

An International Affair



Photo: Alejandra Manjarez

“The competition between molecular researchers is strong. On average, we are receiving around 100 applications per vacancy,” said Claudia Bölter, spokeswoman for the German plant breeder KWS, a company headquartered in the small city of Einbeck. The firm specialises in the breeding of crops for temperate climates and has 4,400 employees in 70 countries. KWS generates new plant varieties and produces and sells seed for maize, sugar beet, cereal crops, oilseed rape, sunflower and potatoes. At the R&D site in Einbeck, scientists are combining conventional breeding technologies with modern biotechnology to improve yields as well as resistance to disease, pests and abiotic stress. Since new vacancies being advertised at the beginning of the new fiscal year, from July 1st onwards, there are still many open positions. These are advertised on the company’s website (see box “Useful Links”), on the job portals *jobvector*, *academics.de*, *academics.com* and *Xing* as well as on the careers pages of *seedquest.com*.

At KWS, molecular plant scientists are working in fields such as cell and tissue culture, DNA diagnostics, genetic engineering and genomics. They are entrusted with basic and applied research, with the development of cellular and molecular tools and with the application of advanced methods in service units. “Some researchers also join our groups and departments responsible for plant breeding, regulatory affairs, quality management and intellectual property rights management,” Bölter explained.

Employed until retirement

“To fill a vacancy, we invite five to six candidates for a first meeting to get to know each other. From these, we select one to three candidates for a second interview,” she added. In this second round, the applicants have to present their thesis and discuss their work with KWS scientists. Applicants for group leader, project leader or scientific staff positions usually hold a PhD. “Due to their academic training, they are experienced in delivering results on sched-

How do molecular plant scientists fare in Europe’s biotechnology-opposing environment? *Lab Times* inquired with company representatives and academics from Germany, Switzerland and the UK.

ule, in interacting and working with different colleagues and in reporting results at meetings,” Bölter said. “However, the career prospects in our company depend more on performance, expertise, scientific background and personal development and less on formal academic qualifications.”

At first, scientists are usually hired for a fixed term. “After a few years, we make the contracts permanent, in general,” Bölter told us. “Most scientists in our company are Research Associates. They are employed in consecutive projects. Some are promoted to group leader,” she said. The chances to stay on are good. The overall average staff membership at KWS is 15 years. “If scientists work adequately, they may stay with us until they retire,” the spokeswoman commented.

Key skills needed

The USA, Brazil and Argentina are key sales markets for KWS. GM crops are favoured in these countries. “Therefore, we will continue integrating green genetic engineering in our R&D work, despite the adverse political climate in Europe,” Bölter emphasised. “The combination of conventional breeding and modern biotechnological methods is crucial for our success.” Currently, KWS does not conduct field trials with genetically modified plants in Germany because of the lack of public and political support.

Asked, which skills would be in demand in the next few years, she replied, “Knowledge of modern breeding technologies, such as genomic selection, of new technologies in sequencing and microfluidics and of methods with regard to the stress resistance of plants.” Further valuable skills would be knowledge of analytical methods

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to enhance the speed and precision of phenotypic data collections and a background in molecular biology and bioinformatics.

Greener pastures overseas

"In Europe, our roles in terms of plant molecular biology and genetic modification are largely related to administration and policy," said Andrew Tommey, Senior Regulatory Manager for Europe for **DuPont Pioneer**. "All of Pioneer's R&D in this field is now conducted outside Europe given the continued reluctance of certain Member States to cultivate GM crops," Tommey added. Globally, the company's scientists develop maize, soybeans, sorghum, sunflower, alfalfa, canola, wheat, rice, cotton, pearl millet and mustard seed via both molecular genetics and conventional breeding. Whilst Pioneer has over 110 research sites in 25 countries on six continents, programmes in Europe are restricted to conventional breeding.

