“In actual fact the garden was laid out in 1917,” scientific director Bob Ursem admits over the noise of a percolating coffee machine. “But the concept of the garden dates back to 1908, when Professor Van Iterson came up with the idea.”

The interview starts in a hurry, which turns out to be typical of Ursem, who is bubbling over with stories and ideas, constantly interrupting himself when even more important ideas present themselves. From his office Ursem enjoys one of the best views of the entire University of Technology, with lush greenery (which he is immune to) and an instrument-bedecked tree that is part of a test. Nature and technology go hand in hand in the field of technical botany.

For the future engineer to fully understand the processes that are required to obtain the precious products from plants he must be given the opportunity to study the crops that form their basis in the way they are presented to the industry, alive in most cases, to quote Professor Gerrit van Iterson Jr of the Department of Chemical Technology and Mining of the Delft Institute of Technology in 1908.

Van Iterson had graduated seven years earlier in Delft, at what was then still known as the Polytechnic School. His teacher had been former botany lecturer and professor of bacteriology Beijerinck, who is regarded as the person who started green thinking in Delft.

Van Iterson became Beijerinck’s assistant, and in 1907 obtained his doctorate for his research on phyllotaxis, the mathematical patterns that occur in nature, such as the pattern of the seeds in a sunflower, the arrangement of leaves on a tree, and the structure of heads of broccoli. That same year Van Iterson was appointed professor of microscopic anatomy. In 1908 he wrote his proposal for the construction of greenhouses and an agricultural garden in his laboratory at the Oude Delft, which had only a small garden at the back. It would take until 1917 before the new building for Technical Botany at the Julianalaan and the garden could be realised. Today the building houses the Kluyver Laboratory of the biotechnology department of the Faculty of Applied Physics.

Paper was one of the most important fibre-based products.

Hair tonic
So what does a university of technology want with a garden? At the time the garden was conceived a question like that was a no-brainer. The Netherlands had interests as far afield as the Dutch East Indies, Surinam and the West Indies.

Botanical Garden celebrates centenary

The Sleeping Beauty awakes

A century ago it was decided that Delft was in need of a garden with ‘technical plants’.

This summer the Botanical Garden that resulted celebrated its centenary with a world conference.

After being neglected for decades, the garden now looks forward to a flourishing period.

Jos Wassink
The overseas territories had long been providers of herbs and spices, and they had also become an increasingly rich source of raw materials. Ursem: “They provided us with new types of timber, fibres, gums, and resins for use in the rubber and paint industries. In the 1920s these raw materials were of major industrial significance and formed the source of many innovations. The garden played a crucial role in this.” Van Iterson stood at the cradle of many of these innovations. He was the managing director of the National Rubber Service, established in 1910 to inspect and promote the natural rubber produced by Hevea brasiliensis in the Dutch East Indies. In 1918 Van Iterson was also appointed chairman of the ‘Committee for setting paper standards’. Paper was one of the main products obtained from fibres, and a need for production standards was felt. In 1937 a chair of paper manufacture was even established. The timber growing industry also received the attention of Van Iterson. Courses on the anatomy and recognition of timber were given at the Laboratory for Technical Botany. The participants agreed with Van Iterson that timber was an important structural material for engineers. For the Department of Public Works, Van Iterson supervised research to find suitable types of timber for harbour construction and he introduced a process for adding lignin to improve timber’s resistance to wear and make it more elastic.

Some of the trees from those early days are still around, according to Gerard van der Veen, who came to the Botanical Garden to work as a gardener 37 years ago. Gradually the scope of his work broadened and he is now responsible for education, public relations, marketing, and communication. Nevertheless his hands are those of a gardener rather than an office clerk, and his Delft accent betrays his roots. He sums up a few of the garden’s timber suppliers with ease: beech, oak, walnut, sequoia, maple, and poplar. To Van der Veen the trees are old friends, like the sequoia from the Himalayas that was planted here in 1952, or the giant poplar that has stood here for the last ninety years. Then there is the birch which, when you lop off a branch in January, will bleed so profusely that the birch juice comes gushing out. The juice was once used as a hair tonic, not that Van der Veen ever tried it himself. His crew cut doesn’t need any tonics.

### Hibernation

The tide turned for the Botanical Garden as the Dutch connections with the East Indies changed, just after the Second World War. On 17 August 1945 Indonesia declared its independence, but it wouldn’t be until 1949 before the Netherlands relinquished sovereignty. The flow of colonial produce, including fibre, timber and rubber declined, and with it the importance of research on ‘technical’ plants in the Botanical Garden. Mineral oil became the prime raw material, and synthetic chemistry was seen as the way of the future.

