

# Building Outstanding Research Environments in Europe and Beyond

## Helga Nowotny



Prof. Dr. Helga Nowotny  
is President of the  
European Research Council.

Professor Dr. Helga Nowotny opens up a broad horizon of historical perspectives and research policy issues. The guiding question is: what makes creative research environments truly outstanding?

### »1. Flash-back moments on major policy shifts

Ongoing discussions on the conditions that influence the creativity and productivity of research provide intellectual focal points for the protagonists to take a stand vis-à-vis major policy shifts.

One such historical flash moment occurred in the late 30ies. During a visit to the Soviet Union, Michael Polanyi became convinced that the central planning of science to address societal needs would lead to suffocation, as it was based on a fundamental misunderstanding of the nature of science. While John Desmond Bernal, a prominent British crystallographer and Marxist, had arrived at the opposite conclusion, Polanyi initiated a movement for freedom of science after the war.

It is an ironic twist of history that Bernal's advocacy of steering science has become accepted practice since, although the definitions of social needs that science is expected to serve, certainly differ.

One of the reasons for this policy shift was the transition from ›Little science‹ to what Derek de Solla Price called ›Big Science‹ in his 1963 landmark publication. So much attention had been fixed on the autonomy of the individual scientist that the spaces conquered by Big Science were left unexplored.

One exception was Norbert Wiener, one of the foremost mathematicians, who took his ideas to engineering and to the design of all sorts of inventions, such as computers, communication networks, radar and artificial limbs. In a posthumous publication he follows the various dimensions of an environment that encourages inventiveness: what were the conditions leading to inventions and how could ideas be cared for?

In his book, written in 1953, he diagnosed an ominous shift towards what he called the almost ›inhuman‹ industrial or government laboratory. His message was clear: truly original ideas cannot be produced on an assembly line, as the consequences of inventions are felt at distant times and places. He was upset about the constraints on scientific creativity imposed by the problems of secrecy associated with the rise of the military-industrial complex. He was wary about what he called ›megabuck science‹ promoted by business and government. These labs, he wrote, were not likely to be a good midwife or nurse to new ideas. Instead, they were producing a generation of scientists with a ›devotion to power and that minted symbol of power, money‹.

For Wiener, the individual was deeply conditioned by the social milieu and the availability of materials and techniques. But there was more to it. ›New ideas are conceived in the intellects of individual scientists, and they are particularly likely to originate where there are many well-trained intellects, and above all where intellect is valued‹.

Let us now jump to today's concerns. They are no longer directed against the military-industrial complex, nor against ›Programmforschung‹, although it is on the increase everywhere. While putting pressure on the individual researcher to acquire a larger share of external competitive funding, thus constraining the choice of research problems, it opens up new opportunities for larger cooperation.

But ›Programmforschung‹ also puts the hard won institutional autonomy, a rather recent acquisition of many continental universities, to a test. Presidents and rectors struggle to balance the often contradictory demands that come with external funding.

While these issues are hotly debated, they are not fundamentally contested. At stake is rather how to cope with the in-built incompatible normative expectations of funding agencies, governments, university leaders and practising researchers. Problematic issues for universities are ways to balance research and teaching, and how to position themselves in a competitive environment, marked by impact, rankings, endless evaluations and research assessment exercises.

Often hidden behind more overt political priorities is the question we are discussing today: what is an outstanding research environment? And how to build one?

Every individual scientist must be embedded in a supportive institutional environment which changes during the career path.

First, the environment needed for talented individuals to emerge. Scientific talent exists everywhere, but there are many places where it goes unnoticed and remains unnurtured. This is the problem of universities overburdened by teaching loads, outdated curricula or lack of vision. It is a problem in certain parts of Europe (and even more, in other parts of the world). The policy question is: can we do better?

Second, the environment needed for the individual to mature. This coincides often with the post-doc stage in the career of a young researcher. There exists immense pressure to seek those environments likely to further one's career by offering attractive opportunities, be it in terms of an inspiring group leader, the prospect of publishing quickly in renowned journals, or simply greater scientific independence.

This phase is highly competitive and fraught with risks. While intellectual mobility remains important, geographical mobility often involves a nomadic

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lifestyle with high personal costs. It is no coincidence, that most women who decide to leave science, do so during this phase. Again, the policy question is: can we do better?

