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With many thanks to: the Dutch Universities for their cases and permission to use images.

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A BRIGHT FUTURE

The power of knowledge

Life on this planet would never have been possible without the sun: our source for precisely the right dose of solar energy. There is an attraction to the idea of hooking our technological devices up to that source, too. It would take care of our energy needs for the time being – and would eliminate our reliance on fossil fuels.

No wonder, then, that efforts are underway worldwide to develop effective and efficient methods to harness the sun's power. What began as a cog in the wheel of space travel has since grown into a broad and important domain of research and development. That applies equally to researchers in Europe, including those here in the Netherlands. In Eindhoven, scientists have spent years fine-tuning silicon solar cell production methods, and researchers in Utrecht had a hand in the invention of foil-based solar cells. Both are instances of close collaboration with industrial partners. Another branch of research is looking at alternatives for silicon, whether in the form of new materials or new conversion processes. Also at specific applications, such as an energy-generating horticultural glasshouse that has expectations high in Wageningen. The idea behind the glasshouse is simple: trap solar radiation for plant growth and use what is left over to generate power. In the end, success is all just a matter of hard work (in that sense, we haven't progressed past the days of Edison) and large-scale investments.

But this publication is about much more than just solar power. Pioneering science and innovative applications are by no means the sole preserve of engineers and physicists. This booklet gives you a glimpse inside each of the Dutch universities in turn and into virtually every branch of science. The idea is to illustrate the breadth of scientific scholarship being pursued at the Dutch universities and, moreover, to convey through these varied examples the value of science. Each example is a testimony that science is not removed from the world but, in fact, is closely engaged in it, and in the interests and exigencies of day-to-day life. No branch of business could hope to survive without knowledge and innovation; nor could education, sports or healthcare.

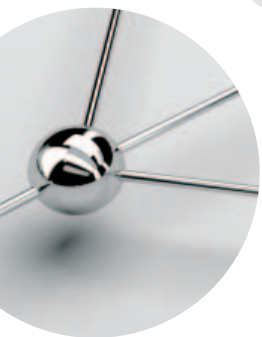
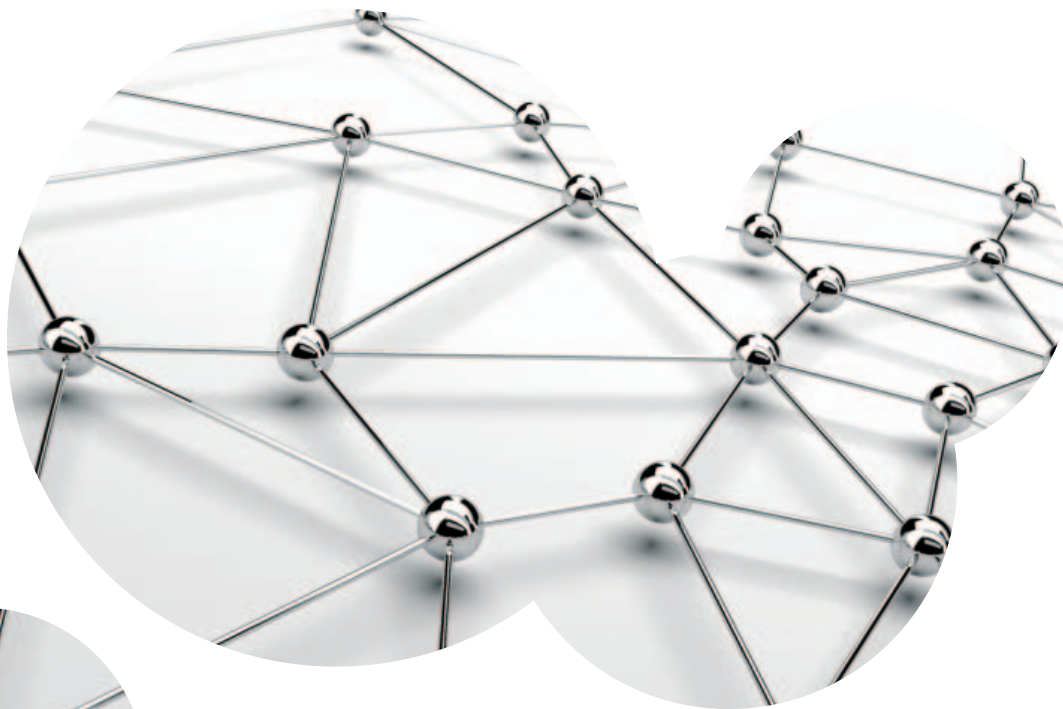
The right dose of sunlight has made life on earth possible. Literally.

But why not give the idea of solar power a metaphorical spin and apply it to research and innovation, where it will light the way to a bright future.

Sijbolt Noorda,
President of the Association of Universities in the Netherlands (VSNU)

CONTENT

PREFACE	A bright future	1
	Content	3
UNIVERSITY OF TWENTE	The way to go	4
ERASMUS UNIVERSITY ROTTERDAM	Mitigating circumstances	6
TU DELFT	Skirted lorry	8
UNIVERSITY OF GRONINGEN	The new Babylon	10
LEIDEN UNIVERSITY	Drugs courier	12
EINDHOVEN UNIVERSITY	Hello sunshine!	14
DUTCH OPEN UNIVERSITY	Taking a different direction	16
WAGENINGEN UNIVERSITY	Flowing traffic like water	18
RADBOD UNIVERSITY NIJMEGEN	Everything flows	20
TILBURG UNIVERSITY	Lexical perplexity	22
MAASTRICHT UNIVERSITY	Pleasure in your work	24
UNIVERSITY OF AMSTERDAM	Banishing the blues	26
UTRECHT UNIVERSITY	A history of black gold	28
VU UNIVERSITY AMSTERDAM	Compassing the pains of suffrage	30
DUTCH OPEN UNIVERSITY	Intelligent feedback	32
MAASTRICHT UNIVERSITY	Research into blood clotting	34
UNIVERSITY OF GRONINGEN	Making it better for children	36
UNIVERSITY OF TWENTE	Keep on moving	38
EINDHOVEN UNIVERSITY	Stirrups with suspension	40
TILBURG UNIVERSITY	Brain-training	42
UNIVERSITY OF AMSTERDAM	Steering clear of misery	44
LEIDEN UNIVERSITY	Arousing eels	46
VU UNIVERSITY AMSTERDAM	Bright idea	48
ERASMUS MC ROTTERDAM	Fitting like a glove	50
RADBOD UNIVERSITY NIJMEGEN	Dancing with the stars	52
TU DELFT	Cleaving the waves	54
UTRECHT UNIVERSITY	Conqueror of giants	56
WAGENINGEN UNIVERSITY	Biological clock gaining time	58
ASSOCIATION OF UNIVERSITIES	Making knowledge useful	60





THE WAY TO GO

Finding the right way is becoming increasingly important, not only for motorists but also for visitors to buildings. A researcher of the University of Twente developed smart signs to help visitors find their way in buildings.

Many people find large buildings like airports, hospitals or hotels unpleasant. They feel lost and do not know which way to go. Although signposts are designed to help, their sheer number only adds to the confusion. Receptionists are often difficult to find, are too busy or are unable to provide the required information, leaving you empty-handed in a labyrinthine mass.

It is not only visitors, however, who struggle with the lack of clarity in large buildings. The people who work in them also find it a challenge, as they are continuously asked for directions by members of the public who are lost. 'I'm looking for Department X. Could you please tell me how to get there?' Such a question cannot simply be dismissed of course, but answering it takes time. It has recently been calculated that the medical

staff of an average hospital loses approximately four person-years each year through the provision of such direction-related services.

How, therefore, could one enable visitors in large buildings to rapidly find their own way? The answer to this question was provided by the University of Twente, where the 'Smart Surroundings' research programme was launched in 2004. Together with companies like Philips, Thales and Océ, the University of Twente is exploring ways of making the built-up environment more intelligent. Examples in this regard include intelligent car parks that guide individual vehicles to free spaces.

A showpiece of the research programme is located in two buildings of the University of

UNIVERSITY OF TWENTE.

University: www.utwente.nl
 Valorisation: www.kennispark.nl
 Partner: www.smartsigns.nl

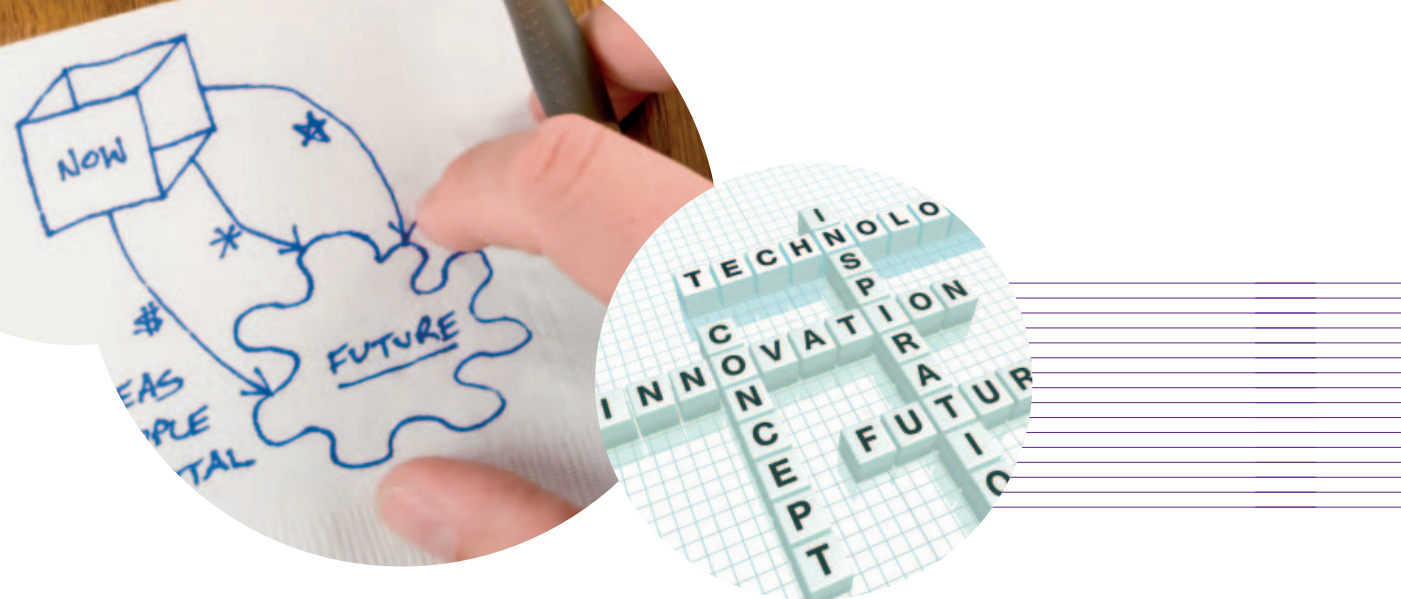
University of Twente shows the way in buildings

Twente itself. Upon arrival, all visitors report at reception, where their respective names and destinations are entered into a computer. They also receive a kind of key ring that transmits the message 'I am key ring X'. When visitors are heading to their destinations, they continuously pass intelligent signs that recognise the key rings. The signs combine the code of the key rings with the data in the computer and subsequently provide directions like 'Visitor X, turn left here'. These directions are continuously adapted to both the flow of people and changes in the building. If a certain route is blocked due to modification or maintenance work, for example, the system automatically provides alternative directions.

Making such a system is no easy matter. The biggest challenge concerned the fact that the network could not be controlled from a single, central computer, as that would compromise the privacy of visitors. Sensors containing their own small computers that could communicate with each other were therefore opted for. Following a considerable amount of work, the system was finally put into operation successfully.

Maria Lijding, one of the researchers involved, took up the challenge of introducing the technology into the market. She first looked into technological feasibility and market potential. When these proved to be positive, she set up Smart Signs Solutions in 2008. She is currently using the funding she received from the Dutch Technology Foundation (STW) to pay six software developers, three of whom live in Paraguay. 'In 2008 I was unable to find suitable candidates in the Netherlands. My mother comes from Paraguay and a cousin of mine who lives there is a computer scientist. He found three freelancers for me who matched the applicable profile perfectly.' Since 2009, however, the labour market has been a lot less tight, so the three newest recruits live and work in the Netherlands.

The first customer has already registered. A children's hospital purchased the system so that staff members and patients could determine what was displayed on the door signs themselves. 'Examples in this regard include a message or information about a patient's medical condition.'



University: <http://www.eur.nl/english/>
 Valourisation: www.eur.nl/informatie_voor_bedrijven/kto/
 (in Dutch)
 Partner: www.erasmusinnovatiemonitor.nl (in Dutch)

MITIGATING CIRCUMSTANCES

We all agree: the Netherlands could use more innovation. However, too often, innovation is still seen as the product of hardcore, technical knowledge. Underestimating their own abilities, many businesses let opportunities pass them by. Erasmus University Rotterdam has decided that it is time for a change.

Say the word 'innovation' and most people start thinking in terms of the latest gadgets: a mobile phone with a built-in GPS receiver, a television with an LED screen or a robot that performs surgeries. In fact, it was not long ago that Philips was using this hardcore image of innovation to promote its products, with the slogan 'Philips invents for you'. But times have changed and, today, companies like Philips are spending more time thinking about the 'softer' side of innovation, such as product design. To go with its new focus, the company came up with a new ad line in 2004: 'Sense and simplicity'.