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**Fine dust magnet**

The freshness that follows a thunderstorm and the pine scent in a wood are all to do with the electrostatic fields in the atmosphere, says Dr Ir. Rein Roos (Applied Physics). He wrote a book on the subject (‘The Forgotten Pollution’). Based on the phenomenon of pine terpenes after a thunderstorm and the way fog droplets are carried aloft by the electrostatic repulsion produced by the sea buckthorn bushes in the dunes of Voorne, he conceived the fine dust filter which the Botanical Garden is now developing in collaboration with the BAM construction company. TUD’s Bob Ursem, Rein Roos, and Jan Marijnissen have since been busy perfecting the CleanAir fine dust filter. Last spring the idea received the Intertraffic Innovation Award 2008.

The system, known as FDRS-PM10, uses high-tension wires carrying 25 to 35 kV strung over a road to create an electrostatic field. The electrically charged field repels the positively charged airborne fine dust particles. Earthed screens alongside the road as well as nearby trees attract the dust particles and remove them from the air. Mother Nature herself uses the same cleaning principle with a dust-repellent positively charged layer, called the electrosphere, at an altitude of fifty kilometres in the ionosphere, but the field of the fine dust magnet is hundreds of times as strong. A small demonstration set-up can cause a mist to settle at a spectacular rate. This autumn BAM intends to conduct the first field tests with the system to see if the full-size variant works equally well.

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**Giant banana plant leaves as seen in the fully restored Van Iterson greenhouse have long been used as a source of long fibres.**

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**Photo’s: Sam Rentmeester/**
In 1964 it was decided to close down Technical Botany. The collection was transferred to the National Herbarium in Leiden, and the garden came under the management of general affairs at the department of biotechnology.

The garden entered a period of hibernation that would last over thirty years, during which the rearmost section of the garden and the adjacent geodesics building were sold to the Department of Public Works, leaving slightly over half of the original garden (2.7 hectares). During this Sleeping Beauty era the garden remained a well-tended location for graduation parties and other gatherings, with an increasing number of members of the public being granted access.

This was the time when people believed everything could be made and that Technology reigned supreme over nature. Scientists turned their backs on the garden and stuck to their laboratory benches.

Not all scientists, though. At one point professor of organic chemistry Dr Ir. Leen Maat was the only researcher to visit the garden. During the 1970s he was working on a synthetic version of morphine, and for purposes of comparison kept a number of specimens of Papaver somniferum, the opium poppy, in the Botanical Garden. The synthesis was ultimately successful, but as poppies were grown in such great numbers during the late 1970s, the price of morphine dropped to two hundred dollars a kilo. Synthetic production cost more than ten times as much.

Another pharmaceutical research project in the early 1990s was that of Dr Ir. Jan Marijnissen (DelftChemTech, nanostructured materials). His aim was to extract from the yew tree, Taxus baccata, a substance that was to become the precursor of the extremely expensive cancer-suppressing drug, Taxol. The alternative was to extract the substance from the bark of the tree, resulting in a rapid decline of the tree population. Marijnissen managed to ‘milk’ the needles by means of an electrostatically charged plate that draws the substance from them, as it were. According to Maat, the method works, but has not yet been adopted by industry.

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**Car park**
The garden’s nadir came around 1995 in the form of plans to close it and turn the site into something else, such as a car park.

**Dam**
Research in the Botanical Garden reveals the special qualities of trees and grasses for use in coastal defences. Mangrove forests for example play a key role in the defence of coasts along tropical and subtropical seas. The mangrove tree (Aegoceras majus) grows in forests on marshy land where salt and fresh water meet. The trunk, supported on curved aerial roots, will often start a long way above ground level. The characteristic network of tough roots breaks the waves as they come rolling in. In the area hit by a tsunami in late 2004, over twenty percent of the mangrove forests had disappeared, beginning in the 1980s. The straightening of rivers, industrial growth, agriculture, and fish farming have been named as the major causes.

At the Botanical Garden a mangrove cultivation programme is underway. As soon as the plants have grown big enough, they will be tested in a wave basin for their specific qualities as coastal defences.

Quite a bit more is known about the tough Vetiver grass. It is a type of grass with long stiff leaves and stems that grow up to two metres in height. The most important contribution made by Vetiver (Vetiveria zizanoides) is underground, however, where its roots go down vertically to depths of as much as four metres and spread out horizontally. It’s pretty hard to think of any better way to reinforce a dyke. Not only does Vetiver protect the dyke against erosion by swells and breakers, it is also very good at slowing down the incoming water, draining it of three-quarters of its energy, as shown by research carried out by the Garden together with the hydraulic engineering section of the Faculty of Civil Engineering and Geosciences). The result is that the amount of water breaking over a dyke is reduced by more than half. Or, a dyke reinforced with Vetiver grass could be twenty percent smaller (less volume) than an unplanted dyke to afford the same level of protection.

