

35 R&D in Europe: Uniting Forces, Moving Ahead

Hubert Markl

This chapter discusses the present state of scientific development in the Max Planck Society, as well as the present state of R&D and science and technology (S&T) in general in Germany and the European Union.

The U.S. budget for FY 2002 will show a 6.1 percent increase (\$5.6 billion) for science and technology. The National Institutes of Health (NIH) alone will receive a 13.6 percent increase (\$2.8 billion), if it all goes as planned through Congress. This increase alone is more than the whole of the combined budgets of the Max Planck Society and the German Research Council (Deutsche Forschungsgemeinschaft), and a couple of other German institutions of similar kinds. That says a lot. The \$2.3 billion that NIH spends on intramural research is more in absolute numbers than all the spending in medical research in my country. And Germany is not exactly a small country in that respect. We are indeed keenly aware of the competition out there. No wonder one is inclined to call NIH, the National Institutes of Wealth!

Of course, figures and financial budgets are not the whole truth. Behind these is the intellectual force. It is the people, especially the young people, who work in these areas that change money into scientific progress. Of course, they work in science and technology because they are paid to work there. But we must remember this important correlation between the budget figures and the work force.

Where is Europe moving in comparison with the United States? It is moving in the right direction. We estimate that up to 25 member states will soon unite forces. We see a tremendous potential to follow America's lead, but also to go in our own ways. Diversity is one of the key notions for the future of our societies and economies. Europe has great

Hubert Markl is president of the Max Planck Society. This article is based on remarks delivered at the 26th Annual AAAS Colloquium on Science and Technology Policy, held May 3–4, 2001, in Washington, DC.

diversity, not only of cultures and people, but also of policies and pre-conceptions, and of historically influenced lines of development.

We have a lot of work ahead of us, and it will not be fast or easy. It will be two steps forward and one step back as always, but I think we are moving in the right direction. We will be able, in the future, to offer the United States and other countries like Japan, China, Russia, or India, a more coherent entity (though diversified in its strengths) for tackling together joint global problems.

The Max Planck Society

We regard ourselves as well-known in the world. We stand for premium fundamental research in Germany, and we will do everything we can to continue to do so. We have gone through very interesting times in the last decade. As a consequence of German reunification, we had the wonderful opportunity to open up 20 new institutes in the former DDR (German Democratic Republic). They are working in some of the most interesting areas. What is very gratifying about the consilience (or, in a very classical sense, the unification), is that now we talk about science again in one word and with the same vocabulary.

If you visit the Max Planck Institute for Evolutionary Anthropology in Leipzig, for example, you will see that the work goes far beyond the sciences. You will see people working in molecular biology, evolutionary psychology, linguistics, and primate behavior. Altogether, they try to understand what it means that human beings have evolved both biologically and culturally. We have many institutes with “multi” names, like biogeochemical systems. More and more we strive to overcome the division into separate disciplines and rather define scientific work by the problems addressed. To solve problems we need contributions from many disciplines. Merging disciplines is a very dynamic process, and it makes possible rapid progress in the natural sciences and beyond. For example, a new institute in Dresden is closely collaborating with experimental institutes trying to not only understand complexity from a physicist’s point of view, but also biology, economics, in one word self-organization in all kinds of systems. This is a wonderful opportunity.

Since we did not expand our budget, we had to retract in other places, mainly in the former Federal Republic of Germany (in the “old Bundesrepublik”). And we had to close down institutes. I got plenty of letters saying, “No, you mustn’t close this institute. It was one of the places where I got my postdoctoral training, and therefore alone, it

should stay there forever.” Certainly sad enough, but such is life, even at institutions.

In spite of closing some institutes, we have overall managed to keep hold of the spirit that drives research. The decision on whether or not we ever dismantle an institute again is not dependent on whether some Noble prize-winning scientist has put his or her foot in a place. It does depend on whether we can keep the spirit that drives first-rate research alive, and transmit it to the new generation. I think we are not doing too badly there.

I will mention just one development. We internationalize in the Max Planck Society to an amazing degree. Although we do research in German institutions, I cannot say any longer that our work is strictly a German scientific contribution, because I have now approximately 25 to 30 percent foreigners among the 250 directors of our institutes. Sixteen are U.S. citizens. The non-permanent scientific work force in our institutes is almost 50 percent foreigners (of course, many come from the European Union). This is wonderful for us because when you transplant people and help them to build up an institute, they bring with them a huge network of connections to all the places they have been before.

We even have institutes where very few people speak German, which raises a problem when people call from outside wanting to find someone they can address in German. They resent it if everyone speaks only English with them. So, we have minor problem. But this is the only way we can do it, since we may have people of 20 nationalities in one single institute!