If it were up to Henk Volberda, more companies would take Philips' lead. As a researcher at Erasmus University Rotterdam, Volberda has

devoted many years to investigating innovation. He discovered together with his colleagues Justin Jansen and Frans van den Bosch that only 25 percent of the success of any given innovation can be attributed to hardcore technology. The remaining 75 percent has to do with the softer dimensions. 'The success of TomTom is not down to the invention of a route planner but to its adaptation for use in older cars. Likewise, while the technology behind ING Direct wasn't particularly pioneering, the way it was put on the market was.'

Innovation goes beyond technology, Volberda asserts. 'A study conducted in the service sector revealed that production capacity continues to lag behind despite major investments in ICT.

EUR puts social innovation on the agenda

Sure, you can install a new ICT system, but it's what you do with it that counts.' Using knowledge creatively and in new ways – that where the real challenge lies. However, companies that want to meet this challenge will have to make some structural readjustments first, based on what Volberda has termed 'social innovation'. In essence, this means that businesses themselves have to create the conditions for their own focal shift towards the softer sides of innovation.

Volberda has actually been calling for social innovation for years. Until recently, he was no more than a voice in the wilderness, but then he hit on the clever idea for the 'Innovation Monitor' (*Innovatie Monitor*). On the face of it, this is a straightforward study on the ways in which businesses innovate. And yet the monitor has yielded more than just interesting articles. Each business that takes part – 9000 in 2006 – receives its own customised benchmark report. The report tells them how they stack up against the competition in relation to a number of critical success factors. This helps them to see how

operational processes can be improved and what they need to do in order to develop innovative products and services.

Since the launch of the first Innovation Monitor, Volberda and his team have seen Dutch interest in social innovation grow in leaps and bounds. For now, the highlight remains the opening of a centre for social innovation in 2006, where businesses can turn with questions about social innovation. The centre also houses an SME powerhouse set up to connect people working in the SME sector with professional experts and advisors. Current activities include a 'flexible organisation' project that helps companies implement flexible forms of timetabling. There is also a Collective Labour Agreement service point that helps social partners seeking to develop more effective and flexible collective labour agreements. And there is even a game – Teambrain – that helps teams brainstorm ways to build more efficient operational processes. In 2008, the centre's web pages received more than 150,000 hits.



SKIRTED LORRY

Lorries guzzle petrol. In the Netherlands, lorries are responsible for more than 17 percent of annual diesel and petrol use. Now, two engineers from TU Delft have come up with a way to cut that consumption.

Road transport is both a blessing and a curse. A blessing, because it helps a myriad of goods get to a myriad of places. A curse, because it is expensive and polluting. Lorry manufacturers are only all too aware of this paradox. In 2005, one such manufacturer published an advertisement posing a challenge for intrepid designers. The ad sparked the imagination of TU Delft Aerospace Engineering student Gandert van Raemdonck, who decided to devote his graduation research to the aerodynamics of lorries.

In looking at simulations, he observed that semi-trailers generated a noticeably high share of lorries' overall drag. As Van Raemdonck describes it, 'It was an aerodynamic disaster! Forty to 50 percent of the total air resistance was coming from the base and rear of the semi-trailer'. With

a view to reducing the drag, he investigated the so-called 'side skirts', or boards that line either side of the trailer. In their existing form, side skirts do little to boost efficiency, but a convex side skirt achieved a significant improvement. Van Raemdonck explains: 'Lateral wind serves to break the air flow, giving rise to whirlwinds. So to catch lateral wind you need a curved surface'.

When the time came to produce a prototype, Gandert turned to his brother Hjalmer for assistance. Also a student of Aerospace Engineering, Hjalmer specialises in materials science. He helped to fashion a 'board' that was curved, lightweight and sturdy. Next came a series of tests: first in a wind tunnel, then on the road. These test results showed that the high-tech side skirt managed to cut fuel consumption by an



University: <http://home.tudelft.nl/en/>
Valorisation: www.tudelft.nl/samenwerken
Partner: www.ephicas.eu

TU Delft students pioneer more efficient semi-trailers

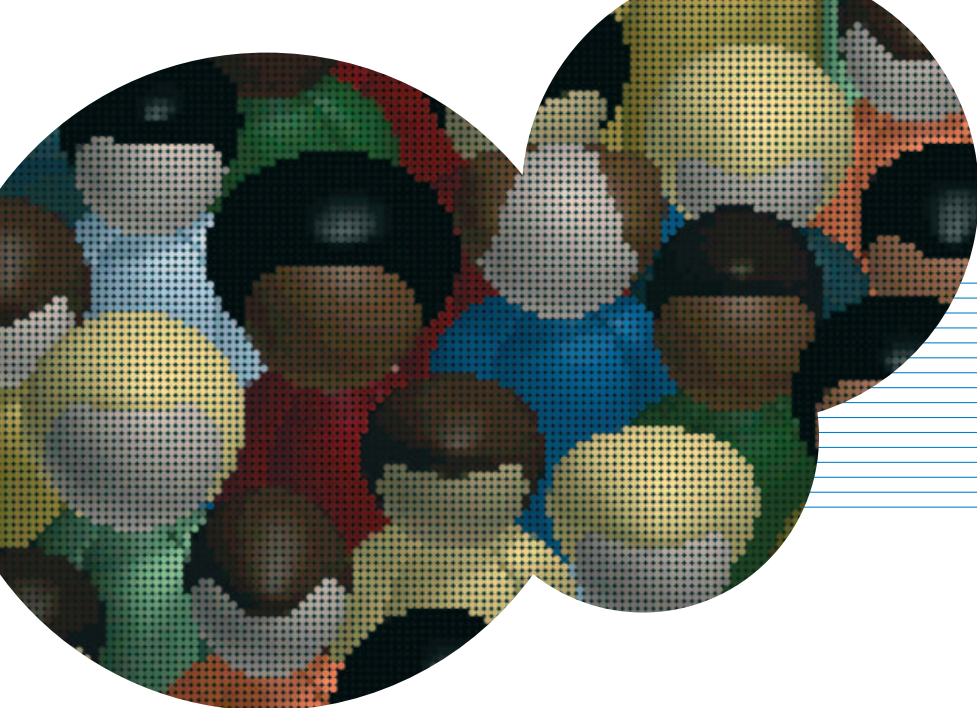
average of nine percent. Translated to the entire Dutch lorry fleet, that would mean an emissions reduction of hundreds of millions of tonnes of Co2 each year.

With the initial tests done using a TNT Post lorry, TNT saw the project's potential and asked if all its lorries could be fitted with the new feature. Spurred by this request, the Van Raemdonck brothers decided to launch their own company: Ephicas. A major supporter along the way was the Delft Young Entrepreneurs society Yes!Delft. 'They played a critical role. The people there and the openness of other technology entrepreneurs were a huge help when it came to navigating the administrative maze. If you have a solid business plan and a good team, financiers and banks will be queuing up to back you.'

After the launch, things started moving fast. The company appointed a commercial director, generated lots of interest (running the gamut to

the Discovery Channel) and raked in six innovation awards within the space of a single year. The jury report submitted by SenterNovem explains why in no uncertain terms, stating, 'This idea has all the ingredients to be implemented on a large scale'. Just a few days before the credit crunch broke out, Ephicas received an innovation loan from the Rabobank, making it possible to get started on production.

Even with all these successes, the Van Raemdonck brothers are hardly resting on their laurels. Their latest project is a 'boot tail' — a tapered structural feature on the tail end of a semi-trailer that achieves an additional ten percent reduction in fuel consumption. But Gandert is also looking farther ahead. For his PhD research he is exploring the aerodynamics of blunt objects. 'By expanding our knowledge in this area, we'll be able to build a system that adapts to wind speed, wind direction and driving speed.'



THE NEW BABYLON

Dutch people are coming into increasing contact with other cultures. A larger number of their colleagues, neighbours and friends come from other countries. Researchers in Groningen are helping to bridge cultural differences.

The Netherlands is becoming increasingly diverse. People from very different cultures and countries are making this country their home. This process is both enriching and a source of friction and difficult situations. Professionals at the frontline of the welfare state, such as neighbourhood community organisers, police officers, social workers and the like, experience the challenges of diversity on a daily basis. They often find themselves in situations in which they are unsure how to respond. What should they do, for example, if a lady from Cameroon raises her voice or a boy with Moroccan parents turns his back on them?

Organisations that work to strengthen social coherence in the Netherlands have been exploring ways to improve intercultural situations for many years. By coincidence, they came into contact with Jan Pieter van Oudenhoven, professor of cross-cultural psychology at the University of Groningen. In the past, Van Oudenhoven conducted research into the functioning of Western expatriates in Latin America. 'I discovered that successful operation in a foreign culture depends on five skills that include openness, empathy and initiative.' Once back in the Netherlands, Van Oudenhoven developed a training programme based on his research. His programme allows expatriates to practise the skills required to operate successfully abroad.



University: www.rug.nl
Valorisation: www.rug.nl/tlg/index
ISW Institute: www.instituutisw.nl
Partners: www.oranjefonds.nl and
www.intercultureelcontact.nl

University of Groningen brings Dutch people together

Three social organisations, the Osmose foundation in Arnhem, Steunpunt Minderheden Overijssel, and Centrum voor Maatschappelijke Ontwikkeling Stimulans (Rijnmond), heard about the training programme and contacted Van Oudenhoven. A plan quickly emerged to make it suitable for the kind of frontline professionals referred to above. The result was the Intercultural Effectiveness Training Programme, or simply IET.

Ideally, the training programme consists of two parts, namely a digital part and a workshop. During the digital part, 14 situations in which something goes wrong in intercultural communication are presented to the participants, who then have to choose one of four possible responses. Commentary on the participants' respective choices is subsequently provided, after which they proceed to address a second set of 14 situations. This second round is also concluded by the provision of commentary. If participants believe that they require additional practice, they can take part in the workshop, during which they are given the opportunity to extensively exercise their intercultural skills.

Initial experiences with IET for Dutch natives were so positive that Oranje Fonds, a social organisation, contacted the Groningen-based Institute for Integration and Social Efficacy (ISW) in 2007 and asked it to make the training programme suitable for all citizens. Operating from within this institute, Jacomijn Hofstra contacted 30 social organisations and asked them to submit descriptions of difficult intercultural situations. This process must ultimately result in 60 film fragments that relate to all aspects of life; that is, private, professional and public. As Hofstra explains, 'In the previous version, Dutch natives played the main role. Since the new training programme is intended for all citizens, however, we now have an equal number of short films in which newcomers play the main role.'

The training programme will be further developed in the coming years. Hofstra will carefully evaluate the responses of participants to the short films and, where necessary, adjust the questions. If all goes well, both Dutch natives and relative newcomers will therefore be able to develop and refine their intercultural skills in the near future.



DRUGS COURIER

Brain-related disorders occur frequently. Since the brain is well protected from its environment, however, treating them is difficult. A Leiden-based researcher is developing a method of smuggling drugs into the brain nevertheless.

The brain is the most complex organ of the human body. Because it is so important, it is extremely well protected. A thick layer of bone and membrane stands between the brain and the outside world. It ensures that all kinds of external things - nails, teeth, poisons, bacteria, viruses and so forth - cannot reach the brain. Despite its obvious benefit, the solid protective barrier surrounding the brain also has a downside, because if something goes wrong, such as a stroke or the onset of Alzheimer's disease or cancer, intervention is difficult.

Things have been going wrong with increasing frequency in recent years. The Netherlands Brain Foundation calculated that in 2005 almost six million people in the Netherlands were suffer-

ing from some kind of brain-related disorder ranging from migraines to brain tumours. That number is rapidly increasing by almost 100,000 a year. In almost all cases, treatment with drugs is impossible, since they are stopped at the so-called blood-brain barrier, a layer of connected endothelial cells that only allows specific substances to pass. Most drugs are not among the substances permitted.

Pieter Gaillard, a Leiden-based researcher, has spent many years exploring ways in which to smuggle drugs into the brain. He discovered that a non-toxic variant of diphtheria bacterial toxin was capable of crossing the barrier. He also realised that the protein involved could be used as a vehicle to conduct proteins through the



University: www.leidenuniv.nl
Valorisation: www.luris.nl
Partner: www.tobbb.com

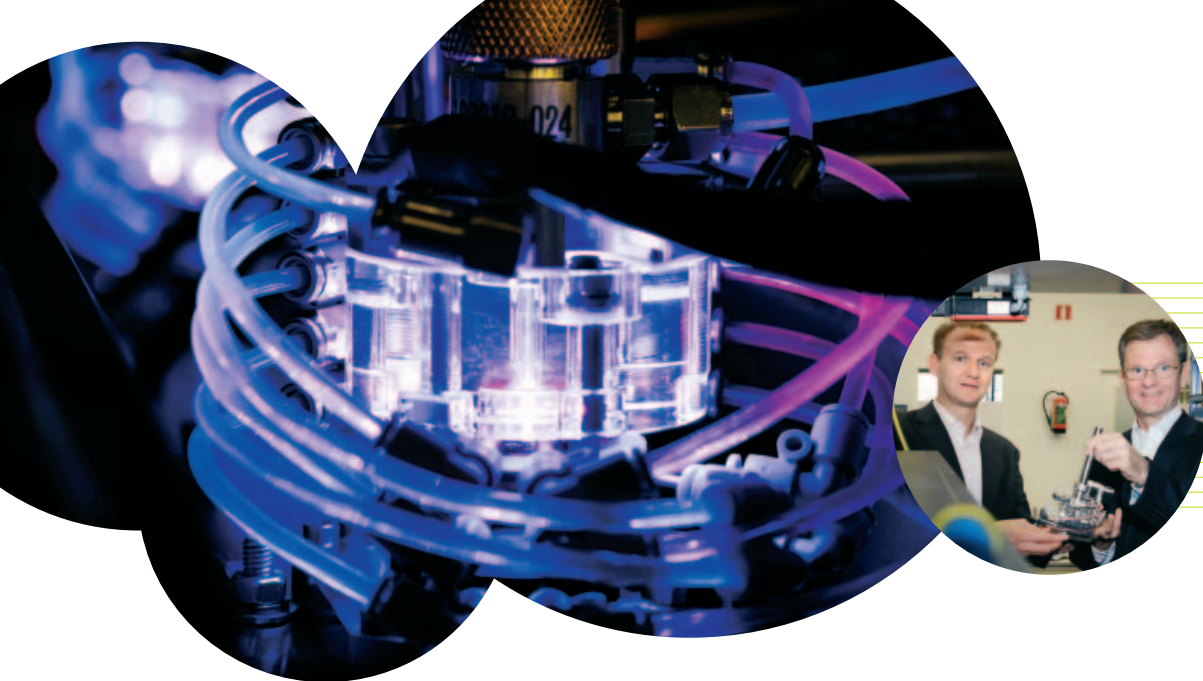
Leiden spin-off crosses blood-brain barrier

blood-brain barrier. 'To our surprise, many of the components that we required had already been clinically tested but had not been patented. Since no one before had been aware of the situation, we were able to patent the new combination.'

