

Helló Magyarország Welcome to Hungary



Photo: Fotolia/DH

Unlike thousands of international medical students, scientists from abroad tend to avoid Hungary, scared off by the language barrier, low income and poor research infrastructure. Are there changes for the better around the corner?

Largely unknown is the fact that Magyars have contributed significantly to the advancement of science and engineering. The light bulb, noiseless matches, ballpoint pen and, well, Rubik's cube all have their origin in Hungary. Prominent scientists include the father of informatics John von Neumann, Edward Teller, the main brain behind the hydrogen bomb, and Leó Szilárd, who conceived not only the nuclear chain reaction but also particle accelerators and the electron microscope. Nobel Prizes were handed over to Albert Szent-Györgyi for unraveling the role of fumarate in the citric acid cycle and the discovery of vitamin C, which was isolated from paprika pepper, Georg von Békésy for elucidating the function of the cochlea and Avram Hershko for describing ubiquitin-mediated protein degradation.

All of the scientists mentioned above have in common the fact that they left Hungary to find better living and working conditions or were forced to do so by political persecution. Some but not all of the Hungarian-born scientists "westernised" their name in foreign lands. The exodus of Hungary's best minds is still ongoing. Current Hungarian expats with a high international reputation include András Nagy from the Samuel Lunenfeld Research Institute in To-

ronto, a pioneer in the field of stem cells and transgenic technologies, and the two neuroscientists Péter Somogyi from Oxford and György Buzsáki from Rutgers University in Newark. In contrast, the number of foreign scientists employed at Hungarian institutions is quite low. Here, *Lab Times* will cover recent developments in Hungary's research landscape.

Background

With ten million citizens Hungary is a medium-sized Central European country. Its largest cities are the capital, Budapest, with 1.75 million inhabitants, followed by Debrecen and Miskolc in the Northeast and Szeged in the South, which each account for more than 170,000 people. Budapest is not only the political and cultural, but also the educational and scientific centre of Hungary. Four out of the five best Hungarian universities and more than 60% of Hungary's research institutions, biotech companies and scientific personnel are concentrated in the greater Budapest region. Furthermore, Hungary is also home to eight UNESCO world heritage sites including the banks of the Danube and the Buda Castle quarter in Budapest, the 800 km² Hortobágy Pusztá, the largest natural grassland in Europe, and the Tokaj wine region. Other

major tourist attractions are Lake Hévíz, the second largest thermal lake in the world, and Lake Balaton. Tourism in general and health tourism in particular are growth sectors. Hungary became a member of the EU in 2004. While the adoption of the euro is in the air, the Hungarian forint remains its currency. Hungary is a parliamentary representative democratic republic with Prime Minister Viktor Orbán as head of the government. The conservative Fidesz party overpowered a coalition of Socialist Party and Alliance of Free Democrats in the 2010 election and is addressing Hungary's large public deficit by quite unpopular austerity measures and reforms.

The history of Hungary dates back to the ninth century or even earlier. The Kingdom of Hungary lasted almost a millennium and fell repeatedly under the influence of major powers. After defeat in World War I, Hungary was forced to give up a third of its population and three-quarters of its territory including parts of nowadays Slovakia, Croatia, Romania, Ukraine, Serbia and Austria. Soviet troops occupied Hungary in 1947 and a post-war government dominated by Communists was installed. The formation of the Republic of Hungary in 1989 terminated "Goulash Communism", which refers to the special mixture

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of socialism and more liberal Western-style elements in Hungary. The transition from a centrally planned to a free market economy was troublesome. After a period of privatization, investments by foreign companies became a major driver of economic growth. Nowadays, Hungary has developed into an attractive place for foreign companies manufacturing cars, pharmaceuticals, electronics and food. Audi has built the world's third largest engine manufacturing plant in Győr and many foreign pharmaceutical companies including Sanofi, GlaxoSmithKline and AstraZeneca are operating manufacturing plants or research centres in Hungary. The Hungarian-owned pharmaceutical companies Gedeon Richter and Egis Pharmaceuticals are the national leaders when it comes to investments into research and development activities. Costs benefits and the internationally recognised high quality of medical staff have made Hungary a favourite place for clinical trials.

