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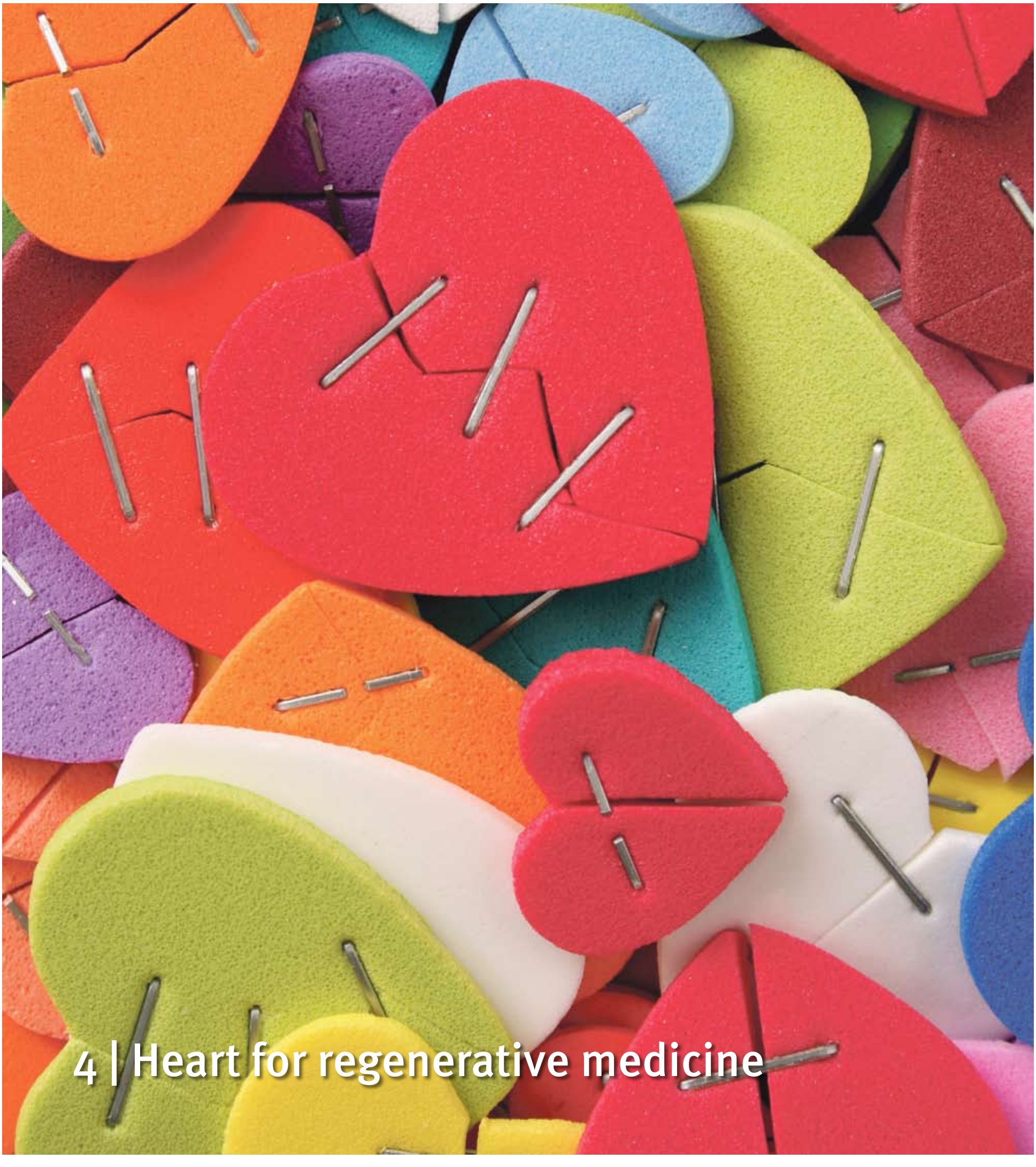

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Every now and then, I return from an interview genuinely excited as it dawns on me I was just treated to a private lecture by an absolute expert in a fascinating field. And it's a privilege I'm paid for at that! I experienced one of those very moments just before Christmas. A day after this Cursor is published, prof.dr. Carlijn Bouten will be delivering her inaugural speech, of which she's already given me a taste. Inspired by the picture she painted of her research, I started on the job I'm really paid for, and the result can be found on page 4. Hopefully, I've managed to convey at least some of that private lecture's magic.