Together with partners from Leiden University and the business community, Gaillard formed the company to-BBB in order to further develop the invention. Everything went well and potential customers and investors quickly showed interest. Gaillard and his team then discovered that a Taiwanese research organisation had come up with a more elegant method. The organisation in question had developed minute fat droplets, liposomes, in which drugs could be packaged. The outsides of these droplets were coated with glutathione, a substance capable of crossing the blood-brain barrier. 'The liposomes function as Trojan Horses, as it were, in transporting the drugs into the brain. We were able to secure an exclusive patent on the method before pharmaceutical companies became aware of it and are in the process of concluding agreements with them to test the technology on their drugs.'

Currently to-BBB is also cooperating closely with the Netherlands Cancer Institute and Antoni van Leeuwenhoek Hospital. The organisations are jointly developing a new drug against brain tumours. They are mainly using the Taiwanese technology for the purpose. Their own technology based on the diphtheria bacterial toxin proved more difficult to apply. As Willem van Weperen, commercial director of to-BBB, explains, 'That method is still in the pipeline but its safety profile is more difficult to develop in commercial terms. Following repeated administration, the diphtheria protein can cause a broad range of reactions in the body. It is also more difficult to produce and test in terms of effectiveness and safety on a large scale.'

According to Van Weperen, application of the technology in the battle against brain tumours is only the beginning. 'The great thing is that liposomes can in principle be filled with a wide variety of drugs, ranging from cytostatics and virus inhibitors to drugs used in the treatment of Alzheimer's disease.' There is therefore hope for patients throughout the world.



HELLO SUNSHINE!

The sun is the energy source of the future: clean, virtually inexhaustible and universally available. Solar energy remains expensive, however, at least relative to the energy generated by the burning of fossil fuels. Together with the company OTB Solar, Eindhoven University of Technology has improved production technology to increase the yield of solar cells and thereby contributed to the battle against climate change.

Solar cells are providing increasing yields and are becoming cheaper. These trends are not automatic, however. Throughout the world, producers must work hard to ensure such gains. OTB Solar is one of them. This Eindhoven-based company has around 250 employees and supplies the machines used by others to manufacture solar cells. These large machines measure approximately 70 metres in length. So-called wafers of amorphous silicon are fed into the front and solar cells emerge from the end of the machine. Dr Paul Breddels, director of OTB Solar, is proud of his machines. 'The latest generation can

process 2,400 wafers an hour, almost twice as much as the previous one. And we're aiming to increase that number.'

In the heart of the machines produced by OTB Solar is a very special unit: the DEPx. This unit applies an extremely thin layer of silicon nitride to the solar cells, an important factor because it is this layer that makes the surface of a solar cell less reflective and therefore more efficient in absorbing sunlight. Moreover, the layer increases the capacity of a cell to repair defects in the silicon. Both effects are crucial in increasing the

TU/e Technische Universiteit
Eindhoven
University of Technology

University: www.tue.nl
 Valorisation: www.tue.nl/ondernemen
 Partner: www.otb-solar.com

Eindhoven University of Technology improves solar cell yield

yield of this type of solar cell. In other words, the better the coating, the higher the yield.

The technology on which DEPx is based was invented, researched and developed by the Plasma and Materials Processing group led by Richard van de Sanden and his predecessor Daniel Schram, both professors at Eindhoven University of Technology. A patent was applied for and a licence granted to OTB Solar for the manufacture of solar cell production machines. Cooperation ensued in which both parties complemented each other well. According to Van de Sanden 'The people at OTB did the engineering. They used the results of the research to modify the machines in order to make them commercially viable. In the industrial sector, unlike the academic one, such machines must operate non-stop.' 'What we got from Eindhoven University of Technology was fundamental knowledge,' adds Breddels, 'knowledge about plasma physics and the characterisation of solar cells. This allowed us to concentrate on the industrialisation of the process.'

With the DEPx unit, OTB Solar is the manufacturer of a very special machine; a machine that is capable of applying extremely thin layers of silicon nitride and doing so rapidly. At the present time, the machine is even the fastest in the world, and it shows. As Breddels explains, 'Our turnover has increased in leaps and bounds in the last four years. OTB currently has 50 machines in the market and we aim to double that number in the coming two years.'

OTB and Eindhoven University of Technology jointly developed a roadmap for the coming years, and new ideas will undoubtedly arise in this regard. One idea, for example, concerns the use of glass instead of silicon. 'That could be very interesting,' says Breddels. 'Silicon is an expensive material, whereas glass is a lot cheaper. The idea is currently in the brainstorming phase but the seed has already been planted. We could also use the help of Eindhoven University of Technology in this development.'



University: www.ou.nl
 Valorisation: www.ou.nl/loopbaanuniversiteit
 Partner: www.loyalis.nl

TAKING A DIFFERENT DIRECTION

As fewer and fewer people in the Netherlands are holding jobs for life, workers are increasingly likely to be confronted with career decisions. With insurer Loyalis, the Dutch Open University (Open Universiteit) has developed an instrument to help workers in that process.

Dutch Open University helps workers consider their careers

words, if you assist them in considering their opportunities step by step, most of them will achieve their objectives.

This is how the idea of a careers roundabout arose. At that roundabout, in principle a worker can take one of three directions: he can opt to modify his current job, invest in developing his personal qualities, or decide to look for a job with another company. A considerable amount of information is required to determine the direction most appropriate to the individual in question. This information is collected by means of online questionnaires. The questions asked are extremely diverse and address issues such as previously acquired competencies, workload, the balance between professional and private life, career orientation, learning capacity, motivation etc.

Together with his careers adviser, Jef selected the questionnaires that he had to complete. Although filling them in did take some of his

time, it was made relatively easy by the fact that Jef could do so at home on his own computer. A few days later, Jef received a report by e-mail. It stated that seeking to modify his existing professional duties or signing up for additional training was not the most obvious course of action in Jef's case. Looking for a different job was the most attractive option.

Jef brought the report to a further meeting with his careers adviser. Together, they decided that he should look for a new employer. On the recommendation of his adviser, Jef also considered positions other than that of facilities manager, as the report indicated that, with his experience, Jef could take on a far broader range of job types. The advice proved wise. Jef recalled that he had always wanted to work in the care sector when he was younger, so he remained alert to the possibilities. A few months later, he was offered a management position at a youth care agency.

'What do I want to be?' used to be a question for children. Now, however, it is also being asked by an increasing number of adults. Take Jef, a man in his fifties living in the south of the Netherlands – a facilities manager who had been working for the same municipality for 20 years. With the latest of many reorganisations being just around the corner, he was quite ready to try something else.

Normally speaking, Jef's decision would entail all sorts of practical challenges that would have to be overcome in a short space of time. For example, he would have to make up his mind about what he wanted to do and was able to do, and consider his opportunities on the local and

regional job markets. Fortunately, however, Jef had a cooperative and helpful superior who put him in touch with Loyalis, APG's private insurance division. Loyalis helps workers consider their future, both before and after retirement.

At Loyalis, Jef met a careers adviser. After a second interview, he received a login code for a new computer program, the 'Loopbaanrotonde' (Careers Roundabout). This program was developed by researchers of the Open Universiteit, who gathered the latest insights in the areas of competency management, job market issues and personnel management. Their conclusion was that more than anything else, people who are considering a career move need clarity. In other



FLOWING TRAFFIC LIKE WATER

The regional road running through Erp in northern Brabant had the village split in two – both physically and partisanally. Residents on one side wanted a ring road to cut the heavy flow of traffic through the village. Those in the opposing party argued that a ring road would destroy the landscape. Into the fray stepped the Wetenschapswinkel, or ‘Science Shop’ of Wageningen University (part of the Wageningen University & Research Centre), which was asked to supply a solution.

Over the years, the road running through the village of Erp had gotten busier and busier. The offenders were cars taking a shortcut to the motorway and lorry traffic heading to the local industrial park. In 2004, the municipality decided to build a ring road to the north and south of Erp in order to relieve the through road of traffic. It was a decision that would come to divide the community. A group of residents rose up against the plan and established a protest group called ‘Vereniging Erp Alert’ (‘Erp Alert Association’) which argued that a ring road would destroy the

landscape and result in not less, but more traffic. Supporters of the road responded by organising their own group, ‘Hoezo Erp Rustig?’ (‘Why Curb Erp?’), pleading in favour of its construction.

Keen to resolve the ‘impasse’, Vereniging Erp Alert turned to Wageningen University’s Wetenschapswinkel. Their call was quickly answered by a team of four researchers led by Derk Jan Stobbelaar. The team started off by talking with residents in order to get an idea of the biggest sticking points. They also asked residents to



University: www.wur.nl/UK/
Valorisation: www.wetenschapswinkel.wur.nl
(in Dutch)
Partner: www.erpalert.nl (in Dutch)

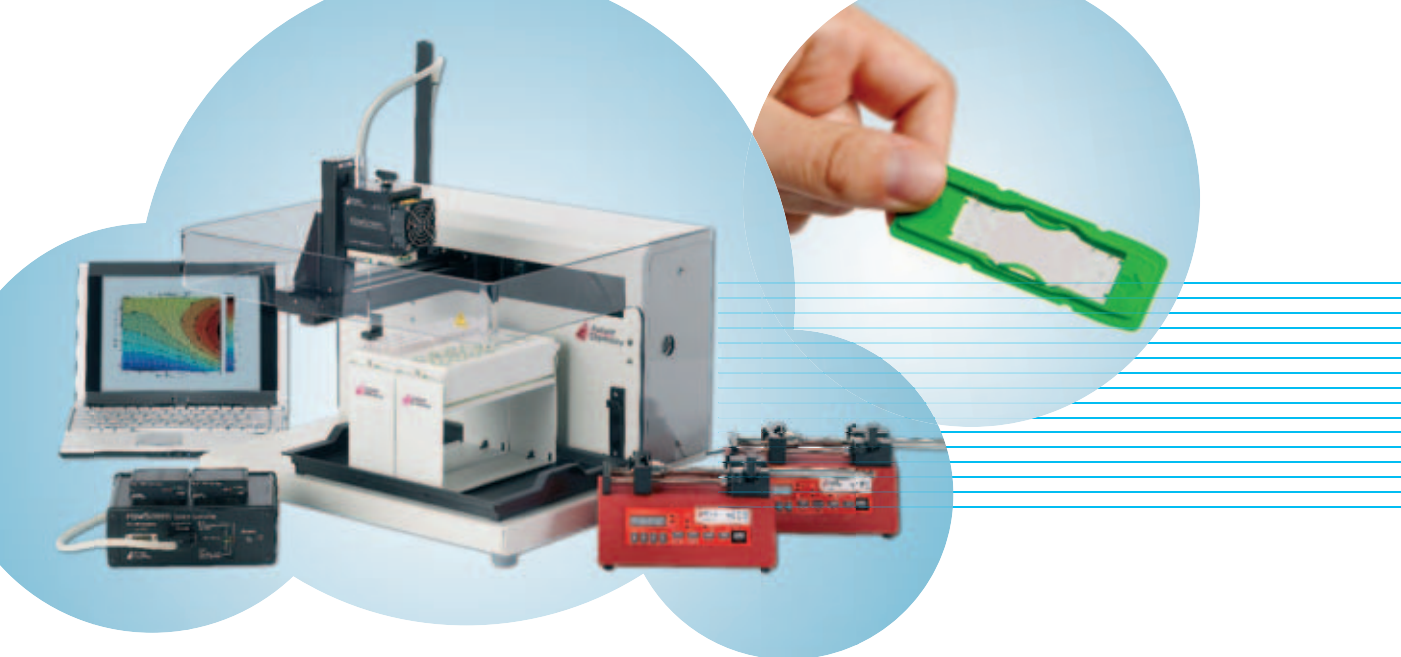
Wageningen University & Research Centre curbs village traffic

describe their ideal scenario. These discussions yielded a wish list consisting of four items. Specifically, the chosen solution would have to result in a reduction in the traffic burden, increased safety, improved accessibility and conservation of landscape quality.

Next, the researchers visited the various engineers who had provided input for the ring road development plans. As it turned out, there were at least ten alternatives to the ring road. Armed with this knowledge, the team sat down to do some number crunching. They used a model that defines the behaviour of traffic in terms of the movement of water: it always seeks out the point of least resistance. Unlike the engineering agencies before them, the researchers looked at the entire region in making their calculations, and not just at the bottlenecks. Stobbelaar explains: ‘The scale of the model network determines the result. But often the scale that gets applied does not extend beyond municipal boundaries. That’s true in the case of Erp, too, which has a whole stack of reports written from that perspective’.

