

R&D: GENERAL IN COMMAND

Prof. Bogusław Ludwik Smólski, a retired officer in the rank of brigadier general, has assumed the post of director of the National Center for Research and Development (NCBR), a newly established institution that aims to support scientific research in Poland.

The NCBR has been set up to manage research projects in areas of strategic importance to the country. Under the relevant law, the center is supposed to “carry out strategic research and development programs that serve the economy and the public.”

The NCBR is expected to consolidate Poland’s fragmented science sector, and it also aims to increase the mobility of scientists and create opportunities for the development of specialized staff trained in R&D management. The NCBR will also work to encourage companies to hire researchers, especially young ones, either temporarily or on a full-time basis.

The center will manage interdisciplinary, inter-industry, national and international projects, many of which may be worth over zł.100 million.

Smólski, aged 60, is an engineer by profession and his main interest is in telecommunications. He specializes in microwave electronics, interferometry, microwave technology and radar systems. He has written a number of publications on microwaves and radar technology. He holds eight patents in areas such as microwave interferometry, having developed innovative designs that are applied in instantaneous frequency measurement (IFM) receivers used by

Polish electronic intelligence systems. He has written five textbooks and 75 scientific papers and reports.

Ever since he became preoccupied with science, Smólski has worked to strengthen the ties between science and business, and contributed to the development of research centers in Poland. In 2004-2006, he was rector of the Military University of Technology (WAT) in Warsaw. He reformed the university and prepared a strategy for its development through 2013. While holding the post, he primarily focused on improving the teaching staff’s qualifications and boosting the development of research. As a result of his efforts, WAT won recognition across Europe.

“We managed to fill a market void in advanced technology,” Smólski says. “Our infrared detectors are exported to the United States, and other achievements include blue optoelectronics, laser technology, materials engineering technology, hydrogen cells, IT systems developed for NATO companies and agencies, and collaboration with around 60 universities and research centers around the world. Moreover, WAT has signed contracts with many countries concerning the implementation of various technologies.” The school has many renowned scientists, Smólski notes, including physicist Prof. Antoni Rogalski who has won the Foundation for Polish Science (FNP) Prize, sometimes referred to as the “Polish Nobel Prize.”

Since 2004, Smólski has been a member of the Presidium of the Conference of Rectors of Academic Schools in Poland, and he has chaired the presidium’s Science Committee since 2005. Also, since 1999 he has been a member of the Science Council of the Industrial Telecommunications Institute; he has been presiding over the council since 2003.

In 1993-1997, Smólski headed the Development and Implementation Department of the Ministry of Defense. Since 1983, he has been a member of the Electronics and Telecommunications Committee of the Polish Academy of Sciences (PAN).

In recognition of his scientific achievements, Smólski has been honored with state medals including an Officer’s Cross of the Polonia Restituta Order, a Gold Cross of Merit and a Medal of Service to National Defense.

Smólski is an avid tourist and skier. He is also keen on photography and never parts with his camera in his spare time. His other hobbies include hiking in the mountains and relaxing at the seaside with his wife and daughter.

Urszula Imienińska

THE POLISH SCIENCE VOICE

From the Publisher

The southern cities of Wrocław and Cracow, along with the Upper Silesia conurbation, form a giant information technology cluster known as the "Polish Silicon Valley." Perhaps the cluster should simply be referred to as an "IT Valley," but the name "Silicon Valley" immediately evokes the desired associations around the world.

A good project is like a delicious cocktail whose quality depends on its ingredients. In this case, the proportions have been chosen with special care. The cluster relies on technical universities, industrial facilities and local governments—plus, of course, money, money, and more money: from the European Union, Polish government coffers and the business community. Add to this two freeways, three international airports, many railway lines, including one wide-gauge link running to Russia, and six capital cities within a radius of 600 km. Companies already active in the cluster include LG Philips LCD, LG Electronics and Toshiba, JVC, 3M, and Funai Electric Co. Ltd., accompanied by a host of smaller players. What more could investors desire? And what else does science need to move into top gear?

The southern IT Valley is the main focus of this issue of The Polish Science Voice. The cluster occupies a special place among the many projects nationwide designed to develop Polish science, enhance its relations with business, and foster international ties.