Biotech Hungary

Did you know that the term "biotechnology" was coined almost 100 years ago by the Hungarian agricultural engineer Ereky Károly? His book *Biotechnology of Meat, Fat and Milk Production in an Agricultural Large-Scale Farm* was published in German and sold several thousand times. Károly put forward the idea that traditional agricultural methods will not be able to erase the word "hunger" from dictionaries but that the combination of research in several disciplines will turn out to be successful. Several decades elapsed until commercial biotech gained ground in Hungary. The biotech sector received priority status and additional funding by the Governmental Development Plan 2005-2010. Five biotech-related university knowledge centres, three bio incubators and the Hungary Biotech Association provide a solid basis for new companies. The Pole Programme, a national cluster development strategy, supports public-private cooperation at the regional level and has already led to several accredited biotech-related clusters, which received substantial support from EU Structural Funds.

Hungary took the lead among 14 new EU member states and candidate countries, which were analysed in the report *Biotech in the New Member States 2009*. With 80 core biotech companies and 1,000 employees, Hungary emerged as the country with the most developed biotech sector. About a

tenth of biotech companies are focusing on novel therapeutics, whereas the majority is dedicated to diagnosis, services or manufacturing. Vaccines and new antibiotics but also novel technologies assisting agriculture, biomass production and food processing are areas of specialisation. The Hungarian biotech sector even continued to grow in the face of the economic crisis, when most venture capital went up in smoke and funding by the Research and Technological Fund, another primary source of financing for biotech companies, was cut by a third or €60 million. But the future seems bright, as the Ministry for National Economy installed the New Széchenyi Development Plan, a long-term multi-billion Euro investment programme, last year. Although the scope and financing of the whole programme is not predictable, small and medium enterprises will be its major beneficiaries.

Room for improvement

How is Hungary's performance in international rankings? Hungary was rated only as a moderate innovator by the Innometrics service of PRO INNO Europe. License and patent revenues from abroad, medium- to high-tech manufacturing exports and international publications were above average, whereas the small number of innovative enterprises, lack of venture capital and the restricted openness of the research system to foreigners led to a lower rating. In the latest Global Competitiveness Report Hungary took the 48th place among 142 countries with very poor grades for its tax system,

public trust of politicians, burden of governmental regulations and brain drain.

Bibliometrics reveals that Hungary's publication output is quite good in comparison to other Eastern European countries. Thomson Reuters' ScienceWatch analysed Hungary's relative world share of publications between 2005 and 2009. Agriculture, mathematics and neuroscience are the fields that stick out. With respect to relative impact space sciences, psychiatry, psychology, pharmacology and toxicology, physics and clinical medicine are Hun-

garian strongholds. In the SCImago Journal & Country Ranking, which covers the last 15 years, Hungary comes in at place 37 worldwide with respect to its number of publications, 35 concerning citations and 25 for citations per paper in countries with more than 50,000 publications. Of interest is Hungary's regional standing. Since a separate ranking for Central European countries does not exist, we have to stick to the list of 24 Eastern European countries. Hungary emerged as fifth with respect to citable documents, as fourth concerning citations and was beaten only by Estonia, when it came to citations per document.

Finally, in the SCImago Institutions Ranking 2011, which takes account of various output indicators, more than 3,000 institutions in 104 countries have been scrutinized. The Hungarian Academy of Sciences is listed as the fifth best academy in Eastern Europe. Individual Hungarian institutions are not represented in the upper fifth of institutions. The following are listed as Hungary's best universities: Budapest University of Technology and Economics, Semmelweis University of Budapest, University of Szeged, Eötvös Loránd University of Budapest and University of Debrecen. No new field-oriented reports have been published, so far, but in the latest exercise Semmelweis University, the University of Szeged and the University of Debrecen were the three most prominent Hungarian institutions in life and health sciences. Noteworthy is that Semmelweis University was in the vanguard of Eastern European institutions in health sciences.

Too many players & seesaw changes?

Hungary spent €1.1 billion on research and development (R&D) last year. This relative expenditure was, at 1.14% of GDP, at the lower end of EU countries. The business sector and, in particular, a few large foreign-owned companies are the main research performers, accounting for almost 60% of all R&D expenses. The Government sector, through the Hungarian Academy of Sciences, and the higher education sector through universities each spent another fifth of R&D resources. The Hungarian Central Statistics Office lists about 21,000 scientists and engineers: half employed at enterprises, 28% at universities and the rest at other public R&D institutions. The research and innovation system of Hungary is often criticised not only for the paucity of available funds but also for its lack of priority setting and coordination, intransparent budget allocations and funding decisions as well as

