

Geiá sou Elláda! Welcome! Hellas!

Greece has become the Achilles' heel of the Eurozone. Prospects for early recovery are poor. But in every crisis there is an opportunity. Why not a makeover of Greek's academia, which is often criticised for nepotism, inbreeding and mediocracy?

Ancient Greek philosophers, such as Plato or Aristotle and physicians, such as Hippocrates or Galen had a major impact on the development of present-day science and medicine. Plato's Academy, Aristotle's Lyceum and the Hippocratic School of Medicine are prime examples of the earliest organised schools in the Western culture. But that's ancient history now. Modern Greece may boast two Nobel laureates in literature but it is not listed among the world's top 150 universities and came off badly in the last PISA studies. By accepting a bailout package in 2010, Greece was forced into harsh austerity measures with detrimental effects on education and research. Many Hellenic scientists are in urgent need of new research grants. Fresh money is available from EU Structural and Cohesion funds. However, the allocation of funds is delayed. Here, *LabTimes* will provide you with some insights on the research system in Greece.

Background

Greece is a country in Southeast Europe with about 11 million citizens. Athens with more than three million and Thessaloniki with close to one million people are the major cities. The mainland, the peninsula Peloponnese and thousands of islands including Crete, Corfu and Rhodes are Greece's main geographic areas. A coastline of more than

14,000 km, a highly diverse natural environment, hundreds of archaeological sites and museums and a pleasant climate attract millions of tourists each year.

The story of Modern Greece began after the Greek War of Independence, which ended almost 400 years of Ottoman rule. In 1832, Greece was officially recognised as an independent monarchy. After World War II, the Marshall Plan of the United States provided more than US\$ 350 million for reconstruction and economic support to Greece. From 1967 to 1974, a military Junta ruled Greece. The dictatorship was terminated by a national referendum leading to the abolition of monarchy and the introduction of a presidential parliamentary democracy. Nowadays, the party system of Greece is dominated by the liberal-conservative Nea Dimokratia and the social-democratic Panhellenic Socialist Movement PASOK, which won the last elections. Greece became a member of NATO in 1952, of the European Union in 1981 and of the Eurozone in 2001.

Public debt and economy

Greece accepted a €110 billion aid package from EU countries and the International Monetary Fund in 2010. The money is being disbursed over three years but the Greeks are already searching for fresh capital. The yellow press is calling for the sale of a cou-

ple of Greek islands or even the Acropolis and to stop squeezing money out of the ordinary citizen. The value-added tax was increased and the salaries of civil servants, including scientists and lecturers, were cut by about 20%. Additional tax hikes, new measures to curtail tax evasion and privatisation of public companies should now bring a return of more than €50 billion.

The causes for the high public debt are manifold. In times of cheap lending, Greece was living beyond its means and failed to implement overdue reforms. Moreover, high pensions after a short 15-year working life, a bloated apparatus of almost one million civil servants representing a fifth of the work force, an expensive health system with highly subsidised drugs and widespread tax evasion, which is estimated to cost up to €20 billion a year, have been disastrous for public coffers.

The economy in Greece has major problems that hinder a quick recovery. It never experienced an industrial revolution and its economy was driven for a long time by agriculture and services. In the early 20th century, industries slowly developed and took advantage of producing all sorts of military supplies. Shipping became a major success story. Tycoons such as Stavros Niarchos and Aristotle Onassis promoted Greece to one of the world-leading nations. Tourism accounts for about 15% of Greek's

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gross domestic product and of the available jobs. Additional sectors are textiles, chemicals, food processing, metal products, mining, light industry and telecom services. The high public debt led to a strong devaluation of Greece in economic rankings. In the latest Global Competitiveness Index, Greece was at the bottom end of all European countries. Out of 139 analysed economies, it was placed at rank 83 between El Salvador and Trinidad and Tobago. Inefficient government bureaucracy, corruption, restrictive labour regulations and unfavourable tax regulations were recognised as the most problematic factors when doing business in Greece.