Was TU/e celebrating a department's bankruptcy? Surely, in a time of forced cutbacks, a more sober reception was in order? Surely, the money that was now literally going up in smoke could have been used for board grants? The fireworks spectacle in light of the Meta-Forum's highest point during TU/es New Year's reception made for some 'oohs' and 'aahs', but there was definitely an occasional 'what?' as well. According to university secretary Harry Roumen, it's unnecessary to deny oneself everything in times of thrift. Well, at least not a 5,000-euro fireworks show - an absolute giveaway according to events manager Annelies Verschuren. TU/e had managed to cut a really good deal, show-wise. Nobody bothered to comment on the event's much more substantial check for drinks, by the way.

Technische Universiteit Eindhoven University of Technology

Rewwwind
www.tue.nl/cursor

Our Rewwwind feature provides you with snippets of last week's news. What happened online after the previous Cursor magazine was published?

Major fireworks in 'trying times'

January 10, 2012 - The serious -financial- challenges for the year to come were only shortly touched upon. In his New Year's speech in the Hoofdgebouw last Monday afternoon, January 9, TU/e's chairman of the Executive Board dr.ir. Arno Peels focused especially on the university's successful anniversary year.

Afterwards, the old and the New Year as well as the highest point of the Meta Forum were celebrated with major fireworks. Inappropriate, as some pointed out on Twitter. "Everyone's saying there's no money, but apparently firing money 'into thin air' is fine", said ID student Dennis de Klein.

Police find remains of missing student

December 22, 2011 - On Thursday afternoon, December 22, police found the remains of 26-year-old Youri Bicker from Breda, in the water of Breda's Markkade. The master student of Biomedical Engineering had been missing since December 19, after having attended a party in Breda's city center. The police assumes a fatal accident. Relatives have been informed.

Government money to cash Brabant knowledge

December 22, 2011 - TU/e will be receiving five million euro from the departments of Economic Affairs, Agriculture and Innovation (EL&I), and Education, Culture and Science (OCW). The money is meant for tailoring education and research to applications that are socially and commercially interesting. TU/e will be carrying embark on the project along with Fontys University of Applied Sciences, the Noord-Brabant Development Agency (BOM), and companies within Brainport Development NV.

