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CULTURE OF GROWTH

From the Publisher

The end of the year is a time to take stock. If there was a program to carry out then it can be especially worthwhile to look back at what was achieved, what was abandoned and what was postponed.

Poland has been in a state of flux for the past two decades during which time radical reform programs have been drawn up and carried out in many areas of society. This does not seem an inordinately long time given the backwardness of every aspect of social life in the previous politico-economic system.

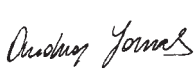
In science and education, leaving aside the achievements of individual researchers and academics, we entered the era of democracy and a free market 20 years ago with outdated facilities and infrastructure. This is one field that was resistant to revolutionary change and not just because of lack of money. As a result, we were plodding toward essential change at a snail's pace. We had no real way of accelerating the process until we joined the European Union five years ago. Over the past two years, we have had to implement some fundamental legal reforms in addition to effective material changes.

In an interview in this issue of *The Polish Science Voice*, Prof. Barbara Kudrycka, the minister for science and higher education, talks about the scope of the new legal regulations drafted by her ministry and approved by the government. "The main idea behind the proposed changes is to support and promote the best at every level—institutions, scientific entities, researchers, postgraduates and students," Kudrycka says. "... I believe that the new rules for financing higher education and the greater flow of funds to universities with the best research and academic results will help the most."

Foreign educational trips are indispensable for the training of young scientists and their future prospects. But the problem is that some scientists decide not to return to their home country after they complete the foreign contract or scholarship.

The Foundation for Polish Science (FNP) runs several scholarship programs for young researchers, including the Columbus program, which provides scholarships for researchers to work at leading research institutions abroad, and the Homing program, which offers grants to those returning. The foundation's Dr. Izabela Wagner has surveyed a number of scholarship holders. The upshot of this survey is an edifying report on the fates, decisions and opinions of the young people, whose presence and development are vital to Polish science.

In addition to all that, this last issue of *The Polish Science Voice* for the year has the usual information about what is happening in the field of research and technology as well as reports on the Maria Curie-Skłodowska University in Lublin and the University of Silesia's Faculty of Biology and Environment Protection in Katowice.



The Polish Science Voice No. 30

Special Guest: Prof. Barbara Kudrycka, minister of science and higher education

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REFORM READY TO ROLL

Prof. Barbara Kudrycka, minister of science and higher education, talks to Danuta Górecka.

After two years of public debate, the government has approved the guidelines for the higher education reform proposed by your ministry. The main guidelines include increased funding and all-round support for the best schools, researchers and students, greater autonomy for universities, an end to nepotism at schools, no more than two full-time jobs per scholar, and just one course of study per student for free. Does this mean that the Polish higher education system will undergo a revolution?

It's not a revolution because that's something I'm against in education. This plan is the first such comprehensive approach to changes in the higher education sector and a decisive step towards a modern system on a par with Western standards. The main idea behind the proposed changes is to support and promote the best at every level—institutions, scientific entities, researchers, postgraduates and students.

The league tables of the world's best universities include just two Polish institutions of higher education, Cracow's Jagiellonian University and the University of Warsaw, both far down in the fourth hundred. Can the proposed reform help these universities move up the list? What are the prospects of other Polish universities?

Ranking lists shouldn't be overestimated, but neither should they be ignored—they are largely responsible for raising a university's profile at home and abroad; they also translate directly into student interest. And we—especially given the imminent population decline and the decreasing number of students in Poland—want to strengthen the position of Polish universities and make foreign students more interested than they are today in studying in Poland.

Our plan for the reform is that the changes will help the best Polish universities make it into the top 20 of Europe's best universities by 2020. I believe that the new rules for financing higher education and the greater flow of funds to universities with the best research and academic results will help the most.

The reform gives more money to the best course providers, which the Ministry of Science and Higher Education has called Leading National Academic Centers (KNOW). This title will only be available through a competition. Who will organize the competition and what will the criteria be for evaluating which courses at which universities are the best?

KNOW status will be available to departments or their federations, research centers and research teams that confirm their highest, world standard of research and teaching. The evaluating teams will include leading foreign scientists—to guarantee transparent procedures independent of any relations within the academic community.

Four units with KNOW status will be selected in the first year of the new law being in force. In the next five years each of them will receive as much as zl.10.2 million on top of the standard subsidy. This money will finance research but also remuneration for scientists—we assume they could earn up to several times more than now.

Financial support will also go to Ph.D. students studying at a KNOW unit; they can expect to receive grants of up to zl.4,000, and graduate students—up to zl.1,500. KNOW status will also mean preference when applying for EU subsidies and grants.

Our plan for the reform is that the changes will help the best Polish universities make it into the top 20 of Europe's best universities by 2020.

What does it mean that universities will gain greater autonomy as a result of the reform?

Autonomy should be understood in two ways, as financial autonomy and autonomy in terms of the curriculum. Our primary focus is to strengthen curricular autonomy and enable the best universities, those that confer postdoctoral degrees, to develop their teaching programs on an independent basis.

We will introduce a National Qualifications Framework, or a description of the skills that graduates of eight teaching areas should have. Based on these guidelines, universities will design their own curricula and build their own courses, taking into account factors such as the needs of employers and the local economy. To put it simply, we will show what knowledge and skills graduates need to have, but universities will decide specifically what to teach and how.

Closer ties with business are an opportunity for applied sciences. What about fundamental research?

The demand for fundamental research is just as great in business and the economy as demand for applied research. To enable both fundamental and applied research to obtain financial support and to make sure that research results are applied in practice, we precisely defined the responsibilities of the National Center for Research and Development and the National Science Center, which are expected to ensure

transparent, competition-based rules for distributing research grants. The National Science Center will finance fundamental research in this way.

The reform provides for easier academic careers and a simplified procedure for obtaining postdoctoral degrees, though these were supposed to be abolished… What new ideas does the ministry have in store?

Today scientists obtain their postdoctoral degree relatively late, at age 46 and later on average. The postdoctoral procedure itself is long, time-consuming and complicated. Along the way, we often lose what is the most valuable—scientific potential. The main thing that will count in the new procedure will be scientific achievements. We have decided to do away with the procedure for defending a postdoctoral thesis and the postdoctoral lecture, and also abolished the obligation to submit the postdoctoral thesis in the traditional form.

Scientists will no longer be allowed to work at several universities at the same time; under the law, they will only be able to work at two. There will also be a ban on smaller institutions "borrowing" scientists from renowned universities. Won't this rule cause protests among academic teachers because it spells substantially reduced earnings for them?

Scientists holding multiple jobs is a plague whose consequences are felt by students and teachers alike. It's not a rare thing for a scholar to receive remuneration from several employers at the same time. This fragmentation results in neglect of research work and increasingly poorer quality of teaching. Scientists themselves are talking about the problem more often and with growing resonance.

Limiting scientists' employment to two jobs will allow them to concentrate on research, on investigating undiscovered fields—after all, this is the mission and vocation of any scientist. At the same time, there will be more job openings for ambitious young scientists many of whom decide to leave Poland today to build their scientific careers abroad. This regulation will also stimulate competition and better work among private universities. After years of "faculty borrowing," these schools might finally make the effort to train their own staff. Our reform plans provide for supplementary funding for Ph.D. studies also at private universities.

Let's consider students. The reform says that only one course at a state-run university will be for free. Students will have to pay for any further course. Does this apply to all students? What about the most gifted ones?

Today half the students from any given year go to university. No country, no matter how rich, could afford to finance university courses for everyone.

Many international organizations, including the World Bank and the Organization for Economic Cooperation and Development (OECD), have pointed out that our system is unfair because 60 percent of students—1.2 million young people—pay double for their education, in taxes and in tuition.

Thanks to fees for a second, extra course, in the case of students with a low credit average the system will become more just. First of all, there will be more places at full-time, free courses available from state universities. This will mainly benefit young people from poorer families and rural areas who pay for their education today.

We will put a stop to the abnormal situation in which some students took up to a dozen or so courses for taxpayers' money and graduated from none. The government cannot consent to mediocre students being given the privilege of taking a second or third course at public cost.

Having said that, we are leaving the possibility of free extra courses for the 10 percent most talented students. In fact, many good universities have long applied the criterion of a student's credit average in a first course when allowing them to take a second course.

And, probably the most important thing, we are making it easier for universities to open interdisciplinary, interdepartmental studies that will slowly replace studies at several courses simultaneously—a practice that is already outdated in the West.

When will the higher education reform take effect?

If the lower house of parliament works efficiently on the package, the changes will come into force in the 2010/11 academic year.

Which of the initial guidelines have you not managed to push through?

