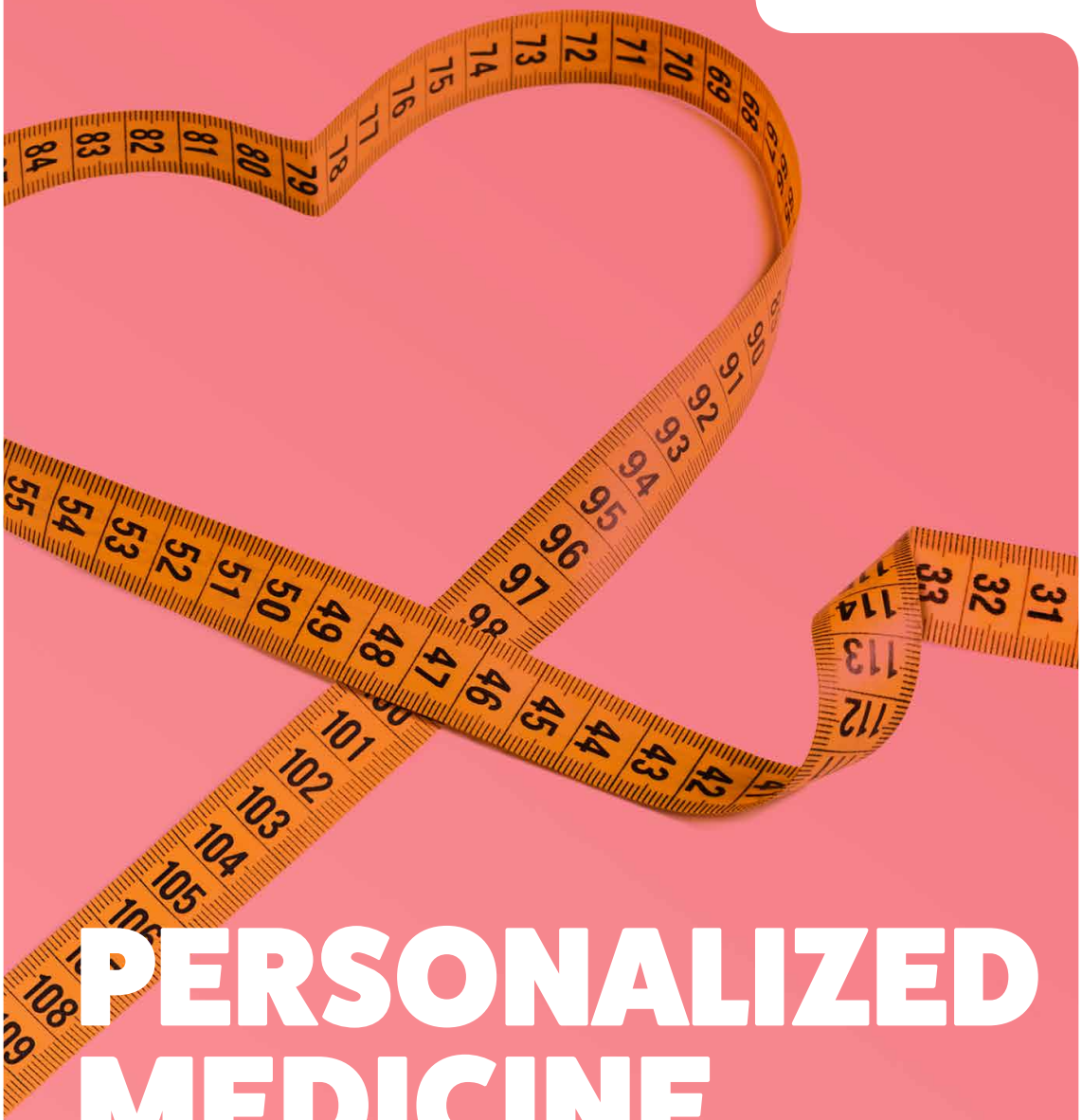
TOP DUTCH

A good place to be great



PERSONALIZED MEDICINE

From 'one size fits all' to 'tailored suit'

Nobody wants to have treatment that doesn't work, yet still produces side effects. Plenty of suffering and healthcare costs can be prevented by personalizing treatments. Personalized medicine is a development within medicine that is really taking flight, and the TopDutch region holds a key position. We combine advanced medical and pharmaceutical knowledge with a globally unique ecosystem for bioanalysis. We have a wealth of health data and the knowledge to process and interpret that data. Together with our pioneering attitude this produces breakthroughs, innovations and business opportunities that start in our region and acquire a global scope

PERSONALIZED MEDICINE: FROM 'ONE SIZE FITS ALL' TO 'TAILORED SUIT'

1.