Having done the math on each of the various alternatives, the research team was ultimately left with just one clear contender. This option combined a feeder road to the industrial park with traffic curbing measures in the village centre. In autumn 2007, the team presented its conclusion to Alderman Jan van Burgsteden, who took their advice into serious consideration and submitted it to a response committee. ‘The group included representatives from all the political parties’, Van Burgsteden says, ‘but didn’t deal in politics itself. Everyone who took part did so with a desire to resolve the issue and bring it – at long last – to a satisfactory conclusion’.

In autumn 2008, following thorough deliberation, the mayor and aldermen of Erp decided to abandon the planned ring road in favour of the solution presented by Stobbelaar and his team. The new plan got plenty of support from stakeholders. Among them was Mari Biemans, financial director of Van den Bosch Transporten in Erp, whom the Brabants Dagblad quoted as saying, ‘We are pleased with this plan. Aside from everything else, it will relieve Erp of traffic to the industrial park’.



EVERYTHING FLOWS

Most chemical processes currently take place in giant reactor chambers that must constantly be filled and emptied. Many chemists dream of replacing this process with a single, continuous process. Two Nijmegen-based researchers have brought this dream a step closer.

Everyone can recall those lab experiments in secondary school during which curious substances were dissolved in an Erlenmeyer flask. The flask would be heated above a Bunsen burner and, after a while, the colour of its contents would change - the chemical reaction had taken place. Many chemical plants still operate in the same way; their chemical processes take place in closed reactor chambers. A process starts after the necessary ingredients have been added and, if all goes well, the desired substances can be taken from the chamber once the process is completed.

Sometimes, however, things go wrong and the entire batch must be discarded as waste or, even worse, the reactor chamber explodes, leaving only wreckage. To prevent the occurrence of such

unpleasant events, chemists have for years been dreaming about chemical processes that take place in pipelines rather than in reactor chambers. The end product could then be collected at the end of the pipeline and transported away for sale. This new approach is referred to as 'flow chemistry'. One of its advantages is that chemical processes can be better controlled. If something starts to go wrong, action can be taken in the form of, for example, adjusting the amount of a substance added, increasing or decreasing the rate, and so forth. Intervening in this way is considerably more difficult with respect to processes that take place in reactor chambers.

Two Nijmegen-based chemists, Pieter Nieuwland and Kaspar Koch, have brought this dream a step

Radboud University Nijmegen



University www.ru.nl

Valorisation: www.ru.nl/valorisatie

Partner: www.futurechemistry.com

Radboud University Nijmegen brings the future of chemistry a step closer

closer. In the course of their doctoral research, they assembled their own 'microreactors'. These are small glass sheets in which they etched minute channels. Any substance chosen can be pumped through those channels by means of a device that they named 'FlowStart'. 'A small glass sheet replaces an entire chemical test laboratory - that's our concept in short,' explains Koch.

Truly new is the 'FlowScreen', a second device developed by Nieuwland and Koch. This new device makes it possible to use *flow* chemistry in an automated way. As Nieuwland explains, 'The testing of new molecules is often still done in the traditional way, step by step. In our devices, this testing is a fully continuous process that we can fine tune and optimise with our software.'

The devices developed by Nieuwland and Koch are very suitable for research in, for example, the pharmaceutical industry. And this is also their ace card. Although German companies have introduced microreactors into the market before, these were designed to produce large, or in any case larger, quantities. Chemical groups like Bayer or Hoechst were not interested because

too large a step was required. They are interested in the devices of Nieuwland and Koch, however. At the 2009 Achema exhibition, the major event for the chemical engineering and process industries, their stand attracted over 200 interested parties. Koch attributes this interest to the fact that the *FlowStart* and *FlowScreen* bridge the gap between the laboratory environment and the realities of production. 'We are a new link between the chemist in a white lab coat and the chemical engineer who designs the production process of an entire plant.'

To make their products available in the market, Nieuwland and Koch have since formed the company *FutureChemistry*. To do so, they received support from, among others, Participatiemaatschappij Oost Nederland, Fraunhofer Institut (the German organisation for applied scientific research) and the SKE project KERN, a Radboud University Nijmegen project concerning the utilisation of knowledge. Contracts with the first customers have been signed. These customers include Schering Plough, the company that took over AkzoNobel's pharmaceutical division.



LEXICAL PERPLEXITY

Game manufacturer Ubisoft was keen to market its brain trainer ‘My Word Coach’ in the Netherlands. But first it needed a 20,000-word database in Dutch – not exactly something you get by flipping through a dictionary. To the rescue came a Dutch-Flemish duo led by Tilburg University professor Antal van den Bosch.

A few years ago, game manufacturer Ubisoft introduced a brain training game called My Word Coach, developed as a tool to help English-speakers expand their vocabularies. After identifying the appropriate language level, the programme serves up unfamiliar words in a varied series of games, designed to teach players four or five new words a day when they play for 20 minutes daily.

My Word Coach met with rapid success, and Ubisoft turned its eye to the Dutch market. An afternoon of Internet sleuthing led the company to Antal van den Bosch, professor of Memory, Language and Meaning at Tilburg University.

His task – if he chose to accept it – was to fill the brain trainer with roughly 20,000 Dutch words, all classified into around 20 different levels of difficulty.

Van den Bosch recruited a Flemish colleague, Walter Daelemans, and together they set to work. Thanks to previous research, they already had access to a collection of texts totalling 600 million words. The first step in scaling that lexical mountain was to remove all redundant word forms: words like ‘larger’ and ‘largest’, for example, which derive from ‘large’. To narrow the collection down to only the root of each lemma, the researchers used a computer



University: www.tilburguniversity.nl/
www.uvt.nl/ticc
Valorisation: www.tilburguniversity.nl/research/tilburg/valorisation/
Partner: www.ubi.com

Tilburg University helps enhance command of Dutch

application which they had already developed, called Tadpole. ‘On a fast computer, Tadpole can process around 10,000 words a second’, Van den Bosch explains. ‘So tagging takes a total of around 1000 hours. We split that job up between several computers.’

After Tadpole had done its work, Van den Bosch and Daelemans had their computers do a further tally. They ran through the entire corpus of 600 million words again to determine the frequency with which individual words occurred, based on the idea that familiar and easy words will occur often, whereas relatively unknown and difficult words will be rare. Van den Bosch explains, ‘A prime word like “economy” comes up around 374,000 times (an average of once every 1500 words), while a word like “xylograph” (wood engraver) occurs only once in the entire corpus. Besides xylograph, there are tens of thousands of other words that also occur just once or twice’.

Ultimately, Van den Bosch and Daelemans were left with a list from which to select 20,000 words for My Word Coach. Rare words were selected for the most advanced levels, frequent words were placed in the easiest levels. According to Daelemans, making those decisions was ‘really tough and subjective. The difference between a level 1 and a level 20 word is clear, but that between a level 15 and level 16 word is impossible to gauge, so in many cases we let statistics be the judge’. As a last step, their selection was screened by two experts on Dutch for undesirable words and brandnames.

Thanks to the efforts of Van den Bosch and Daelemans, Ubisoft was soon able to put its Dutch version of My Word Coach on the market. Here, too, the product was a success, becoming one of the top ten bestselling computer games in the Netherlands immediately after its launch in spring 2008.



PLEASURE IN YOUR WORK

The ageing population in the Netherlands means that its working population is shrinking. Nevertheless, many workers remain absent from work due to illness for extended periods of time. Maastricht University came up with a way to reduce long-term absence due to illness.

Being ill is not pleasant; neither for the ill individuals themselves nor for their colleagues, customers or employers. Nevertheless, many workers remain ill for extended periods of time. Dealing with the problem is a challenge because long-term absence due to illness has many different causes, which makes it difficult to reduce. In recent years, the absenteeism rate has fluctuated between four and five percent.

Precisely because long-term absence due to illness is so intangible in terms of causes and nature, IJmert Kant of Maastricht University has been studying the phenomenon for many years. With the support of the Netherlands Organisation for Scientific Research (NWO), which funds

numerous research projects, he launched a study in 1998 into fatigue on the part of workers. Over 12,000 employees of 45 different companies and organisations were monitored for a four-year period. The study, known as the 'Maastrichtse Cohort Studie' (Maastricht Cohort Study), provided considerable insight into the key risk factors concerning long-term absence due to illness. Those factors differed considerably. As Kant explains, 'The respective setting in the industrial, care or education sector differs entirely from an office environment. The overtones of conflicts can differ and absenteeism patterns are not the same, just as customer contacts are dissimilar. In short, the interaction of factors varies and therefore also the risk.'



University: www.maastrichtuniversity.nl
Valorisation: www.maastrichtuniversity.nl/web/Main1/Onderzoek/ValorisatieOndernemerschap.htm
Partner: www.beter.com

Maastricht University is helping to reduce absence due to illness

When the study had been underway for some time, the Netherlands national news agency ANP devoted a report to it, which attracted the attention of Ate Berkouwer, commercial director of ABN AMRO Arbo Services (AAAS). His interest was immediately sparked: 'We had already been looking for an objective instrument to prevent absence due to illness for many years. It was therefore a great opportunity.' Berkouwer called Kant and, following a ninety-minute conversation, the matter was settled: they would jointly develop an instrument to determine the degree to which workers were at risk of long-term absence due to illness.

AAAS and Maastricht University decided to focus on the office sector first. Kant translated the outcomes of his research into a list of 34 questions. This list included questions like 'Are you currently being treated by a doctor?' and 'Has a traumatic event occurred in your immediate environment in the past six months?' The answers had to be translated into an unequivocal risk profile. Doing so was not easy because the different factors had to be weighed against each other. As Kant explains, 'Our calculation model is complex and cannot be compared with the calculation of a test result such as one found in Viva magazine.'

The questionnaire was christened the 'Balansmeter' (Balance Meter) and tested in an office environment. Almost 4,000 bank employees completed the questionnaire on an expressly voluntary basis. Gladys Tjin A Ton, involved in the test on behalf of AAAS, also stressed that results would remain confidential. 'We are aware that results could be threatening. They will therefore not be made available in any way to the superiors of the employees involved.' Employees with a high score were, however, called by the working conditions service. As Tjin A Ton explains, 'We deliberately opted to contact people by telephone so that we could explain the results and encourage them to schedule an appointment with the occupational physician.'

The method was successful. In comparison with the control group, long-term absence due to illness fell by 35 percent among the risk groups approached. According to Berkouwer, 'We invested considerably in the Balance Meter but it was more than worth it. We are currently working on the further development of the instrument and its use at interested employers. It's a good example of a successful meeting between the market and science.'



BANISHING THE BLUES

During hot summers, blue-green algae cause a great deal of inconvenience in bodies of water used by swimmers. They turn the water into a green soup in which no swimmer will venture. Together with engineering firm Arcadis, the University of Amsterdam developed a method to tackle the problem.

Blue-green algae are among the oldest organisms on earth. They are in fact bacteria, not algae, and have existed for around 3.5 billion years, and were the first organisms that, with sunlight, succeeded in converting water and CO₂ into sugars and oxygen - an achievement that made the development of other life possible.

As grateful as we may be for blue-green algae's early work, we are now inclined to condemn them in equal measure. Blue-green algae have gas bubbles in their cells and float on hot summer days, changing the surface of the water into a green mush. This is disastrous for water plants and fish, since they are then deprived of oxygen. It is also a problem for terrestrial and avian ani-

mals. Blue-green algae contain toxic substances that damage the liver, paralyse nerves or affect the skin. For this reason, provincial authorities issue prohibitions on swimming when there are too many blue-green algae in a given body of water.

Hans Matthijs and Petra Visser of the University of Amsterdam have been studying blue-green algae for many years. In the course of their research, they discovered that blue-green algae are very sensitive to hydrogen peroxide, the same chemical one can buy from a chemist as mouthwash. Studies carried out in aquariums had already revealed that fish and water plants are not affected by the chemical as long as the dose



University: www.uva.nl
 Valorisation: www.uva.nl/bureaukennistransfer
 Partner: www.arcadis.nl

University of Amsterdam combats blue-green algae

remains low. Matthijs and Visser put the two together and realised that, in hydrogen peroxide, they had a specific pesticide against blue-green algae that spares other life.

To make the application of the idea possible, the University of Amsterdam contacted engineering firm Arcadis, which built a special boat with tubes that reach the bottom of a body of water. Highly diluted hydrogen peroxide is homogeneously discharged into the water through those tubes. Following consultation with the municipal authorities of Veendam and the Hunze en Aa's district water board, the technology was tested in the summer of 2009 in Koetshuisplas, a body of water. This recreational location had been plagued by large quantities of blue-green algae for some time already.

The test was very successful. Prior to the intervention, there were 600 million blue-green algae in every litre of water, whereas after three days that number had dropped by a factor of ten.

After two weeks, only 3 million blue-green algae per litre of water were left. As project manager Renée Talens of Arcadis said at the time, 'We hope that the blue-green algae have taken such a beating that they will stay away for the rest of the summer.' For swimmers, the test was an unqualified success. Because there were less than 200 million blue-green algae in every litre of water, the prohibition on swimming was lifted after a few days.

Following the successful test, Arcadis and the University of Amsterdam applied for a patent on the peroxide-based technology. As Talens explains, 'This was a first experiment and we are happy that it succeeded. We will continue development work so that we can combat blue-green algae even more effectively.' As far as Matthijs is concerned, the next test can take place in Gooimeer lake close to his home in Almere. 'It's a dream, because it concerns a very large area. I cross it almost every day and see large spots. I'd like to tackle those.'