Third, the environment needed to sustain and maintain continued productivity at the highest level. It consists of a unique blend of attractive infrastructure, inspirational colleagues and students, stability of funding and the genius loci that allows a place to radiate far beyond the immediate environment. This kind of environment – and how we can do better – is our central topic and I will treat it in two steps.

## 2. What makes a research environment outstanding?

It may come as a surprise how much we know about the characteristics of such places, based on the exploration of the institutional and organisational features that influence the creativity of scientific discoveries.

One of the most detailed historical studies is devoted to what made Rockefeller University such an outstanding place in the 30ies. Timing, as always, played an important role, but it certainly helped to have flat hierarchies, an internationally open recruitment policy with emphasis on diversity, a leader with high scientific reputation and an ambitious vision to cut across existing

fields, and assured and adequate resources. In a study of a large number of research breakthroughs in the US biomedical sciences across different research organisations, Roger Hollingsworth found the same features still valid.

Therefore we know the importance of research autonomy, small group size, international recruitment and a leadership that facilitates, as well as informal communication across research fields, adequate instru-

mentation and reasonable long-term funding. These characteristics are as obvious as they are difficult to replicate.

We also know where the successful research environments are today. We can name them. We can begin with Max Planck Institutes, well-endowed, well-organised, with freedom accorded to directors for seven years to pursue the lines of cutting edge research for which they were recruited. We can include some of the oldest universities, like Oxford and Cam-



bridge, or the universities singled out in the process of the ›Exzellenzinitiative‹. We should mention an outstanding institution like the Weizmann Institute and among more recent newcomers EPFL and IST Austria. Outside of Europe, places like the A\* Institutes in Singapore, HHMI, the Kavli Institutes, Perimeter and others come to mind.

But to recognise which characteristics hold the key to success does not necessarily make it easier to follow. Imitation in itself has never been a wise strategy. Each of these environments has successfully responded to a particular challenge present at the time of their establishment. Path-dependency is not only strong in technological innovation, but also in institutional innovation which makes it difficult to overtake the leaders.

Moreover, like in evolution, we tend to notice only the species of successful research environments that have survived. It is easy to overlook the many failed attempts at building a truly outstanding environment, although failures may also hold important lessons.

Experience after five years of existence of the ERC with some 2.600 grantees that have been funded so far, tells a familiar story. Approximately 50% of all ERC grants go to 50 institutions. They are known. They confirm the concentration effect in science, a variant of Robert K Merton's famous Matthew effect. And let us not forget: one of the relative advantages enjoyed by US universities is the concentration of research funding on less than 10% of degree-giving institutions.

But what about the other half, the approximately 430 host institutions dispersed a bit all over Europe?

According to a recent study on assessing the impact and outcomes of the ERC funding schemes, EURECIA, several of these institutions started to engage in fierce

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competition with other universities. They have understood that it is up to them to provide better conditions, especially for the young talents in their midst and to identify, encourage and guide them.

This leads me to the concluding part: how to create creative environments?

### 3. Creating future creative environments

The first and foremost question is: what is the specific challenge such an outstanding research environment is intended to respond to? At which level and at which interface?

All successful creative environments established in the past seized an opportunity based on a clearly defined response to a perhaps latent, but real and existing need. Abram Flexner's vision laid down in his manifesto ›The usefulness of useless knowledge‹ led to the establishment of the Institute of Advanced Study in Princeton and, subsequently other IAS, such as the Wissenschaftskolleg zu Berlin. If the idea of an IAS has been embraced recently by universities, especially in this country, it is the kind of adaptation and accommodation of an original idea which the Cunning of History is well known for. It also matters to achieve the right mixture between generations, gender and cultural backgrounds.

But most valued of all is serendipity, finding, what one has not been looking for and recognising its importance. It is inscribed in the operational rules of an IAS that otherwise knows no operational rules. The question is how to create conditions for serendipity to occur.

But the decisive question for the future remains: what is it all about?

Let us briefly revisit some of the major policy shifts and their outcomes.

— Creating creative environments is no longer a rallying call against Big Science. This wave is over; the result has been a successful demonstration how big (mostly public, but not only public) money and bright minds can be mobilised. Big Science has become part of our everyday life, and it expands rapidly in ever new directions. Huge data sets continue to be produced, processed, stored and analysed with the help of ever more sophisticated modelling and IT tools. Virtual science connects around the globe in an ever growing

number of networks, alliances, platforms and publications. Cooperation is flourishing as never before. While this poses its own problems, it is more in the direction of how to create virtual environments that are open and outstanding.