In the past, the Max Planck Institutes had an inclination to live too much in splendid isolation from the university world. So we connected all the new institutes on campus with good university partners. We are now building up, rather rapidly, a new system of collaboration between Max Planck Institutes and universities. We have established new cooperative agreements with universities that will become centers for graduate education. We call these the International Max Planck Research Schools. All teaching will be in English only. Schools get money only if they enter into a very formal agreement, which defines the level of cooperation and the curriculum, so everyone knows through the Internet what is going on in each school. The universities, either one nearby, or the person's home university will award the degrees. But the training students receive, and the opportunities for doing research we offer, are the same from institution to institution. More than 50 percent of the participants in these research schools must come from abroad.

I thought it would be difficult to set up these research schools, but we have established almost 20 by now, and it was not difficult at all. When we advertised worldwide, we almost immediately received very interesting applications from all over the world. Many came from Middle Eastern Europe, which was one of our intentions. After the fall of the Iron Curtain, this is a wonderful opportunity to work together to help educate the elite in that part of Europe.

We have to watch very carefully that we do not deplete these countries. Because some of them (Poland, the Czech Republic, Hungary) told me, "We hope you won't do it like the Americans are doing it. Most of our young people stay there after their studies and we need them back home. We need them to build up our countries." With these countries, we enter into agreements where we make sure that the students cannot immediately go on in their studies, but have to return to their home institution to get their degree. We even help them to build up their own research strength at the home institution, because we feel that otherwise we may jeopardize our future collaboration. Even though we would gain in the short run if we kept these students, we would lose in the long run.

The General Situation in Germany

Unification has cost us a lot. Over the last ten years, the net transfer was about \$600 billion. About five percent per annum of our gross domestic product (GDP) went from West Germany to East Germany. This did strain our resources and it was difficult, but I think we have mostly gone through that. Now we will have new opportunities.

What is on the agenda? First, we are seeing a major demographic change in birthrate. Fertile women in Germany, whether German women or women from other countries, have about 1.3 children each. This means that within the next decades, one-third of the German population will be over 60 years of age, and still expecting comfortable pensions. This demographic change is not occurring solely in Germany; it is all over Europe and in many other areas of the world. This is the name of the game for the next decades. To adjust to that will be exceedingly difficult.

The first thing we have to do is to recognize that we always have been an immigration society. Most people do not realize that Germany has, after World War II, absorbed approximately 20 million people. About one-quarter of our population presently in Germany was not born in

Germany. We have integrated 12 million refugees, many coming from the states of the former Soviet Union.

We have gained a lot from the immigrants, but we were not prepared to acknowledge it. We needed them, but we did not acknowledge that they were citizens with us. Now, we have learned better. The need drives us to this realization, and we will have to draw the necessary legal, social and psychological consequences from this fact.

The United States has lived off of the talent of the world in its science system for a long time. We all know what it looks like when you enter engineering or science departments in some of America's best schools. Not too many of the people getting their degrees there were actually born in the United States. This is a situation we have to emulate. We have to learn from you how to attract the very best students to our own universities.

Graduate education was one of the wonderful contributions given to the world by the American educational system. The research university was a German contribution, as most say, but that happened 200 years ago. We have never done so well with graduate schools. We learn from the United States, and I think we should work together to improve our graduate education.

The second point on our agenda is very important for the future. We have to completely reform our educational system, from lower schools to the university system. Many of the old German ways just do not work anymore. We have to reemphasize science and mathematics in the schools. We followed America's lead in the 1960s and 1970s, and introduced curricular reform in which we dismantled a highly successful educational system—the German gymnasium. In this system, every student had enough mathematics and natural sciences to enroll in any subject in a university he or she wanted to. But, we said, "This is not modern. Let them choose the subjects in high school." Well, they chose, but they mostly did not choose math and natural sciences. And if you do not choose these subjects in school, you are not particularly inclined to select one of these subjects as a major in college or in university training. We have to do something about that, and we will.

We also soon hope to get rid of the old German academic career system where habilitation, a formal postdoctoral qualification, played an important role in becoming a university professor. We will let younger scientists come into positions of independence much earlier, at least in the natural sciences. In engineering, habilitation has never been a prerequisite in order to become a professor. In the humanities, in legal stud-

ies, and so on, it takes longer. It is more difficult to change ways there. But you will see the German university change with new legal requirements, quite decisively over the next five or ten years.

We do have other shortcomings still. German universities may not select their students. Universities in Germany are, together with the penitentiary system and the military system (at least under compulsory conscription), almost the only other institutions that get their clients assigned. They do not select them; they receive them. We have to change that, but this is against the grain of the egalitarian assumption in the German educational system. This assumption says that all institutions are equal, so we distribute the students. Since they are equal, it does not matter whether you go to Munich or to Göttingen or Heidelberg. There may have been times when this was true, but it is true no longer. We have to change that. We have to learn how to handle tuition systems too, so that the universities feel more responsible for the students, because tuition comes from the students. Presently, the universities get their money from the state, so a student can be more a load than an asset sometimes. This has to change, and it has changed in many places already.