A HISTORY OF BLACK GOLD

Modern history is steeped in oil. Oil is a fuel for cars and airplanes, as well as a raw material for daily products such as plastics and detergents. In the 20th century, which has rightly been called the century of oil, Royal Dutch Shell was one of the largest oil companies in the world. From its creation in 1907 until today, the company has played a key role in the global oil industry and, for that reason, in the world economy at large.

Looking ahead is something that Shell never stops doing. As one of the largest multinationals in the world, it wants to be prepared for all eventualities. The company has therefore elevated the preparation of future scenarios to a true art. After all, one wants to know whether all those invested billions will continue to yield returns in the future.

Looking back is something that Shell does less well. The company knows exactly what it wishes to be but is less aware of how it has become what it is today. When its centenary was approaching, the company decided that it was

time for a corporate self-examination. It asked a group of Utrecht-based historians to find out how the company had developed in the twentieth century. CEO Jeroen van der Veer volunteered as a Second Reader of the manuscript.

The Utrecht-based researchers were honoured by the request. At the same time, however, they had no illusions about the scale of the task before them. Since 1907, Royal Dutch Shell had been a company with head offices in two cities (The Hague and London), operations throughout the world and a turnover that currently exceeds the GNP of many countries. To maintain order



Universiteit Utrecht

University: www.uu.nl
 Valorisation: www.uu.nl/onderzoekenmaatschappij
 Research: www.uu.nl/EN/faculties/Humanities/research/researchinstitutes/ogc
 Partner: www.shell.com

Utrecht University makes history

in their undertaking, the authors decided to work according to five main themes: the role of national and international politics, the role of technology, the influence of competition, Shell's internal organisation and worldwide operations. As Joost Jonker, a researcher at Utrecht University, explains, 'We adopted a conceptual approach. The narrative acquired a logic by being placed in a broader economic and social context.'

Of course the university insisted that the academic quality of the work had to be guaranteed. This was done by requesting free access to literally all archives. Shell was happy to grant such access. In addition, four Second Readers were requested, two from the company and two from the academic community. According to Jan Luiten van Zanden, professor of economic history, 'They actually never made comments like "This is too long". In fact they often asked that certain issues be explained in greater detail.'

In total, the Utrecht-based historians worked on the project for over five years. The result matched the effort: 1,700 pages divided into

four volumes with 2,000 illustrations and three DVDs. 75,000 copies were published in two languages and were intended mainly for current and retired Shell employees. The English edition was published by Oxford University Press.

Asked about the secret of Shell's success, Keetie Sluyterman, professor of business history, says, 'I believe that the company's Anglo-Dutch origins constituted a key strength. That dual nationality always made the company sensitive to international changes.' As the historians discovered, however, that advantage could also have a downside. They learned that tensions had run high between the Dutch and British branches in the years after the Second World War. 'The matter was discussed at the highest level of government, after which the decision was made to maintain the *status quo*.' Shortly before the company's centenary, that *status quo* did indeed end. Following the controversy about oil reserves, Shell became a company with one CEO and one head office in 2005. As Sluyterman says, 'That provided a nice concluding chapter to our book.'



COMPASSING THE PAINS OF SUFFRAGE

For many people, voting takes on a shade of sufferance as election day draws near. Voters have a hard time deciding which party or candidate to support with their vote. Play it safe and vote the same as last time? Or is it time for a change? For voters in 32 countries, the Kieskompas (Electoral Compass) website, developed by Amsterdam political scientist André Krouwel, provides an answer.

Voters are confronted with ever more and ever more difficult choices. The number of elections in which they can take part is growing, as is the number of parties for which they can cast their ballot. At the same time, the themes they need to consider are becoming increasingly complex, with issues like the General Old Age Pensions Act (AOW), mortgage interest deductions and the environment. Add to that the deluge of election information from newspapers, TV and the Internet reporting new insights, facts, opinions and developments on an hourly basis. It is little wonder deciding whom to vote for has become such a dilemma.

In 1989, Stichting Burgerschapskunde (Citizenship Science Foundation) introduced the Stemwijzer ('Vote Match') to help voters make a more informed choice. Voters could take a test - initially on paper, later on the Internet - and receive a personal voting recommendation. The tool proved very welcome, and Stemwijzer has drawn millions of visitors since its inception. But there were also critics. André Krouwel, a political scientist at VU University Amsterdam, was among them. He pointed out that people who completed the Stemwijzer were often matched with the wrong party because the method the tool employs is not reliable. He decided to devel-



University: www.vu.nl/en/index.asp
Valorisation: www.tto.vu.nl
Partner: www.kieskompas.nl/page/Home/1/en/content.html

VU University political scientist helps undecided voters

op his own tool, pairing up with the newspaper *Trouw* to introduce the *Kieskompas* website in 2006. The website became an instant hit with more than 3 million visitors.

Kieskompas works differently from Stemwijzer. To begin with, the product is different. Instead of giving people binding voting advice, *Kieskompas* tells you where you stand in the political landscape. For example, to which side are you drawn in socio-economic issues, the left or the right? Are your perspectives on cultural issues more conservative or progressive? To narrow down the field, *Kieskompas* asks voters to answer a series of statements. In contrast with Stemwijzer, however, statements dealt out by *Kieskompas* are not those formulated by politicians. 'I don't think we should just put our trust in the pretty words of Bos, Balkenende and Rutte', Krouwel explains, referring to the leaders of three of the Netherlands' major political parties. 'An election programme is a propaganda tool.' *Kieskompas* therefore formulates its own statements and assigns parties a position in the political landscape based on a scientifically-grounded method.

Kieskompas also allows users to indicate which themes are important to them. 'You have voters for whom there are three or four issues of real

significance. In that case, you only need to show them where in the political spectrum they stand in relation to those specific topics.' The degree to which someone trusts candidates is also taken into account. 'We ask about the extent to which they would trust politicians with, say, their wallet, and whether they think the party leaders are competent. Whether they are capable of solving key problems.'

In the lead-up to the 2006 parliamentary elections, *Kieskompas* drew 3.4 million visitors, and has experienced explosive growth since then. Dutch voters used the tool for the elections of the Provincial States (2007), the district water boards (2008) and the 27 countries of European Union (2009). International voters could turn to the site, too, for example for the Belgian parliamentary election (2007), the US presidential election (2008) and the Israeli and Portuguese parliamentary elections (both 2009). In 2007, *Kieskompas* established itself as an independent enterprise with a view to optimising the service it provides for the public. 'I won't claim that *Kieskompas* is perfect', Krouwel says, 'but it's many times better than Stemwijzer. And we will continue to improve voting advice application as two major research projects have been developed alongside *Kieskompas*.'



University: www.ou.nl
Valorisation: www.fi.uu.nl/dwo/
Partner: www.epn.nl/

INTELLIGENT FEEDBACK

Proper learning is primarily a matter of practising, and good practice requires good feedback. The Dutch Open University developed a computer system that enables the provision of such feedback.

Until 2015, at least three-fourths of all teachers in secondary education will retire. Since good teachers constitute the 'fuel' of education, that phenomenon will have disastrous consequences if proper action is not taken. Only teachers know their students by face and name. Only they know how to motivate their students to learn. And only they are aware of the special prompts required by students to solve difficult problems. In other words, taking teachers out of the classroom means taking the soul out of education.

Throughout the Netherlands, strenuous efforts are therefore being undertaken to prevent imminent and acute problems in secondary education. The Dutch Open University is one of the places where those efforts are being under-

taken. This is not immediately apparent, since the Dutch Open University hardly resembles a traditional university. Students learn mainly through self-study and there are only a few lecturers. Precisely because of its structure, however, the Dutch Open University has considerable experience with methods that enable students to learn properly without continuous monitoring by teachers.

Dutch Open University students also complete the Computer Science programme mainly through self-study. The mathematics and logic components in particular involve considerable practise through the completion of assigned exercises. Johan Jeuring, professor at the Faculty of Computer Science, is conducting research into the way in which students solve

Dutch Open University helps students with exercises and assignments

the problems included in the exercises. Do they, for example, approach exercises in the right way? And, just as importantly, do students apply the calculation rules in the right way?

Based on this research, Jeuring and his team developed a system that automatically gives students feedback on their actions. The system can check, for example, whether students are writing formulas that could actually exist. Two successive multiplication symbols in a formula do not mean anything, for example, and the system can alert students to such occurrences. The system can also check whether students are making errors when rewriting one formula into another. The system does not allow, for example, multiplying one part of an equation by two without multiplying the other part by two as well. It can also be, however, that students are not making errors as such but are taking a route that will not lead to a solution. In this case, too, the system alerts students accordingly.

Jeuring developed the system for subjects arising from mathematics and logic. Hundreds of students have since used it and achieved good learning outcomes more rapidly. This success attracted the interest of a major Dutch publisher of mathematics textbooks for secondary schools. The Dutch Open University system is linked to the online exercises that the publisher provides with its books. Thousands of students are therefore able to benefit from the 'intelligent feedback' that they may in future no longer be able to receive from their teachers.

Jeuring was also asked to participate in the European Math-Bridge project. This project focuses on the problems concerning the link of mathematical knowledge and skills between secondary and tertiary education. Within the framework of the project, researchers developed online solutions that students can use to independently improve their knowledge of mathematics. Good feedback is also invaluable in this context.



RESEARCH INTO BLOOD CLOTTING

Cerebral haemorrhages, myocardial infarctions and pulmonary embolisms cause numerous deaths throughout the world. They are often the result of thrombosis, the formation of a blood clot in a vessel. Researchers at Maastricht University developed a way of measuring which individuals are at increased risk of thrombosis.

Expressed in crude terms, the human body is a large bag of blood. Each square metre of skin holds two and a half to three litres of blood. The risks are therefore high. An attack or accident can result in rapid bleeding to death. For this reason, the body has developed a range of mechanisms to ensure that our blood clots in the event of an injury. One of those mechanisms involves the enzyme thrombin, which converts a certain protein in the blood (fibrinogen) into blood clots (fibrin).

Unfortunately, our blood clotting mechanism is not a very discriminating one. It springs into action as soon as any rupture occurs anywhere in

a blood vessel. That was good in a time when our early ancestors roamed the savannah and were menaced by predators. However, now that we are technologically more sophisticated and living longer on a massive scale, we are reaping the bitter fruits of thrombin's eagerness to act. The arteries of older people often harden. Thrombin treats such areas as though they were ordinary points of damage; the blood clots and thrombosis occurs, resulting in myocardial infarctions, cerebral haemorrhages and pulmonary embolisms. These conditions are responsible for approximately a quarter of all deaths that occur each year.



University: www.maastrichtuniversity.nl
Valorisation: www.maastrichtuniversity.nl/web/Main/Onderzoek/ValorisatieOndernemerschap.htm
Partner: www.synapsebv.nl and www.stago.com

Maastricht University measures blood clotting

Because thrombosis is so dangerous, medical professionals wish to be aware of which patients are at high risk, since such knowledge makes it possible for them to refer more groups at risk to care services for thrombotic patients and thereby save potentially hundreds of lives a year. The risk in question can be determined by measuring the amount of thrombin formed in clotting blood. This is done by taking samples from clotting blood every few seconds and measuring the quantity of thrombin in each sample.

Unfortunately, the traditional method used to determine the thrombin level is extremely labour-intensive and not very reliable. For this reason, Maastricht-based researcher Coen Hemker started looking, already in the 1980s, for a way to automate the method and make it suitable for clinical use. The research of Hemker and his team led to the discovery in the 1990s of a molecule that is split by thrombin; a process that results in a fluorescent fragment. That molecule therefore served as an indicator of thrombin activity. By measuring changes in the

fluorescence of a blood sample, Hemker and his team were able to make the formation and disappearance of thrombin visible in twenty samples simultaneously and in real time.

When Hemker retired in 1999, he formed the company Synapse together with Maastricht University. The aim was to make his invention available to medical professionals and researchers throughout the world. This led to the formation in 2004 of a subsidiary, Thrombinoscope, which sells the equipment, software and chemicals required. Work on improving the method continued at Synapse. In 2008, Nijmegen-based researcher Sander van Berkel discovered a number of more suitable indicator molecules.

Synapse's success did not go unnoticed. In 2009 it was taken over by Diagnostica Stago, a French company that is a market leader in the sale of instruments and chemicals in the area of blood diagnostics. Following the takeover, Synapse continued as an R&D group within Stago.



MAKING IT BETTER FOR CHILDREN

Surgical operations are usually very taxing, especially for children. The situation is further complicated if surgeons are unable to properly reach the area that has to be operated on. Paul Broens, paediatric surgeon at the University Medical Center Groningen, developed a way to secure the legs of children during operations.

Sharifa is seven months old and requires an operation on her urethra. The situation is unpleasant for her and her parents. It is also difficult for the doctors. Once Sharifa has been anaesthetised, the doctors must tape her legs to the operating table. It is not an ideal solution, since Sharifa's position is not stable. Moreover, assistants have to remove the tape and lift her legs on a number of occasions to allow the surgeon better access. And all this time, visibility of the area being operated on is not optimal. The result is a tense atmosphere

and, unsurprisingly, everyone is exhausted at the end of the operation. Sharifa also has a bruise on her leg where one of the assistants accidentally squeezed too hard.

Although Sharifa's case is imaginary, paediatric surgeon Paul Broens of the University Medical Center Groningen has experienced similar, real-life situations often enough. It was something that increasingly bothered him, and he therefore started looking for alternatives. He looked throughout the world to see if there was anything



University: www.rug.nl and www.umcg.nl
Valorisation: www.rug.nl/tlg/index
Partners: www.imds.biz and www.pedistirrup.com

University Medical Center Groningen designs paediatric leg support

that could secure the legs of children during operations. 'There wasn't. There is a leg support that is used during operations on adults, but simply nothing for children and infants.'

