

Portuguese Sara Dominguez doesn't only enjoy working in Norway (see Interview, p. 40).

Career strategies for
young European scientists (XXIII)

Velkommen til Norge

Research has only recently become a priority issue in Norway. No wonder, therefore, that the funding system still has several construction sites. The Norwegian Government, however, is committed to working on the shortcomings and is already well on the way to making the country a potentially worthwhile destination.

Social welfare, health and education are top priorities in Norway. For a long time, research and innovation were not. But oil and gas resources may not fizzle forever. Public research spending is on the rise and a couple of key technologies including bio- and nanotechnology are receiving more attention. Foreign students appreciate the tuition-free education and the loan system but often abandon Norway after graduation. It's quite easy to get funding for a short research visit but it appears there are no intentions to attract and, more importantly, keep the best international talent in Norway. Here, *Lab Times* will introduce a couple of funding opportunities and tells you what to expect besides dark days in winter and midges in summer.

Background

The Kingdom of Norway, with its capital Oslo, is a constitutional monarchy with a parliamentary system. With close to five million citizens, Norway is one of the most sparsely populated countries in Europe. A coastline of 16,000 miles including bays and fjords, thousands of islands, extended mountain ranges with barren plateaus and a chunk of the Antarctic, make for some terrific scenery. Fishing, agriculture, forestry and the shipbuilding industry have been main pillars of Norway's economy in the past. This changed dramatically in the early seventies when large oil and natural gas reservoirs were discovered in the North Sea. Nowadays, oil and gas account for 45% of export revenues and

25% of the gross domestic product in Norway. The Norwegian State controls many companies as major shareholder in key areas including Statoil, the world's largest offshore oil and gas company. Whereas oil production decreased over the last decade, gas production is being stepped up and has already promoted Norway to the world's third largest exporter of gas. After lengthy border disputes with Russia have been resolved, the exploitation of novel fields in the Barents Sea is no longer hampered.

Norway's high dependence on oil and gas makes it vulnerable to dwindling natural resources but also to growing public concerns about the risks associated with offshore drilling. To counteract oil price fluctuations and compensate for future income losses, petroleum revenues are routed into governmental funds. The Government Pension Fund Global, also referred to as the Petroleum Fund, was set up in 1990. It is primarily used for long-term investments into the international stock market and, with a current asset of €350 billion, belongs to the top three sovereign wealth funds worldwide. An €80 billion loss in 2008 was compensated by fresh "petrokroner". Returns from the fund are used to balance Norway's annual budget, thereby contributing to the stability of Norway's economy. At the same time, it is an important source of capital for investment into research.

Lavish natural resources including petroleum, fish and forests but also hydropower and minerals have made Norway into a quite prosperous nation. According to the International Monetary

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Fund, Norway is only outnumbered by Qatar and Luxembourg with respect to the gross domestic product per capita. In several international rankings, Norway is doing particularly well. For example, Norway is leading the 2009 Human Development Index, which takes into account life expectancy, educational measures and purchasing power. It is also 11th in the last IMD World Competitiveness ranking, four places up from 2005.

Norway's investment into research and development (R&D) has tripled since 1981 and amounted to €5.3 billion or 1.6% of its gross domestic product in 2008. R&D is performed to a third in the higher education sector, to a half in the industrial sector and to a fifth by institutes from the government sector or institutes serving enterprises. With €1 billion, Information and Communication Technology accounts for the largest share of R&D expenditure, followed by Biotechnology and New Materials/Nanotechnology, which both incurred about €300 million in 2007.

Historically, Norway has had many collaborative efforts in research, education and innovation with other Nordic countries. For example, NordForsk is a Nordic research board promoting high quality research and researcher training in Nordic countries. But Norway is also integrated quite well in the European Research Area. Though Norway's citizens voted 1972 and 1994 against a membership in the European Union, it is closely associated with the EU by its membership in the European Economic Area (EEA). Norway, Iceland and Liechtenstein contribute to the EEA and Norway Grant Scheme. Main beneficiaries have, since 2004, been the 12 most recent EU member countries as well as Spain, Greece and Portugal. In the last five-year period, more than 1,250 projects have been supported with €1.23 billion. Prioritised activities also include programmes for collaborative academic research and fellowships. An agreement was recently reached to continue the programme until 2014.