Internet Resources

- ▶ Euraxess Hungary - <http://euraxess-hungary.hu>
- ▶ Hungarian Academy of Sciences - <http://mta.hu>
- ▶ Hungarian Scientific Research Fund - www.otka.hu
- ▶ Tempus Public Foundation - <http://english.tpf.hu>
- ▶ Hungarian Fellowship Office - www.scholarship.hu

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inefficient resource utilisation. Continuity and sustainability are rarely reached, since not only research policy-making bodies but also funding and implementation agencies are subject to frequent changes to their organisational structures and range of responsibilities. The Government's mid-term science, technology and innovation policy strategy (2007-2013) is in place. Two ongoing economic programmes are supposed to have an impact on education and science in Hungary in the upcoming years: the Science-Innovation Programme of the New Széchenyi Plan, mentioned above, and the National Reform Programme of Hungary 2011-2014.

Planning and cooperation

A novel coordination and decision-making body, the National Research, Innovation and Science Policy Council (NKITT), was established less than a year ago. NKITT is the main policy maker with respect to science, technology and innovation; it is chaired by one of the deputy prime ministers and co-chaired by the president of the Hungarian Academy of Sciences. Additional members are taken from the Ministry for National Economy, the Ministry of National Development and the Ministry of National Resources. The Ministry for National Economy oversees the National Innovation Office (NIH), which replaced the former National Office for Research and Technology in early 2011. The NIH covers areas of strategic planning, analysis and international cooperation with respect to EU Programmes and inter-governmental, bilateral cooperation agreements. In addition, it promotes business innovation and public-private cooperation. The Ministry of National Resources oversees education and research at universities, while the Ministry of National Development oversees the National Development Agency (NDA), which is in charge of measures funded by EU Structural Funds. The Hungarian Economy Development Centre (MAG Zrt) administers and implements support from the NIH and NDA. The Hungarian Academy of Sciences has a central role in Hungary as a policy advisory body and research performer. The Hungarian Rectors' Conference is the major advisory body on topics related to higher education.

Competitive funding for basic and applied research is provided by two funds: ba-

sic research benefits from the Hungarian Scientific Research Fund (OTKA), whereas private sector and applied research are targeted by the Research and Technological Innovation Fund (KTIA). KTIA is financed by an annual innovation levy charged to Hungarian companies and a matching contribution from the state budget. Regional University Knowledge Centres and the National Research and Development Programme have been within the scope of its responsibilities. Almost €150 million, more than a quarter of public R&D funds, were at KTIA's disposal in 2009. Concerns about the prop-



In Hungary, there are many ways to 'spice up' your life and maybe even your research results – either a hearty goulash soup...

er distribution of funds were raised last year, major activities were put on hold and funds already granted were partially reallocated.

Academy business

The Hungarian Academy of Sciences, or Magyar Tudományos Akadémia (MTA), has a pivotal role in the Hungarian research system. The foundation of a learned society for the promotion of Hungarian language and literature in 1825 was facilitated by a donation by Count István Széchenyi. Natural sciences were not a priority until MTA merged with the Academy of Nat-

ural Sciences in 1946. Shortly thereafter, MTA was transformed into a Soviet-style academy. Despite its loss of independence, the scientific output and influence of MTA reached an all time high during the following years. In post-communism Hungary, MTA became an independent public body. Nowadays, MTA has multiple roles as policy advisor, research performer and science communicator. It also represents Hungary in several international organisations including the European Science Foundation ESF and the European Molecular Biology Conference, EMBC, and is co-organiser of the World Science Forum, which deals with global science policies and takes place in Budapest for the fifth time this November.

Increased financial autonomy

The General Assembly is MTA's supreme body and made up of elected members. It adopts the legal framework and budget and elects MTA's top officials, including the president. The Council of Doctors confers the prestigious title of a Doctor of the Hungarian Academy of Sciences. Numerous councils and committees exist. MTA operates on an annual budget cycle. The 2009 Law on the Hungarian Academy of Sciences increased its financial autonomy. In 2011, MTA was allocated about €120 million from the national budget, which included a €20 million package earmarked for the Hungarian Scientific Research Fund, OTKA. MTA's budget is supplemented by its own revenues in the range of €50 million. As a research performer, MTA operates 38 of its own research institutes and two centres, and employs about 2,300 researchers. In addition, it supports

and jointly operates close to 80 research units at universities. MTA's share of Hungary's scientific output is close to 25% of all international publications. MTA institutes are autonomous and determine their own research strategies. In addition, strategic research is conducted according to a special agreement between MTA and the Prime Minister's Office. I just want to mention three MTA institutions, which received Centre of Excellence status and substantial funding from the European Commission in the past and might be of particular interest to life science researchers: the Biology Research Centre (BRC) in Szeged, the Chemi-

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cal Research Center and the Institute of Experimental Medicine (KOKI), both located in Budapest.