For new graduates in molecular plant sciences, it seems a good idea to look for jobs in the growing and emerging markets (see box "Useful Links"). "The US, South America and Asia, especially India and China, appear to have more to offer to graduates in terms of R&D positions than Europe. Jobs are being created there, largely because these countries are moving forward with biotech. Scientists are also needed for in-depth risk assessment studies and their analyses," Tommey said. "In India, Pioneer has a new Regulatory Science group working on biotech and 40 to 50 people have been hired over the last few years."

Arduous approval procedures

Tommey, a former researcher trained in plant molecular genetics, worked in the past for the UK government inspecting field releases of GM crops and subsequently for the European Commission as a policy officer for issues associated with GMOs. He recounted that, in 1996, there were 400 to

500 field trials with new biotech crops in Europe, many of which were conducted by small businesses. However, this has dramatically declined over the past few years. This year, only a handful of trials are being con-

ducted in total across all companies. "The studies necessary for an application for approval of a new GM product in the EU cost millions of dollars. Where cultivation is concerned, they have to be conducted in the Member States where the product will be commercialised. As the EU regulatory requirements have continued to increase and with only one EU approval for cultivation of a new GM product – the BASF starch potato – in the last 15 years, small businesses have simply been driven out of the market," he told us.

plants. In the case of BASF's starch potato, the amylase content is strongly reduced. Under EU legislation, a Member State can invoke a specific "safeguard clause". It can provisionally restrict or prohibit the use and sale of a GMO in its territory because of scientifically-based concerns regarding the safety of the GMO. Six Member States have done so: Austria, France, Greece, Hungary, Germany and Luxembourg. "Such bans tend to be founded on politics rather than science and only add an additional hurdle to the commercial cultivation of GM crops in the EU," Tommey said. In his view, politics and a lack of decision making have been the major factors in obstructing and scaring away commercial molecular plant R&D in Europe.

Changing strategies

In July this year, Monsanto announced that it will no longer be pursuing approvals for cultivation of new biotech crops in Europe. Instead, the company wants to expand its conventional seed production and breeding. The pending application to renew the approval for insect-resistant MON810 maize will not be affected.

In 2012, BASF Plant Science moved its headquarters from Limburgerhof, Germany, to Raleigh, North Carolina. The company stopped the development and commercialisation of all products targeted solely at cultivation in the European market.

These include genetically modified starch potatoes. Research and development activities will be concentrated mainly in Raleigh, Ghent and Berlin. The company announced, it will focus on the more attractive markets for plant biotechnology in North and South America, and in Asia.

Biotech crops were grown worldwide on 170 million hectares in about 30 countries in 2012. The global leaders were the USA, Brazil, Argentina, Canada and India, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) reported. Europe contributed only a small fraction with 129,000 hectares of GM maize in five countries, the leader being Spain with



Rapeseed hybrids developed by DuPont Pioneer. The PR46W20 hybrid outshines wildtypes and other hybrids with its very high oil content and a strong disease-tolerance.

Useful Links

- ▶ KWS careers page – www.kws.de/aw/KWS/company_info/~eezv/Careers
- ▶ Pioneer's careers page – www.pioneer.com/home/site/about/careers
- ▶ Parniske lab – www.genetik.biologie.uni-muenchen.de/research/parniske
- ▶ Hardtke lab – www.unil.ch/dbmv/page21142_en.html
- ▶ Robatzek lab – www.tsl.ac.uk/research/silke-robotzek
- ▶ The Sainsbury Laboratory (TSL) – www.tsl.ac.uk

According to the EU Register of authorised GMOs, several companies also received authorisation for the use of their genetically modified cotton, maize, oilseed rape, starch potato, soybean and sugar beet in food, feed and for other products in the EU. The introduced genes mainly confer resistance to herbicides and tolerance to insects on the

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116,000 hectares. Over 17 million farmers worldwide grew biotech crops, generally small resource-poor farmers in developing countries.