Lavish natural resources

Norway also participates in the new EU Competitiveness and Innovation Framework Programme (CIP) and in EU Research Framework programmes. In the first two years of the ongoing FP7 programme, Norway was involved in 2,000 applications with a success rate of approximately 20%. Its participation was high in programmes related to environment, food, security and safety or energy but quite low in grants from the European Research Council, Marie-Curie Actions and Health research. Norway's activities at the European level are complemented by its participation in several intergovernmental initiatives and organisations including ERA-NET, COST as well as EMBO or the European Organization for Nuclear Research CERN.

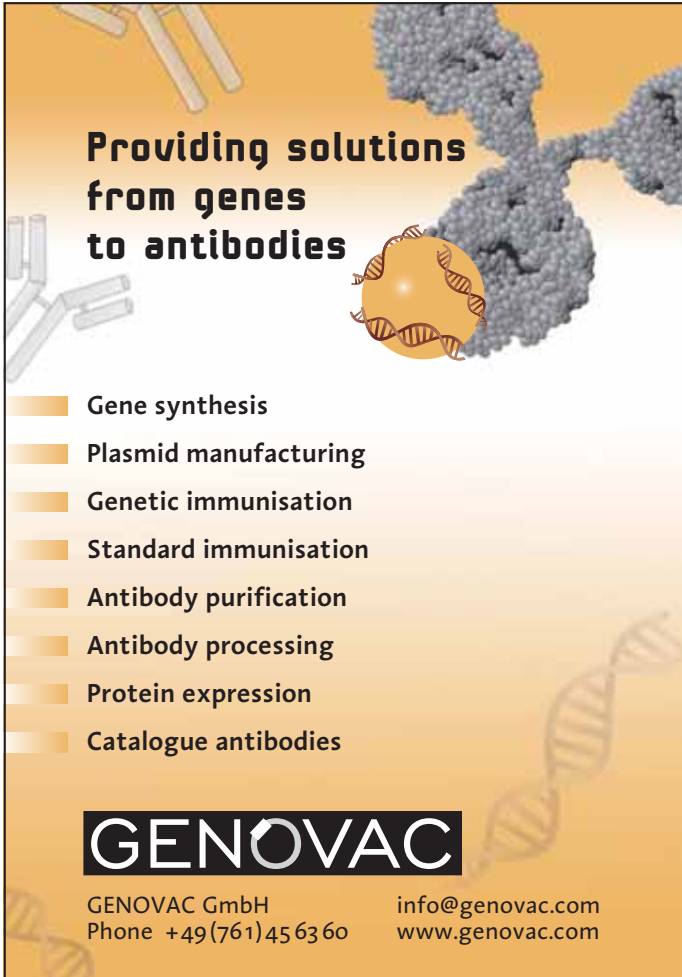
As expected from Norway's population size, it does not belong to the top countries if counting the overall number of scientific publications, however, according to the SCImago Journal & Country Rankings, it is placed 25th in the number of citations as well as in the number of cites per document if including papers published between 1996 and 2008. Behind Switzerland, Sweden, Denmark and Finland, its scientific production per capita was comparable to that of Israel between 2006 and 2008. Based on publications between 2004 and 2008, and citations to these publications, Norway is doing particularly well in Mathematics, Clinical Medicine, Physics, Agricultural Sciences and Geosciences, whereas it lies just below world average in Engineering, Computer Science and Biomedicine.

Patenting activity in Norway in general is moderate. This may be attributed to the lack of larger R&D companies and shortage

of venture capital for start-up companies. Governmental measures to promote public-private collaborations and to sting more activities in the business sector include SkatteFUNN, which provides tax reductions for smaller and larger companies involved in research and innovation, the establishment of Centres for Research-based Innovation and a smaller Industrial PhD programme. In addition, last year about €300 million out of the governmental stimulus package were provided for biotech start-ups and smaller companies to prevent their close-down due to financial short-cuts.

