



PHYSICAL IMPACT

Despite its diminutive size and modest research budget, the Netherlands makes a major contribution to research in the physical sciences. **Quirin Schiermeier** reports.

Twenty-nine year old American astronomer Ryan Quadri was at a point in his career when he found the idea of living abroad appealing. After earning his PhD from Yale University last year, Quadri, who studies the formation of galaxies in the early Universe, considered various destinations. He preferred Europe, and took advantage of a connection he had with a Dutch astronomer. “Living in another country was my main motivation,” he says. “But I did know, of course, that Leiden is a great place for astronomy.” So last November, Quadri relocated to Leiden, a lively university town an hour’s train ride south of Amsterdam, to do three years of postdoctoral research. He has no regrets.

Quadri says it was surprisingly easy to get used to working and living in the Netherlands, a small place with strong scientific hubs in cities such as Leiden and Utrecht. The country has long been known for a welcoming attitude towards research and a history of encouraging scientific discourse. Scientists there have learned to forge international collaborations rather than be confined by the resources of a small country. Quadri also found that the lab culture was very similar to the one he had left behind.

The Netherlands boasts significant achievements in astronomy and other physical sciences, given its size. In August, researchers at Dutch institutions won nine out of 105 advanced grants in the physical sciences from the European Research Council (ERC), making the Netherlands the third most successful nation — behind Britain and France and on par with Italy and Switzerland — in this round of the competition. Researchers in Germany, which is five times more populous than the Netherlands, have won only seven of these prestigious new grants.

“When I moved to the Netherlands in 2001, I was really impressed by the general quality of physics in this

country,” says Michel Orrit, a French condensed-matter physicist at the University of Leiden, who has won an €1.8-million (US\$2.4-million) ERC grant for his work on single-molecule spectroscopy.

And yet the Netherlands’ overall spending on science, some 1.8% of gross domestic product, is far below that of its eastern neighbour and even slightly below the European Union (EU) average.

“Call it the Dutch paradox,” says Peter Nijkamp, chairman of the Netherlands Organisation for Scientific Research (NWO), the main funding agency. Nijkamp suggests that the Netherlands has managed to create very favourable conditions for science despite “regrettably modest public research budgets”.

A city of science

Leiden is one of the country’s centres for physical sciences. With a population of 117,000, it lies in the Holland region, a highly urbanized ring in the west of country and one of the most densely populated areas of the world. An old windmill, quiet canals, flocks of cyclists and the odd coffee shop remind one that this is the land of Vincent van Gogh, cyclist Joop Zoetemelk and pragmatic cannabis policies.

But just below Leiden’s tourist-pleasing surface is a rich and active tradition of science. The Leiden Bioscience Park is one of the oldest and largest in Europe. The university, where the seventeenth-century astronomer Christiaan Huygens studied law and mathematics, also hosts the country’s largest and best-equipped astronomy department. Most research takes place in international collaboration, thus affording privileged access to telescopes, data and computing facilities. And thanks to a generous grant from the Netherlands Research School for Astronomy, Quadri can also travel to conferences and observatory sites around the world as often as necessary.



Jaap Sinninghe Damsté (top) and Michel Orrit have received European Research Council grants for their work.

Indeed, astronomy is one of the country's prime science strengths. Dutch space researchers often work with international colleagues, while trying to maintain a strong domestic base for training students and young scientists. In the past 20 years, more PhD students from Leiden have been selected for NASA's prestigious Hubble postdoctoral fellowship programme than from any other university outside the United States.

"Astronomy is a very attractive field for young physicists," says Quadri's original contact Marijn Franx, a group leader at Leiden University who was awarded a Hubble fellowship in 1991. Franx notes that former students have found positions in fields as diverse as high-energy physics, software development, publishing, funding agencies and even the diplomatic service. In August, Franx received a €1.5-million ERC advanced grant for his research on how distant galaxies come into being. He plans to build up a new group comprising a tenure-track faculty member, two postdocs and two PhD students, to extend his work on high-redshift galaxies by looking even further back in time.