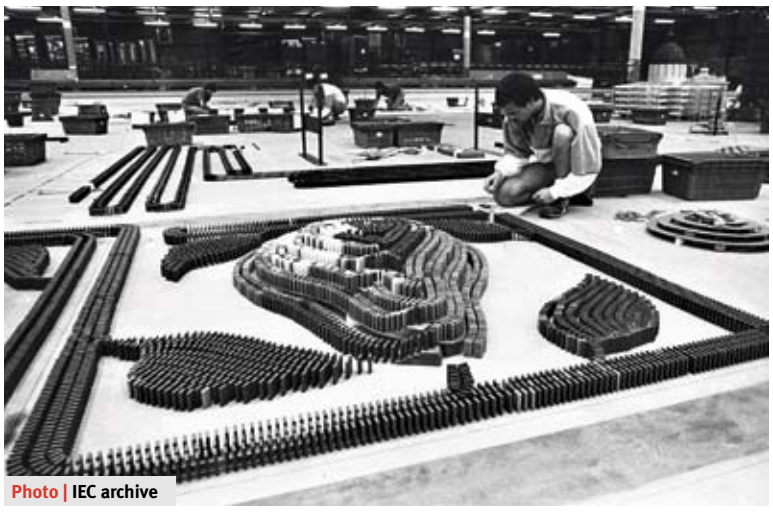

Photo | IEC archive

Photo | Bart van Overbeeke archive

Flashback

Record 2011 versus 1986

Being mentioned in the Guiness Book of Records is cool. In 1986, 45 students of all three Universities of Technology (supervised by our own dr.ir. Kees van Overveld) broke a record by toppling 1,250,000 domino tiles in the Stassen hall in Lisse. It's hard to imagine today, but back then, all cracks and holes in the hall's structure were sealed tight so any possible vermin could be easily killed with poison gas. Another noteworthy fact: these students spent over a month building flower fields, bridges and harbors out of domino tiles.

A slightly more environmentally-friendly and less time-consuming record was set by Eindhoven students on August 26, 2011. On that day, 1,274 students planked on the seats of the Philips soccer stadium. On January 4, the certificate granting a mention in the record book certificate finally reached STU, by the way. (NS)

Clmn
House-hunting and stereotypes

Last autumn I started my internship at a company in Bergen op Zoom. Since it's far from Eindhoven I decided to move closer. Surprisingly, my house-hunting turned into overcoming stereotypes.
The first one: "Students organize parties and bother neighbors". Since Bergen op Zoom is not a student city, there's no student housing. Finding private accommodation is also problematic because most house owners suffer from the prejudice mentioned above and prefer working people. Thus, I decided to search for a room in Roosendaal but there I faced another stereotype: "Female tenants are cleaner than male ones". I was rejected several times because I am a guy and landlords were afraid that I would mess up their property. Since I can't become a girl I decided to move to Breda where I was invited to several 'kijkavonds'. There, I was rejected because Dutch tenants preferDutch candidates. It's not so much a stereotype but rather a cultural comfort phenomenon. It's easier to live with someone speaking the same language who can be your drinking buddy.
So I decided to return to Eindhoven and use the services of the housing agency. However, applying for several agencies (except StudentEindhoven and Vestide) I faced another stereotype: "Students are not financially reliable". Many agencies rejected me or asked me to provide a working person who'd vouch for me. Since I didn't have one, and being tired, I almost gave up.
Fortunately, I soon found a room with another agency, but still this story shows that even in the Netherlands there are stereotypes, even though this country is famous for its open-mindness. Nevertheless, this experience taught me that giving up is not a solution and every stereotype can be overcome by applying a certain level of persistence and patience.

Sultan Imangaliyev, from Kazakhstan, is a student of Systems & Control, Department of Mechanical Engineering

Vox Academici

Prof.dr. Paul Koenraad, professor of Photonics and Semiconductor Nanophysics

Will the latest nanowires speed up computers?

Prof.dr. Paul Koenraad. Photo | Bart van Overbeeke

Over the past years, More's Law has been heavily debated. The idea that the number of transistors that can be placed on a computer chip doubles every two years due to technological advances, is now openly questioned. Miniaturizing the system is limited by physical restrictions related to the material transitions (interfaces) and quantum effects in the device. Yet last week, an Australian research group published her latest atomic nanowires in Science. It turns out that on these naowires there are no apparent quantum and interface effects, so the signal is transmitted perfectly. What's so special about these wires, and are they really that promising for chip technology?

"It's true we want everything to be as tiny as possible", says Paul Koenraad, professor of Photonics and Semiconductor Nanophysics at the Department of Applied Physics. "And by now, we've reached a level of research at which a single consciously-applied impurity atom, also called doting atom, can make a major difference. Impurity sounds negative, but it can be compared to adding salt and pepper to your soup. They're the seasoning. Impurity atoms we add to silicon for example, such as phosphorus atoms, make for better conduction. The ultimate dream is to create a transistor with a single phosphorus atom - it doesn't get smaller than that. Of course, a transistor like that will also need tiny wiring, and that's exactly what the Australian researchers have successfully developed."