Cutting branches in the Van Itterson glasshouse – otherwise they grow through the roof.
UV filter

Why does UV radiation cause paint to peel, whereas a pine tree can grow high up in the mountains with impunity? The ultraviolet radiation is much more intense at altitude — as any ski enthusiast will tell you — and on top of that it is increased by reflections from the snow. This question that had formed in the mind of Bob Ursem resulted in a biological UV filter which in November 2005 won first prize in the sensor technology category of the annual ID-NL innovation festival.

As a student Ir. Urjam Jacobs managed to demonstrate the active component in the branches of Pinus mugo, a mountain pine, which Ursem had collected. The substance collects ultraviolet radiation, and converts it into blue light by means of fluorescence. This does not change the structure of the molecule, and so the substance remains intact. This is where it differs from today’s artificial UV filters that usually consist of ring-shaped molecules with an iron atom at the centre. If a UV photon hits the molecule, the metal absorbs the energy and separates from the molecule. As a result the molecule can only work once, so the UV filter will have to be replaced at regular intervals. Ursem can see all sorts of applications for the long-life, natural UV filter: “It will affect plastics, new waxes and creams will be developed, latex can be made durable, as can bitumen and asphalt. It could even be used to improve the efficiency of solar panels. It really is incredible!”

To commemorate the quinquennial botanist conference the Botanical Garden planted eight hundred sunflowers.
Managing director Bob Ursem sees plenty of new possibilities for the garden. His ideas have already resulted in a number of patents.

Sceptic versus Nobel laureate

A decade after he first voiced his opinions in publications, Björn Lomborg still manages to irritate fellow scientists. He did so at the opening of the anniversary conference of the Botanical Garden with Nobel Prize winner Andreas Fischlin.

Danish political scientist, author, and environmental activist Lomborg (43) is hard to categorise, which is part of the controversy surrounding him. In a blue T-shirt and jeans he cuts a boyish figure as he marches across the rostrum. A microphone arrangement à la Britney Spears ensures that he can reach his audience. It’s all very different and high-tech, but the things he says are lapped up by the established industries and the relatively conservative periodicals such as Elsevier and The Economist. They like to quote from Lomborg’s books ‘The Skeptikal Environmentalist’ (2001) and ‘Cool It’ (2007) to oppose the Kyoto protocol and CO2 reduction measures.

To Nobel Prize winner Andreas Fischlin (58) things are very different. The Swiss ecologist is one of the main authors of the IPCC report (International Panel on Climate Change) about the way ecosystems are being affected by climate change. Last year the IPCC was awarded the Nobel Peace Prize together with climate lobbyist Al Gore (‘An Inconvenient Truth!’).

Fischlin is another person who assumes that the climate change is largely caused by human activity. Contrary to Lomborg however, Fischlin’s point of view is that the changing climate will lead to calamities unless we do something to stop it. The IPCC author also assumes that we still have some control over the climate change. So do Lomborg and Fischlin have anything in common? Yes, they do, since both advocate investing in sustainable energy. Lomborg, like the IPCC, would like to put aside 0.05 percent of the world’s income for carbon-free energy projects. At 2500 billion dollars a year that would be only one seventh of the cost of the Kyoto protocol, while at the same time releasing ten times the amount of money for energy research we are now spending on it. To commemorate the centenary of the Botanical Garden of Delft, the conference ‘Challenges in Botanical Research and Climate Change’ was held from Sunday 29 June to Friday 4 July.

in the field of sensor technology. In 2008, together with Jan Marijnissen and Dr Ing. Rein Roos (Botanical Garden), Ursem won the Intertraffic Innovation Award for a fine dust reduction system, which reduces the amount of airborne fine dust by means of a positively charged field that directs the dust particles to the ground.

Even so, the threat to the garden is far from over. In 2012 the department of biotechnology will be abandoning the Kluyver Laboratory along the Julianalaan. A property developer is hoping to fill the site with a high-rise development and build an underground car park below the garden, Maat explains. ‘That would be the end of the garden,’ was the response by Gerard van der Veen when asked by the Algemeen Dagblad newspaper.

Ursem intends to look ahead and re-use the empty Kluyver Laboratory building for an entirely new laboratory to house all his research projects. ‘We will soon be able to do so with the money our patents will bring in. I just know we will.’ So does Maat believe in that vision? ‘If Bob sets his mind to something, it’s bound to work out all right.’

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‘If Bob sets his mind to something, it’s bound to work out all right’