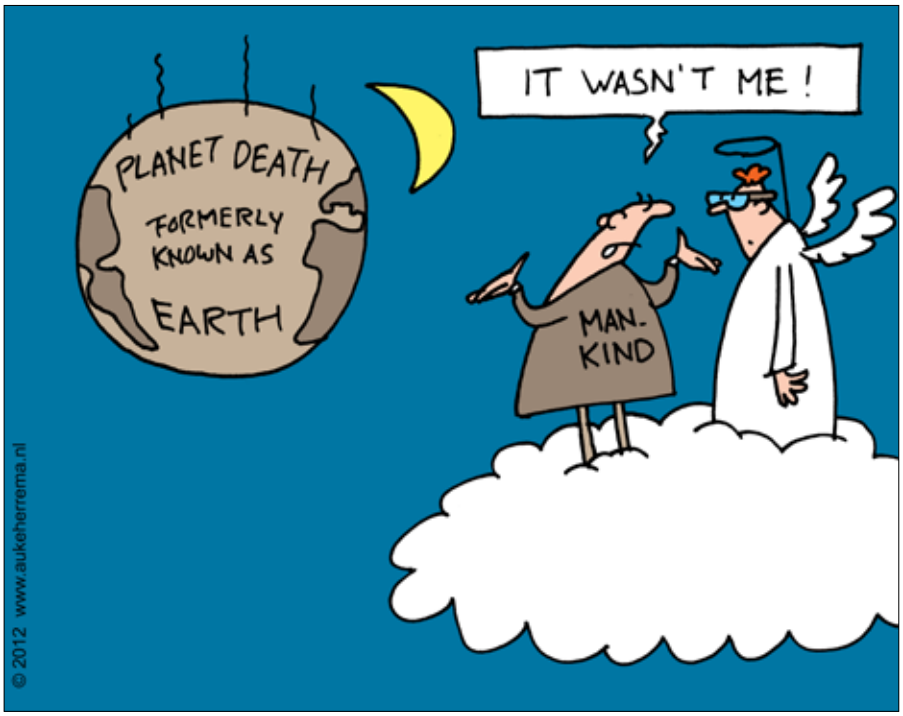
"A technological development, such as chips in the semiconductor industry, can be used for medical purposes, which is ethically responsible, as well as in weapons systems, in which case the ethical aspect is less certain. People claim that technology is ethically neutral, but what that really means is that the ethical development has yet to be completed. In other words, an additional mechanism is necessary to start the ethical development. This can be done by pondering the new technology, or making it the subject of debate."

Sound Bites

"If my parents could see me today: a professor at TU Delft. How crazy can you get!"
Cabaret artist Youp van 't Hek about his guest professorship, in Het Parool.
"After the war in 2003, I developed a simple and cheap kit to enable people to test whether drinking water was contaminated with bacteria. Iraqi officials aren't interested in this sort of invention. They prefer importing goods from abroad, because they are able to earn commissions on imports."
Iraqi microbiologist Dr Salah Al-Zuhairy in the NRC Handelsblad.

"It goes against your instincts to drop out of your degree programme. But I have lots of time left to go on studying. I'm 14 years old. If I start studying again in five years time, I will still be one of the youngest."
Erik van den Boom in Algemeen Dagblad about dropping out of his applied science course for the time being in order to concentrate on his music career.

"Every year in the Netherlands we flush 200,000 tonnes of paper down the toilet. Roughly one kilowatt-hour is needed to break down a kilogram of dissolved toilet paper. If half of the toilet paper dissolves, this is equivalent to the energy consumption of 25,000 households."
Professor of water purification, Jules van Lier, said in Trouw that he thinks it is more sustainable to clean your bottom with water than to use toilet paper.



'The opinion that it is arrogant to think that mankind could affect the gloabl climate is a sign of false modesty.'

Ernst Oldenhof,
physics engineer

‘My teaching skills are very good’

“I would go so far as to say that I can help anyone succeed in maths or arithmetic, if they’re at the right educational level.” She looks a touch uncomfortable as she says it, but Lonneke Boels cuts to the chase. She is good at her job: private tutoring.

Photo: Sam Rentmeester

Boels (45) gives private tutoring and exam preparation for arithmetic and maths from primary school to university level. She also teaches at a secondary school. She works 60 to 70 hours a week and is passionate about her work.

But Boels didn’t go straight into teaching after graduating in electrical engineering from TU Delft in 1991. She spent the first ten years working at CE Delft, an agency specialised in energy and environmental policy. Here she gave advice on environmental issues, a job that tied in well with her graduation research with the energy supply department.