Together with colleagues of the University Medical Center, Broens decided to develop a leg support for children himself. The team soon produced a prototype. It attracted considerable attention. 'While we were developing the support, I noticed a lot of interest from colleagues working at other hospitals. Evidently, there was considerable demand for a paediatric leg support.' Broens decided to patent his invention. He then looked for a company that could market the paediatric leg support. 'That was a rather tense time, since we didn't know if companies would be willing to invest. We also didn't know if the market was big enough. As paediatric surgeons we're a relatively small group.'

Through Business Generator Groningen, Broens came into contact with IMDS BV, a Groningen-based company that develops medical

equipment. Cooperation was excellent. Broens and his team showed IMDS the prototype, which then forwarded suggestions to make the support more practical and aesthetically pleasing. 'Our prototype was made mainly of stainless steel. IMDS suggested making it out of carbon-based material.' Months of intensive contact between the technical and commercial staffs of IMDS and Broens and his team paid off: 'After comprehensive testing, I had to admit that the new paediatric leg support was a lot better than our original prototype as a result of the company's input.'

Within a couple of weeks, the paediatric leg support was being used within the University Medical Center Groningen on a daily basis. Interest in the device is rapidly increasing in the rest of the world. According to Broens, 'The paediatric leg support is already being used in around forty hospitals across the world and the number of locations at which the device is used is increasing by the week. Our Dutch and international colleagues are very enthusiastic about it.'



KEEP ON MOVING

Although almost everything can be entered into a computer, it remains difficult to digitalise human movement. Nevertheless, two students of the University of Twente succeeded in doing so and are now conquering the world market.

'We actually wanted to become a sport brand,' explains Casper Peeters, who, together with Per Slycke, heads Xsens. This Twente-based company is one of the Netherlands' fastest growing technology firms and produces sensors which make it possible to record movement. These sensors, which are no bigger than matchboxes, are packed with electronics and are in demand everywhere. Customers include big names like Gearbox, developer of the video game *Half-Life*, and Industrial Light & Magic of George Lucas, director of *Star Wars*.

When they formed Xsens in 2000, however, Peeters and Slycke were not targeting the film and gaming industries. Both had studied techni-

cal physics at the University of Twente and both had a passion for sport. The idea therefore emerged to develop a sensor that would allow runners to see how fast they were running. Funding from the University of Twente ensured that the speedometer became a reality. The patent still adorns a board room wall. However, the inventors quickly realised that a sport brand would be going a bridge too far. As Slycke explains, 'A tremendous amount of money is needed and you also become a marketing company, whereas we are technical physicists.'

Peeters and Slycke therefore shifted course: Xsens would become a technology supplier. For this reason, the company made use of its

UNIVERSITY OF TWENTE.

University: www.utwente.nl
 Valorisation: www.kennispark.nl
 Partner: www.xsens.nl

Twente-based physicists capture movement

connections with the university. Peter Veltink, a researcher at the University of Twente, speaks with admiration of the company's products. 'Simply put, an Xsens sensor is a spirit level and a compass in one. This combination allows you to determine orientation. The sensor also includes a gyroscope to enable measurement of the change during a movement.' For a real motion tracker, however, more is needed; a real motion tracker must be capable of recording changes in position in three dimensions. Veltink thought that it could not be done. 'They proved that it was possible after all.'

Cooperation with the university was successful. As Slycke explains, 'We were able to further develop our product thanks to the progress made at the University of Twente in the areas of algorithms and signal development. We secured an exclusive licence to the university's know-how in the summer of 2004.' Events proceeded rapidly thereafter. Between 2006 and 2009, Xsens was named one of the fifty fastest growing companies in the Netherlands on four successive occasions.

Xsens' success is partly due to the MVN, a suit

containing 17 sensors that makes it possible for very accurate data on human movements to be entered into a computer. In the past, doing so was very time-consuming, as movements first had to be filmed and then digitalised. Xsens technology makes the intermediate filming step unnecessary and, in a manner of speaking, enters people into a computer in one go. The owner of gaming company Gearbox recognised the potential immediately. According to Peeters, 'He is a visionary who focuses strongly on new technologies. He jumped - almost literally - at the opportunity presented by the suit when he first saw it.' Many producers of games and films have since followed his lead. To serve the market better, Xsens even had to open an office in Los Angeles.

The company has now also entered a new market. A 'biomechanical' version of the MVN, intended for scientific research into the musculoskeletal system, has been produced. In comparison with the standard MVN, this biomechanical version is capable of gathering both greater quantities of data and more detailed data. The first of these advanced suits were delivered to their new owners in the closing weeks of 2009.



TU/e Technische Universiteit
Eindhoven
University of Technology

University: www.tue.nl
 Valorisation: www.tue.nl/ondernemen
 Partner: www.gpgstirrups.com

Eindhoven University of Technology helps riders

STIRRUPS WITH SUSPENSION

Horse riding is a beautiful but dangerous sport. There are approximately half a million active equestrian athletes in the Netherlands. Of those, almost 75,000 suffer an injury each year. Together with Eindhoven University of Technology, a manufacturer of stirrups introduced an invention that makes the lives of riders considerably more pleasant.

From a distance it all looks so elegant: riders and their horses speeding across flat areas and clearing obstacles. When observed from nearby, however, the violence associated with the activity becomes apparent. A horse can easily weigh six hundred kilograms and approximately 40 per cent of its mass is muscle. Tremendous forces are therefore released when a horse moves. In such a situation, minor errors can have major consequences.

Riders have a rough time even if they do not fall from their horses. Their backs and knees con-

tinuously have to absorb shocks, an exhausting experience and one that can lead to injuries in the long term. GPG Horse Suspensions, a company based in Weert, the Netherlands, therefore developed a type of stirrup that absorbs some of the shock by means of a metal spring. Although the stirrups worked well, they could nevertheless be improved and made more durable and lighter.

The company therefore approached Eindhoven University of Technology and, through the university's Innovation Lab, was referred to IME Technologies, a company set up by the Depart-

ment of Mechanical Engineering to provide further assistance to regional businesses. According to Dr Jan van Helvoirt, director of IME Technologies, cooperation was very smooth. 'I wish it always went like that. The GPG people knew exactly what they wanted right from the start and were also to the point. They were open to our advice and immediately incorporated virtually all of our comments into their work.' IME was therefore able to make rapid progress with respect to making calculations and conducting the necessary tests for GPG.

Richard Cornet of GPG Horse Suspensions was also happy with the way things went. 'We carried out tests with different models. In the end, our simplest design proved most suitable. Other models did not meet applicable requirements or were too expensive to launch in the market.' Ultimately, a device the size of a matchbox that operates with pneumatic suspension was developed. Riders can secure the device to the upper side of their normal stirrups. All they have to do before riding off is

make an adjustment for their own respective weights.

The smoothness of the cooperation meant that the project could be completed in less than six months - a record. According to Cornet, 'I did not expect that we would be able to go from good idea to product so quickly.' The development costs were also low, which meant that the price of the stirrup with suspension could also be kept low - 125 euros a pair. Since the world of equestrian sports is by nature rather conservative and not inclined to embrace novelties, such a competitive price is an important factor. The key sales case, however, remains the considerable comfort offered by the product. As Cornet explains, 'Olympic champion Ankie van Grunsven tested one of our earlier models and was very enthusiastic about it. Belgian jumper Ludo Philippaerts and Dutchman Gert-Jan Bruggink were extremely positive about the type now available in the market right from the start. Philippaerts said that he was always uncomfortable while jumping. Those days are now gone.'



BRAIN-TRAINING

The Netherlands is contending with a growing number of youths with serious behavioural problems at risk of derailing. Social workers find it all but impossible to reach these children. Tilburg University is developing a new method to help problem youths calm down.

Jimmy is 14 and not exactly an easygoing youngster. He gets irritated quickly and has trouble keeping a handle on his emotions. Jimmy has few friends and is not doing well at school.

Lately, he has begun to skip school altogether. On the street he has fallen in with other boys like himself. Not long ago they stole a handbag from an elderly woman.

The Netherlands is contending with more and more children like Jimmy. Some of them end up with child and youth psychiatrists – 2.5 percent of all youths aged 18 and under in 2001. But it is not just their numbers that are growing. The nature of their problems is expanding, too. Aside from behavioural issues, many of them also have

ADHD. Or, as one of the boys puts it, 'I always feel restless in my head. Things are constantly whizzing around in my mind'.

Chijs van Nieuwenhuizen is a psychologist/psychotherapist in Eindhoven and is studying youths like Jimmy. She noticed that, as a group, they are difficult to treat. The fact is that traditional methods aim mainly at talking and practising, but social workers have a hard time using talk to connect with ADHD youths. They are simply too restless and too easily distracted.

Dealing with the behavioural problems exhibited by youngsters like Jimmy therefore means first dealing with their ADHD. Scientists already know



University: www.uvt.nl/tranzo and
www.uvt.nl/neurofeedback (in Dutch)
Valorisation: www.tilburguniversity.nl/research/tilburg/valorisation/
Partners: www.reiniervanarkelgroep.nl and
www.ggze.nl (both in Dutch)

Tilburg University helps problem youths calm down

that ADHD is related to a lack of fast brainwaves and an excess of slow or very fast brainwaves. Recent treatments for ADHD have been trying out a method known as neurofeedback. This is a technique that involves measuring brainwaves and linking them to a simple computer game, for example with a car that the player has to keep on the road. ADHD patients who produce enough fast brainwaves are rewarded by staying on the road. Patients who produce too many slow or very fast waves end up in a virtual ditch and have to start over. The idea behind the game is that patients will unconsciously learn to produce enough of the 'right' brainwaves.

Van Nieuwenhuizen, who is also a professor at Tilburg University, decided to test this method on youngsters like Jimmy – youngsters with criminal and/or non-standard behaviour, ADHD and other disorders. She began her research with a pilot study at two mental health centres in the Dutch province of Brabant. The study lasted

around four months and was organised into 40 half-hour sessions in which the youths played the computer game to train their brains.

Initial clinical results of the pilot are in and look promising. Youths who take part in neurofeedback training say they feel calmer and function better. 'The sessions have really helped me', said one, 'and I even enjoyed them. They've helped me to sleep better, be calmer and less chaotic, and I'm able to plan things now'. Parents and counsellors note a difference as well. 'At home, he has kept calm all week. That has never happened before.' A follow-up study is underway and will run until 2012. At its conclusion, Van Nieuwenhuizen hopes to have developed a method that will be able to help youngsters like Jimmy.



STEERING CLEAR OF MISERY

Traffic jams cost time and money and lead to frustration on a daily basis. Researchers at the University of Amsterdam thought of a way to predict traffic jams that enables motorists to opt for an alternative route in good time.

It is a regular occurrence for many in the Netherlands: getting behind the wheel in good spirits, individuals head off to an appointment only to end up in a traffic jam. The result is considerable frustration for both the individuals concerned and the people they had been scheduled to meet. Moreover, all that waiting costs money. According to the Netherlands Institute for Transport Policy Analysis, the damage to society caused by traffic jams amounted to approximately 3 billion euros in 2006.

Precisely because traffic jams are so damaging, the Directorate-General for Public Works and Water Management is trying to do something about them. Detection loops that measure vehicle speeds have been fitted in many motorways. If the average speed of vehicles drops excessive-

ly on a given section of road, the Department for Traffic Information and Traffic Management issues a traffic jam alert. For many motorists, however, that alert comes too late, as they are either already in the traffic jam or can no longer avoid it.

Would it not therefore be far better if motorists were given advance notice of where traffic jams were forming so that they could take those areas into account? Bram Bakker, a computer science researcher at the University of Amsterdam, and his colleague Edwin de Jong certainly think so. They had already been working for some time on the development of a system for power suppliers that recognises patterns in large quantities of data and is capable of projecting those patterns into the future. The technique



University: www.uva.nl
 Valorisation: www.uva.nl/bureaukennistransfer
 Partner: www.adapticon.nl

University of Amsterdam spin-off predicts traffic jams

involved is known as 'data mining' and looked very promising. In the mid 2000s, Bakker and De Jong therefore received prestigious research grants on two occasions from the Dutch Technology Foundation (STW) to enable them to carry out further development work.

In 2008 the technique had been developed to a degree that made it possible for Bakker and De Jong, with the support of the University of Amsterdam, to form the company Adapticon BV. Together, they shifted the course of the company and began focusing on a system that could predict where traffic jams would form. This predictive capability is based on historical data. As Bakker explains, 'Everyone can predict that a traffic jam on the A2 motorway is likely to occur in the area of Culemborg during rush hour. We go a step further and specify the exact probability of such a traffic jam occurring and the delay it will cause.' To make their predictions even more reliable, Bakker and De Jong also use current data on, among other things, the weather and road works. 'For example, we

know from the past what road works mean with respect to traffic jams,' Bakker explains. 'If road works are planned at any location, we immediately enter the data into the system so that motorists know in advance how such road works will affect their respective travel times.'

Adapticon is currently working on applications that will enable motorists to see, shortly in advance or one or two days in advance, the level of traffic jam-related inconvenience associated with a certain route. To develop those applications, Adapticon is having to work with the navigation industry's key parties, namely manufacturers of navigation equipment, designers of digital maps and administrators of online route planners. 'Cooperating with the heavyweights in the field can be a tense experience,' says Bakker. Nevertheless, those at Adapticon are confident about the future. An assignment for Navteq, a large American company, was completed successfully, thereby bringing a world in which motorists can steer clear of misery a step closer.