Pharma and biotech

High-tech companies with a strong research and development (R&D) intensity are rare. In the latest EU Industrial Investment Scoreboard three most prominent Greek companies were the pharmaceutical company Pharmathen, Ellaktor, which is active in the construction and energy sector, and Intralot, a leading supplier of gaming and transaction processing systems. With respect to R&D investments, Pharmathen took the 30th rank among 4,600 EU-based pharma companies.

Biotech companies often have their roots in Science and Technology Parks, which are close to or even managed by public research institutions. Examples include the Science and Technology Park of Crete in Heraklion, the Thessaloniki Technology Park, the Patras Science Park or Leukippos, the Technology Park of Attica. Yearly growth rates in the Biotech market were 17.5% between 2000 and 2007. Outstanding, award-winning companies are Biovista, Embio Diagnostics and FORTH Photonics. Biovista with a focus on new therapeutic uses for known drugs and profiling of drug side effects was established in 1993. Embio Diagnostics was set up in 2007 in Nicosia and specialises in portable cell biosensors for the detection of pesticides, biological warfare, viruses and inflammation markers. FORTH Photonics SA is a medical device company based in Athens and devoted to non-invasive optical detection of tumorigenic lesions.

Over the last decade, Hellenic scientists have more than doubled their scientific output. In the SCIMAGO Ranking covering the years 1996 to 2009, Greece was 26th con-

cerning citable documents and 20th in the category cites per document, where countries with more than 100,000 documents were considered. An analysis by the Greek Documentation Centre EKT from 2010 revealed that between 1993 and 2008 Greece was among the nations with the highest growth rate in the number of publications. In the category publications per million citizens it left behind Spain, Italy and Japan.

A study by Thompson Reuters Science Watch investigated the period between 2005 and 2009 for publications with at least one author from Greece. The majority of articles appeared in journals covering Computer Science, Clinical Medicine and Agricultural Sciences but an impact above world average was only noted for publications in Physics and Agricultural Sciences.

The patenting activity in Greece is improving but is at a quite low overall level. According to Eurostat, Greece filed only 109 patents and had the second lowest number of high-technology patents of all EU countries at the European Patent Office in 2007.

The Greek system

Another performance indicator is the successful participation in EU Framework Programmes (FP). The interim report of FP7 covering the initial three-year period revealed that Greece was among the top ten European countries in the categories number of applications. However, the overall success rate of Greek applications was only 16%, which puts it at rank 24 out of the EU's 27 countries. The Foundation for Research and Technology Hellas (FORTH) was the

the Ministry of Education, Lifelong Learning and Religious Affairs. The former Ministry of Development merged into the Ministry of Economy, Competitiveness and Shipping and had to let go the General Secretariat for Research and Technology, GSRT, the major policymaker and direct funder of research in Greece. The economist Achilleas Mitsos, who headed the European Commission's Directorate-General for Research for several years, was recruited as Secretary General for Research and Technology. He wanted to introduce a new legislation for research and to strengthen the role of GSRT. However, after a year in office, he resigned due to ongoing disagreements with the Deputy Minister of Education John Panaretos.

European funds

The National Council for Research and Technology (ESET) is the highest policy advisory board for research and technology in Greece. The 11-member council started with newly appointed members in late 2010. The 73-year old space scientist Stamatis Krimizis, who was principal investigator of several NASA missions including Voyager 1 and 2, is heading the Council. He is supported by scientists with international standing, such as George Pavlakis, the Director of the Human Retrovirus Department of the US National Cancer Institute, Amanteo Ontoni, Professor of the Aeronautics Department at MIT, Ioannis Iliopoulos, Emeritus Professor of Theoretical Particle Physics at Ecole Normal Supérieure in Paris or Kevin Featherstone, Professor for Contemporary Greek Studies at the London School of Economics and first non-Greek member of ESET. One of the first duties of the Council is to oversee the recruitment of new directors for public research institutions

and to speed up the allocation of about €1 billion derived from EU funds. The Greek expenditure for Research and Development (R&D) is at a low level. Before the debt crisis, Greece spent about €1.7 billion for R&D, which equalled roughly 0.6% of its gross domestic product. About a fifth was derived from the business sector, which is quite low in comparison to other European countries. About two-thirds of governmental funds for R&D go to the higher education sector and are channelled pri-