THE SHIFT TO PERSONALIZED MEDICATION

'One size fits all' has been the standard in the medical world for a long time. Everyone is given the same lifestyle rules to prevent illness - a healthy diet, enough exercise, no smoking, moderate alcohol consumption. When you are diagnosed, you are treated in accordance with a protocol that is the same for everyone.

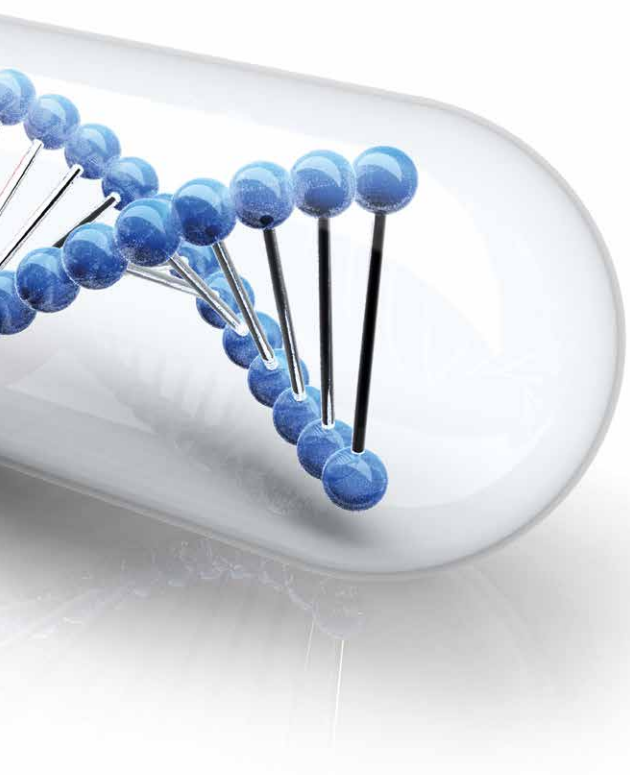
Different patients, different results

Due to comprehensive pharmaceutical tests on thousands of patients, a doctor knows the percentage of cases where the medication is effective, and which side effects will occur with which probability. By administering the medication, they can see what happens and adjust the treatment - change the dose or the medication or prescribe additional medication for the side effects.

Wouldn't it be great if doctors knew the exact risks for particular patients and were then able to prescribe personalized preventive measures? How about treatment for a patient, where the doctor knows in advance that this will be effective for this person without too many side effects? How about moving from a suit off the peg and taking it in here in there, to a tailored suit?

Levels of effectiveness of medicine is dependent on the individual

This shift towards personalized medicine could have many gains for individual patients and for society. Medication is known to do what is intended in 25-60% of all cases. For cancer medication, this percentage is around 30%. Then you have the side effects that can produce a lot of discomfort and sometimes serious harm. If you're really out of luck, you could be given medication that doesn't work and produces nasty side effects. Personalized medicine can prevent a lot of suffering and keep healthcare costs under control.



2.

IMPROVED PREDICTIONS WITH BIOMARKERS

The shift to personalized medicine started around 20 years ago and has accelerated over the past few years. The breakthrough of the Human Genome Project, which charted the complete human DNA in 2001, was an important step in this process. Technological developments and ever improving data processing enabled genetics to take off.

TopDutch residents donate their bodily materials, which is used in biomarker research.

Charting somebody's genetic profile is increasingly faster and cheaper. If you have insight into the genes, you are able to predict the risks of specific diseases for a specific person to some extent, and which medication will work without side effects.

However, good personalized medicine requires more information. For example, the composition of blood, urine or feces can tell a lot about a person. 'The genes and bodily materials contain signal substances, biomarkers', said Ymke van der Geld, CEO of Biomarker Bay. 'For example, cholesterol in the blood is a well-known biomarker for an increased risk of

cardiovascular diseases. We use glucose in urine as a biomarker to diagnose diabetes. There are also biomarkers that help to predict which treatment will work for a patient and which will not.