Critical evaluation

The key to success is minimal bureaucracy and an efficient, highly competitive science-funding system, says Nijkamp. Targeted support mechanisms, for both early-stage and senior researchers, include the NWO's Rubicon grants for postdoctoral scientists and the prestigious €1.5-million Spinoza prize for outstanding achievement. A strict system of performance measurement for scientists and university departments helps grant reviewers allocate resources efficiently.

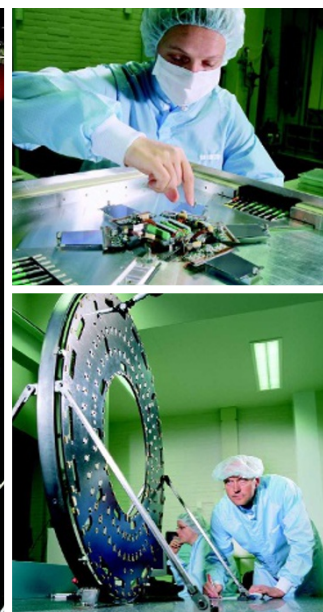
Starting in the 1980s, Dutch universities developed a research and teaching evaluation system involving external reviewers. Criteria include publications and success in attracting grant money. Those who measure up have a much better shot at tenure. Nijkamp says the system has been a big help in improving the quality of Dutch science, although there are winners and losers. "Our scientists have learned that they will be strictly evaluated, and that their success in getting funded depends only on their performance," says Nijkamp.

All NWO programmes are heavily oversubscribed, with grant success rates in some fields as low as 10%. The tough competition, says Nijkamp, does create bottlenecks. "We often have to say 'no' just because the money isn't there," he says. "That's a pity, because it means we're missing out on too many good people."

But tight national research budgets have not diminished the Netherlands' attractiveness as a host for young scientists from abroad. Terms of employment for PhD students are particularly appealing. They are hired on a full-time basis for four years — rather than for three years as in most other European countries, where they often have only student status. And they get paid unusually well: in their fourth year, they can expect a salary of €3,000 a month before tax.

The extra year gives PhD students more time to transform their research into papers, says Jaap Sinninghe Damsté, a molecular palaeontologist at the Royal Netherlands Institute for Sea Research (NIOZ) on the Friesian island of Texel. A good publication record early on helps those who want to stay in research find attractive postdoctoral positions, he says.

Not many young scientists have luck founding new academic labs, however. Sinninghe Damsté, who has won an ERC advanced grant for his method of using



Dutch involvement in physics: (clockwise from left) helping to build the TEXTOR plasma reactor, equipment at the National Institute for Subatomic Physics, and working on a component for the Large Hadron Collider.

fossil molecules in sediments to reconstruct past climate, is a rare example of a successful Dutch scientist who has never worked outside his native country. With the €2.5-million grant he will build up a new group in organic biogeochemistry, comprising three PhD students, two postdocs and a technician. For the first time in many years, the NIOZ — one of ten research institutes run by the NWO — will also create two or three new tenure-track positions.

Generally, however, a young scientist's prospects of finding permanent positions there are bleak. "To try to become a professional scientist here you really have to love research very much," says Sinninghe Damsté.

"It's hard," agrees his postdoc Jung-Hyun Kim. A marine geologist from South Korea, Kim did a postdoc in Bremen, Germany, before moving on to the NIOZ. She came to the Netherlands on an EU-funded Marie Curie fellowship. Despite the challenges, she says, the combination of an open, multicultural society and high standards in science make the country an ideal training ground for young researchers.

Like some other countries, such as Germany, most science jobs in the Netherlands are occupied by postdocs on fixed-term contracts. Kim is therefore putting out feelers towards France, where her husband lives and where she hopes it will be easier to find a permanent position. Her ideal is an ERC starting grant that would help her to build up an independent research team of her own.

When his contract in Leiden expires, Quadri, too, plans to leave the Netherlands and head back to the United States. Despite its success in attracting foreign talent, the Netherlands often remains a stopping-off place for young scientists early in their careers.

Even so, Dutch science as a whole benefits from the flow of international talent — and those who go there benefit from a vibrant and welcoming research community. "I got so into astronomy here," says Quadri, "that all other alternatives disappeared."

Quirin Schiermeier is Nature's Germany correspondent.



Jung-Hyun Kim (top) and Ryan Quadri have both enjoyed postdocs in the Netherlands.