After ten years at TU Delft, Boels had “had her fill” of giving environmental advice. “To be honest, my heart lay in education.” She started out at a Pabo (teacher training college), but found she lacked the necessary teaching skills.

Boels took a sabbatical and went on TU Delft’s teacher training course, the ‘TULO’, to gain her teaching qualification. She first spent three months teaching at a primary school, followed by five years teaching at the Alfrink College in Zoetermeer. Then, five years ago, she moved to the Christelijk Lyceum Delft (CLD) when a vacancy arose. She was already familiar with the school, having done her work placement there, and she has now taught in almost every grade.

‘My heart lay in education’

Shortly after starting at the CLD, Boels set up her own company, so that she could be her own boss for part of the time. “What I really dislike about education is that you’re given ten hours and expected to turn them into 15,” she says. “That’s what you’re told, and it applies to all subjects at school. I’d really had my fill of it.”

Boels began private maths tutoring, which by her own account was successful from day one: “I started with a student who had a 5 for maths in his 3rd year of pre-university education and wanted to take ‘mathematics B’. He needed at least a 7 to be admitted, which is exactly what he got in the final exam. He was allowed to take mathematics B, provided he kept up the tutoring. Eventually he scored a 9 in the subject.”

Boels’ private tutoring website is full of testimonials from children and parents. Like this one: ‘Our son Tom did two test preparation days and it really shows in his math marks. He got nothing but unsatisfactory marks in year 4, but his most recent mark for maths was a 7.7.’

“Quite simply, my teaching skills are very good,” Boels says, in explaining her success. (SB)

In full swing

Singapore is the place to be for researchers from around the world, NRC Handelsblad reports.

While universities in many countries in Europe face cutbacks as a result of the economic crisis, according to NRC Handelsblad, Singapore is investing massively in science and technology. The tiny country is regarded by many as a gateway to Asia and is functioning like a magnet for scientists from around the world.

TU Delft is also active in Singapore, participating in the Singapore Delft Water Alliance programme, together with the National University of Singapore (NUS) and water research institute Deltares.

Involved with this collaboration is hydraulic engineer Professor Guus Stelling, of the faculty of Civil Engineering and Geosciences. He actually has a position as professor at NUS, and is there as we speak. “One of the reasons I’m here is because of the universities double Master’s degree programmes in hydraulic engineering and water management,” says Prof. Stelling. Since 2009 students from both universities can follow these Master’s for which they spend two semesters in Singapore and two semesters in Delft.

“Singapore seeks strong partners from all around the world,” Prof. Stelling continues. “We in Delft are renowned for our work within the field of civil engineering. And so, you can sort of say that they choose us to collaborate with within this field.”

The hydraulic engineer, who will retire from TU Delft next year, says he is surrounded by part-time professors from institutes like Oxford, Cambridge, Stanford, ETH and MIT, who are also nearing the end of their careers, or rather the end of their careers in their home countries. Singapore offers them the opportunity to continue their vocation. “It’s very interesting to be in this booming place.”

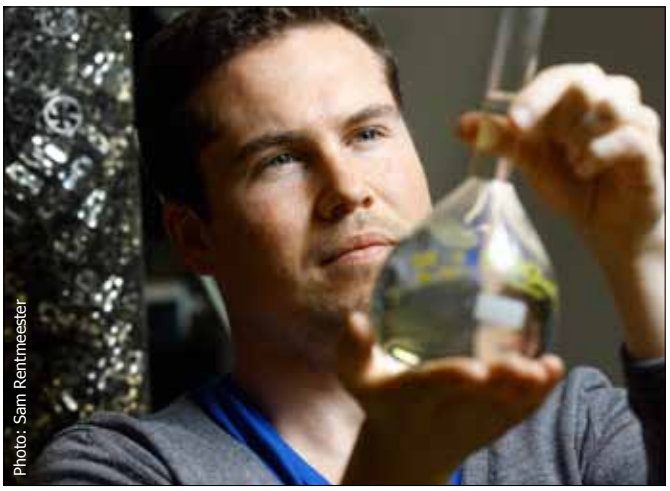
Prof. Theo Toonen, dean of the faculty Technology, Policy and Management, also collaborates with NUS, or more specifically with the Lee Kuan Yew School of Public Policy, which is part of NUS. For one, he supervises the work of one of its PhD students. He’s especially interested in water policy and metropolitan governance and would like to increase collaboration in these fields. But to keep pace with the researchers from Singapore, you need money. “They have so much money,” Prof. Toonen sighs. “So much more than we have.”

He would also like to add some courses in water governance to the curricula of the dual Master’s programme and is having discussions about this option at the moment.