We decided against including a regulation whereby retired professors would've been given what is known as inactive status. We were told that they would be negatively affected, as having inactive status would mean they wouldn't be allowed to work. In addition, as a guarantee for a narrow social group, this would constitute a breach in the overall retirement pension system. We aren't abandoning the idea altogether, though. Three ministries—of science, labor and finance—are working together to come up with a better idea. I have to admit that in the course of arduous work and broad consultation within the academic community, we have managed to achieve a promising consensus on important system changes. That's a major step in the right direction. It's time for more. ■

Returning Isn't Always Easy

Many young scientists have left Poland to pursue research careers abroad—attracted by better pay and work conditions. But now some of these people are coming back, bringing their new-found experience with them, says Izabela Wagner, a Ph.D. at the Foundation for Polish Science (FNP) who has written a report about the problems faced by young researchers returning to Poland after prolonged stays abroad.

In 2006, the Foundation for Polish Science (FNP) launched its Powroty/Homing program to encourage young researchers with Ph.D. degrees to return to Poland. The program is aimed at researchers who obtained their doctorates no more than four years earlier and have worked abroad for some time. Under the program, the best researchers, selected through a competition, receive two-year grants and cash to pursue their research programs and work with host research centers abroad.

Pros and cons

Insufficient funding is the main problem faced by researchers returning to work in Poland, says Wagner. "We cannot demand the same standard and effectiveness of work from Polish scientists when their salaries are four or five times lower than what their Western European colleagues earn," she says. "I think everything else can be put right once we deal with this issue. We have the examples of the Scandinavian countries, which were dominated by agriculture 30 years ago and are now scientific powerhouses."

Acquiring experience by working in another country is an essential stage of a scientific career today, Wagner says. A postdoctoral traineeship abroad is often required to get a job at a leading research center in Poland.

The main reason for going on a foreign research visit is a desire to gain new knowledge and experience in working on an international team in line with international standards, Wagner says. Such visits often help researchers jump-start their professional careers. According to Wagner, FNP grant recipients set great store by their relations with other researchers, contacts with leading centers in a given field, access to publishing channels, and the prestige of the host institution. In retrospect, young researchers usually say that these visits were a turning point in their careers, Wagner says.

A foreign traineeship, however, is a difficult experience for many Polish researchers, Wagner says. Challenges include the need to adapt to a new work environment with stiff competition and heavy workloads.

Most grant recipients return to Poland because working here gives them privileges that a Polish scientist cannot hope for in any other country, Wagner says. The probability of being able to set up one's own research team is greater in Poland than abroad. Apart from family considerations, the decision to come back is often motivated by good relations with one's scientific supervisor and familiarity with Polish procedures, institutions and language. Researchers can hope to find employment at a leading research center in this country

MONEY MATTERS

This year, the Foundation for Polish Science has provided young scientists with 11 grants each with a value of 3,000 to 6,000 euros per month. The money is for long-term research visits to prestigious scientific centers. The FNP has also offered 16 grants for scientists returning from prolonged stays at research centers in countries such as the United States, Britain, Belgium, France, Italy, Greece, Canada and Switzerland. In this year's program, these two-year grants amount to zl.36,000 per year in the stipend part and zl.46,000 per year in the research project part. They will be supplemented with money the FNP receives from the 1-percent tax donation system.

thanks to the experience they gained abroad, Wagner says.

A return to Poland most often means returning to the institution where the researcher started their career before leaving the country, though this is not always the best option, according to Wagner. The returning scientist's new status as an experienced researcher can be hard to accept for others, she says. Returning researchers often deal with unfriendly comments or problems obtaining basic work materials. They are given time-consuming tasks that have little to do with research or the most complicated tasks that slow down their work on a postdoctoral degree.

Another problem Wagner says is that large funds are not easily available to young researchers returning from post-doctoral traineeships, while access to funding enables scientists to carry out their research plans.

The Foundation for Polish Science plays a major role in helping researchers returning to Poland, Wagner says. It provides them with funds to continue their research.

Case studies

Dr. Sebastian Maćkowski works at the Institute of Physics at the Nicolaus Copernicus University in the north-central city of Toruń. He is a graduate of the University of Warsaw's Physics Department, and defended his Ph.D. on the optical properties of quantum dots at the Institute of Physics of the Polish Academy of Sciences, in Warsaw in 2002, in a group headed by Prof. Jacek Kossut. He spent six years as a visiting researcher abroad. He studied quantum dots in the United States for three years, at the Physics Department of the University of Cincinnati in Cincinnati, Ohio, and then from 2005 was on an Alexander von Humboldt Foundation fellowship at the Chemistry and Biochemistry Department of the Ludwig Maximilian University in Munich, where his research field was spectroscopy of photosynthetic complexes. He has received over zł.4 million to spend on research under the FNP's Welcome program.

OTHER FNP PROGRAMS

A wide range of grant programs are available to outstanding scientists in Poland to help them develop their talent and upgrade their research equipment.

The Foundation for Polish Science, a self-financing nongovernmental organization that was established in 1991 to support the country's scientific community, has launched a number of programs to support young scientists and their mentors.

The Start bursary program is one of the foundation's key projects for young scientists who can boast the biggest successes in research.

The Start bursaries, awarded since 1993, are designed to motivate young Polish researchers to remain and develop further in the field of science.

Young people up to the age of 30 years—or 32 in the case of those who have small children and have taken child-care leave—can apply for the Start bursaries if they are either employees or Ph.D. student researchers in research institutions and have had their work published in renowned scientific periodicals. Start bursaries are financed from funds received by the foundation from the privatization of state-owned enterprises.

The foundation's key program is Kolumb (Columbus), which helps young Ph.D. graduates gain experience in scientific work abroad. Kolumb bursaries facilitate stays in the best scientific centers in the world for those people who have not yet worked on a long-term basis abroad.

Mindful of the best scientists who intend to develop their careers in Poland, the foundation has launched several international Ph.D. programs such as Team and Welcome, which are financed from European Union structural funds. These two programs are designed to provide Polish scientists with research conditions similar to those offered by foreign universities. Team and Welcome bursaries fund remuneration, research and collaboration with the best scientists and research centers in the world.

Seasoned scientists are eligible for assistance under the Mistrz (Master) program that each year awards grants to professors. Each professor can take some of the funds for themselves and allocate the rest as grants for their coworkers and students and to finance participation in scientific conferences or new equipment.

The foundation's best known program involves the "Polish Nobel" awards for outstanding scientists for their achievements and discoveries during the last four years.

Yet another award is the Copernicus Polish-German Science Award, a joint initiative between the Foundation for Polish Science and Deutsche Forschungsgemeinschaft, Germany's central public funding organization for academic research.

"The foundation strives to tailor its programs to the requirements of the Polish scientific community," says Magdalena Kowalczyk, from the Foundation for Polish Science's information and promotion department. "International collaboration and stays in research centers abroad are currently the basis of career development for every scientist. This is why the foundation aids Polish academics with secondments to scientific institutions abroad. At the same time, it tries to ensure that the best young scientists want to return to Poland."

"In technical sciences, being in the middle of things scientifically is of great importance," says Dr. Piotr Garstecki from the Polish Academy of Sciences' Institute of Physical Chemistry. "You have to learn about the important things from people who create science and not read about them in publications, because that's two years too late."

Garstecki, who is vice-president of the FNP grant recipients' association, has obtained funds under the FNP's Columbus, Homing and Team programs. After completing a secondment at Harvard University, he returned to the Polish institution where he had obtained his Ph.D. He has spent the past three years developing his research team. He says he was able to finance the project thanks to the Team program.

According to Garstecki, the most important thing is to create a system for developing high-standard research centers in Poland. This is also important for young scientists—the best of them should be offered special start-up packages: premises, jobs and funds to begin research.

At his institute's department of physical chemistry of complex fluids and soft matter, Garstecki examines interactions in liquids. Apart from nuclear interactions, electrostatic interactions are the strongest to be found in nature, he says. The ability to control them in solutions would be useful for preparing new materials.

One of the goals Garstecki set himself after returning from his postdoctoral fellowship was to create a well-equipped laboratory for students. He has largely managed to accomplish this task at the Institute of Physical Chemistry thanks to the FNP's Team program.

Dr. Natalia Letki from the Institute of Sociology at the University of Warsaw has returned from a visit to Oxford University. A recipient of a grant from the European Research Council (ERC), she says her career as a social scientist would have wilted quickly had it not been for the FNP's Homing program. Letki is studying how people in post-communist countries perceive the state and its institutions and what factors encourage the state and citizens to work together in creating public goods.

Letki graduated in sociology from the University of Warsaw and the Central European University in Budapest, Hungary. She defended her Ph.D. dissertation, on social capital in Central and Eastern Europe, at Oxford University. She works as an assistant professor at Collegium Civitas, a private university in Warsaw, publishing papers in leading international political science periodicals and taking part in international research projects.

