SPOTLIGHT ON THE NETHERLANDS

Small size, big impact

Dutch researchers are collaborating in search of solutions to global challenges — from antibiotic resistance to water scarcity.

"The bench and the bedside are starting to meet in a much more dynamic way than we've seen."

René Medema, Netherlands Cancer Institute

WITH LOW unemployment, above-average incomes and a highly ranked quality of life by European standards, it would be easy for the Dutch to adopt an insular attitude. But it's a nation with a broad outlook – especially among its research community. "The Dutch have a tradition of looking beyond their own borders for research," says Arjen Hoekstra, a water researcher at the University of Twente in Enschede (see box). "In bigger countries, researchers tend to focus on their own problems, whereas smaller countries like the Netherlands often have a more external outlook."

Dutch researchers are especially noted for their environmental studies — from wind energy through to water management to sustainable food supply. "It's a great community and an exciting research space," says Frank Biermann, professor of political science and environmental policy at the Institute for Environmental Studies (IVM) at the VU University Amsterdam, who moved to the Netherlands from his native Germany in 2003. "For a country of its size, it's far ahead." The IVM works on projects ranging from assessing the neurotoxic effects of chemicals to spatial analysis of land use and adaptation to climate change.

Interdisciplinary approach

When addressing environmental challenges, integrating political and economic factors is just as important as technical research. Biermann's department focuses on the political, legal and policy implications of issues such as climate, water, food and biodiversity. The strong collaborations between his direct colleagues and natural scientists allow them to study problems like plastic pollution of the oceans. "We have chemists working on it, but addressing the problem also requires legal and political processes. So we have political scientists and toxicologists writing papers together," he says. "It's a lot of fun and it's the future of this community. It has to go in this collaborative direction."

The IVM is one of nine Dutch universities and two research institutes that make up the SENSE Research School for Socio-Economic and Natural Sciences of the Environment. One of the main functions of the initiative is a tailor-made, interdisciplinary training programme for PhD students from across the partner organisations. "The students from across the network take classes, programmes and research assessments together," says Biermann. "It's a product of the cooperative environmental research tradition in the Netherlands."

Dutch companies are also increasingly active participants in sustainability research and development. "Industry research is not what it was 20 years ago, when companies did everything in-house. Now, we focus much more on partnerships with suppliers and academic researchers," says Rob Hamer, director of Unilever's research laboratory in Vlaardingen. "No one company or university can tackle the grand challenges of today on its own. The best way is to do it together," he says. Unilever, the large Anglo-Dutch consumer-goods company, has developed a Sustainable Living Plan as their blueprint for sustainable growth. It has three main pillars: to improve the health and wellbeing of one billion people by 2020; to reduce the impact of the environmental footprint of the making and use of their products by 2020; and to enhance the livelihoods of millions of people through the growth of their business. To meet these goals, the company is developing products such as foods fortified with vitamins and minerals, or easy-rinse, water-saving laundry detergents. "But it's not just about product change," Hamer says. "We have active programmes to promote behavioural change too."

Complex cancer

Big-picture challenges are also a priority for Dutch health researchers. "Oncology is a very strong research sector in the Netherlands," says René Medema, director of research at the Netherlands Cancer Institute (NKI). "The bench and the bedside are starting to meet in a much more dynamic way than we've ever seen."

This translational research is a strong focus of the Dutch Cancer Society, which funds around 50% of the country's cancer research and in 2013 it invested €75 million in cancer research, training and education.

VU UNIVERSITY AMSTERDAM/PETER VALCKX

The charity also encourages and funds collaborations between Dutch researchers and their international colleagues, an essential process, according to Medema. "Cancer is such a complex problem that it's not going to be cracked by a single institute or a single country, but by a combined effort," he says. He emphasises that a combined approach allows certain research questions to be addressed that would not be possible from a single research group or nation, such as when there is only a small group of patients worldwide that might benefit from a certain type of therapy.

Antibiotic resistance is another health issue relevant across all borders. At the Swammerdam Institute for Life Sciences, part of the University of Amsterdam, Leendert Hamoen is studying bacterial cell division with a view to an understanding that will eventually lead to new antimicrobial compounds. "There are currently no antibiotics on the market that target cell division, and we know surprisingly little about it," Hamoen says. He is also collaborating with researchers from the CBS-KNAW Fungal Biodiversity Centre, an institute of the Royal Netherlands Academy of Arts and Science (KNAW) based in Utrecht, to screen their enormous depository of fungal species for new antibiotic compounds.