No reason to worry in Germany

"The future of molecular plant biologists does not depend on the acceptance of GMOs in Europe," commented Martin Parniske, Professor and Head of Genetics at Ludwig Maximilians-University in Munich, Germany. His research group is investigating the interaction between plants and symbiotic or pathogenic microorganisms (see box "Useful Links"). He was recently awarded an ERC Advanced Grant by the European Research Council. "Although GMOs hold a lot of promise for increasing yield, resistance to pests and drought, the impact of molecular plant biology is not limited to transgenic approaches. Our knowledge of plant gene function and of the effects of genetic variants has grown exponentially in the last two decades, especially since we have the technical means to sequence whole plant genomes and to precisely determine the genotype of variants," he explained. For this type of analysis and for the respective knowledge-based plant breeding, molecular plant specialists will continue to be needed.

"On a global scale, the cultivation of GMOs is widespread and the biotechnological development of genetically adapted plants will certainly continue. There would, probably, be more job opportunities in Europe if the political climate was more biotechnology-friendly," Parniske noted. "To secure food quality and production, we have to maximise the diversity of plant germplasm resources [collections of

living tissue, from which new plants can be grown, e.g. seeds, plants or parts of plants, BD] and revert the trend to global monopolisation. To increase the number of plant breeding companies in Europe and to give small breeders a chance, the extremely costly regulations for GMO approval should be simplified," he suggested.

"Internationally, plant molecular biologists trained in Germany are recognised for their exceptional technical expertise," he remarked. Trained personnel would be even more sought after in the future than today, he estimated. For a promising career in academia, he recommended a stint as a post-doctoral researcher in a leading laboratory in the USA or in the UK. Former members of Parniske's research team have international positions as group leaders, postdocs, as a Study Manager at Bayer CropScience, as a manager of a genomics service unit, as a Programme Director for the German Research Foundation, as a college professor and as patent examiners and attorneys.

To improve the public perception of plant biotechnology in Europe, the plant geneticist advocated strengthening scientific education. "The achievements of outstanding scientists, such as plant pathologist Norman Borlaug, should become more common knowledge," he said. Borlaug, a central figure in the Green Revolution, devel-



Photo: DuPont Pioneer

Strict Controls in the EU

Genetically modified organisms (GMOs) and derived products, such as genetically modified (GM) food and feed, can only be authorised in the European Union if they have passed a rigorous safety assessment by the European Food Safety Authority (EFSA). Currently, EFSA is working on 54 GMO applications.

The respective procedures are laid down in Regulation (EC) No 1829/2003 on GM food and feed, which came into force in April 2004, and in Directive 2001/18/EC on the release of GMOs into the environment, which came into force in March 2001. EFSA's GMO Panel has the task to assess any possible risks of GMOs to human and animal health and the environment. The Panel is composed of independent scientific experts. "This assessment typically takes five years or longer," Pioneer's Senior Regulatory Manager Tommy commented. The Panel's scientific advice then forms the basis for taking the final decision on market approval by the Commission and Member States.



Photo: Unicom, Université de Lausanne

Christian Hardtke is sure that molecular plant scientists have all the skills to be able to work in any life sciences field.

oped a high-yielding, short-strawed, rust-resistant wheat by conventional breeding. The new wheat was planted with success in Mexico, India, Pakistan, Central and South America, the Near and Middle East and Africa. In 1970, Borlaug was awarded the Nobel Peace Prize for his role in fighting world hunger.

Stable jobs in Switzerland

"There are good opportunities in basic plant research in Europe because it is well-supported. In applied plant research, the situation is more difficult. Companies gradually move their R&D facilities outside Europe," said Christian Hardtke, a professor at the University of Lausanne, Switzerland. His lab is investigating the genetic control of plant growth and development (see box "Useful Links").