A completely different economic instrument—though one that plays in the same orchestra—is the Foundation for Polish Science (FNP). Its president, Prof. Maciej Żylicz, is the special guest of this issue of The Polish Science Voice. He tells us about the FNP's strategy of dealing with the challenges faced by the Polish research sector as it strives to bridge the gap separating it from its counterparts in other countries. The foundation's policy is based on "supporting only the best so that they can become even better," Żylicz says. He notes that what Polish science needs the most is "freedom—freedom of research, and freedom from politics, and from pseudo-priorities defined by incompetent people." He adds, "We have to create such a system for financing science that will only support the best, while introducing rigid rules for financing research based on who is more competitive. We have to learn the rules of fact-based research criticism." Żylicz outlines the foundation's methods and describes its specific projects.

Other stories in this issue of The Polish Science Voice revolve around various other research projects in Poland—based in different cities and involving different sectors of the economy. They are all part of this issue because they have one thing in common: they testify to the strengthening bond between science and business.

Andrew Jones

Young Blood Needed

Prof. Maciej Żylicz, president of the Foundation for Polish Science (FNP), talks to Urszula Imienińska.

What are the strengths and weaknesses of Polish science?

A permanent shortage of funds is certainly one of the main weaknesses. Annual spending on research in Poland is a paltry 17 euros per capita, compared with 170 euros in Western Europe. Unfortunately, even these small funds are not always used sensibly. Nearly 70 percent of the government subsidies for research are earmarked for maintaining old infrastructure and facilities developed under communism.

In highly developed countries, most of the money for research is spent on the most promising projects proposed by scientists. In Poland, only 13 percent of the science budget goes to such projects.

Another weakness is that politicians think science should focus on certain fields, and they try to define those fields. However, they often lack imagination. For example, biotechnology or nanotechnology generate a lot of profit in highly developed countries, while in Poland the situation is more complex. Countries leading the way in these fields began investing in fundamental sciences such as physics, chem-

istry and biology some 20 years ago. Given the current competition worldwide, Poland is some 20 years behind. Are we capable of making up for the delay and winning new technology markets? I doubt it.

Is there an alternative? Certainly. We should invest in those scientists and research teams that despite insufficient funding and shortages of infrastructure and equipment, are still able to be competitive internationally. It is easy to determine several disciplines of science in which Poles are really good. Let us remember that science doesn't like compromise. You have to finance the best people. If you finance the mediocre, only because they have promised to introduce some new technologies to industry, you are just wasting money because they will never succeed.

People are the key to success. Several dozen scientific teams with a strong reputation in the international science community are Poland's strongest asset. Unfortunately, people can also be a drawback sometimes—especially if, despite their impressive names and titles, they do not pursue real science, but obstruct reforms and prevent genuine scientific debate, only

because they have little to say themselves. Some people also block the careers of young scientists because they fear their students might prove to be better.

How should this problem be resolved?

We strive to follow the principles of healthy competition at the Foundation for Polish Science. While supporting scientists, we are always guided by the motto of "supporting only the best so that they can become even better."

In your opinion, what is the greatest need of Polish science?

It needs freedom—freedom of research and freedom from politics, and from pseudo-priorities defined by incompetent people. We have to create such a system for financing science that will only support the best, while introducing rigid rules for financing research based on who is more competitive. We have to learn the rules of fact-based research criticism.

The FNP was established in 1991, and you have headed it for the past two years. After taking over as president, you came up with the idea of creating special programs targeted at young scientists. What is the essence of this idea?



Ideas for new programs had been maturing at the FNP long before I became its president. Indeed, the foundation has introduced three new programs aimed at young researchers in the last two years. If we want to improve the science sector, we have to invest in these people. I do believe that their uncompromising attitude and enthusiasm will help change our petrified system from within. But in order to succeed in this task, we have to select the best people, not only in terms of academic achievement, but also in terms of meeting all the professional ethics criteria. Then, we have to grant them freedom to pursue their research and give them money. They will do the rest. Young people are usually free from inhibitions. They have little to lose and are not afraid of taking risks. They have the capacity to break taboos and act unconventionally.

Sometimes a young person comes up with a great idea. Paradoxically, if they had more knowledge and experience, they wouldn't be that bold. Philosophy is a discipline for mature minds, while physics and natural sciences are an exercise for young people. Einstein made his greatest discoveries when he was 26, and Newton when he was 24.

Returning to the new programs introduced by the FNP last year, these included *Homing*, *Focus* and *Innovator*. *Homing* is for those who have been on fellowships abroad and might be willing to come back to Poland despite the poor pay in research institutions here. *Focus* is designed to encourage young scientists to create and head their own research teams. *Innovator* encourages research that can be promptly applied in the economy.

Almost from the beginning of its work, the FNP has been awarding 12-month grants that have recently become known as "Start" grants. They are intended for young researchers under 30 who are only beginning their careers in science but have already had some success. The goal is to motivate them to develop, and the amount of the grant enables them to focus exclusively on research. This funding is available to scientists who are staff members or Ph.D. students at colleges, Polish Academy of Sciences (PAN) institutes

and other institutions dealing with scientific research.