Veni, Vidi, Vici

Hamoen is a 'Vici Fellow', a researcher in the final phase of the Innovation Research Incentive Scheme, otherwise known as the Veni, Vidi, Vici programme, funded by the Netherlands Organisation for Scientific Research (NWO). The three-phase scheme funds scientists who have recently obtained their PhD qualification (Veni); those who have several years of post-doctoral experience (Vidi); and those who have branched into independent research (Vici). Hamoen's Vici Fellowship, which is worth €1.5 million over five years, funds his position as well as that of a technician, a postdoc and one or two PhD students. This brought him back to his home country after 10 years in the UK.

"This programme is an excellent way to build careers," he says. He's a supporter of the scheme, which funds both basic and applied research, but is also among the number of scientists in the Netherlands concerned that funding for basic research is decreasing as a result of the government's 'top sector' policy. The policy specifies nine sectors — ranging from agri-food to energy — in which the Netherlands excels globally and which the government is prioritising. Although the nine categories cover many disciplines, there are concerns that the policy's focus on science that has direct links to industry limits funding allocation to highly applied research.

Other scientists have a more positive outlook on the scheme. Before joining Unilever, Hamer was director of the Technological Top Institute Wageningen Centre for Food Sciences (now called the Top Institute Food & Nutrition), which was part of the government's early phase of the top-sector approach. He says the institute, which involves more than 30 companies including all major European food companies, is a landmark example of how such collaborative private-public partnerships could work. "The science world needs to change from monodisciplinary to multidisciplinary," he says, "but it always takes time as you go from one model to another, and some people will experience this as making it more difficult to access funds." But, he says, it is important for the model to respond to feedback from both the research and industry communities.

VU University in Amsterdam.

A new approach to science can itself be seen as a global challenge, according to Frank Miedema, Dean and Vice Chairman of the Board at the University Medical Centre Utrecht (UMC Utrecht). "We need more inter-disciplinarity, more diversity of careers and we need to break away from the short-term scientific credit cycle that is mainly based on publications in high-impact journals," he says. "We need longer-term appointments so that scientists can take on more complex and risky projects, and we need to assess the impact of science more imaginatively." Miedema is one of the initiators of Science in Transition, an initiative that seeks to bring these ideas to debate among the research community and with government. He is also trying to implement these ideas at UMC Utrecht. "We bring our stakeholders into the research process," he says. "These include companies, charities and patients. Their understanding of 'impact' is completely different compared to the standard measures of scientific impact that scientists use".

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Arjen Hoekstra: Game professor

ARJEN HOEKSTRA

Most people are familiar with the concept of a carbon footprint. Arjen Hoekstra, professor of water management at the University of Twente, wants to make a water footprint just as well known. His ambitions are lofty — to combat increasing water scarcity around the world through more efficient, sustainable and equitable use of the precious resource.

"Some ways of solving water-scarcity problems, such as desalination, water transfer across large distances or deeper digging projects, are very energy intensive. And some approaches of moving away from using fossil fuels, such as using biofuels, are very water intensive. So if you look at things in isolation, you design a water-crisis solution that creates an energy crisis, and vice versa," says Hoekstra.

Hoekstra has developed educational tools to demonstrate the complexity involved. In one, the River Basin Game, participants are farmers trying to optimise their benefits by irrigating their fields, where water is the limiting factor. "It teaches about the 'tragedy of the commons' and about economic incentives and policies, as well as the physical system", says Hoekstra. "I've played it with participants at the World Bank and at secondary schools. Everyone can learn something from it on their own level."

Hoekstra says his research is an example of a strong Dutch tradition of an environmental research agenda that looks beyond the country's borders.

But sometimes what looks like an external focus is actually closer to home. "Water gets a lot of attention in the Netherlands, although more because we're at risk of flooding than water scarcity. But around 95% of the Dutch water footprint is abroad, so we have more connection to problems of water scarcity than we might realise in our everyday life."