The students from the dual Master’s programme are in Delft this semester. One of them is Phi Bang Do (23). He has a different view of things. “Everybody gets bored very quickly in Singapore,” he says, when asked why he choose to temporarily leave Singapore and come to Delft. “Most students signed a contract obliging them to work for three year in Singapore after graduating, in exchange for which they pay less tuition fee. So we can’t run away. While participating in the dual Master’s however, we do get the opportunity to leave the country for a while.” **(TvD)**

David Moed's invention removes arsenic from groundwater

David Moed (Civil Engineering and Geosciences) has devised a sustainable and economical method for the removal of arsenic from groundwater, making him the winner of the UfD-Strukton MasterAwards. He was one of three shortlisted candidates to present their ideas for the improvement of the environment on 8 March. Arsenic in drinking water can lead to skin lesions, various types of cancer and cardiovascular diseases. In Bangladesh, where millions of pumps provide the population with water, the high concentration of arsenic in the groundwater causes major problems. Moed's research investigated Subsurface Arsenic Removal (SAR). By pumping oxygenated water into the ground, it is possible to oxidise the iron in the groundwater. The oxidised iron then captures the arsenic by means of adsorption. The jury were greatly impressed by the way Moed combined his civil engineering background with chemistry. "In his research, he tackled a major social problem and his solution meets all the criteria", was the panel's verdict. Moed received a prize of five thousand euros for his idea. Eefje van der Werf took second place, with Bart van Lakwijk coming third. They each received a cheque for €2,500.



David Moed combined his civil engineering background with the chemical field.

Turning sea water into safe drinking water

Sid Vollebregt (Sustainable Energy Technology) has won the UfD-Cofely Energy Efficiency Prize with his project "Sustainable Drinking Water Production by Desalination". In addition to the honour of winning he received a prize of five thousand euros. Cofely and the Delft University Fund invited Master's students to compete for the prize by devising innovative solutions in the area of reducing energy consumption and CO_2 emissions and the effective utilisation of sources of sustainable energy. Vollebregt investigated the possibility of giving every inhabitant of our planet access to clean drinking water using sustainable solutions. He and a colleague researcher travelled to Indonesia to carry out their study.

They investigated how solar panels could be used to control a water purification system that converts salt water into drinking water by means of reverse osmosis. On the island of Bali they built a prototype of this system, which as well as being powered by sustainable energy also makes clever use of the residual water generated by the reverse osmosis process. Among the factors that won Vollebregt his prize were the substantial societal relevance of his final project and his extremely persuasive presentation. Projects submitted by Daniël van Kersbergen and Emile Nijssen were each rewarded with a prize of 2,500 euros.

Sid Vollebregt likes to provide clean drinking water for every inhabitant of our planet.

New: UfD-TBI Internship Fund

Since 1 January students at TU Delft who wish to do an internship can request a financial contribution from the UfD-TBI Internship Fund. TBI Holdings B.V. and the Delft University Fund Foundation have signed an agreement setting up this fund. TBI is a network of businesses that are active in property, construction and technology. The organisation is providing annual funding of 15 thousand euros over a five-year period. The Delft University Fund will assess students' applications and award the grants.

Wanted: Alumnus of the Year

Alumni who have been a source of inspiration for others or made an exceptional contribution to technology, innovation, science and entrepreneurship have a chance of becoming Alumnus of the Year. The winner will be announced at the alumni symposium on 12 October. In addition to a special memento, the winner will be awarded two prizes: a cash prize of €2,500, which may be spent as the recipient sees fit, and €7,500 to be spent on a TU Delft research project of their choice.
Do you know a suitable candidate for the award? Or perhaps you feel that you qualify for the title of Alumnus of the Year yourself? Send in your nomination via the website www.universiteitsfonds.tudelft.nl or http://tudelft.nl/over-tu-delft/alumni/, before the closing date of 12 September 2012.

Water gas from water and solar cells

The Shell Bachelor Master Prize encourages young engineering talent to think about and work on technological solutions for a sustainable future. On 14 February Chemical Engineering Master's student Maarten de Nier (Applied Sciences) won the first prize of five thousand euros. "I feel greatly honoured, especially considering the strength of the competition", said De Nier. "My technological innovation is a piece of equipment that allows water gas to be produced using water and solar cells. I hope to encourage enthusiasm for this technology among prospective students."

Agenda

A summary of activities and events celebrating the 170-year anniversary of TU Delft.