"We're talking wires measuring one by four atoms in diameter, they're unbelievably small. It's quite impressive for people to be able to make them, but what's truly wonderful about this particular study, is that these nanowires still behave according to Ohm's law. For those who've forgotten about Ohm: the current through a conductor between two points is directly proportional to the potential difference across the two points. It was expected that on an atomic level, quantum effects originating from moving electrons would influence the current intensity. It didn't happen, which is exceptionally good news: surprisingly, the nanowire works just as well as a standard brass wire."

"In our group, we make a different kind of nanowire - slightly thicker at 20nm - and have proven that when doting atoms are too close to the interface, conduction isn't as good. The Australians have a great technique to prevent just that, and can even apply doting atoms at locations that have been previously determined. In short, they cover a layer of silicon with hydrogen atoms, remove them from a certain spot using a scanning-tunneling microscope and coat the new pathway with phosphoric atoms. It's deliberate local 'pollution' that perfectly fits the new field of solotronics, as I recently postulated in an review article in Nature Materials. After all, to create nanotransistors, we'll have to work with a very specific box of tricks."

"It's taken some ten years to create these nanowire circuits and there's still room for improvement. And what's great: a PhD candidate from our group will be leaving for Australia to work as a postdoc with the group there. In the short run, I don't see any widespread uses. Rather, these nanowires may be used in future quantum computers that can calculate extremely complex problems. And we probably won't be needing many of those. For faster home computers we still have to rely on ASML for now." (NT)

TU/e starts off 2012 with major fireworks

TU/e New Year's reception at the Hoofdgebouw on Monday, January 9, saw approximately **450 guests**. Together they consumed **3,123 drinks**, **1,750** of which were **beers**, and enjoyed **1,500 snacks**.

During his speech, chairman of the Board Arno Peels showed a PowerPoint presentation counting **126 slides** (mostly pictures) to support his retrospective of the past luster year.

After the speech, **100 kilograms** of fireworks including **244 'mines'** and **48 'flowerbeds'** were set off to celebrate the highest point of the Meta Forum building. The show, which was entirely computerized and lasted **5,13 minutes**, cost TU/e **5,000 euro**.

Photo | Bart van Overbeeke

Heart for regenerative medicine

Completely curing patients who now have to undergo lifelong treatment, that's the promise of regenerative medicine, and prof.dr. Carlijn Bouten's (1967) dream. In an attempt to realize that dream, not only does she work long hours at the lab, she also stays in touch with doctors and patients all the time. On Friday, January 13, Bouten will deliver her inaugural speech.

In regenerative medicine, damaged tissue or organs are repaired with the help of living tissue and cells. This may be done by injecting stem cells, or implanting tissue that was cultured in the lab, such as cardiac valves. "Regenerative medicine goes beyond supporting the body by means of medication in an attempt to fight an illness," says Carlijn Bouten. "It's a one-time intervention after which you let the body do the rest. This approach can be especially beneficial to people who suffer from chronic or congenital conditions and are currently looking at lifelong treatment."

The use of bodily cells and tissue knows numerous advantages. Take patients with a cardiac valve defect, for example. Today, when people receive an artificial cardiac valve, they often need to take blood thinners or medication to prevent rejection. Using a bodily heart valve that's been cultured in the lab, these problems are non-existent. And what's more, a bodily valve grows as the heart does, whereas today, children receiving a new cardiac valve have to prepare themselves for numerous surgeries.

All in all, a patient would be much better off with a cultured valve. Although such magical valves don't exist yet, they will in the near future. At Bouten's home base, the Soft Tissue Biomechanics and Tissue Engineering research group, people have been working on growing bodily heart valves. The group has already earned substantial grants and is approaching the actual implementation of cultured valves in patients, mostly with the help of successful spinoff QTIS/e.

Right now, Bouten and her fellow researchers are already working on their next step: growing tissue inside the body by implanting a biodegradable material that temporarily takes over the function of extracellular matrix, the framework the cells 'live in'. In living tissue, said matrix consists mostly of collagen and elastin, proteins regulating the tissue's sturdiness and elasticity. Cells surrounding the implant are supposed to nest in that artificial framework, being attracted by special attractants. Once in the implant, the cells will colonize the uncultivated area and gradually create an extracellular matrix from proteins while the plastic matrix slowly dissolves.