Piotr Bartosz

East or West Home is Best

Twenty years after the fall of communism, Polish research centers are finally beginning to treat their best research groups in the same way as their counterparts in Western Europe, says Piotr Wasylczyk, a Ph.D. from the University of Warsaw's Institute of Experimental Physics who spent six months working at Oxford University under a scholarship from the Foundation for Polish Science's Homing program.

An expert in the optics of ultra-short laser pulses, Wasylczyk went to Oxford directly after obtaining his doctoral degree. While in Britain, he joined a group of researchers supervised by Prof. Ian Walmsley to conduct research on new methods to measure ultra-short laser pulses.

Before he went to Britain, Wasylczyk was a member of a research group led by Prof. Czesław Radzewicz at the Institute of Experimental Physics in Warsaw. The group worked under the guidance of Oxford University's Walmsley.

According to Wasylczyk, the research groups in both

Oxford and Warsaw are organized in a similar fashion, centering around professors who are "excellent experimenters." The professors spend most of their time pursuing administrative and organizational routines and they also coordinate the work of their groups and determine research objectives, Wasylczyk says. Each group includes several assistant professors, or post-docs—two in Warsaw and five in Oxford—who manage individual research projects. Then, there are graduate and postgraduate as well as senior-year students, Wasylczyk says. In both Oxford and Warsaw, research is mostly funded using long-term grants that are spent on equipment, day-to-day research work and salaries. The only difference is that in Poland pay for the researchers constitutes a small part of the grants, Wasylczyk says.

Spider-Man

While at Oxford, Wasylczyk says he got to watch ultra-fast processes in molecules. He sought parameters for inducing laser pulses to cause two-atom potassium molecules vibrate the longest, that is put them in a state where they interact with their environment as little as possible.

Ten years ago, Walmsley proposed using spectral interference where spectroscopic techniques had been previously used to achieve that effect. Such was the beginning of SPIDER, short for Spectral Interferometry for Direct E-field Reconstruction. Initially, SPIDER was a complex system with many degrees of freedom, Wasylczyk says. He and a few other Polish researchers teamed up with Simon-Pierre Gorza from Université Libre de Brussels and Alex Radunski from the University of Rochester to use certain properties of non-linear crystals, to radically simplify the SPIDER structure. The time spent in Britain resulted in a prototype, miniature LX-SPIDER that the APE company in Berlin has just introduced to the market.

Asked about the method, Wasylczyk says, "Imagine a light beam shining through a plate made of transparent material, such as ordinary glass, several centimeters thick. For light emitted by sources like a flashlight or a commercially available laser pointer, nothing special happens. The beam passes through the plate and only a small part of the light reflects from the glass surface. Things look totally different when high-intensity light is used. The momentary power of laser pulses used in experiments can reach tens of gigawatts (GW). In comparison, the peak power of Poland's largest power plant in Bełchatów is around 4 GW. The secret behind obtaining such enormous power from a laser system that fits on a single lab table and takes electricity from an ordinary socket is that researchers can generate extremely short laser pulses lasting for a fraction of one-millionth of a second. Such extreme conditions open the gate to the realm of nonlinear optics, Wasylczyk says.

Prof. Czesław Radzewicz

Until the invention of the laser, optical experiments could only make use of linear phenomena where the response of the medium through which light passed was proportional to the amount of light. When the strength of the electrical field of a light wave becomes comparable to fields that bind electrons in atoms, matter begins to act differently than in normal conditions, Wasylczyk says. In nonlinear optics, the response, such as deflection of a bound electron, or medium polarization, may depend on the second, third and even higher powers of the light's electrical field.

Laser amplifiers used to generate ultra-short pulses in high-power lasers will remain confined to labs for long, if not forever, Wasylczyk says. For the time being, he adds, the systems are so complex that it takes a lot of know-how and practice to just start them up. One also needs to have air-conditioned rooms with systems capable of purifying the air and precisely adjusting the temperature. Green laser pointers are among the devices that rely on nonlinear frequency conversion, Wasylczyk says.

Ever shorter laser pulses

In a string of experiments carried out under the supervision of Prof. Radzewicz, Wasylczyk observed an extraordinarily wide range of phenomena. It turns out that under appropriate conditions, it is possible to split a laser pulse into two or more parts, produce new frequencies (colors of light) and alter the shape of the laser beam, Wasylczyk says.

In order to precisely measure ultra-short laser pulses before and after a beam passes through material, Wasylczyk turned his attention to techniques used to measure such pulses. The techniques constitute a vast branch of optics in their own right. The result were several innovative techniques and devices enabling precise description of laser pulses.

Watching processes that occur in a certain time frame requires measurement techniques with a time resolution comparable and preferably finer than that of the studied time frame, Wasylczyk says. For example, a photograph of a bursting balloon taken at a shutter speed of 1/1000th of a second will provide little data about the bursting process and will likely be blurred, with all the phases rolled into a single image. Currently obtained laser pulses are short enough to let researchers see, for the first time, processes that occur on the molecular scale in real time, including vibrations inside molecules and the formation and decomposition of molecules. To gain insight into atoms, even shorter pulses will be necessary, Wasylczyk says. All the emerging techniques to produce such pulses rely on nonlinear processes and take profound knowledge of the electric field of light pulses that trigger the processes.

Piotr Bartosz

Adding Value to Communications

Marcin Mierzejewski

Prof. Marek Amanowicz from the Telecommunications Institute of the Faculty of Electronics at the Military University of Technology (WAT) in Warsaw; a member of NATO's Information System Technology research group, talks to Marcin Mierzejewski.

You deal with electronics, radio communications and telecommunication systems. What is your main area of expertise?

My specializations have changed over time. I started with radio communications, then for many years I also modeled and designed telecommunication systems. The results of my work were used to cater to the needs of Poland's economy at the time. Then I moved on to electronic combat technology, a field of research that seeks to identify enemy radio-electronic systems and diminish their capabilities. I conducted many projects that found practical applications in reconnaissance systems in airplanes and helicopters, for example. At the same time, I studied issues related to electromagnetic compatibility and aerial design. Together with my colleagues from the Military University of Technology, I succeeded in devising and patenting several practical solutions for cell phone systems. The designs won a number of awards at international innovation and invention exhibitions.

My further interests involved the analysis and design of telecommunication systems. At present, I focus on developing methods and technologies that could be used in situations that require safe access to dynamically built and dispersed information resources. Such methods and technologies enable users, for example troops in a battlefield, to use authenticated information to increase the efficiency of operations.

Is this technology available for civilian use and what are the greatest challenges in this area?

As far as technologies and techniques are concerned, ideas and theories developed by scientists are not classified. What can be classified is only a certain level at which such ideas are applied. It would be hard to say what technology has been used where and what opportu-

Factfile

Prof. Marek Amanowicz was born in the central city of Łódź in 1946. In 1970, he graduated from the Military University of Technology (WAT) in Warsaw with a master's degree in radio electronics. He obtained his doctoral and postdoctoral degrees in technical sciences from WAT in 1978 and 1990 respectively, specializing in telecommunications. In 2001, he became a professor.
Amanowicz is a member of the Electronics and Telecommunications Committee of the Polish Academy of Sciences. He founded and for many years presided over the Polish Division of the Armed Forces Communications and Electronics Association (AFCEA).
Amanowicz represents Poland in a NATO group that coordinates research in information technology.

nities it presents to a given system. An intriguing trend in techniques and technologies is that while just yesterday telecom infrastructure was a means of information transfer, today it is becoming a medium to build community relations. To a large extent, the internet is about the activities of community groups. Community networking websites are popping up like mushrooms, which means that a technology that was originally used by Mr. X to get a message through to Mr. Y now finds a much more extensive use, enabling a given group to remotely pursue certain common goals.

Interestingly, this trend, which is only natural in human behavior, can be easily transferred to the contemporary military environment. What we usually see nowadays are not military operations conducted by a single country or a group of countries, but many organizations taking part in joint operations. This is best exemplified by Afghanistan, where the NATO operation involves many countries and organizations, both military and civilian. There are also humanitarian organizations, commercial organizations and the media in the area and it all can only function properly when the people who have joint tasks to perform are able to form something like an online community.

When somebody deals with reconnaissance and intelligence systems, then regardless of their location, it is vital that they have the technological capability to exchange information. When somebody takes care of supplies, it is important to avoid situations where a Polish soldier is forced to use Polish resources only and bring supplies from Poland when in the neighborhood there is a military unit from a different country with the right supplies.

The point is also to build a knowledge database and be able to exchange the knowledge safely. It is also important to make sure that different command centers interpret obtained data and assess the situation in the same way.

Moving on from ideas to actual projects, what have you been working on lately?

I am an architect in a major research project by the Ministry of Science and Higher Education. The project, being carried out by seven research centers, aims to come up with different methods and technologies to improve the efficiency of coalition military operations. Among other things, we are working on developing new, more efficient procedures in conducting operations. These days, there is more to operation efficiency than technology alone. It is also the knowledge of what to do to ensure greater efficiency and take full advantage of opportunities presented by technology. We build on methods and information techniques that are already there and devise new ones that improve the security of information command support systems and form what is known as common situation awareness on the battlefield. We also prepare scenarios to verify technological solutions we come up with.