18 May 2012 to 27 May 2012
Delft Amazing Technology
Groundbreaking developments in technology and science. The heart of this event will be a technological spectacle on the marketplace in Delft, with films, presentations, demonstrations and activities. A number of businesses and institutions will also be exhibiting. See: **www.datdelft.nl.**

28 May to 1 June 2012
Festive Water Week
A week of "watery" activities, including rubber bath duck races in the canal, a water day alongside the Schie and the announcement of the winner of the TU Delft Urban Water Movie Contest.

1 June 2012
TU Delft Zomerfestival
A festival on campus featuring rising talent and established names from the Dutch contemporary music scene.
See: **www.zomerfestival.tudelft.nl.**

13 June 2012
Festival of Knowledge
The theme is "water", as water-based technology is an area in which Delft truly excels. See **www.kennisfestival.net.**

13 to 15 June 2012
Scientific Congress "Water & the City"
International researchers from the fields of science, design and engineering will work on current case studies involving four cities, each with its own unique water-related problems: Singapore, Jakarta, Rotterdam and New Orleans.
Location: TU Delft Aula Congress Centre

Urbanism alumni win Europan Award

A team of alumni from the Complex Cities studio, the Master's degree programme in Urbanism offered by the faculty of Architecture, have won the prestigious Europan Award with their proposal to transform a university campus into a self-sufficient "Multitalented City".
The project focused on a '60s-style university complex on the periphery of the French city of Reims. This is a stand-alone and inward-looking campus with large open spaces, rather isolated from its surroundings. Urbanists Justina Muliuolyte and Tadas Jonauskis, working with architect Lukas Rekevièius, aimed to transform this campus into a largely self-sufficient area. The key concepts were flexibility and adaptation to environmental, societal and economical changes. The team also considered solutions which would potentially allow the locality to generate its own energy. The jury felt that this project had a really clear concept and programme, and highly valued the manner in which the plan considered alternative and novel lifestyles. "Among the project's strengths are the size and scale of the proposed public spaces", reported the jury. "The project is both realistic and highly original."

The price winning design of a self-sufficient university complex.

Five UfD-Imtech Bachelor Grants awarded

The University Fund and Imtech awarded five UfD-Imtech Bachelor Grants of two thousand euros each, in order to promote innovative technology. Eligible for this prize are students who have written outstanding final reports for their Bachelor's degrees, either individually or in teams. This year's UfD-Imtech Bachelor Grants were won by the following projects:

- "EchoStop special music earplugs" by Eline van der Kruk (Industrial Design)
- "Clean drinking water following a natural disaster; disinfection using chlorine" by Martijn Sparnaaij (Civil Engineering and Geosciences)
- "City Cloud" by Jos Kraaijeveld, Johan Laanstra and Tom Verhoeff (Technology, Policy and Management)
- "The detection of cartilage damage using echography" by Elise Buiter, Thijs Bosma, Wouter Roobeek and Goof van de Weg (3mE)
- "AcoustiCam: a low cost/high resolution acoustic camera" by Maurice Boon, Maarten Debrouwere, Joris Domhof, Rick van der Groot, Jorg Hendriks, Anne Koelewijn, Kirk Scheper, Ewoud Smeur, Laura Uyttersprot and Jan Verwilligen (Aerospace Engineering)

Publication information:

Alumni portal
www.alumniportal.tudelft.nl
Changes of address
Subscribe or unsubscribe
- e-mail newsletter
- alumni events

Join our LinkedIn group TU Delft Alumni

Register with the Delft University of Technology Alumni group

Friends of TU Delft
Become a "Friend of TU Delft" and support Talent, Technology and TU Delft with your contribution.
Account number: 22 68 50 471
Stichting UfD, mentioning "Friends"
http://universiteitsfonds.tudelft.nl

Questions or suggestions?
Alumnibureau@tudelft.nl
(015) 2789111

who & where

Delft University of Technology has eight faculties, each of which is engaged in education and research in one or more disciplines. The University was founded in 1842 by King William II. With 13,000 students, 2,800 scientific staff members and 2,000 technical and administrative employees, it is the largest university of technology in The Netherlands.