Internet Resources

- ▶ Euraxess Greece – <http://mobility.certh.gr>
- ▶ National Strategic Reference Framework – www.espa.gr
- ▶ General Secretariat for Research and Technology – www.gsrt.gr
- ▶ Greek Bilateral Scholarships – http://apps.gov.gr/minedu/foreigner_scholarships
- ▶ State Scholarship Foundation – <http://www.iky.gr>

leading Greek institution with 111 retained applications. In the first three rounds of the Starting Grant and Advanced Grant Competitions by the European Research Council, the success rate of applications for scientists with Greek nationality was below the average of all countries. Overall, 25 Starting and 15 Advanced Grants were approved but more than half the grantees were Greek expats.

After the 2009 elections, responsibilities for education and research focussed on

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marily through the general university funds as institutional support in the form of block grants. Competitive project-based research grants for individuals or research teams financed exclusively by Greek sources are currently not available. Scientists have to apply for such grants via the EU Framework Programme or the EU Structural and Cohesion Funds. Both sources account for more than 20% of the expenditure for R&D in Greece. Currently, an updated National Strategic Research and Innovation Framework 2010-2015 and a Europe 2020 Strategy are in place. In addition, there is a new legal framework for research and education in preparation, after the law introduced by the last Government turned out to be too bureaucratic.

In the 2007-13 period, Greece is expected to receive more than €20 billion from

several EU sources including Structural and Cohesion funds. According to EU regulations, these funds have to be topped-up by Greek co-financing, which is in the range of €6 billion. Although the current funding period ends 2013, funds may be used up until 2015.

Whereas the National Strategic Reference Framework (NSRF 2007-13) describes the overall strategy, operational programmes provide the measures for the use of funds. It is estimated that between €1.1 and €1.6 billion are earmarked for research, innovation and technical development. Scientists benefit primarily from the operational programmes “Competitiveness and Entrepreneurship” and “Education and Lifelong Learning”. The allocation of funds was initially quite slow, due to missing or inefficient implementation and evaluation

structures. A first round of calls was made in 2009 but, so far, no money has arrived at the Greek scientist.

In March 2011, the Ministry of Education provided an update on the status of the NSRF programmes Archimedes III, Thales, Heraclitus II and Postdoc Support. More than 7,000 proposals have been received and evaluated with the help of about 2,000 foreign reviewers. The full assessment of all proposals shall be finished this summer. So, it seems that lots of open positions and fellowships will become available at Greek institutions later this year. Archimedes supports research teams at Technological Educational Institutes and focuses on interdisciplinary and inter-institutional projects, which run for up to three years and are supported with up to €100,000. Scientists at universities benefit from the €120 million

In the Spotlight: *Biomedical Sciences Research Center “Alexander Fleming”*



The BSRC has one of the best views in the world (Varkiza Bay).

Photo: BSRC Fleming

The Biomedical Sciences Research Center (BSRC) “Alexander Fleming” is located in Vari, about 15 km south of Athens. It launched its activities as a governmental, non-profit research institution in 1998 and is supervised by GSRT. BSRC Fleming is linked to the Greek Foundation for Basic Biological Research, which was initiated by a donation of Alexander Fleming’s Greek widow, Amalia. In 2005, BRSC Fleming was proclaimed a Centre of Excellence in Biotechnology and Biomedical Sciences by an international expert review panel.

Nowadays, it has about 100 staff members including 13 group leaders. Three group leaders are EMBO members and less than 8% of the scientific personnel are from abroad. Research areas encompass immunology, genetics, animal models of human disease, gene expression control and stem cell differentiation. In addition, state-of-the-art core facilities including units for transgenic animals, flow cytometry and expression profiling have been established. With a Regional Research Potential EU grant the genomics facility was equipped with a new next generation sequencing system last year.