Given the incredibly fast advances in this area, is it possible to predict the future directions of telecommunications development?

Yes, there are such forecasts. I believe that in the near future, one can expect significant progress in mobile radio communications, which will depart from single, dedicated solutions. For example, cell phones as we know them will be replaced by devices based on programmable radio technology. They will be like intelligent radio stations. A device like that will be able to recognize its environment at a given moment and choose the right communication mode, in terms of frequency, type of modulation and so on, to secure the best possible connection. At the same time, such devices should guarantee optimal use of the entire system's spectral and energy resources. While exchanging data between each other, such intelligent robots will autonomously organize and reorganize the network.

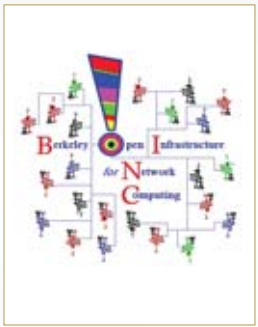
Another area of research involves essential changes to user interfaces. Some kinds of interfaces available today do not require the user to type anything. All it takes is a touch screen on which all kinds of information are accessed through dragging the picture. I believe we will soon start using entirely voice-controlled interfaces. One more area subject to extensive research are automatic translation systems.

What achievements can Polish science boast in your field of research?

Some solutions developed by Polish scientists have drawn the attention of the NATO transformation command. My colleagues will soon attend technology workshops in the United States where they will recommend a way of implementing NATO security services involving user authorization and authentication.

Myself, I represent Poland in a NATO Information System Technology group that conducts extensive research in different areas of information technology. Poland is a very active member of this group with Polish researchers taking part in 15 subject groups and chairing several subject areas. To a large extent, we owe it all to Polish universities of technology which produce new scientists with a superb education. As far as telecommunications is concerned, Poland can most definitely contribute an added value to world science.

Pole Position



Network computing, or a host of computers working together to solve a specific problem at the same time, is an area of information technology that opens new prospects for scientists and research institutions in Poland, according to researchers affiliated in a group called the BOINC Polish Project association.

The group has set its sights on spreading awareness of the potential offered by network computing in this country.

BOINC, short for Berkeley Open Infrastructure for Network Computing, is a noncommercial project developed at the University of California, Berkeley, by a team of researchers led by David Anderson. The National Science Foundation, an independent U.S. government agency, supports the project. It involves personal computer users taking part in scientific projects that require enormous computing power. BOINC aims to create a shared infrastructure for various research programs that need to use computing power exceeding that of available equipment by tapping into the potential offered by network computing.

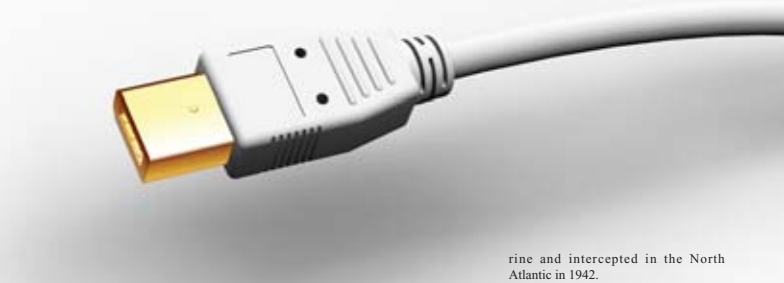
Free and open

The BOINC is a science project software platform for volunteer network or grid computing involving many personal computers working on one problem at the same time. Network computing requires operational computers, a well-defined research question and an efficiently distributed workload between individual PCs. The BOINC uses free, open-source software launched under the Lesser General Public License (GNU LGPL) system. It comprises the project server software and volunteers' PC software. The server distributes data for computing between individual PCs taking into account their computing power, RAM capacity and average time devoted to BOINC-related work. The computers are provided with all the necessary applications and data to start a given operation. The operation may take from a few seconds to hundreds of

hours. Thanks to regular saving, the process does not need to be completed "in one go." The results of work on each portion of data are sent to the server.

Users make their computers available for the project, thus expanding the computing database and contributing to the problem's solution. This kind of computer base constitutes a supercomputer that could not otherwise be built and operate as an independent machine, involving hundreds of thousands or even millions of computers and enormous computing power.

In most projects, the same data is sent to a number of PC users so as to compare and verify the results and eliminate any errors. BOINC participants can be involved in one or more projects at the same time.



In the grid

The BOINC Polish Project association was established Aug. 10, 2006 as an initiative by five young researchers: Michał Jarosz, Krzysztof Dmochowski, Artur Gregorczyk, Adam Hajok, and Krzysztof Piszczek.

The association's statutory tasks include launching and promoting Polish network computing projects, collecting and providing technical information required for the projects to be carried out, and spreading awareness of the achievements of Polish scientists and technicians. These tasks are expected to be fulfilled by organizing meetings, lectures and exhibitions, conducting publishing operations, running an online information center, and working with individuals and institutions dealing with similar issues. BOINC members also want to support network computing projects involving non-members, both firms and institutions working for the sake of such initiatives. They also want to win sponsors and attract the attention of the media and communities and groups to network computing and its advantages.

Search for extraterrestrial intelligence

The first BOINC technology-based project was SETI@home, launched at the university in Berkeley in 1999. The project was a scientific experiment using internet-connected computers in the Search for Extraterrestrial Intelligence (SETI). Participants were asked to run a free program that downloads and analyzes radio telescope data to identify and decipher any possible signals from alien civilizations, if they exist. The project turned out to be a big success. It had more than 5 million users worldwide over five years.

Based on the SETI experience, American scientists followed up with the BOINC revolutionary platform that makes it possible to work with many projects of this kind simultaneously. Further projects in various fields of science mushroomed, taking advantage of the BOINC computing power.

BOINC enthusiasts include mathematicians, physicists, nuclear physicists, climatologists, graphic designers, astronomers, cryptographers, biologists and geneticists.

Enigma and other challenges

Poland's first BOINC project dates back to August 2006. It was launched under the name NagrzewanieStali@home, part of the master's thesis of a student of computer science. The project operated for less than a week, bringing together more than 130 participants from various countries. The next fully Polish project was Enigma@Home, aimed at deciphering a WWII German Enigma-encrypted message sent from a submarine and intercepted in the North Atlantic in 1942.

At present, Polish researchers are taking part in 15 BOINC platform projects:
Climateprediction.net
Einstein@home
The Lattice Project
LHC@home
µFluids
Orbit@home
Pirates@home
Predictor@home
PrimeGrid
Rosetta@home
SETI@home
SIMAP@home
SZTAKI Desktop Grid
RALPH@home
World Community Grid.

Julia Pawłowska

Stress, Rats and Diet

A Cracow neurobiologist has received a cash boost from the Foundation for Polish Science to study the impact of stress on eating habits. Her research involves experiments on rats with a view to developing a drug to treat obesity, anorexia and other eating disorders in humans.

In her experiments on rats, Anna Błasiak, a neurobiologist at the Institute of Zoology of the Jagiellonian University in Cracow, studies the impact of a newly discovered protein, relaxin-3, on brain cells responsible for obesity and anorexia. She hopes one day her research will contribute to developing a drug for stress-related eating disorders.

Błasiak is studying the flow of current through the membranes of rat nerve cells involved in stress response under in vitro conditions. These are electrophysiological experiments conducted on single cells isolated from the brain.

Bad eating habits

Why do some people develop eating disorders when they are stressed? One such disorder is obesity, a lifestyle disease that is reaching epidemic proportions these days. At the other end of the spectrum is the growing number of people suffering from anorexia, bulimia and many other behavioral disorders, Błasiak says.

According to researchers, stress has a serious impact on eating-related disorders. In animals, nervousness can be linked to poor environmental conditions, the presence of predators or insufficient food. This activates certain cells in the brain that are responsible for eating habits. Are humans subject to a similar mechanism?

Answering this question could become easier thanks to research on relaxin-3, a recently discovered neuropeptide and a protein from the insulin family. Found in the brain of humans, mice and rats, relaxin-3 has a role to play in regulating food intake, Błasiak says. Her research, which involves electrophysiological experiments on rats, is designed to determine how relaxin-3 affects nerve cells. This electrophysiological research is supplemented by neuroanatomical research that aims to identify the nerve routes involved in regulating food intake.

During her Ph.D. studies, Błasiak worked on the neuronal mechanism of daily rhythm regulation in mammals, with the help of extracellular recordings of the electric activity of rat neurons under in vitro conditions.