Marine life sciences as one focus

The biotech sector in Norway is not highly developed but has strong research activities in biomedical, marine and agricultural biotechnology. More than 70% of biotechs are into cancer research and are mainly concentrated around Oslo. Oslo Bio is a network of major players in Life Sciences. It catalyses projects between the public and private sector. Other tasks are marketing and international cooperation. Oslo Bio is also cooperating with MedCoast Scandinavia, a Swedish-Norwegian network with the goal to promote the biomedical sector in the Göteborg-Oslo region. Marine life sciences, cancer therapy and diagnostics, as well as wireless healthcare are focus areas of Oslo Bio. MareLife is a member organisation covering aquaculture, fisheries and marine compounds. Another member is the Oslo Cancer Cluster. It was established in 2006 and has more than 60 members includ- ▶▶



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► ing small biotechs, pharmaceutical companies, university hospitals and research institutions. Long-term financing was secured in 2007 by obtaining the status of a Norwegian Centre of Expertise. The Oslo Cancer Cluster currently seeks approval to start building its own €150 million innovation park next to the Radium hospital. Another goal is to improve the existing system for early clinical trials, to accelerate the transfer of scientific results into new cancer treatments.

R&D System

The R&D system of Norway operates at several levels. Starting, the Norwegian parliament, makes the final decisions on research policies. The Ministry of Education and Research oversees the largest share of public research funds but despite being the coordinator of national research policies, it is lacking in political perseverance. This is partly due to the fact that other ministries, including Agriculture and Food, Health and Care Services or Trade and Industry, are in charge of research in their own sector and have significant research budgets of their own. RCN, the Research Council of Norway, is the dominant policy advisory and funding agency for research and innovation. SIVA, the Industrial Development Corporation of Norway, is an enterprise of the Norwegian State and responsible for improving the national infra-

nationalisation, high quality of research and a well-functioning research system. To guarantee long-term financing of its research activities, the government launched the Fund for Research and Innovation in 1999. Since its start, the fund rapidly grew and after substantial cash injections in the last years, now totals close to €1 billion. Returns are primarily used to supplement ministerial budget allocations for research and also to cover Norway's participation in EU programmes.

Research Council Norway

The RCN develops strategies for the government and puts national research priorities into practice by targeted funding programmes. Additional tasks encompass evaluations, promotion of international cooperation and networking between research, business and society. RCN has 350 employees in four divisions, which comprise administration, science, strategy and innovation. Individual boards or committees are appointed for each of the programmes. More than 800 members from research and educational institutions and organisations, as well as from industry and government, participate on these boards. The Research Council strategy is laid down in multi-annual programmes. The current strategy "In the Vanguard of Research" covers the period from 2009 to 2012.



Several clichés about Norway on one postcard

structure for innovation. Through its partial ownership of more than 150 companies it is in charge of science and research parks, business incubators, industrial parks, venture capital institutions and research and development industries.

The current research policy is laid down in the white paper "Climate for Research". It confirmed the thematic priority areas of Norwegian research, which are energy and environment, health and welfare, oceans and food. A strong emphasis is placed on global and social challenges that need to be addressed by Norway's research community and which will influence the distribution of governmental funds in the future. Four comprehensive goals were formulated: efficient use of results and funding, inter-

The RCN budget amounts to more than €910 million, a third of public funds earmarked for R&D in Norway. Main contributors to the budget are the Ministry of Education and Research, the Ministry of Trade and Industry and the Research Fund. Half the funds are distributed via 3,000 research programmes, a quarter goes into infrastructure and less than 15% into independent projects. To give an overview on all activities is beyond the scope of my article. Of special interest are the Centres of Excellence (CoE) as a potential place to do a PhD thesis or a postdoc, the Outstanding Young Investigator scheme supporting scientists on their way to independence and a couple of programmes funding research visits to Norway.

Centres of Excellence (CoE) are a measure to increase the number of scientists and research groups performing research at a high international standard. They receive long-term financing for basic research and have to provide research training. In two rounds, 21 Centres have been selected. A CoE is initially funded for five years and upon positive evaluation there is a five-year extension. The CoE may form a larger consortium with additional universities, colleges, research institutes or enterprises. Each Centre receives up to €2.5 million a year from the RCN, and co-financing by the host institution and additional partners. Seven Centres are active in Life Sciences. The University of Oslo and the Rikshospitalet University Hospital host the Centre for Immune

Regulation, the Centre for Cancer Biomedicine, the Centre for Molecular Biology and Neuroscience and the Centre for Ecological and Evolutionary Synthesis. The Centre for Biomedical Computing was established by the Simula Research Lab in Oslo, the Aquaculture Protein Centre by the Norwegian University of Life Sciences in Ås and the Centre for Biology of Memory by NTNU in Trondheim. You may contact individual group leaders for research opportunities.