Does the foundation focus exclusively on young researchers?

Not at all. Ever year, we have many programs for scientists of various ages from many different disciplines. This year, we are running 20 such programs. These include a competition for the FNP Prize, recognized as the most important award for scientific achievement in Poland. There is a range of grants targeted at young researchers as well as several grant programs for teams and science institutions designed to meet the different needs of the science community. These 20 programs are available to scientists at various stages of professional development. For instance, we have the *Mistrz* (Master) program, which provides funding to those who set a good example, teach and help young scientists. Then there is *Nestor* (Senior) for retired professors who would like to use their knowledge and experience to contribute to the development of new colleges and institutes.

How do you want to encourage talented scientists to pursue a career in Poland instead of going abroad?

Foreign fellowships are necessary for a scientist's proper professional development. So I'm not going to discourage anyone from traveling abroad. But I would like to encourage talented people to return to Poland after their Ph.D. studies or a post-Ph.D. fellowship and continue their career here. This is the aim of the *Homing* program. Science needs young blood. Young people increasingly travel abroad. Some leave right after completing their master's studies to obtain a Ph.D. from a renowned foreign institution. Others go after they obtain their Ph.D., usually for a one- or two-year fellowship. Most young scientists do not intend to leave Poland for good. They just want to gain the experience of working in good Western institutions, and then come back. Such a system is quite popular among their peers in Western countries, and it facilitates professional growth.

However, in Poland, this sometimes works in a different way. Sometimes a scientist returns to Poland, but there is no place for them to work. Even though they have written an excellent Ph.D. dissertation and have a long list of good publications under their belt as well as contacts with prominent researchers, the doors to many scientific institutions in Poland remain closed to them. Meanwhile, they receive offers from abroad, so they leave the country again, this time for longer. Some of them never come back.

This also applies—though much less often—to the recipients of the FNP's grants, who are "the best of the best." For over 10 years, we have run the *Kolumb* (Columbus) program whereby we offer grants to the best young Ph.D. holders for fellowships at the world's best research institutions. Roughly 95 percent of them return to Poland. For a few years, they have been associated in the FNP Fellows Club. We learn a great deal from them. Unfortunately, a small number of our grant recipients failed to find satisfactory jobs after returning to Poland, so they packed their bags and waved Polish science goodbye. This is a big loss.

Under the *Homing* program, we offer financial packages to scientists coming back to their "nests"—at least zł.50,000 a year, granted for two years, with the possibility of extension.

Who is eligible for such a grant?

It is intended for scientists who have earned their Ph.D. degrees over the past four years and who want to come back to Poland after a longer stay abroad, or have returned within the past 12 months. When awarding the grant, we examine the candidate's scientific achievements, their ideas for a research project, and the possibility of financing it from other sources. The FNP also wants to make sure that scientists returning to Poland keep up their cooperation with the foreign institutions that hosted them during their fellowships. This will be facilitated by agreements with foreign institutions at which many of our researchers work. So far, the FNP has signed agreements with the Max Planck Society in Germany, the German

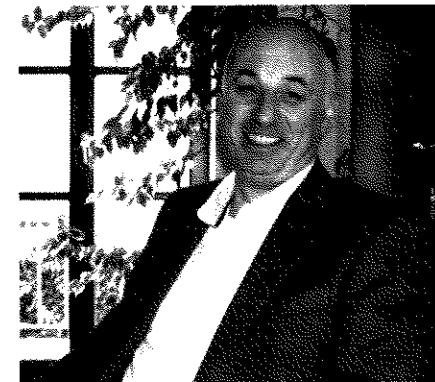
Research Foundation (Deutsche Forschungsgemeinschaft), the Alexander von Humboldt Foundation, the Institute for Human Sciences in Vienna, and the Austrian Science Fund. We have also signed an agreement with the Research Council of Norway, which has helped us obtain funding from the European Economic Area. We are in the process of signing yet another agreement with the National Institutes of Health in the United States.

The Focus program is mainly targeted at young Ph.D. holders who have "remarkable scientific achievements" and want to establish their own research teams. Is it at all possible for a young person to have considerable scientific achievements?

"Remarkable scientific achievement" does not only involve a large number of publications. We focus on the quality of work and on a candidate's intellectual independence. We want to know if they have already worked on their original ideas. Once a year, the foundation selects a few ambitious scientists who conduct research in a field "of special significance to the country's development." This year, these are astrophysics and space research. Last year, under the first *Focus* program, we gave grants to scientists specializing in the mathematical modeling of biological processes, a field in which Polish scientists are international leaders.