Stress control

Błasiak is trying to find out how the negative impact of stress can be halted or even reversed. To this end, she must identify the neurotransmitters released by stress-sensitive cells and examine them to see if these are released into structures linked to eating. Then she must use the appropriate neurotransmitters on the cells of centers related to food intake and observe their response.

Błasiak is working under the supervision of Prof. Marian Lewandowski at the Jagiellonian University. She is conducting her research in consultation with experts at the Howard Florey Institute in Melbourne, Australia, the world's largest center of research on relaxin-3.

In 2005, Błasiak's work was named the best research project by a young scientist at the 7th International Conference of the Polish Neuroscience Society. In 2009, she received a grant under the Foundation for Polish Science's Start program, one of the most prestigious awards for young scientists in Poland.

Piotr Bartosz

Push for Patents

The Gdańsk University of Technology in northern Poland is stepping up its push to patent more inventions.

Global statistics show that only one in 20 inventions is ever applied in industry, according to experts from the Gdańsk University of Technology. This is due to factors such as misguided patent policies, they say.

"The past few years at the Gdańsk University of Technology have been marked by a distinct focus on innovation," says Czesław Popławski, the university's patent officer and innovation manager.

In 1998, the Gdańsk University of Technology submitted only eight inventions to the Patent Office. In 2007, twenty-eight inventions were submitted, followed by 32 in 2008 and 45 this year as of September. More patents mean more revenue from innovation-oriented projects and extra funds from the Ministry of Science and Higher Education, Popławski says.

Awards and accolades

According to Popławski, the Gdańsk University of Technology's inventions stole the show at this year's International Poznań Fair in the western city of Poznań. Visitors were particularly interested in hydraulic engines exhibited by the university's Department of Hydraulics and Pneumatics and the Faculty of Mechanical Engineering; the same was true of inventions developed by a team led by Prof. Andrzej Czyżewski (*see issue 27 of The Polish Science Voice*), Popławski says.

The university was also successful at the International Gdańsk Fair, where it received 14 medals and awards, according to Popławski. A team headed by Prof. Jan Hupka won the top prize of a competition accompanying the Technicon 2008 Industrial Technology, Science and Innovation Fair. The winning invention was a mobile cyclone reactor that the competition judges found the most interesting design shown at this year's fair, Popławski says.

Researchers from the university's Chemical Faculty have also won many awards this year, according to Popławski. One of these, known as the Pomerania Province Chairman's Award, went to a team that had designed and built Poland's first mobile system to survey gaseous pollutants in the air. The invention had been developed by specialists from the Chemical Faculty together with their colleagues from the Faculty of Electronics, Telecommunications and Informatics. The project also involved experts from the Regional Air Monitoring Agency in the Gdańsk Metropolitan Area.

Money can't buy everything

Every year, the Gdańsk University of Technology releases a report on its innovation-related projects. A recent example of such a project is a new method to produce the 1-hydroxy-1-phosphono-2-pyridin-3-yl-ethyl phosphonic acid and its monosodium salt known as risedronate sodium. The compound is a well-known bone resorption inhibitor used to treat osteoporosis. The method was developed by the research team of Prof. Rachoń and the university patented it last year together with the Polpharma SA pharmaceutical plant in Starogard Gdański.

The Gdańsk University of Technology says it sometimes makes its inventions available for free as part of EU programs. Recently, the university has signed a number of agreements to waive license fees in the first year. The agreements include a deal with the WiComm Center for Excellence that was established by the Ministry of Science and Higher Education in October 2004 to conduct research and development work on wireless telecommunication systems.

In 2007, the Gdańsk University of Technology earned zł.175,000 from patents; last year it received zł.21,000 from license fees. Revenue from innovation totaled zł.27,000 in 2007 and zł.41,000 last year.

The Gdańsk University of Technology has clinched a number of deals with large companies. These include an agreement with fuel corporation Grupa Lotos SA on joint operations in R&D and know-how exchange and mutual support in research and education. Under the agreement, the university and Grupa Lotos will work together on innovative technological projects. The corporation will also place orders for other research and development jobs with the university.

Another example is a science and industry consortium that the Gdańsk University of Technology has formed with the universities of technology in Cracow and Łódź and with the Merten Polska Sp. z o.o. and Zdania Sp. z o.o. companies which provide technology for building mains. The consortium aims to promote and introduce energy-efficient technologies for electrical installations in buildings by engaging in long-term joint research and

development projects. The partners plan to transfer advanced electrical technology to business and help enterprises obtain new technology to improve their competitiveness.

Role model

Ideas developed at the Gdańsk University of Technology were cited as model examples of intellectual property protection in academia during the Creativity—Innovation—Enterprise conference held at the Pomerania Science and Technology Park in Gdynia earlier this year. Conference participants discussed the role that centers for innovation and enterprise play in the emergence of a knowledge-based economy.

"We have worked out such terms and conditions of copyright protection that regulate the procedures and rules for signing contracts, providing assistance to inventors and, first and foremost, paying them," says Popławski. "Unfortunately, the public remains unfamiliar with copyright laws. Businesses often find it difficult to agree on the rules of negotiations and the contracts they are about to sign."

When it comes to intellectual property and patents, Popławski says, things are relatively easier for the university's Chemical Faculty because most of its inventions are of immediate practical value. One example is a technology for the continuous, waste-free and environmentally-friendly chemical recycling of car tires.

The registration of a new drug, on the other hand, takes 10-15 years of work and hundreds of thousands, if not millions, of zlotys, Popławski says.

Electronics, in turn, is a powerhouse of innovation, according to Popławski. New inventions are put into use right away and having them patented does not always pay off. Patent procedures take five to six years, while one can succeed on the market without patenting an invention, Popławski says.

Swapping experience

Practical experience is worth exchanging, even within a small group of researchers, Popławski says. Such an exchange was facilitated by a Polish-American conference that the Gdańsk University of Technology held together with the Gdańsk Science and Technology Park in September.

Attended by decision makers, officials and experts from university-level schools, research institutions and businesses in Poland and the United States, the conference was devoted to innovation, science and technology. Conference participants debated opportunities to intensify Polish-American cooperation for innovation in energy, electronics, computer science and medicine. They agreed that joint projects would stimulate economic growth and improve the quality of life in both countries. Strong ties between universities and industries boost their international competitiveness, but the question is how such ties should be developed, conference participants said.

Innovation is not a luxury; it is a necessity, said Dr. Charles Wessner, a U.S. National Academy scholar and director of the Program on Technology, Innovation, and Entrepreneurship. According to Wessner, the most important challenge that Poland will face in the coming years is the need to build strong relations between university-level schools and businesses as part of an international innovation system. The chief task of university-level schools in the 21st century is to produce know-how that meets the growing requirements of the market, Wessner said. It is essential to focus on research that it not only thrilling but also needed in industry, he added.

Adam Grzybowski

Toward a Knowledge-Based Economy

A high-profile conference on technology transfer was held in Cracow in late October as part of an annual meeting of the Association of European Science and Technology Transfer Professionals (ASTP), an international organization with 22,700 members.

The conference, called "ASTP Fall Meeting: Challenges and Opportunities in Technology Transfer," attracted a host of academics and businesspeople who discussed issues such as a plan to establish an Intellectual Property Institute in Poland to facilitate the country's move to a knowledge-based economy.

Opinion

Conference participants discussed mechanisms for supporting technology transfer and barriers hindering the process.

Piotr Moncarz, a Polish professor working at Stanford University in Palo Alto, California, in the United States and one of the academics behind the idea to establish the Intellectual

Property Institute, said that Poland is well positioned to become an IP management hub because its economy is growing dynamically, faster than other economies in the European Union.

Andrzej Pawlak, a professor at the Lawrence Technological University in Michigan, Minnesota, in the United States, said that individual regions should strive to develop advanced technology clusters as part of their strategic planning policies. This will allow them to carve out new market niches and spur the development of small and medium-sized enterprises.

According to some experts, Poland is on track to becoming a European powerhouse in niche sectors such as underground coal gasification, production of synthetic liquid and gaseous fuels, and CCS technology based on injecting carbon dioxide underground.

Piotr Moncarz

Scientists and businesspeople from Europe, Asia, the Americas and Australia need to exchange experiences despite international competition in innovation and access to both physical resources and intellectual property, said Pawlak. Competition contributes to progress and one cannot work alone in a global economy, Pawlak added. Countries need to work together in transferring technology developed in laboratories to industry and in applying ideas developed at research institutes and universities. Exchanging views at international conferences provides the basis for cross-border economic growth, Pawlak said.

IP culture

Moncarz, who was a keynote speaker at the conference, focused on changes taking place in the business culture of developed countries including the European Union, North America and Australia. According to Moncarz, countries that treat intellectual property in the same way as production-related values were treated at the end of the 19th and beginning of the 20th century will become global economic leaders and ensure the development of education, social welfare, healthcare and infrastructure for their citizens. Everyone else will be lagging behind and asking others for help, Moncarz said.