Scientists at BSRC Fleming are actively involved in several international research projects. For example, they act as coordinators of the FP7 Marie Curie Initial Training Network InteGeR with a focus on gene regulatory mechanisms during cell differentiation and lead a €7 million work package of the Innovative Medicines Initiative consortium BeTheCure, which aims to develop new methods for prediction, diagnosis and treatment of rheumatoid arthritis. In 2006, Biomedcode Hellas was founded as a spin-off of BSRC Fleming and provides pre-clinical drug evaluation services for inflammatory, autoimmune and related diseases.

The Institute’s total budget is €4.62 million this year. About two-thirds of the budget are from competitive grants, services and contract research. About a fifth of the budget is derived from the Ministry as basic, non-performance dependent financing, which is 13% less in comparison to last year.

“The economic crisis is threatening not only the future of BSRC Fleming but the best Greek research institutions,” says Babis Savakis, the current director of BSRC Fleming. “Reduced basic financing, a six-year period without any funding from national research initiatives and the delayed provision of Greek matching funds for EU projects have led to serious cash flow problems. In addition, there are no funds available for attractive start-up packages to recruit promising group leaders from within Greece and abroad. But there is some hope, since the Government just announced it will speed up the implementation of EU Structural Funds.”

Despite the ongoing economic crisis, plans for a better future are being made. “We want to significantly improve our infrastructure for bio-imaging and mouse biology, fully establish *Drosophila* as animal model at BSRC Fleming by recruiting two new group leaders and set up an International Scientific Advisory Board,” fancies Savakis. “In the longer term, we have expansion plans to develop the Vari campus into an international centre of excellence in research, innovation and advanced training in basic and translational biomedical research, focusing on understanding the interaction of genes and environment in health and disease, with emphasis on the use of animal models.”

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Thales programme. Again, networking between different institutions from various sectors is promoted. Up to five-year projects receive maximum grants of €600,000.

Heraclitus II is a €40 million package, which will provide up to 1,300 PhD student scholarships for universities. Applicants are professors at all levels with the right to supervise PhD students. Only research within the context of existing Greek PhD programmes is supported. Proposals for PhD students with a supervisory committee member from a non-Greek EU university receive a bonus during evaluation. €30 million are available in the frame

of "Support for Postdoctoral Researchers". Each maximum three-year project receives up to €150,000 including a monthly net living allowance of €1,600. Postdocs, who obtained their PhD title no more than seven years ago, may apply irrespective of nationality. Research may be done at Greek or non-Greek universities and research institutions. Some restrictions apply. There is a two-stage application process. The deadline for submission of summaries passed in last November. Additional calls within these four programmes might be announced soon and be published by NSRF (www.espa.gr). Aristeia, a novel excellence programme, is about to be announced. It was designed together with the "new" National Council for Research and Technology and provides €60 million in 2011 and the same amount in 2012. The programme should become a prime example for a new funding policy in Greece based on meritocracy, excellence, transparent evaluation and repetitive funding cycles. Aristeia will address basic and applied researchers, all types of research institutions and all disciplines.

Public research performers

Twelve independent public research centres account for about a fifth of research done in Greece. They vary widely in size and in the spectrum of research areas covered. They are supervised and receive institutional funding by the GSRT. Some are located on a single campus, while others have several institutes distributed over Greece. Due to the smaller size of individual research units and the fragmentation of research topics into several organisations, the merger of institutes with the aim to reach

critical mass and avoid duplicate infrastructure is an on-going discussion. The institutes are regularly evaluated in five-year cycles and are quite successful, when it comes to attracting third party funding or Greek expats. They are definitely worth a second



This is how your lunch break could look.

look – also by the scientist from abroad. A list of institutes active in Biosciences is available, for instance, at HBio, the first Hellenic Life Sciences cluster (<http://www.hbio.gr/lsgreece.shtml>). Examples include the Foundation for Research and Technology Hellas (FORTH), which operates the Institute of Molecular and Biology and Biotechnology at Heraklion and the Ioannina Biomedical Research Institute, the Hellenic Pasteur Institute in Athens, the National Hellenic Research Foundation (NHRF) with the Institute of Biological Research and Biotechnology in Athens or the Centre for Research and Technology Hellas (CERTH) with the Institute of Agrobiotechnology and the Institute of Biomedical and Biomolecular Research at Thessaloniki.