Facilitating innovation

Biomarker Bay facilitates finding innovative biomarkers and bringing them to the clinic. 'We bring the strong biomarker players together. On the one hand they are the University Medical Center Groningen (UMCG) and University of Groningen (RUG), where fundamental innovative biomarker research is carried out and which have access to the patients that are at the heart of it all.

'On the other hand, we have world-class contract research organizations, such as QPS, Ardena, IQProducts and MercachemSyncom', said Ymke Van der Geld. 'Clients from all over the world know where to find us, because this region is really strong in bioanalysis and in developing medication efficiently.'

Unique cohort

'And we have the data', added Martin Smit. He is the founder and co-director of Biomarker Bay. 'In the region we have large, long-term cohort studies, where we collect data and biomaterial of people who are or were ill. So we have plenty of knowledge about lung cancer, kidney disease, and Crohn's disease. At Lifelines we have a wealth of information about the average population.' Lifelines tracks 10% of the Northern population - around 167,000 people of all ages - with extreme accuracy and over a long period of time. Besides blood, urine, and feces, Lifelines also collects information about the lung function, blood pressure, town, socio-economic status, diet and stress. Lifelines has the DNA profile of around 13,000 people. Martin Smit continued 'We have a lot of information and also know how to process that information properly.'

3.

TOPDUTCH FIRMLY ON THE INTERNATIONAL BIOMARKER MAP

All in all, the strong mix of data and talent ensures that the TopDutch region is firmly on the international map for all those who are looking for biomarkers. Many biomarkers have already found their way from the region to clinics in the Netherlands and abroad. For example, the Groningen company Diagnoptics acquired a position in the Deloitte Fast 50 with the AGE reader.

Preventive biomarkers

In the 1990s, the UMCG discovered AGEs (Advanced Glycation End-product, glycation products in the blood) as biomarkers for diagnosing diabetes. The fact that the AGEs could also *predict* the disease was proven recently by UMCG researchers, headed up by Bruce Wolffenbuttel, with data from Lifelines. The higher the AGE measurements in the first round of measurements amongst healthy participants in Lifelines, the greater the chance they would have diabetes during the second round of measurements four years later.

'We are keen to discover these types of preventive biomarkers', said Ymke Van der Geld. 'If we can see who runs an increased risk of getting a certain disease early on, we can also look at what helps that specific person to stay healthy longer. Lifelines is now entering its third round and is able to look back almost 15 years. With that type of information, you can really find innovative biomarkers.'

'If we can see who runs an increased risk of getting a certain disease early on, we can also look at what helps that specific person to stay healthy longer.'