The Science Budget in Germany

Germany is far behind the United States in the percentage of the GDP spent on R&D. It is approximately 2.4 percent now, but increasing (slowly) again after the first ten years since unification. It is approximately \$50 billion, with about two-thirds from the private sector and one-third from the public side. We could use more, and we will get more when the tax reforms that have been enacted come into place. But we are too slow in social reforms, pension system reforms, and working relations reforms. A social democratic government, as we have, may find it difficult to make the necessary adjustments in the social relations and security systems. But we will get it done.

Our politicians are well aware of the importance of the innovative sector of science and technology. Our budget for S&T is actually better per capita than that of the United States, if you look at only the non-defense, non-NIH budget.

European Unification

The European Union tries to become a decisive leader as far as the economy and trade in Europe is concerned. But as far as science is concerned, different member states perform on different levels. For example, science in Brussels commands for the whole European Union, less than five percent of the available resources. That may make decision-makers in the United States say that they want to deal with London, or Berlin, or Rome, or Paris, but not with Brussels. We hope this will change.

There is a movement in the direction of a more focused, less bureaucratic concentration on larger projects of added European value, projects no single member state could tackle. Together we can make real progress, and we are working for that.

We are finally beginning to set common priorities and define common centers of excellence in Europe. These centers will be involved in training a pool of young European researchers who will not define themselves as Germans or Italians or Belgians, but as members of the European community, as Europeans. We still have a long way to go, but we are moving in the right direction.

It is important that we have a way to convey a message of enthusiasm to the young European generation. We have to engage them in the excitement of scientific research. We have to make them enthusiastic. But, we may lose the enthusiasm of these young people if they are not inclined to learn to do scientific research. We should not wonder when they all become business analysts, lawyers, etc., and do not select subjects from the sciences or from engineering. We must draw them in.

Future Opportunities for Collaborations between the European and U.S. R&D Systems

What Germany has achieved after the Second World War would not have been possible without the help we received. The achievements of Europe as a whole would not have been possible without the collaboration and the openness that all of us have found in the best of America's institutions. The United States gained a lot also, of course, from being so open.

Scientific development is the most grandiose non-zero sum game in human history. It has helped us come forward in the developed world, and we hope this progress will expand to the developing world in the

next decades. We have to do this through collaboration, while at the same time, being highly competitive. This combination of competition and collaboration is the decisive message we can take from the last 50 years.

This is the reason why many of us in Europe, especially from the scientific field, are so deeply disappointed about the recent Kyoto decision made by the U.S. government. We do not think Kyoto is the only solution, however. In fact, Germany (as many other countries) did not meet the goals and will not be able to meet them, even though we meet them better than some others. But it was at least a step in the right direction. The Kyoto Protocol would help all of us determine a concerted action for problems that we have to solve together. To get a message of non-collaboration from a country that holds approximately four percent of the world's population but produces 20 to 25 percent of greenhouse gas emissions is a blow indeed. The United States sent the message that they do not want to take part in this concerted action; this was highly disappointing.

I hear about the terrible fate of having to pay \$2.00 a gallon for gasoline in Chicago. Europeans pay \$5.00 a gallon, and we are not living in dismal poverty. We hear that we failed to develop new technology, yet we produce the most energy-efficient cars in the world, and sell them at a profit. We do the same with gas turbines, and even renovated our energy production along these lines. We partially lead the world in preparing for hydrogen technology and using fuel cells and many other things in this respect. We lead in exports and in gaining money in environmental technology of the highest quality. Our drivers, including myself, have fits when we pay our gasoline bill. Of course we do, but we realize that this price rise means that we had not so much aim for conservation only. This is actually not the real goal for tomorrow's world. Aim for energy efficiency: this is the real goal, with new technology, better technology.

Together we have to invest in new technology that will be more energy efficient. Together we have to aim for a sustainable world. We do not believe that one country, even if it is the largest country, the leading country, and the only remaining superpower, can do it on its own. As Benjamin Franklin said, "We must all hang together, or assuredly we shall all hang separately."

Germany alone can do almost nothing of global importance, nor can the European Union. But this is also true for the United States, even with all its superpower qualities and amazing economic prowess. I am the first to appreciate these qualities, envy them, and congratulate the

United States on them. In order to get to that level though, the United States has relied, for decades, on a sizeable fraction of the most highly qualified people of the world. The message is that we have to work together. We have to do it together. We have to have global collaboration for science. We must demonstrate to the politicians of all the countries that we know how to serve them well in that respect, and they should solve their problems so we can do our work. The Internet is there for us to use, and approximate English is there for us to use. We have the tools, and the determination. We need the support. And we need to do it together.

The needs are there, the tools are there, so why should we not do it?

