

Basic Research Is the Key Driver of Innovation

The current crisis highlights the fact that a policy for growth that will safeguard our medium- and long-term prosperity must put far more emphasis on innovation than has previously been the case. And this innovation must not only improve existing systems to keep them competitive for a little while longer, but also lead to fundamentally new solutions and breakthroughs.

TEXT **PETER GRUSS**

The decision to continue the Higher Education Pact, the Excellence Initiative and the Pact for Research and Innovation cannot have been an easy one given the huge cost to the government and the constantly rising levels of public sector debt. But by spending more on science and research, we are laying the foundation for our children's future. This is an investment that promises lofty returns. Science and research are

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not just important in driving the development of new products and processes, they are also essential in resolving major global challenges, such as climate change, food supply and health.

Other countries, too – foremost among them the US – are consciously boosting their research efforts in the crisis. Under the economic stimulus programs, the National Institutes of Health alone will receive more than USD 10 billion in additional funding,

which is a third of their annual budget. US expenditure on research and development this year will total USD 172 billion – the largest research budget in the history of the United States. Germany must stay hard on the heels of its main competitor in the field of research!

Financing commitments that enable researchers to plan ahead with security will have a huge long-term impact on the potential for innovation, and thus also on economic vitality. Such expenditure has marked location benefits. Consider the jobs that are created in industry and services in the environs of research institutions. Munich offers an example of the evolving effects of such clusters: the past 30 years of biomedical research have propelled the region to pole position in European biotechnology. The nucleus of this cluster is the Max Planck Institute of Biochemistry. There are now a total of 164 small and medium-sized enterprises in the field of biotechnology located in Bavaria, primarily around Munich.

There is more evidence than just the example of clusters that expenditure on research and development safeguards a country's ability to innovate. Robert Solow, winner of the Nobel Prize in Economics, states in his *Contribution to the Theory of Economic Growth* that the key drivers of economic growth in industrialized countries are not labor and capital,





but advances in technology. According to his calculations, as much as 80 percent of gross domestic product results from the introduction of new technologies. The closer the status of technology in any given country approaches to the highest level known worldwide, the more these investments stimulate economic growth. This is proven both by a study conducted in 22 OECD countries between 1960 and 2000, and by a comparison between US states.

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nections between quarks and electrons, or the immensities of the universe, creates the basis for revolutionary innovations. It is a question of more than just conventional technologies and employment – the results of this research are the foundation on which the world of tomorrow will be built.

In terms of public expenditure on basic research, it is difficult to calculate a precise and all-inclusive rate of return on investment. This is due in part to the often lengthy period of time between discovery and application. Calculations by economists and statisticians indicate returns of between 30 percent across all subject areas, and up to 700 percent in certain special fields. Scientists at Stanford University and the Analysis Group have calculated that, over a 30-year period, stem cell research will return a profit of at least 120 to 236 percent on capital employed. Should stem cell research lead to greater improvements in the treatment of diseases, the expected return could be as high as 700 percent.

Of course we would all like to know specifically how much a country should invest in basic research. Hans Gersbach, in a theoretical analysis conducted together with colleagues at the Center of Economic

Research at ETH Zurich, broadened the Schumpeter growth model to include government-supported basic research. The result shows that the more technologically advanced a country is, the more its government should invest in basic research.

We all know that this is particularly applicable to Germany. The reports by the Commission of Experts for Research and Innovation for 2008 and 2009 unanimously state that basic research and innovation funding in Germany are fundamentally underfinanced. It is thus not sufficient to continue to spend at previous levels. The pacts for the future and other initiatives related to the high-tech strategy point in the right direction. It is to be hoped that business and industry can now contribute their share of investment in order to safeguard Germany's position as a leader in scientific and economic competition.

Another major challenge facing both industry and science is how to use the findings of basic research even more effectively to power innovation. This special issue of MAXPLANCKRESEARCH presents some successful examples, the innovation value of which is already foreseeable: the development of new materials for the cars of tomorrow, the search for new substances for more efficient solar cells, new ways of storing

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energy using innovative battery technology. Our scientists are also working on the development of vaccines and on ways to keep crops free from pests and diseases by exploiting the plants' natural defenses.

Unfortunately, we are still not adequately succeeding in transferring our researchers' knowledge to business enterprises. Science and industry must enter into a constructive dialog at an earlier stage than has previously been the case. We are contributing to this di-

alog through a variety of initiatives – from exchanges of staff between institutes and industrial companies, to workshops with corporate directors of research and Max Planck scientists, to the activities of our technology transfer agency Max Planck Innovation. Furthermore, the market for venture capital in Germany is only weakly developed – small and medium-sized enterprises have too little funding.

In this area, too, the Max Planck Society has established some initiatives – with the aim of enhancing the transfer of findings, products and concepts to industry through maturation or validation, thus reducing the financial risk for potential investors. The Lead Discovery Center in Dortmund, for example, takes up promising projects in the field of basic biomedical research and carries them forward to produce leads for the subsequent development of drug candidates. This initiative can help to derive profits more rapidly and directly from investments in basic research. How it works in detail is covered in this special issue.

However, basic research is of value not only for the potential material benefits it may yield. New discoveries alter our view of the world and our understanding of mankind. Consider, for example, the decoding of the human genome, the traces found of ancient man, and the pictures of Mars and even of the universe. And, of course, as a contribution to our stock of knowledge and a cultural achievement, basic research is not restricted to the natural sciences. It embraces every discipline, from the humanities and social sciences to biology to physics.

Bob Wilson, the first Director of the great particle accelerator laboratory Fermilab, summed up the value of his research for society with a somewhat provocative remark at a hearing before the American Congressional Committee. In response to the question of what his laboratory would contribute to the defense of the country, he replied: “Nothing, but it will make it worth defending.” ◀



THE AUTHOR

Prof. Dr. Peter Gruss has been President of the Max Planck Society since 2002. He was previously a Director at the Max Planck Institute for Biophysical Chemistry in Göttingen working on developmental biology themes. The subject of transferring knowledge from basic research to practical application was especially close to his heart. His idea of using developmental biology as the basis for innovative therapies to treat disease was honored with the German Future Prize in 1999, which he won in conjunction with fellow scientist Herbert Jäckle.