The Outstanding Young Investigator (OYI) scheme started in 2003 to support excellent research talent from all scientific fields. It replaced the Top Researcher programme, which was limited to research in medicine, biomedicine and other health-related science disciplines. Targeted are scientists who completed their doctoral degree no more than eight years prior to application. All applications are done together with the host institution. In the first two rounds 46 applicants were successful. The success rate was 12% and four beneficiaries from the second call were from abroad. Up to €315,000 a year for a maximum of five years may also cover your group leader salary. The average age of OYI in the 2007 selection round was 35. According to Sonja Prehn, senior adviser in charge of the programme, the RCN would like to make a third call in 2011 but this depends on the available budget.

The International Scholarship Section of the RCN offers many opportunities for foreign students and scientists. If you are funded by a Marie Curie action of the 7th framework programme you may apply for top-up financing, which reduces pay inequities between Marie Curie and RCN fellows. Targeted are early researchers/PhD students in Initial Training Networks as well as experienced researchers/postdocs on a Marie Curie fellowship. Bilateral relations with countries such as the USA, Canada, Japan, India, China, Russia, Argentina, Brazil or Chile have priority. Research collaboration in connection with development projects is focused on South Africa and West Balkan Countries.

The mobility programme Yggdrasil was launched in 2009, replacing the previous Norwegian Government Scholarship programme. It is for scientists from abroad, including PhD students and postdocs with a PhD title received no longer than six years prior to application. Both have to be affiliated during the visit with a higher education or research institution from abroad. Scientists from roughly 50 non-European and European countries with the exception of other Nordic countries may apply for stays between one and ten months. Monthly allowance are paid, €1,500 for students and €1,900 for postdocs, and a settling-in allowance of €1,250. There is no family allowance and travel expenses are reimbursed only if you are from a few select countries. In the first call, half of the 300 applications were financed. The next deadline is Feb 16, 2011. Other notable fellowship and reciprocal exchange programmes are the Aurora with France, DAADppp with Germany, Leiv Eiriksson with the USA and Canada and High North with Russia, USA and Canada.

Higher Education

The University of Oslo (UiO) was opened in 1813; it is the oldest and, with about 29,000 students and 6,000 employees, the largest university in Norway. About 10% of the faculty staff and 12% of students are from abroad. There are more than 40 Master programmes taught in English, eight PhD programmes and 22 graduate schools. UiO's share in the Norwegian Higher Education sector is quite high: close to half of the highly-cited researchers and National Centres of Excellence, and about a third of conferred PhD degrees, EU-funding and scientific publications.

Internet Resources

- ▶ Mobility Portal Norway – www.euraxess.no/
- ▶ Norwegian Research Council – www.forskningradet.no/
- ▶ Centre for International Cooperation – www.siu.no/en
- ▶ Oslo Cancer Cluster – www.oslocancercluster.no
- ▶ New in Norway – www.nyinorge.no

Altogether, there are seven major public universities, a few highly specialised universities and about 25 university colleges in Norway. A couple of private institutions, primarily providing business degrees, attract less than 15% of all students. The four oldest Norwegian universities made it into the 2009 THE-QS World University Rankings: the University of Oslo at rank 101, the University of Bergen (UIB) at rank 144, the Norwegian University of Science and Technology (NTNU) at rank 270 and the University of Tromsø at rank 302. In the subject ranking Biomedicine and Life Sciences, UiO was 112th and UIB 256th. Since 2005, three former colleges have been upgraded to university status: the Norwegian University of Life Sciences in Ås, the University of Adger and the University of Stavanger.

Not all major universities cover the full range of academic disciplines. Individual universities are autonomous with respect to teaching and research. Higher Education institutions are financed to a large extent by governmental funds, which they receive as block funding. A performance-based component was introduced a couple of years ago but applies only to a small percentage of the allocation. Norwegian universities initially experienced no major effects of the financial crisis. The universities' share of the €2.2 billion governmental stimulation package went into infrastructure for building maintenance and renovation. And only last year, university rectors asked for and received more money to increase the number of students, especially at the doctoral student level.