Carlijn Bouten. Photo | Bart van Overbeeke

According to Bouten, one of the major advantages of this in situ method is that it doesn't involve any complex regulations and ethical issues that surround the growing of bodily tissue in the lab. "For example, you might wonder whom a cultured heart valve belongs to. Is it the patient's, because they donated their cells? Or does it belong to the doctor or the people who've cultivated the cells? With in situ, you don't implant living tissue; it's a dead implant. Regulations for doing that have already been outlined quite a while ago. It's also much cheaper than growing cells in a laboratory, a process that also requires extreme cautiousness at that, to prevent infections."

The cells colonize the uncultivated area

The in situ technique is still in its infancy, Bouten stresses. "We still have a lot to learn about how tissue grows on an implant, and how exactly the plastic dissolves. It's the reason we mimic the procedure outside the body first. And we're also working on imaging techniques to be able to track the process inside the body as well.

You obviously can't just operate on people to check the process' progress, and we don't want to sacrifice any animals if we don't have to."

Another line of research Bouten is particularly excited about, concerns the regeneration of cardiac tissue. "If someone suffers a heart attack, that's because part of the heart is no longer supplied with oxygen due to a clogged blood vessel. Without oxygen, cells die. The problem is that cardiac tissue barely regenerates. Instead, scar tissue appears. Scars on the skin tend to disappear after a while, but after a heart attack scars remain on the heart forever. Eventually, this leads to flabby cardiac tissue, decreasing the heart's capacity. In the lab, we create mini tissue that can take over the heart function – contraction for pumping blood – locally."

Growing larger slabs of tissue is a lot harder than creating cultured mini tissue, since it's not just a matter of giving it more time to grow, says Bouten. "We're now able to grow tissue the size of a two-euro coin, but only if they're less than a millimeter thick." Thicker tissue causes the inner cells to choke: there's not enough oxygen, unless it's supplied by a blood vessel, and that means you'll have to grow those as well. "Unfortunately, it's still very hard to have blood vessels grow along with the tissue and subsequently attach them to the existing circulatory system. My colleague Daisy van der Schaft is mostly working on that right now."

All in all, growing large chunks of tissue is an expensive process, meant for experts only. It's one of the reasons Bouten's in favor of implanting 'intermediate products' that continue to grow inside the body and are eventually adopted by it. "In the future, I think fully-grown tissue will be especially useful as test systems for new medication."

Growing larger tissue with blood vessels may become commercially viable if cultivated meat is grown on a large scale for consumption. Bouten once worked for the Eindhoven Cultivated Meat research, which is currently led by the previously mentioned Van der Schaft.

Bouten is very much aware of the fact that the social impact of her research will depend on the acceptance of doctors, and patients' susceptibility. For that reason, she wouldn't dream of locking herself in the lab. She's spent much time at Utrecht UMC, Utrecht University's hospital. "I've worked at cardiothoracic surgery (heart and lung department, ed.) to get to know the field. I've spent a lot of time in operating rooms to see what happens in there."

In the operating room, the first female professor of Biomedical Engineering realized she would have to adapt her product already in the earliest of stages to reach her goal: placing it inside the patient. "For example, we started working with human products rather than animal ones. For cells to grow, nutrients are needed, which normally come from animal blood serum.

"I've spent a lot of time in operating rooms to see what happens in there."

We switched to human serum." She has another example of a seemingly simple yet essential practical insight she picked up from the operating room:

"An artificial heart valve comes with a ridge for ease of attachment, so we'll have to make sure to grow that, too."

You have to really work closely with everyone who'll stumble upon your product at some point, including insurers, is Bouten's conclusion. "You have to work together on this, because you'll never make it on your own." (TJ)

Bouten will deliver her inaugural speech on Friday January 13, 16.00 in the Blauwe Zaal.