AROUSING EELS

Young eels are being fished, fattened and eaten on a large scale. Now the species is nearing the brink of extinction. Two biologists from Leiden came up with a method to encourage reproduction amongst eels in captivity.

Eels not only taste good, they are also a cheap source of protein. As animals, they are far more efficient in converting food to flesh than pigs or cows, for example. And so fishermen the world over cast out their nets for young eels. These glass eels, as they are called at this stage, are fattened up and subsequently served up. It could have been the ideal form of factory farming, were it not for the fact that eels in captivity do not reproduce. As a result, the large-scale fishing of glass eels is bringing the species to the brink of extinction.

reproduce. To observe their behaviour, Van den Thillart set up a number of large Plexiglas tubes with a constant water flow. 'We let them swim continuously in the tubes. After three months, the males' testes had tripled in size. Things were a bit more complicated for the females, which stop producing eggs after swimming for a few weeks. We think the females may actually require a temperature stimulus that they get when they enter the Sargasso Sea.' That would explain why eels in hatcheries fail to spawn: no migration, no offspring.

Leiden biologist Guido van den Thillart has been studying eels for years. Amongst other things, he discovered that their annual migration to the Sargasso Sea is crucial to how these fish

Armed with this knowledge, Van den Thillart devised a way to fool nature. He recruited Herman van Spaik, a colleague whose research focuses on the stem cells of zebrafish. Together,



University: www.leidenuniv.nl
 Valorisation: www.luris.nl
 Partner: www.newcatch.eu

Leiden University helping eels spawn

they sought artificial techniques to spur eels to sexual maturity. 'The trick', Spaik says, 'is to give the fish sex hormones continually over the course of a few months'. They hit on the idea of an artificial hypophysis, or pituitary gland: take some stem cells from a zebrafish, add a few eel genes and implant this in an eel.

The outcome was even better than expected. Not only did the artificial pituitary gland bring on sexual maturity, it also resulted in mature eggs. This was a true first, and the two biologists were quick to put a patent on their invention. Since then, they have set up two companies: New Catch, which focuses on hatching eels and other fish species, and ZF-screens, responsible for the ongoing development of artificial hypophysis technology.

But there is still some work to be done before supermarkets start stocking genuine 'farmed eels'. As Van den Thillart explains, 'We still have

to figure out what to feed the larvae. No one has managed to do that yet, but recently we got an excellent tip from a Japanese biologist. He said that larvaceans in the Atlantic Ocean are probably a food source for eel larvae'. New Catch is now working on techniques to reproduce these larvaceans in conjunction with the Blijdorp sea aquarium, which has considerable experience in cultivating such organisms.

Meanwhile, there is also a party interested in starting an experimental hatchery for glass eels, located, quite appropriately, in the fishing village of Volendam. The province of Noord-Holland and the Ministry of Agriculture have already granted a large grant for this new venture. If all goes according to plan, the new corporation will set up shop in the basement of 't Hemeltje café in Volendam. And in a few years, and with a bit of luck, visitors to the museum upstairs will be able to see the new eel larvae break out of their eggs.



BRIGHT IDEA

Many elderly nursing home residents with dementia have troublesome sleep-wake rhythms. They may spend their days dozing, while waking up frequently during the night. Eus van Someren, a neurobiologist affiliated with the Netherlands Institute for Neuroscience, the Leiden University Medical Centre (LUMC) and VU University Amsterdam works on solutions.

Imagine yourself a demented resident of a nursing home. Chances are, you'll spend your days sitting around in the common living room, since nursing staff have little time to spare for taking patients on a stroll. Spending your days just sitting inside certainly won't do any favours for your heart and circulatory system, bones or metabolism. But, as neurobiologist Eus van Someren discovered, sitting indoors all the time also has a negative effect on the sleep-wake rhythm. Why? The human cycle of day and night is regulated by a biological clock in our brains. 'That clock needs a stimulus in order to do its job, and the stimulus is bright light.' Unfortunately, indoor light is never very bright. Even on

an overcast day, the light outside is around a hundred times brighter than that inside.

The fact that elderly nursing home patients with dementia tend to spend their days sitting around indoors means that their biological clocks are failing to get the regular stimulus they need. 'When elderly people don't get enough light, as happens in nursing homes, it upsets their day-and-night cycle', Van Someren explains. 'So they may end up dozing during the day and prowling the halls at night.'

As soon as Van Someren realised how essential light is for undisturbed sleep, the solution was



University: www.vu.nl/en/
Valorisation: www.tto.vu.nl
Partner: www.slaapregister.nl
(in Dutch; other languages will follow)

VU University Amsterdam researcher helps demented elderly patients get a good night's rest

clear. Newly build facilities should aim for large high windows, skylights and conservatories. Or, where this is not an option, ceilings could be fitted with more lamps instead. This would help residents to better maintain a cycle of sound sleep during the night and relatively good functioning during the day. He and his team decided to put his theory to the test and launched a study at 12 nursing homes. 'We installed lamps with an intensity of 1000 lux in half of them, and lamps of 300 lux at the rest. Additionally, in each condition, half the patients were given an extra evening dose of melatonin, which is a hormone that may help to keep our biological clocks on track.'

The additional light proved to do the trick, sometimes especially in combination with melatonin. Residents' cycles of sleeping and waking improved, they were less restless and depressed. Even their mental capacities profited. 'Though their overall decline continued, in relative terms they were doing slightly

better. The effect is comparable to that of the cholinesterase inhibitors prescribed for many dementia patients with Alzheimer's disease.' But we should be careful not to expect too much, he warns. 'This is not to say that sufficient light will prevent dementia. However, it trains the biological clock and can relieve sleeping problems. So stepping outside to walk for an hour or so each day certainly wouldn't hurt.'

Van Someren is now working on getting the public involved in a major national study to learn more about what causes poor sleep and to identify possible solutions. Participants simply fill in an online form every now and then with a few questions about sleep, stress, health and so on. Van Someren is appealing not only to insomniacs but to good sleepers, too, since they may just harbour the key to helping poor sleepers get a good night's rest. Everyone is welcome to register, with no further obligations, at: www.slaapregister.nl.



University: www.erasmusmc.nl
Valorisation: www.erasmusmc.nl/tto/ktr/afdeling_kennistransfer
Partner: www.handshoemouse.com

FITTING LIKE A GLOVE

Although computers have lightened workloads, they have also given rise to new problems. Workers whose professional activities are based on the use of a computer frequently have problems concerning their necks, arms and hands. Erasmus MC designed 'Het Paard' (The Horse), now generally known as the HandShoeMouse, to help prevent such problems.

Everyone who works with computers on a regular basis is familiar with the phenomena: a burning sensation in the hands and wrists, no strength in the arms and a cutting pain in the neck. Mouse arm syndrome, a form of repetitive strain injury (RSI), has become an epidemic. In recent years, it affected 15 percent of the working population. In two to four percent of workers, the condition resulted in absence due to illness. For some, the effect went even further. One in every three hundred workers ended up on benefits under the Invalidity Insurance Act as a result of mouse arm syndrome.

Generally, RSI therefore causes a lot of mis-

ery, and indeed damage. According to a 2005 estimate of the Netherlands Organisation for Applied Scientific Research (TNO), RSI costs Dutch society in excess of six billion euros a year. It is therefore not surprising that a host of parties have spent years exploring ways in which to prevent mouse arm syndrome. After all, even a small improvement has a major impact in this regard.

Chris Snijders, affiliated with Erasmus MC, has been conducting research into complaints concerning the arms, neck and shoulders since the 1980s. His research revealed that the complaints referred to were related to the fact that people must now frequently complete squeezing and

Erasmus MC Rotterdam designs ergonomic mouse

gripping motions or maintain such positions. As a result, the muscles are continuously tense and the passage between the first rib and clavicle can narrow. As Snijders explains, 'Blood vessels and nerves running through this passage can even be squeezed, as a result of which the arms and hands are undersupplied, waste substances are not transported away to a sufficient degree and the muscles acidify.' Those squeezed nerves often cause a tingling sensation - the first sign of mouse arm syndrome.

Armed with this knowledge, Snijders, together with Paul Helder, focused on the operation of computer mice. They investigated muscle tension in arms and hands and discovered that ordinary mice were often too small. According to Helder, 'While operating an ordinary mouse, the hand cramps up because the fingers are continuously raised to prevent undesired clicking.' Contrary to their expectations, the same applied to so-called ergonomic mice, irrespective of whether these were specially shaped mice, trackball mice or pen-and-tablet combinations. In all cases, excessive squeezing and gripping were required on the part of users.

An improvement was clearly needed. The resulting design was so large that it followed the shape of the hand. Users are therefore able to rest their hand on the mouse in a relaxed position and only have to tense their muscles when operating the buttons. The design was called 'The Horse' and transferred to Hippus NV, a spin-off of the university. The name 'HandShoeMouse' and tagline 'the only mouse that fits like a glove' were opted for to appeal to the international market.

The road from design to production proved long. As Helder explains, 'It was initially very difficult to convert our aesthetic, flowing design into an attractive product through rapid prototyping.' Arranging the financing was also problematic, though Rabobank and a number of shareholders came to the rescue. In any case, the challenges were overcome and the HandShoeMouse has now been in the market for some time. The website testimonials indicate satisfaction on the part of users. One of them, an architect, stated, 'I no longer have to fight back tears of pain while working.' It is certainly an encouraging note for the designers.



DANCING WITH THE STARS

Translate the results of scientific research for the general public - that is the assignment associated with the 'Academische Jaarprijs' (Academic Year Prize). Students of Radboud University Nijmegen took on a major challenge and opted for an obscure physical phenomenon. Their efforts won them the main award.

Each year, the Academic Year Prize Foundation challenges scientists and students to make recent breakthroughs in scientific research accessible to the general public. In 2009, a team of Radboud University Nijmegen opted for the theme of cosmic rays. Cosmic rays consist of particles from, for example, the sun or supernovas. When they reach our atmosphere, they collide with molecules like nitrogen and oxygen. These collisions release more particles, which in turn collide with other molecules in the atmosphere and thereby release further particles. Cosmic rays therefore cause a constant stream of particles to rain down on the earth.

Physicists have been aware of this phenomenon for some time already, as it was discovered at the beginning of the twentieth century. The Pierre Auger Observatory located in western Argentina has been in operation for a number of years. It is a giant complex, taking up a surface area of 3,000 square kilometres, and is managed by 17 countries, including the Netherlands. Measurements taken up to 2007 showed that cosmic rays with the highest energy do not reach earth from all directions. Rather, they originate mainly from parts of space in which giant black holes are located.

Radboud University Nijmegen



University: www.ru.nl

Valorisation: www.ru.nl/valorisatie

Partner: www.academischejaarprijs.nl

Radboud University Nijmegen makes cosmic radiation hip

How can a phenomenon as intangible as cosmic rays be explained to the general public? Led by Sijbrand de Jong, a group of Nijmegen students and researchers came up with a solution: let the rays determine what music is played during a dance event. As De Jong explains, 'We opted for dance music because we wanted to appeal mainly to young people.' The team submitted its idea to the Academic Year Prize Foundation. The jury was enthusiastic and allowed the Nijmegen team to further elaborate its idea and present it on a website and on TV.

Erik van Schaaik was willing to do the animations. As De Jong says, 'I wanted to know if he was good. "Sure, he can do it," I was told. So the short film was made by someone whose work, as it turned out later, almost became the Dutch entry for the Oscars.' It was one of the reasons the team made it to the following round. Developments proceeded rapidly thereafter. Office Broomer, an organiser of dance parties, was contacted for the event itself. Office Broomer had a 15-metre-high, dome-shaped tent. The idea therefore emerged to project cosmic and

atmospheric events on the inside of the tent so that visitors would be able to see where the rays come from.

Enthusiastic about the idea, Office Broomer contacted Black Hole Recordings, the record label started by DJ Tiësto and Arny Bink and that was willing to assist with respect to the music. There will ultimately be three levels of music: 'cosmic conductor' (at the entrance), 'cosmic ambient' (in the tent) and 'cosmic remix' (through headphones). All music will be determined to a greater or lesser extent by the impact of cosmic particles.

When all arrangements had been made, the municipal authorities were eager to cooperate in order to give the event a place of honour at the parties that will take place in Nijmegen as part of the 2010 International Four Days Marches. The whole package was enough to win the main award, an amount of 100,000 euros. Radboud University Nijmegen granted the same amount. Visitors will therefore literally be able to dance on stardust in 2010.



CLEAVING THE WAVES

Coursing the seas at high waves and winds at high speeds – not only the Royal Navy and Coast Guard dreamed about, but the off shore industry as well. However, since stormy seas will simply make a fast ship jump out of the waves and plummet back into the water with a smack, a dream it remained. Until Lex Keuning of TU Delft came up with the axe bow.

A calm sea can be as smooth as glass. And when it is, a ship easily reaches top speeds and slices through the water. But during stormy weather, the sea is transformed into a raging landscape of pointed peaks and deep valleys. Experienced seamen know better than to go at full throttle under those conditions. A ship can drop from the cliff of a wave (slamming) with a force that is large enough to cause damage to both the construction and crew.

by the police and customs, he naturally also had to take onboard measurements. 'During one of those expeditions there was an accident in which the ship slammed down from the wave. My kneecaps were shattered. Looking back, that was the moment where I unknowingly must have decided to devote more of my time and energy to improve deployability and safety of the fast fleet of ships on the seas and oceans.'