His former employees had no problems to find a stable job, he said. However, not all stayed in science. Hardtke has supervised 20 postdocs and PhD students, so far. Four of his former lab members have permanent academic research positions. Some continued their academic research careers as postdocs, while others joined the R&D or marketing and sales departments of companies, such as Bayer CropScience and Syngenta. Some former members of Hardtke's lab or department are working in the pharmaceutical industry, as consultants, as clinical monitors, in genetic counselling or in public administration. "Molec-

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ular plant scientists have generic transferable skills, which are very useful for positions in the life sciences in general and beyond," the plant geneticist explained. "With their rigorous training in techniques and concepts of molecular genetics, they are on a par with other life scientists."

Europe in danger of missing the boat

Last year, Hardtke visited research facilities at BWK Agriculture Biotech, a company in Beijing, China. "It is impressive how commercial biotechnological plant research is developing there. Europe should not ignore these trends and pretend to have a self-sufficient economy. We already depend on imported transgenic feed, today," he pointed out.

To strengthen the job market for molecular plant geneticists in Europe, Hardtke advocates the founding of more plant biotech start-ups with expertise in next generation molecular techniques. "I fear that Europe might become a backwater that loses its ability to create and evaluate state-of-the-art sustainable plant products as technology progresses elsewhere. We cannot afford to become dependent on the expertise of other countries; the world will move beyond the simple-minded GMO debate and our well-trained scientists will have to go overseas to do applied research," he said. To improve the public perception of green genetic engineering, knowledge should become more widespread about how society benefits from molecular plant research on a daily basis, he added.

Multiple talents required in the UK

"In the current academic or industrial environment, it is not sufficient to only know about a particular specialised area, such as genetics or biochemistry. Instead, scientists need a broad knowledge of different approaches and must be able to combine them," said Silke Robatzek, a group leader at The Sainsbury Laboratory (TSL) in Norwich, UK. Her team is studying the role of membrane trafficking in plant immunity (see box "Useful Links"). She added that bioinformatics was also an important field, e.g. for genome and transcriptome analysis as well as for advanced bioimaging studies. "Computational biology, such as mathematical modelling, will be increasingly combined with classical biology. This will provide opportunities to tackle questions that can hardly be solved by wet lab methods only," she predicted. "Communication skills are also more and more in demand in research," she said.



Silke Robatzek points out that plant scientists need more than specialist knowledge.

Robatzek's former lab members have positions in academia or industry as group leaders, postdocs, as an R&D manager at agro-diagnostics company Bioreba AG and as a product manager at biotechnology company Biotype Diagnostic GmbH. Postdoc and group leader positions are usually non-permanent. At TSL, this is not an absolute picture as is often the case in other European countries. "Group leaders can stay on following the end of their five-year contracts, depending on performance," the scientist explained. She would prefer a wider application of this US-style tenure track system throughout Europe. "TSL funds scientific talents rather than projects and promotes innovative, curiosity-driven, long-term research," she told us.

The institute was established in 1987 as a joint venture between the Sainsbury family's Gatsby Charitable Foundation, the John Innes Foundation, the University of East Anglia and the Agricultural and Food Research Council. Research at TSL focuses on plant interactions with microbes and viruses. Currently, around 85 scientists from 25 countries work at the laboratory. Since 2009, the 2Blades Foundation operates an applied research programme within TSL. Open positions can be found at the TSL website (see box "Useful Links").

Room for improvement

To promote commercial genetic plant engineering in Europe, Robatzek suggested it might be better to regulate products, rather than the technology, by which these products were generated. The group leader criticised that academic experience as a PhD student or as a postdoc did not count when scientists applied for jobs in industry. "It is possible to get internships in industry but this is quite unattractive given the experience our students and postdocs have," she said. In academia, she noticed a lack of individual fellowships for postdocs and PhD students, which enabled them to apply for a position in their country of residence. "Funding agencies focus too much on mobility criteria. It is more important to choose a lab with a matching scientific focus, the best infrastructure and resources for your research. Whether this is next door or far away, shouldn't really matter."

BETTINA DUPONT

ONE FINE DAY IN THE LAB...

BY LEONID SCHNEIDER