— Nor does the controversy that raged in the 70ies about the ›steering capacity‹ of funding agencies and governments and whether science can be ›steered‹ at all, raise an eyebrow today. Not ›Programmforschung‹ per se is questioned, but rather how much, when and how.

— Nor does the prescient warning by Norbert Wiener back in the 50ies against ›megabuck science‹ excite us today. Tendentially, he described the growth of business and government-dominated laboratories as fuelled by a generation of scientists with a ›devotion to power and that minted symbol of power, money‹. Today, universities are exhorted to be as close as possible to industry and business. Who would seriously object within academia to closer ties with the ›minted symbol of power‹?

— Last but not least, the existence of the ERC with its bottom-up, excellence only approach targeting the individual P.I. and his/her team, provides a fertile ground for individual scientific creativity to emerge across the whole spectrum of ›Wissenschaft‹ in Europe. And it remains to be seen whether the new, experimental scheme of Synergy grants will become the core of future oriented creative environments.

Which then are the major challenges today that call for the creation of outstanding creative environments?

The one major challenge I see is to safeguard and to nurture the production of a variety of new ideas in order to sustain the dynamics of scientific, technological and scholarly activities, which got started some four-hundred years ago with the European Enlightenment.

The growing influence of public policy goals on the allocation of resources for research – such as the Grand Challenges to be tackled in Horizon 2020 and other problems waiting to be incorporated into research priorities – can only be successfully taken

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up, if they can safeguard, nurture and increase the variety of scientific and intellectual activities.

It is paradoxical that universities entering a European, if not global, competition are becoming structurally more similar to each other. Competition may lead to differentiation, but it may also foster structural similarities – for better or worse.

Therefore, it is up to us as members of the scientific community to withstand the pressure to conform. It is up to us to refuse to make promises we know that cannot be kept or to anticipate outcomes that we know cannot be predicted, only because we think we have to swim in the mainstream – although an old Chinese proverb warns us, that only dead fish swim there.

This is a task that in the end we, the scientific community, must passionately become engaged in – with the welcome and necessary support from the ›Stifters‹, foundations and other policy-makers. We must make sure that the potential richness of sometimes seemingly odd ideas is not slashed before they even get a chance, only because they cannot calculate the impact that is expected from them. It is our responsibility to make sure that we, as peers, do not fall under the spell of our inbred conservatism, nor under the illusion that our pet ideas mark the cutting edge of science.

This one and major challenge to preserve and increase variety in the generation of new ideas emerges in a radically changed context: the global scientific landscape. We, the Euro-Americans, are no longer alone in shaping neither volume, nor content of the production of new knowledge. The double-digit increase in research funding and in numbers of publications in other parts of the globe speak a clear message.

More is to come. Brazil and other countries from ›the rest of the world‹ have established fellowship schemes in order to attract bright, young and experienced researchers to work in these countries. This increases global competition for talent, but it also provides an opening for the variety of ideas to flourish.

Let me be very clear. Science is not done differently in São Paulo, Bangalore or in Beijing. But different modes of thinking or what historians of science refer to as styles of scientific thought, different ways of using equipment, the experience gained in environments that are less endowed materialistically and therefore

ingeniously inventive in other ways – they all form part of increasing variety at the global level.

Faced with these challenges staring in our face the components for building outstanding research environments remain the same. Yes, adequate resources are needed, the institutional hierarchy must be flat. Internationally open selection procedures with excellence as the only criteria must be in place, just as a facilitating leadership and communication across research fields are indispensable.

But what counts in the end is how much creative variety will be encouraged to flourish and which kind of variety.

Future generations of scientists and society will assess our achievements or failure as ›Stifters‹, funders, policy-makers and as responsible members of the scientific community, on the basis of whether we have been able to see beyond our immediate time horizon, and whether we have succeeded in transcending not only national, but also European boundaries. Whether we have understood that to sustain the long-term vision that began with the European Enlightenment calls for investment into research and education, even in times of economic and financial crisis. Whether we have been able to lay the foundations for outstanding creative research environments with the objective of increasing variety of ideas, including variety among the outstanding creative research environments that hopefully will emerge. «

This is a slightly abridged version of the speech.

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