In the nineties Keuning developed part of the solution in the form of the 'Enlarged Ship Concept'. The crux was to make the vessel longer, narrower and move the superstructure for the crew towards the back of the ship. These changes



University: <http://home.tudelft.nl/en/>
 Valorisation: www.tudelft.nl/samenwerken
 Partner: www.damen.nl

TU Delft lets ships course stormy seas

yield all sorts of benefits, including less resistance and improved ship movement in waves. Also, the ship's deployability improves substantially, as the possibility that slamming occurs decreases substantially. 'Crews aim to avoid extremes', Keuning says, 'You only have to experience the tremendous slam of one of those waves once in your life to say to yourself: never again'.

As soon as the Dutch Royal Navy got wind of Keuning's invention, they went to Damen Shipyards, asking them to cooperate with Lex Keuning in designing fast patrol ships based on the Enlarged Ship Concept, for deployment at the Dutch Antilles. This ultimately resulted in the Jaguar, the Panther and the Puma.

Having experienced a taste of success of new ship development, Keuning now teamed up with Damen, the Dutch Royal Navy and the US Coast Guard to pursue a new idea: the Axe Bow. As Damen's Jaap Gelling explains, 'This revolutionary design comprises an extremely high and deep bow, that stands upright and is extremely slender: the flare in shape that a regular bow

would show is totally absent. Actually, the Axe Bow is an extreme version of the Enlarged Ship Concept, where a number of these characteristics were already applied, but in a less pronounced way. The resulting Axe Bow literally cuts through the waves. Additionally the bow extends that deep below the waterline that even in high waves the front of the ship hardly ever rises from the water. Combined with the sharpness of the shape, it prevents slamming from occurring in ships with Axe Bows. Compared to fast ships with a conventionally shaped hull, the highest vertical acceleration is decreased with a factor four in Axe Bow ships.

The axe bow has gone on to become a huge success. Damen Shipyards has an exclusive license agreement on the patent and has already sold 26 Axe Bow vessels. Another 13 vessels are currently in production. The majority of these ships are deployed in the offshore industry. Axe Bow ships have also been sold as patrol boats and recently three of them have even been sold as 'dinghy' for a Mega-yacht. Imagine that: a dinghy that is between 50 and 67 meters long!



Universiteit Utrecht

University: www.uu.nl

Valorisation: www.uu.nl/onderzoekenmaatschappij

Partner: www.enceladus.nl

CONQUEROR OF GIANTS

Diseases like rheumatism are difficult to combat. Utrecht University came up with a solution. Researcher Bart Metselaar is trying to further develop the drug.

One to two percent of the Dutch population suffers from a form of rheumatism. The lives of these individuals are not easy, because the course of the disorder is unpredictable. Sometimes the disease is mild. At other times, however, it can unexpectedly become acute. Its consequences - pain, fear and frustration - are then overwhelmingly manifest.

Rheumatism is an autoimmune disease in which macrophages are key players. Although its exact cause is unknown, its symptoms can be countered, for example, with corticosteroids. These agents have serious side effects, however, namely cataracts, bone decalcification and high blood pressure. Sustained use for a long period of time is therefore not possible. Lower-

ing the exposure to corticosteroids in terms of quantity and period of time is not a solution as it fails to alleviate symptoms.

To escape this dilemma, Bart Metselaar of Utrecht University came up with a ruse. He incorporated corticosteroids in minute droplets of fat, or liposomes. The liposomes deliver the inflammation inhibitors automatically to the sites of inflammation caused by rheumatism. As Metselaar explains, 'It is known that blood vessels close to inflammations have holes in their walls; holes through which our liposomes can pass. In the affected joints, they subsequently encounter very damaging inflammatory macrophages that "see" the liposomes as a tasty meal. When they proceed to eat the liposomes,

Utrecht researcher wages war on rheumatism

however, the corticosteroids are released and silence the macrophages.'

Of course, a very specific kind of fat droplet must be used to make the ruse work. According to Metselaar, 'The liposomes must not be larger than 100 to 150 nanometres, their outer walls must contain a lot of cholesterol and lipids with a high melting point, and they must have polymer coatings. The foregoing properties ensure that the balls of fat can remain in the bloodstream for a long time.'

Metselaar was able to prove that his invention worked well, at least in rats. Nevertheless, major industrial players were not interested. 'Large pharmaceutical companies considered the market for the application of corticosteroids as being too small and the risk too high.' Metselaar thought otherwise. Once the patents could be transferred to the university, the choice was therefore simple: together with Universiteit Utrecht Holding BV and a few colleagues, he started his own company to further develop the drug. Metselaar named the company Enceladus after the giant - one of the Gigantes - of Greek mythology who was buried under Mount Etna

on the island of Sicily and who was said to be responsible for the volcano's irregular eruptions.'

Metselaar was assisted by many upon the launch of Enceladus. Together with the Holding of Utrecht University, he worked on the new company's patent portfolio. Stichting Biopartner of the Ministry of Economic Affairs provided funding to temporarily cover his financial expenses. Together with the pharmacy of Slotervaart Hospital, he developed and prepared the drug for use in humans. Radboud University Medical Centre was willing to conduct the first clinical trial among rheumatic patients.

The provisional results of the new drug, called Nanocort, are promising, not only in the treatment of rheumatism but also in that of multiple sclerosis. There are even indications that Nanocort can be used against cancer. As Metselaar explains, 'Liposomes probably enter tumours through openings in new, as yet improperly formed blood vessels. Once there, the substances enclosed in the liposomes that inhibit inflammation also appear capable of strongly inhibiting tumour growth in an indirect manner - a very surprising result.'



University: www.wur.nl/UK/
Valorisation: www.wur.nl/NL/over/samenwerking
(in Dutch)
Partner www.natuurkalender.nl (in Dutch)

BIOLOGICAL CLOCK GAINING TIME

The climate is changing – that much is clear. But what does that actually mean? For many of us, the warnings of melting polar ice caps, rising sea levels and expanding deserts are simply too abstract to really visualise. So Wageningen University, part of Wageningen University & Research Centre, and the Dutch television broadcasting company VARA teamed up to zoom in on the consequences of climate change.

A polar bear fashioned from car tyres which launches an oil drum at passing cars. This statue was put up by a group of activists from the city of Den Bosch last year as a way of drawing attention to the climate issue. At the same time, it expresses just how difficult it is to get people interested in something they cannot visualise. This is a problem the VARA programme *Vroege Vogels* ('Early Birds') also found itself wrestling with in the early years of this millennium. The broadcaster had been looking for a vehicle to bring the issue of climate change to the fore, but

how could it do that without coming across as nagging?

Its answer came in the form of Arnold van Vliet, a lecturer at Wageningen University. Van Vliet was engaged in a project aimed at linking up the wide range of nature societies active in the Netherlands. His dream was to create a network in which thousands of volunteers would share and maintain all their observations of Dutch flora and fauna. Van Vliet's initiative captured the interest of *Vroege Vogels*, which saw the project's

Natuurkalender sheds light on climate change

potential for bringing climate change closer to home. From this partnership, a new initiative would ultimately be born: the *Natuurkalender*, or 'Nature Calendar'.

Natuurkalender is a website that collects data about ecological changes in the Netherlands. Maintained by 7000 volunteers, it compiles their daily observations of significant events in the natural world. Such observations include where and when the first barn swallow makes its appearance or when the leaves on the horse chestnut trees begin to unfurl. Similar reports are made for dozens of different animals and plants. Each observation is entered according to a strict protocol, which is already quite a task in itself.

But the website is not restricted to observations alone. Natuurkalender takes all this ecological information and links it with climate data such as temperature and precipitation. The result is a database that provides a clear indication of the state of nature's 'clock'. And those indications are worrying. Its analysis of 180,000 observa-

tions reveals that the seasons are out of joint, with spring starting earlier year by year, summers getting steadily warmer and autumns steadily longer. 'We may have to let go of our approach to splitting up the year into four seasons of three months each', Van Vliet opines. 'If you want a sign of the climate problem, you can't get more tangible than that.'

Natuurkalender brings together a wide range of parties. First and foremost is Wageningen University, with Van Vliet coordinating the project as a whole. VARA's *Vroege Vogels* is responsible for bringing the results to its large interested public by announcing findings on a weekly basis. Also involved are special interest groups like Dutch Butterfly Conservation, the Dutch Mammal Society and Vogelbescherming (bird protection society), which provide support and recruit volunteers. Most important, however, are the 7000 volunteers who take to the trails year in, year out, to observe how nature is doing. Without their efforts, we would never know that nature's 'clock' is gaining time day by day.



MAKING KNOWLEDGE USEFUL

The Dutch universities have two main tasks: to educate at an academic level and to conduct scientific and scholarly research. In fulfilling these tasks, they provide one of the key underpinnings for our modern knowledge society. The more than 30,000 doctors, lawyers, engineers, teachers and others who graduate from higher education each year are continually raising the bar on Dutch professional expertise, and the more than 25,000 scientific articles that scholars publish annually are devoured by medical specialists, R&D business professionals, policy advisers and other researchers.

Alongside education and research, however, universities also have a third key task: they make discoveries – lots of them. They develop new devices, formulate new protocols, create new designs, devise new rules; the list goes on. And universities also play an active part in conveying their discoveries to society at large. This yields all manner of innovations, from new products to better treatment methods or more efficiently designed spaces and buildings. The term used to describe this task is 'valorisation'.

Facilitating knowledge transfer

The task of making discoveries and presenting them to the wider world is all but simple and straightforward. In fact, universities rely on a broad spectrum of tools to facilitate this process. Similar to the myriad of aspects involved in the development of educational programmes – designing curricula, creating educational spaces, gathering teaching material, recruiting and training qualified staff – universities likewise have to make all sorts of provisions to bring innovative discoveries to interested users. Broadly speaking, these provisions fall into two categories. In the first are measures that universities put in place to help match parties in search of innovations with relevant discoveries (bringing users to discoveries). In the other are steps they take to promote promising discoveries for which demand does not yet exist (bringing discoveries to users).

The central point where all these activities and expertise meet are the valorisation centres set up by individual universities. Known by such names as 'Technology Transfer Office' (TTO) or simply 'Valorisation Centre', they help to bring discoveries to users, and vice versa, and offer expertise in a range of areas including ownership rights, subsidies and business management. Parties outside the university circuit may not always realise that these offices exist, operating behind the scenes as they do to mediate with knowledge consumers.

BRINGING USERS to discoveries

Top institutes

Large corporations and government bodies are faced with the constant challenge of needing to serve clients and citizens with ever greater speed and efficiency. Innovation is essential. Universities are keen to help. Working within a network of so-called 'top institutes', they engage with businesses and government in partnerships focusing on joint research and on finding viable solutions for real-world problems. The Netherlands has 12 such top institutes: nine in the domain of technology – in areas such as plastics, ICT, nutrition and life sciences – and three in the domain of social science subareas like pensions and urban policy.

SME centres

For many small and medium enterprises, the scale of the top institutes is too big to be a good fit. They are not interested in long-term, structural partnerships with universities but in a place where they can turn with questions, and in the expertise that universities can provide. More and more universities are meeting this demand by setting up 'SME centres' where regional business owners can come with questions and get customised advice.

Science shops

Imagine that you are a member of a residents' committee and are seeking legal advice in a conflict with a tenant. Or, you sit on a neigh-

bourhood council and are trying to find out how much air pollution will be generated by the new ring road. To answer questions like these, eight universities have established so-called 'science shops' (wetenschapswinkels), which cater largely to less financially resourceful parties. Several universities have combined their SME centre with a science shop, while at others both exist side-by-side.

Network meetings

How do you make sure that parties both within the region and outside it know about all the services that your university can offer? After all, no matter how great your product is, if you don't advertise, no one will buy it. To advertise their services, more and more universities are scheduling regular 'science cafés'. Essentially a form of network meeting, these events introduce interested parties to the work being done at the universities and to the researchers themselves.

Graduation research and work placement projects

Students are a virtually inexhaustible source of good ideas, energy and enthusiasm, and are always eager to sink their teeth into a juicy problem. Having realised this, a growing number of universities are building websites on which businesses and public organisations can propose topics for graduation research and work placement projects, and where students can 'offer' their talents.

Bringing discoveries TO USERS

Start-ups

University employees and students are constantly coming up with new applications for which there is no specific demand. In many cases, the university will first explore whether there is any external interest in using the discovery. If there is, the two parties reach an agreement on the conditions for use. But what if there is no interest from external parties? In that case, universities are increasingly opting to launch a new business based on that product. Often, the inventors themselves set up the business – in nine out of ten cases with support from the university along the way. That support can be financial in nature, but can also relate to operational management, intellectual property rights and so forth.

Holding companies

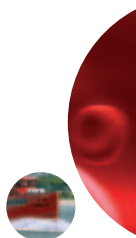
At any one time, a university may have dozens of businesses which it is helping along the long road to success. In exchange for their support, universities are typically issued shares in the company. Each university has established its own independent legal entity – usually a limited company that acts as a holding company – to control these blocks of shares. This arrangement prevents any overlap between a university's public tasks and its risk-bearing commercial activities.

Accommodation and science parks

Entrepreneurs who are just starting out with university support are often very keen to meet people in a similar position. Talking to other entrepreneurs can help head off mistakes, provide inspiration and unexpected cross-pollination may lay fertile ground for new ideas. Many universities have responded by establishing collective on-campus business premises with favourable terms where budding business owners can set up shop. As they expand, such businesses often prefer to stay on or near the campus. Over the years, this has led to the development of 'science parks' – business parks that accommodate a high density of knowledge enterprises.

Education in entrepreneurship

Entrepreneurship is not something you are born with, it's something you learn! More and more universities are therefore building entrepreneurship into their curricula. Eight of the Dutch universities have partnered together in so-called 'centres of entrepreneurship'. Here, students learn all the ins and outs of starting a business and develop the skills needed to get it up and running. ■



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