Ymke van der Geld, CEO of Biomarker Bay

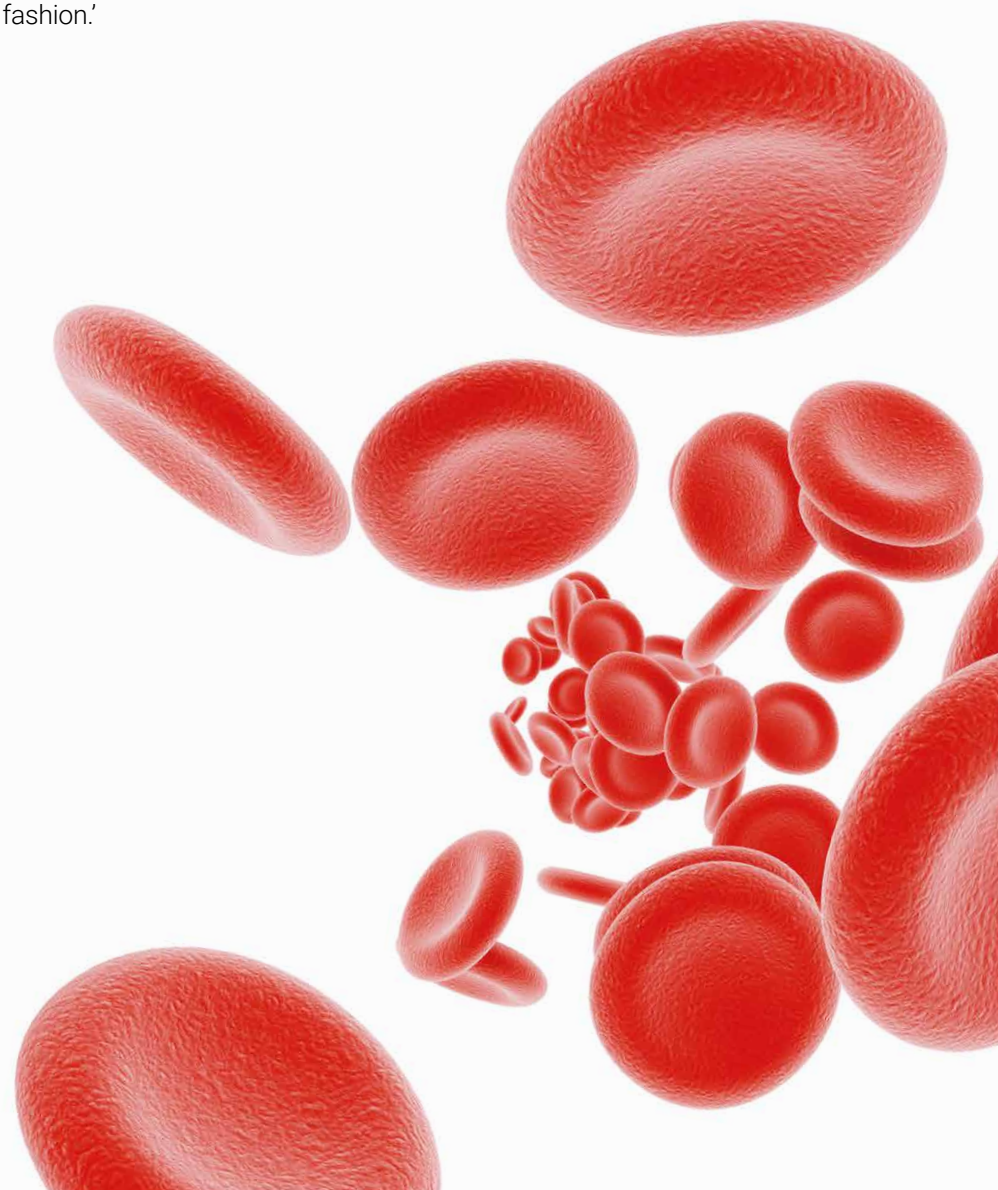
4.

SHINING A LIGHT ON THE EFFECTIVENESS OF CANCER MEDICATION

The use of biomarkers will be very useful for the prevention of disease in the coming years. However, when one does fall ill, biomarkers are also being used to develop other personalized treatments. We can use biomarkers to be able to predict which medicines will work the most effectively on different patients.

Checking for side effects in advance

Immunotherapy doesn't attack the tumor directly, but the immune system is helped to destroy the tumor. Usually the immune system is perfectly capable of doing that. People constantly have cell damage. The immune system identifies the damaged cells and eliminates them before they can grow into a tumor. Some cancer cells cheat the immune system, and go under the radar as it were. 'At that point you have two choices. Either you give antibodies that make the cancer cells visible again, so that the immune system can attack them. Or, and this is most effective, collect immune cells from the blood, cultivate them and give them a boost with so-called CAR T cells. Once back in the body, these killer cells switch off the cancer in a targeted fashion.'



Immunotherapy is on the rise and is already used for certain types of cancer, including melanoma and lung cancer. The big advantage is that is really works, but the disadvantage is that is doesn't work for everyone. The products are also expensive and the side effects can be significant. Instead of giving the product to all patients and using scans to check for whom it worked afterwards, which is standard practice, doctors would like to know who would benefit from the medication in advance. This can be achieved by testing the product with so-called 'companion diagnostics biomarkers'.

That is exactly what Tracers technology does. 'We administer the product, a therapeutic protein, in extremely small doses. In this microdose, the medication doesn't work and has no side effects. As we have given it a fluorescent label, we can see whether the boosted immune cells go to the tumor or not and whether it works or not. We can also see whether the cells end up in many other different places. In that case, you can expect side effects.'