TU Delft
P.O. Box 139
2600 AC Delft
The Netherlands
telephone +31-15 278 9111
telefax +31-15 278 6522

Disciplines

Aerospace Engineering
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 2058

Applied Earth Sciences
Mijnbouwst raat 120
nl-2628 RX Delft
Telephone +31 15 278 1423

Applied Physics
Lorentzweg 1
nl-2628 CJ Delft
Telephone +31 15 278 7774

Architecture
Berlageweg 1
nl-2628 CR Delft
Telephone +31 15 278 4184

Chemical Technology & Bioprocess Technology
Julianalaan 136
nl-2628 BL Delft
Telephone +31 15 278 2667

Civil Engineering
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 5440

electrical engineering
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Geodetic Engineering
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 3289

Industrial Design Engineering
Landbergstraat 15
nl–2628 CE Delft
Telephone +31 15 278 4750

Life Science & Technology
Julianalaan 67
2628 BC Delft
Telephone +31 15 278 8271

Marine Technology
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Materials Science
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Mechanical Engineering
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Computer Science
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Applied Mathematics
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Technology, Policy & Management
Jaffalaan 5
nl-2628 BX Delft
Telephone +31 15 278 7100

Multidisciplinary Centres

Adhesion Institute
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5353

Biotechnological Sciences Delft Leiden (bsdl)
Julianalaan 67
nl-2628 BC Delft
Telephone +31 15 278 5140/2342

Centre for International Co-operation and Appropriate Technology (cicat)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 3612

Centre for Transportation Engineering
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 6634

Dutch Institute of Systems & Control (DISC)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 7884

Koiter Institute Delft (Institute for Engineering Mechanics)
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5460

Netherlands Institute for Metals Research (NIMR)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 2535
Fax +31 15 278 2591

Wind Energy Research Group
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5170

Reactor Institute Delft
Mekelweg 15
nl-2629 JB Delft
Telephone +31 15 278 5052

OTB Research Institute for Housing, Urban and Mobility Studies
Jaffalaan 9
nl-2628 BX Delft
Telephone +31 15 278 3005

Open Building Working group (obom)
Berlageweg 1
nl-2628 CR Delft
Telephone +31 15 278 5400

Delft Institute for Microelectronics and Submicron-technology (dimes)
Feldmannweg 17
nl-2628 CT Delft
Telephone +31 15 278 3868

Interduct Delft University Clean Technology Institute
Rotterdamseweg 145
nl-2628 AL Delft
Telephone +31 15 278 7233

J.M. Burgerscentrum Centre for Fluid Mechanics
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 3216

Netherlands Schools for Advanced Studies in Construction
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 3332

Advanced School for Computing & Imaging
Mekelweg 4
nl-2628 CD Delft
Telephone +31 15 278 8032

Trail Research School
Kluyverweg 4
p.o. box 5017
nl- 2629 HT Delft
Telephone +31 15 278 6046

Central Library

Delft University of Technology Library (dutl) supplies information and provides services, particularly in the area of the technical sciences.
It comprises a central library and twelve sub-faculty libraries housed at the respective sub-faculties and institutes.
The dutl is intended for students and staff at the Delft University of Technology. However, as the task of the library is to provide scientific and technical information at a national level, its facilities are also available to the general public. As well as all areas of technology and natural sciences, the library also contains a general collection in the social sciences, economics etc.
This relates not only to books or periodicals, but also to standards, reports, reference works and congress proceedings.
Literature not in the collection or not on hand can be obtained through Delft University's Central Library from other libraries in the Netherlands or abroad.

For further information:
Delft University Central Library
Prometheusplein 1
p.o. box 98
nl-2600 MG Delft
Telephone +31 15 278 5678

Delft University Press
IOS Press
Nieuwe Hemweg 6B
nl-1013 bg Amsterdam
www.iospress.nl
Telephone +31 20 688 33 55
Fax +31 20 620 34 19
E-mail order@iospress.nl

Information

General information:
Information office
p.o. box 5
nl-2600 AA Delft
Telephone +31 15 278 5404

Information on facilities for foreign students:
Student Advisory Office
Jaffalaan 9a
nl-2628 BX Delft
Telephone +31 15 278 4670

Liaison between business and research:
Liaison Office
Mekelweg 2
nl-2628 BX Delft
Telephone +31 15 278 1500

Information on research fellowships:
Mrs. M.Y.M. Spiekerman-Middelplaats
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 3773

General information on university education in the Netherlands:
Min. of Education, Science & Culture
Central Information Dpt.
p.o. box 16375
nl-2500 BJ Den Haag
Telephone +31 70 412 3456

(Post Graduate) Courses

Delft TopTech
(vocational courses)
Mekelweg 2
p.o. box 612
nl–2600 AP Delft
Telephone +31 15 278 8019
Fax +31 15 278 1009
www.delft-toptech.nl

Institute for Biotechnology Studies Delft Leiden (bsdl)
Julianalaan 67
nl-2628 BC Delft
Telephone +31 15 278 2355

For information on courses in the Dutch language:
Language Laboratory
Jaffalaan 5
nl-2628 BZ Delft
Telephone +31 15 278 4124