In today's world, everyone wants to be a leader, but not everyone knows how to do that, Moncarz said. Education, research and development, consumption and production—all these values are indispensable today, he added. If a country or region fails to include one of these values in their development strategy, they may lose stability—like a table with a missing leg, Moncarz said.

Countries should make sure they balance their development strategies in the right way, Moncarz said. Those who excessively concentrate on consumption may one day find themselves on the verge of an economic catastrophe. Those who exclusively focus on education and research may also face a disaster sooner or later because they will lose their human capital: people will emigrate to other countries where they will be able to put their education and research potential to a good use. Those who focus on production while neglecting all the other values may end up as a colony exploited by those who have ideas, know-how and capital, according to Moncarz.

Polish decision makers are aware of the need to maintain such an equilibrium, Moncarz said. The Ministry of Science and Higher Education is putting pressure on academia so that professors leave their "ivory towers" and establish ties with industry. The Ministry of the Economy is steering Polish industry toward modernization and new technology. The Environmental Protection Ministry is setting ever higher requirements for industry and encouraging producers to apply new research results in order to upgrade their production standards and protect the environment from hazardous emissions, Moncarz said.

Success sharing

Conference participants agreed that more attention needs to be paid to "bringing down the barrier" between universities and industry in Poland. According to Moncarz, universities should stay in touch with their graduates who are often ready to sponsor university projects and place orders for research work with university staff. Graduates who have become successful businessmen are often willing to share their success with their alma mater, Moncarz said.

According to Pawlak, success in business, especially at a time of crisis, depends on a country's ability to come up with the right development strategy and on finding new applications for already existing technologies.

Every field of applied science offers market niches that can be tapped. To spot these niches, it is necessary to look for new uses for existing technology and protect intellectual property with patents, Pawlak said.

Another important determinant of success is an ability to find strategic partners and establish working contacts with them, conference participants said. New technology may be capital-intensive, but in the case of start-ups, seed capital, or funds intended for development and implementation, are available in Poland.

Disruptive, or revolutionary, technology deserves special attention, according to conference participants. Most new firms rely on "incremental technology" that only guarantees small technological improvements. No more than 12-14 percent of new firms rely on disruptive technology, according to experts.

An innovative technology does not need to be built from scratch, conference participants said. Technologies used in some industries could also be applied in other market segments. For example, traction control and cooling systems used in passenger cars and trucks can also be applied in computer servers and personal computers.

Research shows that about 10 percent of existing technologies could be easily applied in other sectors of the economy, conference participants said.

Piotr Bartosz

GREEN EDUCATION

A 19th-century building topped with a greenhouse in which barley ripens all year round—this is where the University of Silesia's Faculty of Biology and Environment Protection is headquartered not far from the center of Katowice. The faculty is marking its 40th anniversary this year and its Department of Genetics has 30 years of experience in growing experimental crops such as barley.

The faculty's research and teaching facilities include interdepartmental laboratories—among them a molecular biology lab, a molecular cytogenetics and image processing lab, an environmental biotechnology lab, and a plant biotechnology lab—equipped with special scientific instruments, classrooms and computer rooms with audiovisual equipment. Special premises and equipment are used for growing plants in artificial conditions. These include growth rooms, three phytotrons, greenhouses and an experimental field.

The growth rooms are used to grow plants, fungi and microorganisms. Each room reproduces any required conditions thanks to electronic control of temperature, light intensity and duration, and humidity. The faculty also has a growth room that is authorized to grow transgenic plants. Two greenhouses allow for maximum utilization of light and heat from the sun in creating the required microclimate. They are also fitted with electronic devices for heating, cooling and lighting as well as air exchange.

The experimental field occupies 4 hectares of land and is located in Boguchwałowice, a village not far from Katowice. It includes a utility building with a post-harvest plant analysis lab and a barley gene bank. The experimental field is fitted with seed counters, threshers for single plants, a vacuum packing device to pack seeds, and refrigerators to store them.

The Faculty of Biology and Environment Protection comprises a Botanical Documentation Unit with a Scientific Herbarium. The facility contains about 120,000 specimens, including one of Europe's largest and best known collections of evening primrose—*Oenothera L.* (about 10,000 specimens). Ongoing work to expand the herbarium includes efforts to document

Growth room

the contemporary flora of the Upper Silesia region, in addition to documentation of subtropical floras, herbal collections from countries in Europe and South Asia as well as Spitsbergen, an island in the Arctic Sea. In 2005, the Botanical Documentation Unit joined the Polish Biodiversity Information Network (KSIB), which is part of a worldwide network called the Global Biodiversity Information Facility (GBIF).

Three courses

The University of Silesia's Faculty of Biology and Environment Protection provides three courses to students: in biology, biotechnology and environment protection. The biology course encompasses two specializations: general and experimental biology, and biology in environment protection. Biotechnology students can choose from two specializations: crop plant biotechnology and environmental biotechnology. The environment protection course offers four specializations: biological basis of environment protection, physicochemical methods of environment protection, geo-ecology, and application of advanced instrumental methods in environment monitoring and protection. The environment protection course is taught jointly with the Faculties of Earth Sciences and Math-Physics-Chemistry, enabling students to gain broader knowledge and take advantage of all three faculties' educational resources.

The system of studies includes a first-level course (Bachelor of Science degree) and a second-level course (Master of Science degree). A third level, Ph.D. studies in biology, is also available.

The Faculty of Biology and Environment Protection recently launched "Advanced Methods in Biotechnology and Biodiversity" Ph.D. studies, taught in English and financed under the "Universities as Partners of a Knowledge-Based Economy" project. The first 12 students began their studies here in the 2009/2010 academic year.

The faculty's students take part in many international exchanges under the European Union's LLP Erasmus program, which the faculty joined in 1998. Apart from being able to go on traineeships, students can study abroad for a semester or a whole year. The list of partner universities abroad includes 15 schools in the Czech Republic, Austria, Denmark, Finland, Greece, Germany, Norway, Britain and Italy.

At the moment, the University of Silesia has 17 bilateral agreements with other universities abroad that involve biological sciences.

From the start, the research topics at the Faculty of Biology and Environment Protection were determined by the faculty's location within the Upper Silesia industrial region. In response to the development of biological sciences worldwide, the faculty has made biotechnology of plants and microorganisms its second most actively developed field of research.

Four research areas

Overall, the faculty focuses on four key areas of research: environmental biotechnology; plant biotechnology and experimental biology; analysis of environmental changes in the postindustrial era; and the taxonomy, phylogenesis and phylogeography of selected groups of plants and animals.

The faculty's environmental biotechnology research focuses on the use of

CALLING ALL GRADUATES

The Faculty of Biology and Environment Protection of the University of Silesia is looking for photographs depicting its history as part of its jubilee celebrations. This appeal for the loan of photographs is directed to anyone who has ever had any connection with the faculty and who has photos of official, cultural or social gatherings, like Faculty Day, song nights, field trips, and scientific expeditions, such as a 1979 Middle East excursion. The assembled material will be used in designing our jubilee publication and will also be displayed in the faculty's photographic gallery.

microorganisms in the processes of bioremediation of soil contaminated with hydrocarbons, pesticides and heavy metals and on seeking biomarkers of environmental stress. Experimental work concentrates largely on studies of bacteria and fungi whose huge biodegradation potential make them an attractive alternative for expensive and environmentally unfriendly physicochemical methods of eliminating organic pollution. Experiments are also carried out to study the biodegradation of synthetic and synthetically modified polymers used in making plastics. The practical goal of the research is to find microorganisms capable of quickly and completely decomposing environmentally harmful hydrocarbons, pesticides and plastics. Such microorganisms are used as the basis for biosubstances that could be introduced into the soil to reduce the concentration of these pollutants and their toxic impact. The search

In vitro cultures

Greenhouse

is also on for microorganisms that could improve the condition of soil polluted with heavy metals and those that could be used to separate heavy metals from industrial waste.

Research on plant biotechnology and experimental biology involves studying the structure and function of the plant genome, using molecular cytogenetics, functional genomics, molecular physiology and cell biology methods. Experimental work concentrates on model plant species *Arabidopsis thaliana* and *Brachypodium pinnatum*, as well as on different crops, such as barley (*Hordeum vulgare*), wheat (*Triticum aestivum*) and rapeseed (*Brassica napus*) and other Brassicas. The research projects include: analysis of changes in chromatin and chromosome structure during phylogenetic, ontogenetic and biotechnological processes; identification, genetic mapping and isolation of genes controlling plant growth and development; analysis of the expression of genes responsible for plant morphogenesis *in vivo* and *in vitro*; research on hormonal regulation of plant growth—especially under stress conditions; studies of the genesis and function of electric potential in plants; analysis of the role of symplastic communication and physicochemical cell wall changes in cell differentiation; and the mathematical modeling of plant organs' growth.