Focus is targeted at a wide group of scientists, including foreigners. The program takes the form of an open competition that we also announce in foreign specialist publications such as *Nature* and *Science*. We offer opportunities for foreign scientists wishing to work in Poland. The teams selected in the competition receive around zł.80,000 annually over a period of three years, with the possibility of extending the grant to two more years. Regardless of the grant, the winning teams may apply for additional funding to create research laboratories, buy equipment and renovate their premises. We estimate that each year we will be spending some zł.2-4 million on this.

The Innovator program helps young inventors set up their own businesses. What are the requirements?



"People are the key to success. Several dozen scientific teams with a strong reputation in the international science community are Poland's strongest asset."

A person's Ph.D. degree must be no older than four years, and they should have an idea for an innovative project to apply modern technology and services in the economy. We can help them found their own company, raise funds, and develop a business plan. A select group receives 100 hours of training and workshops teaching them how to run an innovative company. We want to provide the researchers with at least basic knowledge of management, accounting, intellectual property regulations, and so on, so that their products or services can be competitive on the market.

At the end of the training program, the researchers write business plans that are later evaluated. The best three or four applicants receive non-repayable financial assistance. We would like to see such companies established at colleges, PAN institutes and R&D facilities. This would stimulate these units to generate their own internal regulations for private companies operating on the borderline of science and business.

In general, scientists are not prepared for working with industry. They don't know how to promote themselves and how to put their achievements to commercial use. Meanwhile, a range of options is available: they can patent

their inventions and sell them, or they can find partners and establish companies. Also, a college may invest in the company. But you have to know how to go about it.

Who will evaluate the quality and usefulness of these projects for industry?

We have a group of experts who include heads of large consulting firms, scientists and successful businesspeople.

You are a researcher yourself. You have won international recognition with your research into chaperone proteins. You have been quoted over 5,000 times in international scientific publications. Has your research career been a bed of roses?

I've always wanted to conduct experiments. As a young researcher, I was impatient. I wanted an experiment today and a conclusion tomorrow. That was possible in molecular biology. When I was just under 28, after obtaining my Ph.D. degree I went on a fellowship supervised by Prof. Georgopoulos at the University of Utah in the United States. After a year of work as a fellow, I got my own laboratory and assistants, and for the next two years, laboratory work filled my life. My goal was purely cognitive in character: I wanted to explain certain mechanisms controlling cell behavior. I wanted to know how cells reacted to changes in external conditions such as a sudden temperature increase or thermal shock. I managed to isolate previously unknown proteins that chaperone other proteins. After nearly three years I returned to Poland and established my own research team to continue the work I had started in the States. We made our greatest discoveries in Poland, even though we worked in difficult conditions, with little money and equipment. I have very fond memories of that time. Five of my colleagues from that period are professors today, working with their own research teams.

In the meantime, it turned out that the same chaperone proteins could be found in bacteria and drosophilas, or fruit flies, as well as humans. These are near-

ly identical proteins, with an almost identical structure, and the same functions. These proteins have not changed significantly over the last 3 billion years. Today we already know that chaperone proteins play an important role in protecting cells against the negative effect of stress and unfavorable changes in the environment. In general, one can say that they enforce order in the cell and protect it from sudden destructive changes in the environment. What is especially fascinating is that the protective properties of these proteins can be used for example to develop an autovaccine against cancer or to delay the appearance of symptoms of neurodegenerative diseases. We know this thanks to experiments conducted in other laboratories. Billions of years of evolution have created this system of cell protection. Now man can use this system to treat or prevent certain diseases.

Do you know everything about chaperone proteins by now?

Certainly not. Today I'm chiefly preoccupied with the relationship between these proteins and cancer. For seven years I have exclusively been dealing with human proteins related to cancer. I run a team at the International Institute of Molecular and Cell Biology in Warsaw together with my wife Alicja, who is also a professor of molecular biology. We are studying a protein called p53, also known as "the genome guard." If any undesirable changes take place in our genome, that is, in our DNA, p53 launches a repair system. If it is unable to repair the cell, the protein forces the cell into suicide. In this way, it prevents the multiplication of genetically altered cells and restrains the occurrence of cancer. In people suffering from cancer, this protein is often damaged. We have discovered that p53 does not act alone, but requires chaperone proteins to cooperate. I hope that in future this discovery will allow us to develop new methods of treating cancer, particularly those cancers that are resistant to conventional chemotherapy. But this is a thing of the future.