Universities almost for free

Norway was one of the first countries to implement the Bologna reforms: three-year bachelor, two-year master and three-year doctoral studies. Admission to Bachelor programmes is regulated by the Norwegian Universities and Colleges Admission Service and is primarily based on school grades. There are no tuition fees. Only a small fee for student welfare organisations has to be paid. In addition, students may apply for financial support from the Norwegian State Educational Loan Fund, which is initially a loan but, in part, converted to a fellowship upon study completion. Approximately 20% of all Master degree courses in Norway are taught in English. And 7% of all students are from abroad. Norway seems to be more attractive among doctoral students. Last year, more than a quarter of students receiving a PhD degree were non-Norwegians citizens. Foreign students have to fulfil three criteria to enter the system: proof of Norwegian language skills, accommodation and funds in the range of €11,000 per year. English-taught degree courses may waive the language requirements.

A grant scheme, the Quota Scheme, provides full fellowships for 1,100 international students primarily from developing countries and countries in Eastern Europe and Central Asia. Other foreign students may also apply to the Loan Fund; 70% of the sum is given as a loan, which is annulled once the student has fin- ▶▶

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Interview

“I Got All The Help I Needed”



The Portuguese **Sara Domingues** is a second year PhD student in the Gabriela Jorge da Silva group at the Centre for Pharmaceutical Studies in Coimbra, Portugal. Last year she was successful in the Yggdrasil mobility programme of the Norwegian Research Council and received a five-month fellowship to visit the University of Tromsø. Her work focuses on antibiotic resistance and the transfer of genetic material in disease-causing bacteria.

Why did you choose the Tromsø University, the northern-most university in the world?

Domingues: I came to Norway for the first time in 2008, in the frame of my Master studies in Cell Biology at Coimbra. Funded by an EEA/MCTES grant, I had the choice between Iceland, Liechtenstein or Norway. As my Portuguese supervisor had previously collaborated with Kaare Nielsen from the Department of Pharmacy in Tromsø, the decision was easy. Since our work turned out to be fruitful, I applied afterwards for a binational PhD grant for research collaboration by the Portuguese Foundation for Science and Technology. I will come to Tromsø several times during my four-year PhD studies.

What about the application for the Yggdrasil programme?

Domingues: As far as I remember, it wasn't complicated and took me only a few hours. It required some personal details as well as a short CV, some practical information about the expected stay in Norway, a short project description and an invitation letter from the host university. The application was quickly processed and in less than two months I got the positive answer.

What about your current stay in Norway?

Domingues: I came to Tromsø at the end of January and will stay here until June. I was in Portugal over Easter and have also attended a scientific meeting in Vienna, presenting some of the scientific results obtained so far. That trip got a bit more challenging than expected due to the volcanic eruptions on Iceland but I managed to come back after one week.

How smooth was your start in Norway?

Domingues: Apart from the emotional adaptation necessary in the beginning, everything else was quite easy. I got all the help I needed from my research group. They took care of my accommodation and showed me the main places of the university and the city. Bureaucracy was mainly presented at home. I do not recall any complication with paperwork here in Tromsø. The Yggdrasil programme did not request anything else beyond the application form and the payments have arrived as expected.

How international is your current research environment?

Domingues: My group here is very international and the working language is English. Actually, foreign researchers coming from Austria, Denmark, Germany, Portugal, Russia and Yemen outnumber the locals. I have attended some introduc-

tory level Norwegian classes. Right now I am able to follow conversations a bit but there is no pressure because almost everyone, both in the scientific and non-scientific settings, speaks English.

Are you able to compare the way of doing science between Norway and Portugal?

Domingues: The way of doing science is similar in both countries. The major difference is the available research budget. In Norway it is easier to work because there is much more material available. In Portugal, we have to deal continuously with budget problems, which may limit and delay our work. But I think excellent research is taking place in both countries.

What about social life in Tromsø?

Domingues: In the beginning it was a bit hard to get integrated in the social life, as after work everyone just goes home. But as soon as I started knowing other people, especially international ones, it became much easier. In Norway, they usually have parties or meetings at home rather than in pubs or bars, which is completely different from the Portuguese culture. Tromsø also offers great opportunities for outdoor activities and a variety of cultural events such as music or movie festivals. So you can always find something to do after work.

How is the spirit of younger Norwegian scientists?

Domingues: In general, the Norwegian society is very relaxed and the younger scientists are no exception. Everyone has a good quality of life, independently of the job. So in my perspective, their future is not something that really worries the students.

(For more information and interviews on doing life science research in Norway go to www.labtimes.org)

“It is easier to work because there is much more material available.”

“I do not recall any complication with paperwork here in Tromsø.”