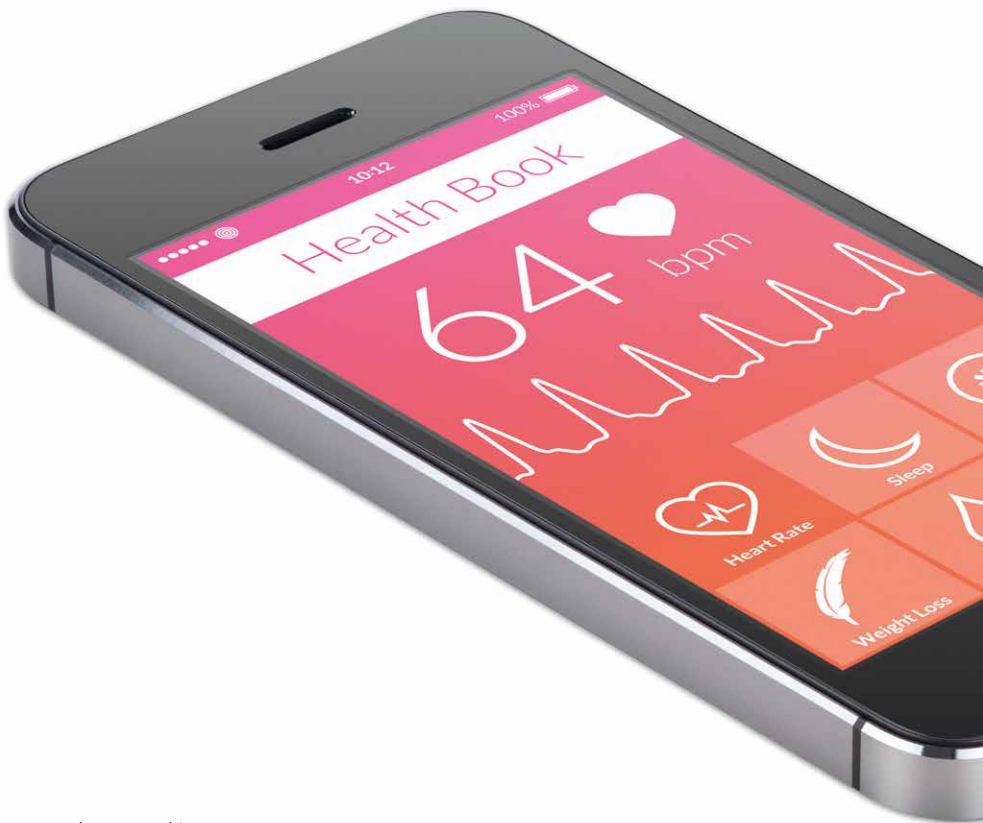
5.

ACCELERATE THE DEVELOPMENT OF MEDICATION

A doctor in a clinic can use this information to assess whether their patient benefits from a specific registered product. It can also help pharmacists to accelerate the development of new medication.

Saving time and money

'That is actually the mainstay of our work', explained Go Van Dam. 'Usually it is fairly late on in the process when a pharmacist discovers whether a product is effective and whether its effect outweighs the side effects. At that point large amounts of money have gone into large-scale and long-term trials and hundreds of patients in those studies received medication that didn't work. In three to six months we can say a lot about the effect by giving patients a microdose and showing where the product ends up. This produces enormous cost savings and ensures that medication that does work well enters the market sooner. Not just for cancer, but for infections and for autoimmune diseases, such as Crohn's disease.'



More and more people are tracking their own lifestyle data digitally.

Taking major steps towards personalized medicine means we have to find the right biomarkers and we need large amounts of data, commented Martin Smit of Biomarker Bay. 'In the Netherlands, everyone will soon have access to their own health data via a digital personal health environment (PGO). It is likely that this will be the place where - apart from lab results, previous diagnoses and treatments - information will end up about somebody's genetic profile and the composition of their intestinal flora. Possibly also data about diet, sleep, stress and exercise that somebody collects. All this data enables an individual to track his or her own health. It will become more common for a doctor to use that information to prescribe personalized health advice and treatments.'

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Go van Dam, founder of Tracer

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Want to find out more about what makes the TopDutch region a good place to be great, or view the digital edition? Head over to our website www.topdutch.com

Are you interested in exploring what your business possibilities could be? Connect with Gerard Lenstra, our Life Science & Health expert.

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