One of the younger Greek research organisations is the Bioacademy, which was established by the Biomedical Research Foundation of Athens in 2004. It moved to a stunning €40 million research building two years ago and more than 50 group leaders and 350 postdocs and PhD students have been recruited. The realisation of plans to hire additional staff and to expand the new building further, thereby creating one of Europe's largest centres for translational medicine, are delayed in face of the current economic situation. The Bioacademy was featured in a recent *Nature* article (*Nature* 458, 700-701, 2009).

The National Center for Scientific Research Demokritos (NCSR D) is an example of an older research institution in Greece. NCSR D has its roots in the Nuclear Research Center Demokritos, which was established about 50 years ago to promote non-military nuclear research. Nowadays,

research activities are much broader and encompass biotech and health, nanotechnology and new materials. It is the largest research centre in Greece with about 1,000 employees including 150 permanent researchers, 100 postdocs and 120 PhD students. Research is performed in eight independent institutes. The Institute of Biology focuses on age-related diseases, animal model systems to study cellular functions, structural biology and new materials. NCSR D established the first graduate programmes in Greece in 1963 and operates the Scientific & Technological Park of Attica.

Greek higher education

Universities account for roughly 70% of research done in Greece. If you look for possibilities at universities, the top performers in university rankings may spark your interest. In the latest QS World University Rankings, five Greece universities made it into the top 500. The National and Kapodistrian University of Athens (NKUA) was ranked as 286th university in the overall standings but was also rated as 'Best Greece University' in Life Sciences (rank 178) and Natural Sciences (rank 229). The Aristotle University of Thessaloniki (AUT) scored in Life Sciences and the University of Patras in Engineering and Information Technology, whereas the National Technology University of Athens (NTUA) and the University of Crete were represented in Natural Sciences. In the SCIMAGO world ranking of 2,833 research-intensive universities and institutions, the above-mentioned universities and the University of Ioannina surfaced as primary Greek institutions.

Public higher education is provided by 23 universities and 16 technological education institutes (TEIs) and is funded primarily by the state. Greek austerity measures included a 30% cut for universities. Universities and TEIs are autonomous institutions but operate under the auspices of the Ministry of Education. About half of all universities are multi-disciplinary, the rest are more specialised. The Hellenic Open University offers distance learning, while the International Hellenic University in Thessaloniki is providing programmes in English and attracts about one-fifth of its students from abroad. Admission depends on performance in nationwide exams. Eight percent of available study places are reserved for EU students, about 1% for non-EU students. Proof of Greek language skills has to be provided. In general, higher education is free of charge and textbooks are provided

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free. However, specific postgraduate courses charge tuition fees. In 2009, 84,230 students were enrolled and about 2,000 PhD students graduate each year in Greece.

The entry position at Greek universities is the temporary lecturer. Minimum requirements are a PhD title. Positions may be renewed for a further three year period. Lecturer positions require a PhD, two scientific publications and proof of teaching or research experiences. Lecturers and professors are nominated and elected by committees with a third being non-local members. After three years, they may apply in open calls for promotion. Tenure is available only after three years as assistant professor. At many institutions, academics with no local strings have only a minor chance to get a position. Knowledge of the Greek language is a must for employment, since almost all courses are taught in Greek.