Stopping the brain-drain

MTA supports not only its own scientists below the age of 35 through its Young Researcher's Fund but manages several programmes not restricted to Academy scientists. Momentum (Lendület) has become Hungary's brain-drain-stopping flagship programme. It was introduced in 2009 and provides long-term support for excellent young scientists and research groups. Five-year support is given to young scientists between 30 and 40 years old as well as established group leaders aged between 35 and 45 working either at institutions of the Academy or, since this year, at universities. Positive evaluation of the project may lead to a second funding period and permanent employment of the group leader. The number of new awards has been increased from five in 2009 to 16 in 2011. In 2011, Lendület's budget amounted to almost €4 million. The programme is also receiving increasing attention and additional financial support from Hungarian companies wishing to benefit from local talent. The János Bolyai Research Scholarship programme, named after the famous Hungarian geometer, is another popular programme for postdocs below the age of 45. On average, every third application is funded and about 190 awards are made each year. The up to three-year fellowship pays €420 a month, which is quite low and needs to be combined with other sources of income. In comparison, an EMBO postdoctoral fellow in Hungary gets about €3,150 to take home each month. János Bolyai applications require a doctoral title, a letter of acceptance by the Hungarian host institution and the payment of an application fee of about €40. There is one call per year with a deadline in March.

This December, the General Assembly will have to make far-reaching decisions on infrastructure renewal, performance-based budget allocation and the formation of larger MTA research units. It is in planning to decrease the overall number of budgetary institutions from 58 to 23 and to establish a new research network encompassing just

six institutes and nine research centres instead of the former 40 research institutions. Administrative staff will be reduced and the money, thus made available, invested into modern research infrastructure and highly qualified research personnel including young scientists.

Forints for basic research

The promotion of scientific excellence and young scientists are primary concerns of the Hungarian Scientific Research Fund (OTKA). OTKA has provided competitive grants for basic research in Hungary since 1991. Additional efforts are made to integrate expats and to stimulate international exchange and cooperation. Special programmes with open calls to attract foreign scientists to Hungary are currently not in place. However, foreign scientists working at Hungarian institutions are eligible to



...or simply plain pepper.

apply for OTKA funds. Applications can be made by individuals, research teams or research institutions. Each year OTKA grants 350 new projects with an overall success rate of about 20%. The annual budget is in the range of €20 million. A step up to €27 million in 2012 needs final governmental approval. Regular research projects with no pre-set topics and a contribution of between €1,700 and €20,000 per project per year account for half of OTKA's budget. Another third is given to postdocs for research or for starting their first own group. According to Előd Nemerkenyi from OTKA, 17 such starting grants have been awarded this year. Applications in life sciences and some other fields are submitted in English and evaluated with the help of international experts.

The oldest Hungarian University is the University of Pécs, which was funded

by Louis the Great in 1367. Nowadays, the higher education sector of Hungary consists of 69 institutions, including 18 state-run universities. The Loránd-Eötvös-University of Budapest is, with 31,000 students, the largest university. A new degree structure meeting the objectives of the Bologna process was introduced in 2004 and encompasses bachelor (alapfokozat), master (mesterfokozat) and three-year doctoral (doktori képzés) study programmes. The number of programmes not taught in Hungarian is limited. A total of 360,000 students are enrolled, of which two thirds are full-time students. More than 7,000 students pursue a doctoral degree. The percentage of international students is on the rise. They constitute about 5% of all students and more than 7% of doctoral students. Many foreign students belong to the Hungarian minority in neighbouring countries including Romania, Slovakia, Serbia and Ukraine. Nepalese, Colombians and Paraguayans account for more than half of foreign doctoral students. Medicine and dentistry are the most attractive study programmes for international students. It is estimated that more than 6,000 foreign students are enrolled at Hungarian Medical universities. For example, students from abroad account for a quarter of all students at Semmelweis University, where more than 1,000 prospective medical students apply

for the 180 spots in the German-taught programme each year. In addition, an outpost in Hamburg, the Asklepios Medical School GmbH, was opened three years ago, where students continue after a two-year course in Hungary and receive the internationally recognised Dr. med. (SOTE), according to the curriculum of Semmelweis University. Annual tuition fees for these programmes amount to €11,600 in Budapest and €14,400 in Hamburg.