Environmental studies of postindustrial areas are conducted mainly in the Upper Silesia Industrial Region, though for reasons of comparison they often also include the entire South Macroregion of Poland. This extensive, specialist and multidisciplinary research aims to evaluate, with the help of model species and biological phenomena, how advanced the changes are in postindustrial ecosystems, analyze the potential for self-regeneration in the seriously disturbed biological equilibrium as well as assisting the process of reclamation of degraded areas.

Among other things, phenomena occurring in the soil of areas subjected to industrial impact are studied. Special attention is paid to research on cleansing mechanisms in soil polluted with metals, involving the plants growing there—metallophytes, and on the role of macrophytes in the self-cleansing of water reservoirs in the region.

When assessing the condition of the environment, it is important to determine the indicators of how plant and animal organisms connected through trophic chains function in a strongly changed environment, and particularly in an environment contaminated with toxic chemical substances. Research in these areas concentrates on looking for

Molecular biology lab

species useful in biomonitoring, including plants—such as bryophytes—and invertebrates.

The research field described as taxonomy, phylogenesis and phylogeography of selected plant and animal groups comprises taxonomy and chorology projects involving phylogenetic relationships within the *Hemiptera* order of insects at the family and suprafamily levels, explaining evolutionary processes and reconstructing the family history of representatives of the order *Hemiptera* on the basis of paleontological studies with the help of morphological, histochemical and molecular analyses. Special attention is paid to studies on the postglacial migration of plants in Central Europe, the genetic diversity of plant species on rangeland borderlines and the impact of environmental stressors on microevolutionary processes in selected taxa of vascular plants. Studies on inter-species hybridization in invasive plant species comprise another major topic.

In a recent achievement in biology research, a team of University of Silesia researchers led by Dr. Andrzej Woźnica from the Department of Biochemistry won an award at the 7th International Competition for Environment Protection Projects for their "Automatic biodetector of general toxicity of water—a tool for monitoring the presence of toxic substances in water." The University of Silesia received a first-degree award and was named a Master of Ecology.

Designing the future

The Faculty of Biology and Environment Protection pays a lot of attention to biotechnology. Its research and teaching potential in this area, however, is restricted by inadequate premises and infrastructure that comprises only two buildings set far apart from each other. This explains why, as it celebrated its 40th year, the Faculty of Biology and Environment Protection came forward with an idea to build a new research and education center called the Biotechnology and Biodiversity Center of the University of Silesia.

The aim is to enable Katowice biologists to become part of the global drive to develop biotechnological and biological sciences alongside other leading Polish universities and research institutes. According to the researchers involved, the University of Silesia's specialist laboratories and research facilities would make it possible to intensify the development of state-of-the-art research technology in genomics, bioinformatics, proteomics, and molecular phylogenesis and ecology. The Biotechnology and Biodiversity Center would continue the unique biodiversity research and develop methods for the biodetection of water toxicity, biodegradation of xenobiotic compounds and bioremediation of areas polluted with heavy metals and pesticides.

The center would comprise not only modern research and teaching facilities but also space friendly to the region's residents. The facility would serve as a venue for promoting environmental education and awareness. It would be open to the general public and teem with life on weekends when it would host exhibitions, lectures and various interactive projects.

The center in itself would be an environmentally friendly building, one that would rely on alternative energy sources and biological waste treatment systems. According to the designers, this type of building would play an educational role, showing the practical application of environmental and bioengineering technology such as solar panels, heat pumps, wind turbines, hydroponics, and small waste treatment systems.

Ewa Dereń

Photos: University of Silesia Faculty of Biology and Environment Protection

UNIVERSITY OF SILESIA FACULTY OF BIOLOGY AND ENVIRONMENT PROTECTION IN FIGURES

• Number of full-time courses	3
• Overall number of students	1,388
• Number of Ph.D. students	70
• Number of teachers (including 14 professors, 22 academics with postdoctoral degrees, and 80 Ph.Ds.)	137
• Number of graduates (up to the 2007/2008 school year)	4,417
• Number of doctorates conferred (up to the 2007/2008 school year)	299
• Number of postdoctoral degrees conferred	57
• Bilateral agreements signed by the University of Silesia involving biological sciences	17
• Number of partner schools abroad under the LLP/Erasmus program	15
PUBLICATIONS (AS OF 2008):	
• monographs	83
• research papers published in science periodicals included on the Thomson Reuters Master Journal List (referred to as the "Philadelphia List" in Poland)	141
• publications in other periodicals	188

Multilingual Education

During its 65-year history, the Maria Curie-Skłodowska University in the southeastern city of Lublin has conferred almost 150,000 graduate degrees, 3,000 doctorates and more than 640 postdoctoral degrees.

The university has 10 departments, 25 institutes and five units with institute status. Students can choose from among 39 programs and over 120 majors. This academic year, the university enrolled 31,000 undergraduate students in full- and part-time programs, in addition to 900 postgraduate students.

The university has 428 professors and academics with postdoctoral degrees, in addition to 1,286 Ph.D.s and junior lecturers. It operates branch colleges in Radom, Biała Podlaska and Biłgoraj and an Undergraduate Fine Arts College in Kazimierz Dolny. The university library, opened in 1944, boasts a collection of more than 2.5 million volumes.

Past and present

The Maria Curie-Skłodowska University began operating on Oct. 23, 1944. In the beginning, it had four departments: Medicine, Natural Sciences, Agriculture, and Veterinary Science. The Department of Pharmacy opened three months later. The academic year officially opened Jan. 14, 1945. The university had 42 teachers and 806 students in that first year. Prof. Henryk Raabe, a zoologist, was the university's first president.

Today Maria Curie-Skłodowska University students can choose from among the following departments: Philosophy and Sociology, Humanities, Economics, Pedagogy and Psychology, Political Science, Law and Administration, Arts, Chemistry, Mathematics and Physics, and Biology and Earth Sciences.

Over the past two years, the Maria Curie-Skłodowska University has launched several new programs, including Speech Therapy with Audiophonology, Tourism and Recreation, Finance and Accounting, and Iberian Studies. Students can also take up individual and interdisciplinary studies. Postgraduate studies encompass more than 80 programs and are also available as part of the European Social Fund.

"We are concerned about making sure that our graduates find their place on

the labor market," says Katarzyna Mieczkowska-Czerniak, press spokeswoman for the Maria Curie-Skłodowska University. "The university has a thriving Career Office where both students and graduates can get free assistance in gathering job experience and skills necessary to make a successful professional career."

Seven languages

Knowledge of foreign languages is one of the prerequisites for success on the job market, Mieczkowska-Czerniak says. At the Center for Foreign Language Teaching and Certification, students can attend courses in seven languages: English, German, Russian, French, Spanish, Italian, and Latin. The classes are available to students of all full-time, part-time, postgraduate and evening programs.

After Poland became a member of the European Union, the university opened the European Documentation Center under an agreement with the European Commission. The center gathers EU documents on a regular basis. The university has access to a large collection of official EU-related publications and most European online and offline databases. The European Documentation Center also stores documents of the Organization for Security and Cooperation in Europe (OSCE). It disseminates information about the EU, conducts research and preliminary archival research and holds seminars and conferences.

FLEXIBILITY AND OPENNESS

Prof. Andrzej Dąbrowski, president of the Maria Curie-Skłodowska University:

The university is highly flexible with regard to available undergraduate and graduate programs as well as the steadily developing range of postgraduate studies. Our students have a lot of freedom in choosing elective subjects. We also provide them with opportunities to travel abroad and refine their linguistic and athletic skills. Our university is open to students' suggestions concerning better quality of education, changes in the university's image, and the work of our numerous academic clubs. It is extremely important to integrate education and research by getting senior-year students involved in research work. We also keep developing our programs of remote education and lifelong learning.

Students of the Maria Curie-Skłodowska University are members of 68 academic clubs, including the Academic Club of Antiquity Enthusiasts, which holds classes in "living history" for young people. The Academic Club of English Studies stages and performs plays in English. Other clubs include the artistic Frakcja Sucha Academic Club, the experimental Physicists' Academic Club, and the Alkahest Academic Chemistry Club.

In 1990, the Maria Curie-Skłodowska University opened a British Center in association with the Polish branch of the British Council. The Maria Curie-Skłodowska University British Center is a partner institution of the British Council and comprises a British library, a British Multimedia Information Center, and a British Council and Cambridge University Examination Center in English for Speakers of

Other Languages (ESOL). The library and information activities mainly concern English teaching, studies and life in Britain and British literature and culture. The Examination Center organizes General English exams, including First Certificate in English (FCE), Certificate in Advanced English (CAE), Certificate of Proficiency in English (CPE), and the International English Language Testing System (IELTS), in addition to Business English (BEC) and Legal English—Test of Legal English Skills (TOLES) and International Legal English Certificate (ILEC).