More funding opportunities

If you want to join a Greek institution, I suggest applying for international fellowships such as EMBO, Human Frontier Science Organisation or Marie-Curie. In comparison to Greek fellowships they do not only pay more but also come along with some extras such as bench fees, which will make your lab life a little bit more inde-

pendent from financial constraints. Funding possibilities for outgoing Greeks clearly outnumber those for incoming scientists. Starting points for exploration are Euraxess Greece, a site with job postings of Greek institutions and a couple of links to Greek fellowships. A more comprehensible database has been compiled by the liaison office at the Aristotle University of Thessaloniki but is only available in Greek (www.cso.auth.gr). This pertains also to the Ministry of Finance and the Ministry of Education that are in charge of a couple of scholarships and bequests. In addition, you may find local exchange programmes or job offers in the frame of international research projects at international offices of universities or public research institutes.

Several Greek ministries provide scholarships for foreigners. In general, they have one deadline per year, are coupled to the academic year and often limited to studies on Greek language, culture or arts. At the Ministry of Education, Lifelong Learning and Religious Affairs fellowships for citizens from developing countries are granted by the Directorate of International Relations in Education. Fellowships encompass ten three-year postgraduate and five up to six-month postdoc fellowships as well as 100 one-month Greek Language Summer Scholarships. There are currently new calls for applications due to budgetary restrictions. The Directorate of Studies and Students' Welfare manages scholarships in the frame of more than 40 bi-national agreements. In 2011, the application deadline was on May 31. IKY, the Foundation of State Scholarships, made 130 awards in the last academic year including 40 fellowships, for example, for up to one-year postdoc research visits or up to four-year postgraduate studies. Eligibility criteria widely vary. IKY postgraduate scholarships include a one-time settlement allowance of €600, tuition fees to learn Greek, emergency medical care and a monthly allowance of €500 for PhD students and €650 for postdocs. A deadline for applications for the next academic year has not been announced, so far.

Charities and non-for-profit funding do not play a significant role in absolute terms. A couple of ship owners and industrialists have set up larger foundations. Scholarships or research grants are available for example by the Latsis, the Onassis or the Bodossaki Foundations. The John S. Latsis Foundation is granting annually 20 one-year projects to scientists working at Greek institutions, irrespective of nationality. The Alexander S. Onassis Foundation is Greece's

most prominent foundation with assets estimated to exceed €0.6 billion. The foundation was named after the son of Aristotle Onassis and awards 35 scholarships to non-Greeks for research and postgraduate studies in Greece per year. Although the Onassis Foundation is also active in the health sector, for example, by providing funds for the establishment of the Onassis Cardiac Surgical Center, its scholarships are limited to humanities, social sciences and the arts. Another renowned foundation, the Bodossaki Foundation, provides only scholarships for people with Greek nationality or of Greek origin.

Outlook

Research and education in Greece not only suffer from the current economic situation but also from a science and education system that is not up to international standards. Regular evaluations leading to performance-based funding of universities, recurrent calls for competitive national research grants, measures to promote scientific excellence or an independent funding agency have not been established. Internationalisation efforts are presently at a level, where Greek students and scientists are sent abroad for education and training. There are only limited resources to recruit scientists from the excellent Greek research community abroad or even to attract scientists of non-Greek nationality. Some initial steps, which might turn out to be favourable for the Greek scientific community, are the centralisation of research policies and funding measures under one ministry, and the appointment of new members for the National Council for Research and Technology.

However, not lip service is needed but a clear political commitment for change and a roadmap specifying problems and their solutions. Too often in the past have lengthy legal processes, red tape and conservative forces fearing the loss of power and privileges diluted or even impeded necessary reforms. Against all odds, a couple of Greek institutions have mustered to attract sufficient resources to perform international competitive research and are attractive also for the scientist from abroad.

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If you are interested in reading some personal insights on doing science in Greece, please visit our accompanying *Lab Times* editorial online at www.lab-times.org. The author thanks Zina Kiparissides (CERTH) and Dimitris Loukas (NCSR Demokritos) for insights on funding opportunities and research policies.



Competitive Pipetting could soon become an Olympic discipline, too. Zeus has already given his consent.