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► ished and left Norway. Students may also apply for travel allowances at the beginning and end of their studies and for one home visit per year. Applications to the Quota Scheme are highly competitive and need to be made at the university or college of your choice. Be aware that not all institutions offer access for PhD students via the Quota Scheme. The Norwegian Centre for International Cooperation in Higher Education, SIU, is a public agency under the Ministry of Education and Research. SIU is located in Bergen and in charge of promoting internationalisation of education and research. It operates the site www.studyinnorway.no, the official gateway to Higher Education in Norway. In addition, it provides an overview with details and further links on funding programmes for international students and researchers, including many bi-national cooperation programmes.

Norway introduced a tenure-track system in 1993. Career steps include PhD candidate, postdoc/research fellow (Førsteamanuensis)/associate professor and professor. With the exception of PhD students financed by the Quota Scheme and postdocs with fellowships, most PhD candidates and postdocs are employed with full social benefits. PhD students in Norway belong to the best-paid PhD students worldwide. A PhD title is required for a permanent academic position. The transition from a postdoc to a permanent position is a major career bottleneck in Norway, as in other countries, too. A national committee evaluates the promotion to professor, which is based on academic performance and does not depend on a vacant professorship.

Other Funding Sources

In Norway, education and research as well as health care are seen as public goods and it is rather unusual to make donations in these areas. Moreover, there are no tax advantages for philanthropism. This means that in contrast to many other European countries, the opportunities to get a fellowship or a little extra cash for your research from a foundation are quite limited. A notable exception is the Norwegian Cancer Society Kreftforeningen, the largest non-governmental sponsor for cancer research in Norway. In 2009, more than €20 million were spent on research. Major sources of income are wills, donations, revenues from State betting companies and the fees of more than 90,000 members. Fifty percent of all funded research is basic research but the Society wants to invest more funds into patient-oriented research, in future. PhD students, postdocs and visiting foreign scientists are supported by fellowships. Applications are done together with the host institution. Last year, about half of the 261 applications in the categories researcher-initiated projects and support for positions were fully or partially granted. There is usually one application deadline in the summer of each year.

To push donations, the Norwegian government installed the so-called Donation Reinforcement Initiative in late 2005, which adds a 25% premium to all donations. Donations have to be used for long-term basic research and not for covering daily expenses. Donors are not allowed to have any commercial benefits from supported research. The minimum sum that receives the premium is €375,000. Beneficiaries are universities, colleges awarding doctorates, the Norwegian Academy of Science and Letters and the Norwegian Research Council. The initiative turned out to be quite promising and has already acquired close to €120 million in the first three years of operation.

Earlier this year, the Bergen Medical Research Foundation received one of the largest single donations ever made by individuals in Norway. The family of the late Kristian Gerhard Jebsen

contributed €100 million of their fortune made in the shipping business for medical and maritime research, to be spent over the next 30 years. One of the first activities is to spur translational research by setting up several "K.G. Jebsen Centres for Medical Research". Each will receive up to €2 million for a four-year period. Other important givers are Trond Mohn, who contributed more than €60 million to the Bergen Medical Research Foundation and the University of Tromsø; the billionaire Stein Erik Hagen, who gave a million to start the Foundation for Clinical Heart Research at the UiO and the Norwegian born physicist Fred Kavli, whose foundation supports the Kavli Institute for Systems Neuroscience at NTNU in Trondheim. Places to watch, with enough resources to develop into international leading research institutions.

Outlook

The research funding system in Norway has several major construction sites. It has been criticised for the commercialisation of academic research, for negligence of basic research, for patronisation and over-regulation, and for high fragmentation leading to an inefficient usage of public resources. But the Norwegian Government is committed to working on the shortcomings. Major activities with respect to Life Sciences and biomedical research are an ongoing infrastructure and large equipment programme, the mentioned Centre of Excellence programme and a programme strengthening regional activities. In addition, a large-scale programme that succeeds FUGE is at the planning stage. With a total budget of €200 million, FUGE is Norway's largest biotech programme, which is focused on functional genomics and will come to an end next year. There is also an ongoing discussion on the internationalisation of Norwegian research, which so far did not result in any major activities that could attract and retain foreign researchers at all levels. Nonetheless, if you are interested in doing research in one of the well-funded priority areas with international standing, Norway seems to be a good choice.

RALF SCHRECK

ONE FINE DAY IN THE LAB..

BY LEONID SCHNEIDER