Polish for foreigners

The Maria Curie-Skłodowska University also has students from abroad. Education in the Polish language and culture for foreign students is provided by the Polish Language and Culture Center for Foreigners and Poles Abroad, which prepares course books and textbooks. The center also conducts research on the Polish language and culture. Students wanting to start education in Poland can take a one-year course in Polish. The center also provides a three-year, full-time undergraduate course in Polish studies and a two-semester Postgraduate Course in the Humanities for Foreigners.

The Maria Curie-Skłodowska University organizes special courses in Polish for foreign students as part of the European Union's Erasmus program and the Lane Kirkland Scholarship Program sponsored by the Polish-American Freedom Foundation (PAFF). The latter program, launched in 2000, aims to share Polish experiences in political and economic transition with students from other countries in Central and Eastern Europe by providing them with complementary studies at Polish universities. The program is specifically targeted at students from Ukraine, Belarus, Russia, Georgia, Moldova, Armenia, Azerbaijan, and Kazakhstan.

In October 2007, the range of courses available at the Polish Language and Culture Center for Foreigners and Poles Abroad was expanded to include Postgraduate Qualification Studies in Teaching Polish as a Foreign Language. The classes are conducted in Poland and the United States (New York). During summer vacations, specialist short-term courses are organized for foreigners and Poles living abroad as part of a project called Polish Summer. When not in class, project participants get to visit the most beautiful sites in and around Lublin and take trips to other Polish cities, such as Warsaw, Cracow and Częstochowa. They also get to meet Poland's cultural leaders.

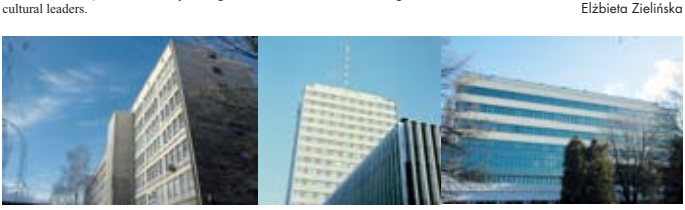
The Polish Language and Culture Center for Foreigners and Poles Abroad holds academic conferences and issues two series of publications: Educating Polish People from the East and Language-Culture-Society.

Something for Lusophiles

In 2005, the Maria Curie-Skłodowska University launched the Portuguese Language Center under a cooperation agreement with the Camões Institute in Lisbon, Portugal. It is the first and so far the only such center in Poland that aims to spread knowledge of the Portuguese language and the culture of Lusophone, or Portuguese-speaking, countries. These include Portugal, Brazil, Mozambique, Angola, Tomé and Príncipe, Cape Verde, Guinea-Bissau, and East Timor.

The Maria Curie-Skłodowska University plans to launch a Media Incubator to train journalism students using EU funds. The institution would cover television, radio and other media, according to Mieczkowska-Czerniak.

Elżbieta Zielińska



Human Bones, Snake Skeletons...

Archeologists from the Maria Curie-Skłodowska University in the south-eastern city of Lublin have discovered the remains of human bones and snake skeletons in graves in Tominy, a village near Ożarów, Świętokrzyskie province. The finds come from the Middle Neolithic period and date back around 6,000 years, the archeologists say.

The presence of snakes in the graves could have been associated with magic rites, the archeologists say. They are still investigating the finds, examining their age and making photographic and drawing documentation.

The archeologists originally came to the site to examine an Early Neolithic settlement dating back around 7,000 years. In August, they started digging in a new place, which they thought was on the outskirts of the settlement. But they unexpectedly found a burial ground of the Funnelbeaker culture dating back around 5,500-6,000 years to the Middle Neolithic period. They discovered several stone graves typical of that period—small box graves built of lime blocks. In two of the graves, apart from human bones and pottery, the archeologists found exceptionally well preserved skeletons of snakes.

The Funnelbeaker culture was a Neolithic culture that developed from around 3,700 BC to 1,900 BC in what are now Jutland, Sweden, Germany, the Netherlands, Poland, Volhynia and Podolia. The Funnelbeaker culture is named after its characteristic pottery—beakers and amphorae with funnel-shaped tops.

Wisent Farms Under Development

Poland's animal husbandry experts plan to build a network of farms to breed wisent, or European bison, the heaviest surviving land animal in Europe.

Such farms are the best way to protect and develop the species, which was until recently threatened with extinction, says Prof. Wanda Olech of the Warsaw University of Life Sciences, an adviser to the environment minister and coordinator of the wisent breeding program.

One wisent farm has already been built in the eastern province of Podlasie, Olech says. Similar facilities are planned in the western Lubuskie and Wielkopolska provinces and in southern Poland.

The wisent (Bison bonasus), also known as the European bison, is about 3 m long and 1.8 to 2.2 m tall, and weighs 300 to 920 kg. It is typically lighter than the related American Bison (Bison bison), and has shorter hair on the neck, head and forequarters, but longer tail and horns.

Poland's wisent population is now so large that their natural habitats in Białowieża and Borecka Forests are becoming too small, Olech says. On the other hand, wisent numbers are still not large enough to ensure safety for the species, she adds.

The farms will provide a lot of space and optimum living conditions for the animals, in addition to veterinary care, Olech says.

According to experts, it is necessary to look for new places for the wisent in order to create small herds, distribute the population on a larger area and increase its total size. Herd dispersion may additionally contribute to reducing the risk of disease and the spread of parasites within the population.

Observations conducted by researchers indicate that the wisent do not have enough space in Białowieża Forest because they migrate to places outside the forest. At present, the wisent herd on the Polish side of Białowieża Forest numbers over 450 individuals. In the middle of the 19th century, there was a record number of wisent living in this forest—1,800. The largest number of wisent were killed during World War I when they were hunted for meat and transported to Germany. Local people also hunted for wisent for the same purpose.

Wisent were reintroduced successfully into the wild, beginning in 1951. At present, the global wisent population exceeds 3,000, but the animal is still on the International Union for Conservation of Nature's Red List of endangered species.

Polish Archeologists in Crimea

The defensive walls of the ancient town of Tyritake, a dugout dating

back to the times of Khazar rule, and the foundations of an early Christian basilica of the 6th century are among the discoveries made on the Kerch Peninsula in Crimea, Ukraine, by a group of Polish archeologists from the National Museum in Warsaw. The archeologists have been conducting excavations in the area for two years.

Tyritake, an ancient Greek town located in the eastern part in Crimea, was founded by colonists from Ionia in the middle of the 6th century BC. Archeological investigations were first conducted on the site in 1932.

"This year's discoveries allow us to presume that we have managed to locate one of the prewar trenches dug by Polish archeologists," says Alfred Twardecki, head of the project. "Its exploration had been discontinued due to the war while incomplete documentation and topographic changes that took place on the site during World War II made it difficult to locate the place. The latest discovery will greatly speed up our work because it will allow us to combine our discoveries with the prewar excavations. Our goal is to investigate a broad strip of the ancient town from its western to eastern border."

This year, the archeologists started work on three new excavation squares. They uncovered well-preserved remains of defensive walls dating to the Archaic Period—6th-5th century BC. While working in this part of the excavation site, they also came across well-preserved remains of a stone dwelling older than the walls.

Another interesting find is a dugout dating to the times of Khazar rule. Khazars were nomadic Turkic people who dominated the area between the Caspian and Black Seas from the 6th to 10th century AD.

In their previous excavation season, the archeologists also discovered an early Christian basilica, one of the earliest in the region. This year, Ukrainian officials decided that the building should be reconstructed. In the future, Ukraine's first archeological park will be established on the site of the ancient city.

Compiled by Tadeusz Belerski

MYSTERIES OF COPERNICUS' ASTRONOMICAL TABLE

Recent studies show that the astronomical table drawn by Nicolaus Copernicus on a wall of the Olsztyn Castle in northeastern Poland was probably a visual aid the astronomer used to explain the phenomenon of the equinox, presumably to guests visiting him in the castle, rather than a research instrument, as was believed until recently.

The previous hypothesis was that the table was a research instrument used to determine the exact moment of the spring and autumn equinox. Researchers now think the table could have been used as a visual aid.

Copernicus stayed at Olsztyn Castle between 1516 and 1521, but left no information in his papers about the device depicted on the castle wall.

In order to find out what the device had been used for, the researchers repeated Copernicus's experiment involving the observation of the spring and autumn equinox. They made a copy of the table and placed it on the southern wall of the castle, which is exactly parallel to the wall with the original table. They observed sun rays reflected from a mirror. Copernicus could have used a similar mirror, they say.

Contemporary observations and calculations show that the lines on the original table are not precise. This led the researchers to conclude that the table had not been used by Copernicus as a research instrument. He probably used it to show his guests the moment of the spring equinox. This moment was important because it was used to determine the date of Easter and other movable Christian feasts. It is also clear that the table was not a sundial, the researchers say.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