Small research units

In the latest University rankings, Hungary found mixed success. Whereas it is not listed among the 400 leading universities in the present Times Higher Education Ranking, four Hungarian Universities made it to the top 700 universities in the QS Ranking as indicated: the Central European Univer-

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sity of Budapest (372), Eötvös Loránd University (501-550), the University of Szeged (551-600) and Corvinus University of Budapest (601-700). These four universities, together with Semmelweis University, also received the prestigious title "Research University" from the Hungarian government in 2010 to highlight their excellence in research. Autonomy when it comes to education, research, budget allocation and hiring is a key feature of Hungarian universities. Institutional block funding for education, research and maintenance is provided by the national budget and is performance-independent. Research units at universities in general are quite small, which is evident from the fact that the 5,000 scientists and engineers employed in the higher education sector are distributed over 1,400 research units. The Balassi Institute provides

students to stay and work in Hungary for a certain period after obtaining a degree before they are allowed to leave the country. Thousands have already protested against this new educational concept and the 2012 budget draft, which foresees a cut to the higher education budget of roughly €100 million, or more than 10%.

Business and pleasure

If you want to become familiar with Hungary, visit the web pages of Euraxess Hungary or of the Tempus Public Foundation (TPF). Both provide not only an initial overview of education and research but also share many details of everyday life in Hungary. You will learn that *gulyásleves*, *húsleves* and *halászlé* refer to goulash, meat and fish soup, that you can enter Hungary by hydrofoil on the Danube via Vienna

national fellowships in the "Development of Human Resources for Basic Research" programme or by the Marie-Curie co-funded MOBILITY programme.

If you want to visit an institute of the Hungarian Academy of Science, you must first contact your potential host lab and discuss opportunities given by bilateral exchange programmes before you apply for support at the International Relations Department of MTA. The Balassi Institute operates the Campus Hungary programme and the Hungarian Scholarship Board Office, which provides fellowships for foreign students, professors and researchers in frame of Governmental bilateral agreements or via a scholarship pool. Applicants from more than 50 countries may apply for up to ten-months stay as PhD student or postdoc or for full participation in a 36-month PhD programme. Additional opportunities exist for Austrians via the Stiftung Aktion Austria-Hungary (www.oma.hu) or at universities through their own international partnership programmes.

Outlook

Hungary has several universities and research institutes, which may be of particular interest to life scientists from abroad. There are just a few funding opportunities for foreign scientists from Hungarian sources, which in general provide only limited funds under the motto "barely enough to keep body and soul together". So, if you really want to give Hungary a try, bring along your own international fellowship or grant or look out for well-funded Hungarian scientists, for example, winners of European Research Council grants or Wellcome Trust fellows. Be aware that learning Magyar is a real challenge. Reforms by the Hungarian Academy of Sciences and universities are pending but it is hard to predict whether they will be enforceable and lead to a change for the better in a timely manner. Support for postdocs and young group leaders in Hungary has become increasingly important over the years and will be extended in the upcoming years. The number of expats returning home has increased. Hopefully, Hungary's large public debt will not turn out to be a major stumbling block for further investment in science in the future.

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If you are interested in reading more about scientific careers in Hungary, please visit our accompanying editorial online at www.labtimes.org.



To achieve a harmonious work-life balance, just take a break at the largest lake in Central Europe, Lake Balaton.

several international fellowships on behalf of the Hungarian government. For example, it maintains the Hungarian Scholarship Board Office, which is offering a wide variety of university and research scholarships. Foreign postdocs below the age of 45 may get a fellowship for up to ten months and worth €690 a month.

The reform of education in general and higher education in particular has been under discussion for a long time. Points raised are the merger and closures of institutions, better support for the best institutions, the overall reduction of study places receiving governmental support, measures to increase the number of students in natural sciences and engineering as well as the introduction of binding agreements to force

and Bratislava and that you need at least 100,000 forint or €370 a month for a decent standard of living with occasional evenings out. With respect to fellowship opportunities, TPF has been charged with responsibility for a couple of international programmes promoting scientific exchange in the higher education sector and beyond. Examples include the EU mobility programmes Erasmus, Mundus and Tempus, the Central European Exchange Programme for University Studies (CEEPUS) and the European Economic Area (EEA) grant scheme. You will have to find out for yourself whether the combination of your educational/professional status and your nationality qualifies you for financing. There are currently no open calls for inter-